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RELATING QUALITY ADJUSTED LIFE YEARS TO CONTINGENT VALUATION:
ACUTE VERSUS CHRONIC CONDITIONS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the
Degree Doctor of Philosophy in the Graduate School of
The Ohio State University

By

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2000

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ABSTRACT

Traditional measures used to assess and compare the value of health care programs focusing on mortality are no longer regarded as adequate because they do not consider patient preferences. These benefits of a health care intervention can be assessed and compared by the use of quality adjusted life years (QALYS) and contingent valuation method (CV). Proponents for both metrics claim that QALYS and CV are based on the same theoretical foundations in welfare economics, therefore regressing QALYS onto CV should result in a statistically significant and positive association. Given the advantages and disadvantages of these competing methods, exploration of this association would be of importance in public policy decision making, especially as it applies to interventions that affect quality of life, such as cancer treatment, since for many a cure is not anticipated. The primary objective of this study was to investigate the association between CV and QALY in acute and chronic conditions. The secondary objective of this study was to investigate the sensitivity of the two metrics in assessing benefits of health care interventions for acute and chronic conditions. Currently QALYS are recommended for use in health care priority setting, however, there is evidence to support that QALYS discriminate against acute conditions. Two face-to-face interviews were conducted in a convenience sample of women aged 22 to 50 with no history of breast cancer or cancer requiring chemotherapy (n=119). Study participation required completion of two
surveys: one for an acute condition, post chemotherapy nausea and vomiting, and the other for a chronic condition, breast cancer. QALY metric was assessed using visual analogue scale (VAS) and top-down titration standard gamble method (SG). Utility values were acquired for acute and chronic health states by evaluation of hypothetical health state scenarios. Willingness to pay was measured using bidding game approach. Results indicated that regression of WTP onto four predictor variables: QALYs, income, age and health explained a statistically significant proportion of the variance at the 0.05 level. The models with most predictive power were the double log models explaining up to 25 percent of the variance in WTP, however, based on bivariate correlations, most of the predictive power of the model can be attributed to the economic status variable. \( \Delta QALY \) variable was not an important predictor of WTP. Models estimated using VAS and for chronic conditions explained a greater proportion of the variance in the criterion than those for acute conditions and SG. This can be attributed to respondent risk aversion with SG especially with assessment of acute health states. For the second objective, as expected, change in QALY for acute conditions approached zero, indicating these health interventions were of negligible benefit. However, WTP for the same intervention was significantly greater than zero, indicating that the intervention for the acute condition did have value to the respondents. The results of this study imply that the use of WTP for QALY estimation may be a better measure of utility than QALY, while for assessment of utility for chronic conditions that significantly affect longevity (Y), QALY may be a preferable measure of utility.
I would like to express my gratitude to the following individuals who were instrumental in the completion of this study.

My adviser, Dr. Dev Pathak, for his patience, guidance, support and continued faith in me over the past five years. He appreciated that all of his students were different and his individualistic approach to mentoring ensured appropriate guidance was given to acquire the needed tools for success. Dr Pathak's faith in me never faltered, even when I doubted my own ability. He always seemed to know just how much to push to ensure that I stayed focused and successfully completed tasks in a timely manner, although his continual fire-lighting was not always appreciated at the time.

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CHAPTER 1

INTRODUCTION

The purpose of this dissertation is to address methodological issues in the area of health outcomes research, specifically as they apply to quality adjusted life years and contingent valuation. Thus the first chapter begins by providing background information to the theoretical foundations of the two metrics - rational for the study. An overview of the use of quality adjusted life years and contingent valuation is presented in terms of their use in acute and chronic conditions focusing on their differences and measurement issues. This is followed with a presentation of the research questions. The chapter concludes presenting study assumptions, limitations, listing abbreviations used and defining key terms.
Background

Prior to the mid-1980's, traditional measures used to assess and compare the value of health care programs focused on natural units such as number of lives saved. However, comparing programs solely on lives saved is no longer regarded as adequate since mortality does not account for variability in quality of life generated by different programs, i.e. it does not account for patient preferences (Dolan, 1998; Jachuk, Brierley, Jachuk, 1982; Krabbe et al, 1997; Gold et al, 1996; Torrance and Feeny, 1989). For example, a five-year life extension due to a kidney transplant may be preferable to a five-year life extension attributed to hemodialysis. These findings began to suggest pharmaceutical manufacturers should account for and report on this performance dimension – patient preference for quality of life. Furthermore, health care intervention evaluations were further complicated by global changes focusing on value of money (Blumenschein and Johannesson, 1996; Weinstein and Stason, 1977). This is especially applicable to pharmaceuticals, which constitute a readily discernible component of health care expenditures (Blumenschein and Johannesson, 1996). The term pharmacoeconomics evolved in the late 1980’s (Luce, 1998) and continues to be widely used.

Pharmacoeconomic tools were developed to evaluate and compare competing medical technologies or interventions by comparing both their costs and consequences (Johannesson and O'Brien, 1998). Costs are typically measured in monetary units, however, there is no consensus on the best way to measure benefits (outcomes or
Consequences can also be measured in dollars or in terms of effectiveness, quality of life and quality adjusted life years (Pharmaceutical Research and Manufacturers of America, 1988). The four primary pharmacoeconomic tools used in health care program or intervention appraisal include cost-minimization analysis (CMA), cost benefit analysis (CBA), cost-effectiveness analysis (CEA), and cost utility analysis (CUA). CMA analysis assumes that intervention outcomes (benefits) are equivalent and therefore only compares costs between two or more programs. Since the focus of this study is intervention outcomes, CMA will not be discussed further. For the three remaining pharmacoeconomic ratios, all costs (numerator) are measured in monetary terms, but the ratios differ in how benefits (denominator) are measured. Our concern is with CUA, regarded by some as a type of CEA, and CBA.

CEA measures health outcomes in natural units, for example, mmHg reduction in blood pressure with antihypertensive therapy, number of adverse drug events averted, and number of lives saved. CEA is also known as the ‘decision maker approach’ to economic valuation, since it is contingent on what the decision-maker wants to optimize (Blumenschein and Johannesson, 1996). CEA is designed to compare a common effect of interest between different programs. As a result, different CEA studies are often not comparable due to variability in outcomes measured. Therefore, CEA is not suitable when multiple clinical indicators are of interest. In addition, this metric is of limited value when assessing a single health program because a comparator cost-effectiveness ratio is needed (Torrance, 1986). Furthermore, consumer valuations/preferences of these
outcomes are not included in the analysis. CEA is not consistent with welfare economics and thus lacks theoretical foundation (Blumenschein and Johannesson, 1996). Therefore, CEA will not be discussed further.¹

Although CUA and CBA share the same theoretic foundations, welfare economics (i.e. patient preferences are incorporated into benefit measure), – the association between these two metrics has not been adequately developed. (Gold et al 1996; Birch and Gafni 1992; Blumenschein and Johannesson, 1996; Phelps and Muslin, 1991; Birch and Gafni, 1992; Birch and Gafni, 1993; Johannesson and Weinstein, 1993). Given the gap in the literature, benefit measurements of CUA and CBA (i.e., QALYs and CV, respectively) are the focus of this study¹.

Study Rational: CUA versus CBA

CUA, a ratio of costs to benefits, regarded by some as a variant of CEA, is distinguished by a common outcome measure, namely quality adjusted life years (QALYs). (Gold et al, 1998). QALY is an index designed to synthesize an individual’s health changes in terms of both quantity of life (Y), typically measured in years, for example the rest of the respondent’s life, and quality of life (Q). QALY changes can also be aggregated across individuals (Pathak, 1995). Although two research teams, Zechhauser and Shepard (1976), and Weinstein and Stason (1977), both coined the term QALYs, the latter team

¹ CEA in this context refers to the narrow definition of a ratio of cost versus effects. Since CUA is regarded as a type of CEA, the term CEA is also broadly used by some to encompass both CUA and CEA (Gold et al, 1996)
has been credited for defining QALY in 1977 (Pathak, 1998; McAlearney, Schweikhart, Pathak, 1999).

Historically, there has been no single theoretical foundation attributed for CUA, however, classic welfare economics has been adopted as the theoretical framework by CUA advocates (Gold, 1996; Gafni, 1997). Welfare economics does not require outcomes (benefits) to be measured in monetary units, therefore use of QALYs as an outcome measure is consistent with welfare economic theory (Gafni, 1997; Birch and Donaldson, 1987; Pauly 1995). Furthermore to be consistent with welfare economics, QALY measurement needs to be based on utility theory. Theoretically, QALY is a bivariate utility function of quality and quantity of life, and can be written as QALY=U(Q*Y). However, this is only true when certain strict assumptions beyond von Neuman Morgenstern (vNM) utility theory are adhered to (Pathak, 1995).

In contrast, the benefits of health outcomes in CBA are measured in monetary units by use of the contingent valuation method (CV) – commonly referred to as willingness to pay (WTP) or willingness to accept (WTA) methods. As the name implies, respondents are asked to value goods, i.e. health care interventions, in a contingent or hypothetical market. According to welfare economics, asking respondents to state the maximum monetary amount that they are WTP or the minimum amount that they are WTA to receive or forgo, a health care intervention, respectively, can capture respondent preferences. Theoretically, preferences ascertained using WTA or WTP should be

The primary difference between CUA and CBA is how outcomes are measured. In CBA, both resources consumed and benefits (health outcomes) of the intervention are measured in monetary units. Expressing the costs and benefits in the same units provides the decision maker with a single metric, net benefits, to assess the value of the program from an efficiency perspective. Although not designed to be an overriding decision criteria, CBA enables more informed economic decision-making. Transformation of costs and benefits to monetary units enables program comparisons between healthcare and nonhealth interventions to ensure optimal allocation of resources (Zarnke, Levine, O’Bien, 1997). Furthermore, unlike CUA, CBA does not require adherence to the strict assumptions of utility structure (Mitchell and Carson, 1989). Table 1 summarizes major differences and similarities between the two metrics.

CEA and CUA have become the standard methodology for the evaluation of health care interventions in Australia, Canada, United Kingdom and the US (Mishan, 1988; Gold et al, 1996; Johannesson, 1996; Detsky, 1993; Henry, 1992, Jacobs et at 1995). Charged with the mission to develop recommendations to develop quality and comparability of studies used in health economics, the Panel on Cost Effectiveness in Health and
Medicine supports the use of CUA over CBA. The Panel describes their rationale for advocating CUA in the following excerpt: "Because of CBA's explicit grounding in welfare-economic principles, it is natural to ask why one would use cost-effectiveness rather than cost-benefit analysis if one wants to build from a welfare economic foundation. Our interest in cost-effectiveness [CEA defined broadly and encompasses CUA] derives largely from its broad acceptance within the health care field, in contrast to the skepticism that often greets cost-benefit analysis" (Italics added to clarify terms used) (Gold et al., 1996, p28). Thus, the panel's support of CEA appears to be based on popular acceptance, not theory.

The Australian Pharmaceutical Benefits Advisory Committee (PBAC), which makes recommendations to the federal government, formulated guidelines for the pharmaceutical industry for the addition of pharmaceuticals to the national drug formulary for reimbursement purposes. Because these guidelines associated the use of the human capital approach with CBA, they promoted the use of CEA and CUA, and did not support the use of CBA (Detsky, 1993). Similar to the health care system in Australia, pharmaceutical reimbursement guidelines were also formulated for Canada. The Canadian guidelines support the use of QALYs as the outcome measure in CUA, although, CBA is also encouraged using WTP (Detsky, 1993).

---

2 A nonfederal panel of 13 scientists convened by the US Public Health Service (PHS) in 1993, with expertise in CEA, clinical medicine, ethics, and health outcomes measurement. The panel was assembled after criticism of CEA used to prioritize Oregon Medicaid health budget. Furthermore inconsistencies in published CEA studies resulted in incomparability of results and confusion. The panel was convened to address these issues (Gold et al., 1996)
CUA and CBA used to measure benefits of health care interventions.

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<td>Both based on welfare economics (Gold et al., 1996; Meltzer, 1997; Phelps and Mushlin, 1991).</td>
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<td>Objective: maximization of health gains for a given amount of resources (Johannesson and Weinstein, 1993)</td>
<td>Objective: to determine whether a number of health care intervention should be undertaken at all, and if available funds are limited, which interventions are among those predicted generate a surplus benefit over cost should be selected from a welfare economics perspective (Gafni, 1998)</td>
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<td>Both metrics result in similar (or identical) resource allocation decisions (Phelps and Mushlin, 1991; Gold et al, 1996)</td>
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<td>Requires compliance to axioms, beyond von Neumann Morgenstern expected utility theory in order to measure utility (Gold et al, 1996).</td>
<td>Also based on utility theory, but does not require adherence to von Neumann Morgenstern expected utility theory.</td>
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<td>QALY more acceptable by decision makers than WTP in health care (Gold et al, 1996)</td>
<td>Over 2000 CBA studies conducted in environmental (nonhealth care) literature, but less than 50 in health care literature.</td>
</tr>
<tr>
<td>Measuring health preferences in QALYs is a much less daunting task than using CBA (Gold et al, 1996).</td>
<td>Difficult to measure health in monetary units (Gold et al, 1996).</td>
</tr>
<tr>
<td>Both metrics are supported for use in acute and chronic interventions (Gold et al, 1996).</td>
<td></td>
</tr>
<tr>
<td>QALYs discriminate against acute interventions (Pathak, 1995).</td>
<td>WTP is sensitive to interventions that produce significant changes in quality of life even if they are short lived (Mitchell and Carson, 1993).</td>
</tr>
<tr>
<td>CUA requires a comparator – single programs cannot be measured in isolation (Johannesson, 1996).</td>
<td>CBA can be used to measure the net benefits of a single program (Drummond, Johannesson, 1996).</td>
</tr>
<tr>
<td>Decision criterion for CUA is subjective and based on decision rule selected by decision maker. For example, if the health improvement costs $100,000 per QALY, how does the decision maker know if the cost is worth the benefit? Since the cost and benefit are not measured in the same metric, decision criterion must be made implicit (Johannesson, 1996; Gafni, 1998).</td>
<td>Decision criterion for CBA is explicit, for example, if net benefits are positive, or cost to benefit ratio is less than 1.0, based on analysis intervention is recommended (Johannesson, 1996; Mitchell and Carson, 1993).</td>
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Methodological problems in measurement of both CUA and CBA, for example, their hypothetical nature (Mitchell and Carson, 1993).

Table 1.1: CUA and CBA: differences and similarities.
Assuming a decision was made to use CUA over CBA, the analysis is incomplete without resource allocation decision rules. For example, the Australian PBAC recommended the use of a “yardstick”. Johannesson (1996) interpreted this to mean WTP (or price) per QALY. Therefore, if the WTP exceeds cost per QALY, program selection would result in allocative efficiency. The Canadian guidelines initially included three categories of acceptable costs per QALY (based on strength of evidence) which implicitly provided the decision maker with maximal WTP per QALY. Implicit prices were subsequently removed from the guidelines to leave decision makers to make their own implicit WTP values (Johannesson, 1996). The most obvious decision rule would be to adopt the program that provides the most QALYs per dollar. However, this rule would use CUA as a test of technical efficiency – ensuring the production of the same output (i.e. QALYs) at the lowest cost, as opposed to allocative efficiency – how to allocate a fixed quantity of resources between competing courses of action, the objective of economic efficiency (Gafni, 1997; Donaldson, 1998)\(^3\).

Thus despite the popularity of CUA, in addition to problems with measurement, interpretation of results may be difficult. For example, CUA does not provide decision makers with guidance on the value of the specified outcome, and the value of a single

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\(^3\) If results of CUA study suggest that intervention A cost $100,000/QALY and intervention B cost $50,000/QALY, and the decision rule was based on selecting the alternative that produced more QALYs per dollar (i.e. best buy) then selection of intervention B would be an example of technical efficiency. If however, it was also found that the benefits for intervention A measured in monetary units exceeded $100,000, but benefits for B were valued at less than $50,000, and intervention A was selected, this would be an example of allocative efficiency. In this case benefits are weighed against the cost of the respective intervention. As indicated in this example, it is quite feasible that respondents value the outcomes of the more costly intervention A more so than its less costly competitor.
program cannot be determined in isolation – a comparator is required for CUA (and CEA) to have meaning (Gold et al, 1989; Makie, Richardson, Singer, Kuhse, 1998; Pathak, 1995).

For CUA to have meaning the decision maker must decide how much he is willing to pay (or how much society is willing to pay – depending on perspective) to achieve a desired outcome. Advocates of CUA argue that allocative efficiency can be achieved by using aids such as the budget constraint, cost per QALY threshold and league tables, to assume the role of WTP for intervention (Johannesson and Weinstein, 1993). Valuing the worth of a QALY by whatever rule means that CUA does not avoid monetary valuation of human life, a prominent criticism of CBA. Price per QALY is made implicitly in CUA. For example the budget constraint assumes a WTP for treatment. CUA is limited unless complemented by willingness to pay per QALY gained (Blumenschein and Johannesson, 1998). Valuation of QALYs would convert an economic analysis of technical efficiency to one of allocative efficiency. The primary purpose of this study is to attempt to derive a model to convert QALYs into a contingent valuation monetary preference measure.

Instead of attempting to convert one measure of patient preferences to another it would seem much more expedient to adopt either CBA or CUA as the standard in health care for measuring outcomes. Unfortunately, the solution is not that simple. Adoption of the most popular PE method in health care, CUA, may not be the best approach.
Consideration should be given to the nature of the comparison and the decision maker's needs and biases (Longo, 1999). In a recent informal telephone interview, decision makers were surveyed to determine which PE outcomes, QALYs or CV, would be most useful in their decision making process. The responses were split, those with formal PE training preferred data to be presented as "cost per QALY". The remainder preferred outcomes to be provided in monetary terms because they found QALYs too difficult to understand (Longo, 1999).

Advocates of CBA have argued that CUA, at best, was a truncated form of CBA (Mishan, 1988, p110), and promotion of CUA was the result of unfair criticism of CBA. For example, CBA places monetary values on life while CUA does not, (Gold et al, 1996; Kenkel, 1997). Then why not abandon CUA in favor of CBA? The National Oceanic Atmospheric Administration (NOAA), released a report provided by the Contingent Valuation Panel, supporting the use of CV for natural resource damage assessments after the Exxon-Valdez oil spill in Alaska (Arrow et al, 1993). Furthermore, economists describe CBA as the method of choice for determining reallocation of expenditures on environmental, health and safety regulations or policies (Arrow et al, 1996). In addition, WTP, pioneered in environmental economics, has remained popular in the assessment of economic efficiency, which includes valuing life, for example, policy recommendations for seat belt use, and the effect of pollution on lung function.

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4 Four decision makers were selected for study participation from different geographical regions if Canada. Decision makers were asked for their preference for PE data. Given the choice would they prefer "cost per QALY" (CUA) or CBA. Although not specified, given that Canada has socialized medicine, decision makers were most likely formulary and hospital decision makers.
The problem in simply adopting CBA over CUA in health care lies in skepticism regarding the use of CV method—despite its inherent versatility in comparing programs with different or multiple health outcomes. The resulting number of CBA applications in health care is limited, while CUA has flourished (Blumenshein and Johannesson, 1996; Gold et al. 1996; Labelle and Hurley, 1992). For example, a recent (1998) review of contingent valuation studies conducted in healthcare revealed a total of 48 CV studies conducted in healthcare (Diener, O'Brien, Gafni, 1998). Furthermore, a MEDLINE and Social Science and Citation Index (SSCI) search indicated that only five original WTP papers in oncology have been published since the aforementioned review (Dranitsaris, 1997; Giesler, Ashton and Brody et al. 1999; Gerking and Dickie, 1996; Ortega, Dranitsaris, Puodziunas, 1998; Protiere et al, 1998). Therefore, the number of CBAs in health care is insufficient to be useful in program decision making. Furthermore, current resentment towards explicitly valuing health care inventions in CBA (as opposed to implicitly valuing health using CUA) would most probably result in pharmacoeconomic analysis not being used in the decision making process if CV was the only metric available. Resistance to CV method by the medical community can be clarified by the following quote “The major disadvantage of the benefit-cost framework is the requirement that human lives and the quality of life be valued in monetary units. Many decision makers find this difficult or unethical and do not trust analyses that depend upon such valuations” (Weinstein and Fineberg, 1980; Gold et al, 1996). In other words monetizing health outcomes was regarded as inappropriate by some (Gold et al, 1996;

Furthermore, in using CBA in preference to CUA, consideration should be given to providing decision makers with information that is meaningful and useful to them (Longo, 1999). Instead of regarding CV and QALY as competing methods to assess outcomes research, perhaps they should be regarded as complementary.

Burden of cancer treatment
Chemotherapy in the 1980's witnessed a growing interest beyond the clinical parameters of therapeutic success such as survival and toxicity of therapy (Aaronson, 1991). For many cancer patients a cure is not anticipated and the purpose of medical treatment is to optimize quality of life while improving patient survival. Patient quality of life may be impaired by disease, but chemotherapy may also be deleterious, therefore perceived patient benefits from therapy are uncertain (Selby, 1987; Cella and Tulsky, 1993). CUA and CBA capture utility of health care interventions beyond increased survival. Health related quality of life (HRQOL) is of particular significance in analyzing the benefit-to-cost ratio of chronic illnesses such as cancer (Cella and Tulsky, 1993). Additionally, CUA and CBA are recommended for the assessment of acute and chronic health care interventions (Gold et al, 1989).
In this study two conditions in cancer will be considered. Post chemotherapy nausea and vomiting (PCNV) and breast cancer are the acute and chronic conditions used in this study, respectively.

In this study two treatments investigated are:

(1) Post chemotherapy nausea and vomiting (PCNV), the acute condition, is regarded by patients to be the most distressing symptom of cancer treatment (Kwong and Parasuraman, 1999; Coates et al 1983; Levine et al, 1987; Lindley et al 1989; Richardson et al, 1988). PCNV has been reported to occur in 60 to 100 percent of patients receiving chemotherapy (Kwong and Parasuraman, 1999). Intensity, duration and frequency of PCNV varies depending on the emetogenicity and prior patient experiences with chemotherapy (Osoba et al, 1997; Morrow et al, 1998). Typically, a temporary symptom, PCNV lasts one to five days with an average of three days after chemotherapy (Osoba et al, 1997; Grunberg et al, 1996). In this study, respondents will be provided with background information describing cancer, chemotherapy and its side effects including PCNV and two therapies to prevent PCNV: standard preventative therapy (partial alleviation of PCNV) and optimal preventative therapy (complete alleviation of PCNV).

(2) Breast cancer, the chronic condition, is one of the three most common forms of cancer, the others being colorectal and lung cancer. In 1999, an estimated 43,300 women died of breast cancer in the US. Breast cancer treatment serves as a paradigm for why quality of life research is important – changes in breast cancer treatment over
the past 20 years were based on patient quality of life given that different therapy options did not prolong life (Kuchler, 1998). In this study, respondents will be provided with background information describing breast cancer and its treatment. Therapies will describe breast cancer treatment, and breast cancer treatment and cure for breast cancer recurrence. The breast cancer scenarios used in this study will describe a situation one-year after treatment; therefore, acute symptoms such as PCNV are not expected to confound utility values provided.

Acute versus chronic health states
Definitions for acute and chronic conditions used in this study were based on Torrance (1982, 1986), Sackett and Torrance (1978), Stedman’s Medical Dictionary (2000), and US National Center for Health Statistics (2000). Torrance (1986) defined temporary conditions as health states lasting for a specified period of time followed by good health – no reference was made to the intensity of disutility. Acute conditions are defined as referring a health effect that is brief and intense (Stedman’s Medical Dictionary, 2000), and less than three months in duration (NHIS, 1994). For the purposes of this study, an acute condition is defined as a severe, health effect of short duration – less than three months (i.e., PCNV ranging from one to five days with an average of three days). Since, PCNV lasts an average of three days and typically does not lead to death, the definition of an acute condition appears more appropriate than that of chronic. Thus, PCNV scenarios used in this study can be viewed as acute conditions occurring simultaneously with an underlying chronic health state, cancer.
Chronic health states describe long-term conditions. Torrance referred to such conditions as lasting for the rest of a person’s life. In other words, they are permanent conditions (Torrance, 1986). The US National Center for Health Statistics (1994) and Stedman’s Medical Dictionary (2000) refer to chronic conditions as those lasting a long time—greater than three months and typically implying a low intensity. For the purposes of this study, a chronic condition is defined as a health effect of long duration (i.e., greater than a three months) since an objective of this study is to compare QALY measurement for short-term and long-term health conditions. Chronic health states used in this study will depict the rest of the respondent’s life and vary in the number of years depending on prognosis of the condition (i.e., two and 10 years, and until 74 years of age).

QALYs: measurement issues

Theoretically QALY is a bivariate health related utility function consistent with welfare economic theory, i.e. \( U(Y*Q) \), where \( Y \) is measured in years, and \( Q \), the utility is typically measured on a scale with lower and upper anchors set to zero (death) and one (perfect health). Approaches commonly used to measure \( Q \) include the visual analogue scale (VAS), time trade off (TTO), and standard gamble (SG). However, these holistic utility weights can be difficult to measure. Furthermore, QALY measurement can vary depending on how \( Q \) is measured (Gold et al, 1989). For example, for the same health outcome scenario, SG utilities typically exceed VAS values, resulting in QALYs estimated using SG (QALY-SG) being greater than QALYs valued for VAS (QALY-
VAS). This has been attributed to SG incorporating risk in utility assessment while values acquired using VAS do not. Furthermore, since SG does incorporate risk into the decision making process it is regarded as the gold standard method for utility estimation (Gold et al, 1996), this study will use SG as utility measure.

QALYs: acute versus chronic conditions.

QALYs discriminate against interventions for acute conditions. For example, treatment of PCNV is short lived but not life-saving, however, PCNV can result in significant disutility and therefore a large change in utility score. Measurement of QALY for an acute non-life threatening ailment results in a large ΔQ (change in Q) and no effect on Y (i.e. Y is much less than one) so that ΔQALYs measured is miniscule. A numerical example is provided in Figure 1.1.
Example: ΔQALYs for prevention of PCNV is equal to QALYs for PCNV prevention (QALY_{No\,NV}) minus the QALYs for no prevention (Q_{NV}) where QALY = ΔQ x Y. In other words, ΔQ is multiplied by duration (Y) of prevented PCNV.

If, Q_{No\,NV}=0.79 and prevention of PCNV affects quality of life for 3 days (Y=3/365), and Q_{NV}=0.27\(^5\), and no prevention of PCNV affects quality of life for 3 days (Y=3/365), then,

\[
\Delta QALY = QALY_{No\,NV} - QALY_{NV} \\
= Δ [Q_{No\,NV} - Q_{NV}][Y] \\
= (0.79 - 0.27)(3\,\text{days}) \\
= (0.52)(3\,\text{days} \times 1\,\text{year}/365\,\text{years}) \\
= 0.004\,\text{QALYs (Grunberg et al, 1996)}.
\]

\(\text{Figure 1.1: Example of }\Delta\text{QALYs resulting from an intervention in an acute condition.}\)

\(^5\) In estimating QALYs with the lower and upper anchors set to death (zero) and perfect health (1.0), respectively, Q_{NV} is subtracted from Q_{No\,NV}, as opposed to the utility value of perfect health, because it cannot be assumed that prevention of one ailment, for example, PCNV, would cure any and all other underlying comorbidities experienced by the patient. PCNV implies that the patient is prescribed chemotherapy because she has cancer. Therefore, by definition, the patient must have at least one underlying co-morbidity (Fryback and Lawrence, 1997; O'Brien, 1997).
In contrast, treatment of a chronic illness such as breast cancer can impact Q and Y. Typically, treatment of chronic illnesses will produce a greater change of QALYs (Ganz, 1994). A numerical example is provided in Figure 1.2. In other words, treatment of an illness that affects both Q and Y would result in substantially more QALYs. The result of this idiosyncrasy of QALY measurement for treatment of temporary versus chronic ailments is that acute conditions will be discriminated against in terms of funding or prioritization by health care institutions (Pathak, 1995). In this dissertation, PCNV and breast cancer will be the acute and chronic conditions studied, respectively. These two conditions were selected because prevention of PCNV essentially affects Q only, breast cancer treatment predominantly affects Y (and a hypothetical breast cancer cure affecting Q and Y). Therefore, ΔQALYs reported for the two interventions are expected to be substantially different. The first and second research question addresses the effect of treating acute and chronic conditions in cancer when benefits are measured in terms of ΔQALYs.
Example: ΔQALYs for treatment of breast cancer, is equal to QALYs for breast cancer
treatment (QALY_{BrCA \_T}) minus the QALYs for no treatment (QALY_{BrCA}), where

\[ \text{QALY} = Q \times Y. \]

\[ Q_{\text{BrCA \_T}} = 0.85 \] and treatment results in life extension of 12 years (\( Y = 12 \))
\[ Q_{\text{BrCA}} = 0.56, \] and no treatment results in immediate death at the end of 2 years (\( Y = 2 \)),

then, \[ \Delta \text{QALY} = Q\text{ALY}_{\text{BrCA \_T}} - Q\text{ALY}_{\text{BrCA}} \]
\[ = (Q_{\text{BrCA \_T}} \times Y_{\text{BrCA \_T}}) - (Q_{\text{BrCA}} \times Y_{\text{BrCA}}) \]
\[ = (0.85 \times 12) - (0.56 \times 2) \]
\[ = 9.08 \text{ QALYs}, \ (\text{Miles et al, 1999}). \]

**Figure 1.2:** Example of ΔQALYs resulting from an intervention in a chronic condition.

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\[ ^4 \text{In estimating QALYs with the lower and upper anchors are set to death (zero) and perfect health (1.0),} \]
\[ \text{respectively. Similar to } Q_{\text{BrCA \_T}}, \text{the utility for } Q_{\text{BrCA}} \text{ is not assumed to be equal to perfect health utility} \]
\[ \text{for the following reasons. First, breast cancer treatment implies improvement in utility not cure. Second,} \]
\[ \text{even if treatment did result in cancer cure (} Q_{\text{BrCA \_T}}, \text{this would not result necessarily in perfect health since} \]
\[ \text{the patient may be suffering from other underlying comorbidities such as asthma or arthritis (Drummond} \]
\[ \text{1987; Fryback and Lawrence, 1997; O'Brien, 1997).} \]
Research Question 1: Does breast cancer treatment versus do nothing (i.e., $QALY_T - QALY_R$) result in more QALYs than PCNV standard preventative therapy versus do nothing (i.e. $QALY_{PrevNV} - QALY_{NV}$)?

Research Question 2: Does breast cancer cure versus treatment (i.e. $QALY_C - QALY_T$) result in more QALYs than PCNV optimal versus standard preventative therapy (i.e., $QALY_{NoNV} - QALY_{PrevNV}$)?

CV: measurement issues

CBA does not require adherence to the restrictive assumptions of QALY in order to capture utility (Bala et al, 1998). Utility theory is still applicable, however, vNM utility theory does not have to be followed. CBA is founded on welfare economics or Pareto optimality (Dasgupta and Pearce, 1972; Gafni, 1997). Theoretically, preferences ascertained using WTA or WTP should be equivalent. However, due to the endowment effect (whether an individual already possess' the good) and income effects (individual’s income status), WTA exceeds WTP (Mitchell and Carson, 1989). WTP is favored because individuals can relate WTP to everyday financial decisions. Given the inflated values resulting from WTA, WTP is recommended by Contingent Valuation Panel of National Oceanic Atmospheric Administration (NOAA, 1993). The CV “Blue Panel”

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1 Where subscripts “NV”, “PrevNV”, and “NoNV” represent QALY measures for presence of PCNV, standard preventative therapy for PCNV, and optimal preventative therapy for PCNV, respectively. Similarly, “R”, “T”, and “C” represent QALY measures for breast cancer (recurrence), life extension with breast cancer treatment and complete cure of breast cancer, respectively. Furthermore, as specified earlier, QALY-SG and QALY-VAS represent QALYs (i.e. $Q \times Y$), where Q is calculated either using the SG or VAS approach, and Y is measured in years.
Guidelines were proposed to assist in the judicial inquiry of damage assessment cases in an environmental setting (Arrow et al., 1993). They are used as a standard for CV study design including healthcare (Johannesson, Jonsson and Karlsson, 1996), although it is not known how applicable these guidelines are to other disciplines.

Due to the unique nature of health care, many individuals feel their access to health care is a right (Ginzberg, 1999; American Hospital Association, 1992; Queen’s Medical Center, 2000). As such, utilizing the “property rights rule” (Mitchell and Carson, 1989), WTA, not WTP would be the appropriate method to assess CV (Donaldson, Farr, Mapp et al., 1997). In addition, WTA is not susceptible to the income effect, therefore, WTA has been favored by some over WTP because it would not discriminate against poorer individuals. As a result, there is controversy regarding choice of CV methodology (Mitchell and Carson, 1989; Donaldson, Farr, Mapp et al., 1997). The validity of WTA has been questioned in a user based approach because a patient could conceivably ask for infinite compensation for certain loss of life which would make CBA void (Bala et al., 1997; Jones-Lee, 1976). Since a user-based approach will be adopted in this study to allow for elicitation of QALY measures (Bala et al., 1999), WTP will be adopted as the CV measure, consistent with NOAA recommendations. WTA technique will not be addressed further in this study.

As the name CV implies, respondents are asked to value goods (health care interventions) in a contingent or hypothetical market using survey methods. Survey methods used to
measure CV can be divided into open-ended and closed ended (Johannesson, 1996). In open-ended questions the researcher tries to measure the respondents maximum WTP and in closed ended (binary questions) respondents either reject or accept a bid. The latter is sometimes referred to as the referendum approach.

Open-ended questions include the open-ended format, the bidding game and the payment card approach (Johannesson, Johansson and Jonsson, 1992). The simplest elicitation method is to directly ask respondents their maximum WTP (open-ended format), however, respondents find it difficult to answer WTP questions about nonmarket goods. This particular method is associated with a poor response rate and lacks reliability (Mitchell and Carson, 1989). As a result this method is not recommended by the Blue Panel (Arrow et al, 1993).

To aid respondents in providing values for nonmarket goods, the bidding game was introduced by Randall et al (1974). This method resembles an auction – a real life situation, and is therefore thought to be familiar to respondents (Mitchell and Carson, 1989). The bidding game consists of a series of iterative dichotomous choice questions. The bid is increased or decreased depending upon the previous response until the maximum WTP is reached. The main problem with the bidding game approach is that responses can be influenced by the first bid, for example, a higher starting bid can result in higher WTP values. This is known as starting bid bias (Mitchell and Carson, 1989).
Mitchell and Carson developed the payment card approach, an alternative to the bidding game, to counter starting point bias. The payment card approach enables respondents to select a bid from many presented choices, but similar to the bidding game given choices can influence respondent valuations — range bias (Mitchell and Carson, 1989). The effect of range bias can be measured by the inclusion of more than one bidding algorithm (O’Brien, Goeree and Gafni et al, 1998).

An alternative to the open-ended questions are the closed-ended or binary (yes/no) questions, also known as the referendum approach. By varying the bids across a number of respondents it is possible to calculate the mean WTP. The binary method was favored because the referenda are reflective of real life situations. In other words, based on a market price, either the respondent chooses to purchase or not purchase the good. The referendum approach is void of starting point bias, however the disadvantage is that a greater sample size is required in studies since each response provides much less information than open-ended questions (Johannesson, 1996).

The NOAA panel report (1993) supports the use of the binary or referendum approach in addition to other methods that include dichotomous choice models such as the bidding game, as long as bias is addressed. Furthermore, although mail and telephone interviews have been used to acquire CV with some success, the Panel recommends the use of face-to-face interviews to increase the likelihood of reliable responses (Arrow et al, 1993). In this study, the bidding game method will be used due to its efficiency and support by the
Blue Panel in a face-to-face interview format. Furthermore, two bidding game algorithms will be used to quantify any starting point bias.

**WTP: acute versus chronic conditions.**

WTP, unlike QALY, will not minimize the disutility of an ailment (acute or chronic) based on its duration (Y). Instead disutility can be assessed in terms of the individual’s maximum WTP that must be paid for intervention access to maintain at current (before) level of utility or minimum WTA that must be paid to loser to maintain current (before) level of utility (O’Brien and Gafni, 1996). Therefore the CV approach enables measurement of respondents preferences allowing for disutility of an ailment to be expressed without discriminating against temporary conditions. This limitation of QALYs to value morbidity in acute illnesses has been explicated in the literature only recently as noted in this excerpt: "Even with its limitations, the WTP methodology may have a better chance of leading us to optimal treatment decisions than the QALY methodology for acute self-limiting conditions, where the diminished quality of life is known to last for only a short period of time." (Bala and Zarkin 1999, p13). Prior to this publication, this issue had only been alluded to in the literature (Bala et al, 1998; Gafni, 1994; Pathak, 1995). The remainder of this section will present examples of CV sensitivity to Q alluded to in the literature, by describing examples of treatment for first, acute conditions - affect Q only, second, chronic conditions - affect Y only, and third, chronic conditions - affect Q and Y.
First, CV studies for acute conditions include WTP for treatment of angina pectoris attacks (acute episodes of disutility). By definition, these patients must have underlying cardiovascular disease. The study used a compensating variation, ex-post user based design (Mitchell and Carson, 1989; Diener, O'Brien and Gafni, 1998). Authors reported a mean WTP of US$345 for 50% reduction in angina attacks over three months (or a mean of $115 per month) (Kartman, Andersson and Johannesson, 1996). Similarly, another study evaluating WTP to avoid angina episodes, using equivalent variation, ex-ante-user based perspective, estimated a mean WTP of US$218 to avoid 8 angina episodes (Chestnut et al, 1996). The transient nature of acute episodes are analogous to the prevention of PCNV examined in this study (i.e., prevention of the pathognomonic nausea and vomiting associated with chemotherapy).

Second, studies evaluating WTP for antihypertensive care and hyperlipidemia, describe treatments for chronic illnesses that affect Y, not Q. Antihypertensive study reported mean WTP of US$93 per month (Ramsey, Sullivan, Psaty and Patrick, 1997). The lipid lowering study reported median WTP of less than US$50 per month. The CV estimates for changes in Y were more modest, than aforementioned for changes in Q. Increasing Y, not Q for a chronic condition will be evaluated in this study by assessing respondent preferences for breast cancer treatment that prolongs survival.

Furthermore, an additional scenario will be added to test the scope effect (Arrow et al, 1993). The scope effect is a validity check and states that the increase in WTP should be
associated with increased size of treatment effect. The scope effect for chronic conditions in this study will be assessed by comparing hypothetical cure (increase in Y and Q) over no treatment, versus treatment (increases Y alone) over do nothing. It is hypothesized that WTP will be greater for the hypothetical cure of breast cancer. (Research questions are not presented in this section since this test is part of the construct validity test).

Third, a WTP study evaluating treatment for a chronic illness that affects both Q and Y include WTP for hormone replacement therapy (HRT). HRT study used equivalent variation, ex-post user based approach and reported WTP of US$5,793 per year (or a mean of US$482 per month). Mean change in utility values using TTO were reported as 0.29 (Zethraeus, 1998). These chronic conditions are analogous to breast cancer cure scenario adopted in this study.

In summary, comparing the WTP values reported for acute versus chronic conditions, there appears to be a trend of higher WTP for acute episodes of significant disutility, while diseases that are asymptomatic (affect Y, Q remains unchanged) such as hyperlipidemia and hypertension warrant modest WTP values. In contrast, treatments of illnesses that affect Q and Y result in high WTP values. No prior WTP studies to the best of the researchers' knowledge have been designed to investigate the association between interventions that affect Y versus Q and Y. It is hypothesized that mean CV values will be substantial for both PCNV and breast cancer treatment, with mean CV for breast
cancer treatment being equal to or greater than mean CV for PCNV. CV is expected to be more sensitive to Q than Y. CV is expected to be more sensitive to treatments that affect Q than ΔQALYs. Therefore, the difference between CV values for acute and chronic condition is expected to be less pronounced than ΔQALY estimates for the same conditions (research question 1 and 2), assuming that QALY measurement is affected significantly by Y. This leads to the third and fourth research questions:

Research question 3: Does WTP for breast cancer treatment versus do nothing (i.e., WTP_{T-R}) result in greater WTP than PCNV standard preventative therapy versus do nothing (i.e., WTP_{PrevNV-NV})?

Research question 4: Does WTP for breast cancer cure versus treatment (i.e. WTP_{C-T}) result in greater WTP than PCNV optimal versus standard preventative therapy (i.e., WTP_{NoNV-PrevNV})?

The anticipated limitation of QALY sensitivity to Y versus WTP flexibility to capture Q independent of Y, leads to the fifth research question. It is hypothesized that incremental ΔQALYs for breast cancer cure (i.e. QALY_{C} − QALY_{T}) will result in more QALYs than incremental ΔQALYs for treatment (i.e., QALY_{T} − QALY_{R}), because the cure increases Y and Q, while treatment only increases Y. Furthermore, since incremental PCNV optimal preventative therapy (i.e., QALY_{NoNV} − QALY_{PrevNV}) and incremental PCNV preventative therapy (i.e., QALY_{PrevNV} − QALY_{NV}) both increase Q only, there is no
expectation for incremental optimal prevention versus standard preventative therapy of PCNV to be different. The fifth research question is:

Research Question 5: To what extent is (1) incremental $\Delta$QALYs breast cancer cure (i.e. $[QALY_C - QALY_T]$) greater than incremental $\Delta$QALYs breast cancer treatment (i.e., $[QALY_T - QALY_R]$) and (2) incremental $\Delta$QALYs for PCNV cure (i.e. $[QALY_{NCNV} - QALY_{PrevNV}]$) different to incremental $\Delta$QALYs PCNV treatment (i.e., $[QALY_{PrecNV} - QALY_{NV}]$)?

Association between WTP and QALY.

Previous studies linking CV with utilities, QALYs, or HRQOL instruments have been reported in the literature (Thompson, 1986; Blumenschein and Johannesson, 1998; Stavem, 1999; Reed-Johnson, Fries and Banzhaf 1997; Olsen and Donaldson, 1998; Bala et al, 1998; O’Brien and Viramontes 1994; Flowers 1997). Thompson (1986) acquired WTP and utility values for a hypothetical cure for rheumatoid arthritis, recognizing the impact treatment has on Q but not Y. No attempt was made to measure the association between the two types of health preference values. However, the author noted respondents tended to consider the impact of therapy on improving functionality when answering WTP questions, while, reduction in pain was more important when responding to SG questions (Thompson, 1986). Studies varied in the level of uncertainty associated with contracting the illness and/or success of required therapy for CV and health related
utilities measured (Stavem, 1999; Olsen and Donaldson, 1998; Flowers 1997; Reed-Johnson, Fries and Banzhaf 1997), and remainder reported to compare preferences for CV and utilities under the same conditions of uncertainty (Blumenschein and Johannesson, 1998; Bala et al, 1998; O'Brien and Viramontes 1994). Blumenschein and Johannesson, (1998) did not predict CV from QALYs, but instead correlated Q weights or scores on HRQOL instruments (SF-36 and Asthma Type) with WTP. However, since WTP evaluates different treatments using a health-time profile, QALYs not Q weights should be used to account for health-time trade-off (Bala et al 1998). Bala et al (1998) correlated WTP with QALY, as opposed to Q, but made no attempt to predict one preference measure from another.

Reed-Johnson, Fries and Banzaf (1997), used regression analysis to predict WTP from the Quality of Well Being Scale scores (QWB, HRQOL instrument that provides utility scores), however, patients were not used to acquire utilities for QWB scores, but a panel of experts were used to provide values they regarded as appropriate. Then WTP values were acquired from a meta-analysis using varying levels of uncertainty. It has long been recognized that different uncertainty levels are expected to provide different monetary values since most individuals tend to be risk averse, i.e. increased uncertainty is associated with increased WTP. Furthermore, the population who stands to gain from the program as opposed to “expert panels” or health care professionals should be used to acquire utility values.
If CUA and CBA are based on the same theoretical foundations, they should provide decision makers with the same resource allocation recommendations (Butler, 1992). The primary research question of this study is to investigate the relationship between the two preference measures: QALYs and CV. The final and primary research question of this study is to attempt to derive a model to associate QALYs with CV monetary preference measure. Thus, the sixth research question is:

Research question 6: What proportion of variance of WTP is accounted for by $\Delta$QALYs resulting from (1) breast cancer treatment versus do nothing (i.e., $QALY_T - QALY_N$), (2) PCNV standard preventative therapy versus do nothing (i.e. $QALY_{Prev_NV} - QALY_{NV}$), (3) breast cancer cure versus treatment (i.e. $QALY_{C} - QALY_T$) and (4) PCNV optimal preventative therapy versus standard preventative therapy (i.e., $QALY_{NeNV} - QALY_{Prev_NV}$), accounting for age, economic status, and health status?

ASSUMPTIONS

For the purposes of this study it is assumed that both CUA and CBA are founded in welfare economics. Standard assumptions in economic evaluations in CBA were adopted, for example, that women maximize their expected present value utility, consume goods, and value their own health (Zethraeus, 1998). Additionally, it is also assumed that the marginal utility of income was equal for individuals affected by the program, therefore an additional dollar of benefit had the same social significance to whomever it
accrued (Butler, 1992). In addition, it will be assumed that respondents answered interviewer questions honestly (strategic bias was not a factor) (Reardon, Pathak, 1989) and understood descriptions of scenarios provided. The latter will be supported by feedback from the pilot study in addition to validity checks testing for scope effects as recommended by NOAA (i.e. the blue ribbon panel). Reliability and validity issues will be discussed further in chapter 3.

It also follows that conventions of CUA assumptions were also adopted (Gold et al, 1996; Butler, 1992). These include that the difference in the worst and best health outcome was equal for all individuals, in other words utilities were weighted equally (Butler, 1992). Justification for assumptions adopted will be further elaborated in chapter 3.

LIMITATIONS

Full-time, female graduate students and women aged 22 to 50 with affiliations to The Ohio State University will be interviewed, therefore, results cannot be generalized to other female populations or men. The study utilizes CV method and utility measures to assess benefits for hypothetical scenarios in a relatively healthy population, as a result, all limitations and assumptions applicable to these methods also apply to this study. Potential sources of bias include the following:

- hypothetical bias – respondent perceives scenarios as unrealistic.
- information bias – response is influenced by how information is presented.
• interviewer bias – where respondent answers differ from her true answers because she is aiming to please the interviewer.

• nonresponse bias – respondents' answers to valuation questions are different to those of nonrespondents (Mitchell and Carson, 1989).

ABBREVIATIONS

Listed below are the abbreviations used in this study. Terms in italics are defined in “Definition of Terms” section that follows.

CBA: cost benefit analysis.

CEA: cost effectiveness analysis.

CMA: cost minimization analysis.

CUA: cost utility analysis.

CV: contingent valuation.

HRQOL: health related quality of life

NOAA: National Oceanic Atmospheric Administration.

PCNV: post chemotherapy nausea and vomiting.

Q: QALY weight or utility (measured on a zero to one scale).

QALY: quality adjusted life years.


QALY_R: QALYS for do nothing for breast cancer recurrence.

[QALY_T – QALY_R]: ΔQALYS for breast cancer treatment versus do nothing.
QALY\textsubscript{C}: QALYS for breast cure.

\[ \text{[QALY}_\text{C} - \text{QALY}_\text{R}] : \Delta \text{QALYS for breast cancer cure versus do nothing.} \]

QALY\textsubscript{PrevNV}: QALYS for post chemotherapy nausea and vomiting standard preventative therapy.

QALY\textsubscript{NV}: QALYS for post chemotherapy nausea and vomiting (do nothing).

QALY\textsubscript{NonNV}: QALYS for optimal post chemotherapy nausea and vomiting prevention.

\[ \text{[QALY}_\text{PrevNV} - \text{QALY}_\text{NV}] : \text{incremental } \Delta \text{QALYS for standard preventative PCNV therapy versus do nothing.} \]

\[ \text{[QALY}_\text{NonNV} - \text{QALY}_\text{PrevNV}] : \text{incremental } \Delta \text{QALYS for optimal preventative PCNV therapy versus standard preventative therapy.} \]

\[ \text{[QALY}_\text{NonNV} - \text{QALY}_\text{NV}] : \text{incremental } \Delta \text{QALYS for optimal preventative PCNV therapy versus do nothing.} \]

SG: Standard Gamble.

TTO: Time Trade Off method.

VAS: Visual Analogue Scale.

vNM: von Neumann Morgenstern.

WTA: willingness to accept.

WTP: willingness to pay.

\[ \text{WTP}_T - R: \text{Incremental WTP for breast cancer treatment versus do nothing.} \]

\[ \text{WTP}_C - R: \text{WTP for breast cancer cure versus do nothing.} \]

\[ \text{WTP}_C - T: \text{Incremental WTP for breast cancer cure versus treatment.} \]
\( WTP_{\text{PrevNV} - NV} \): incremental WTP for standard preventative PCNV therapy versus do nothing.

\( WTP_{\text{No NV} - \text{PrevNV}} \): incremental WTP for optimal versus standard preventative PCNV therapy.

\( WTP_{\text{No NV} - \text{NV}} \): WTP for optimal preventative PCNV therapy versus do nothing.

Y: time measured in years.

\( \Delta \): change.
DEFINITION OF TERMS

Certainty: a health outcome is known to happen. The occurrence of the outcome is associated with a probability of 0 or 1.0, i.e. an individual is 100 percent confident of the outcome, either it will definitely happen or not.

Cost Benefit Analysis (CBA): Both costs and outcomes are measured in monetary units.

Cost-Effectiveness Analysis (CEA): Broad definition, ratio of costs to health effects: additional life years or QALYs. This broad definition assumes that CUA is a subset of CEA. For the purposes of this study, to avoid confusion the CUA and CEA shall not be used interchangeably. CEA shall refer to analyses that measure benefits in nonmonetary physical units of effectiveness.

Cost Utility Analysis (CUA): Ratio of costs, measured in monetary units to benefits measured in QALYs.

Contingent Valuation (CV): Survey based approach to acquire respondent utility values for a non-market good or service contingent on a hypothetical market to purchase the good (Reardon and Pathak, 1989). In this study the term CV and WTP will be used interchangeably, however, it should be recognized that WTP can also be used to value goods in existing markets.
Ex-ante: study refers to a study in which the individual does not know with certainty whether he or she will require treatment for a particular disease, although he or she may know the risk (probability) of requiring such a treatment. Ex-ante studies can be further decomposed to ex-ante insurance based and ex-ante user based. Ex-ante insurance based refers to studies where the respondents are assumed to be at risk of contracting the disease requiring intervention. Uncertainty is associated with requiring treatment in the future in addition to benefits or side effects of treatment. Ex-ante user based refers to studies where respondents already have the disease requiring intervention, but have not as yet received treatment. In this case, uncertainty is associated with benefits or side effects of treatment (Diener, O’Brien, and Gafni, 1998).

Existence value: also known as “passive use” or “non-use” value. Term derived from environmental economics, refers to the inherent value of an health intervention even if the individual does not intend to use the facility. Satisfaction is derived from knowing that it exists or that it is available to others (NOAA, 1993).

Ex-post: This study will use the definition of ex-post user based perspective. In this scenario, the respondent is asked to assume that he or she has the disease and requires treatment, i.e., is at the point of consuming some unit of the program being evaluated. Uncertainty is associated with benefits or side effects of treatment. (Diener, O’Brien and Gafni (1998).
Health Related Quality of Life (HRQOL): Given that there is no universally accepted definition of HRQOL, for the purposes of this study, HQOL shall be defined as “a comparative judgment based on a point in time assessment of an individual's present health state relative to that individual's reference health state.” HRQOL is often used interchangeably with quality of life (QOL), a broader term which encompasses many aspects of life outside the scope of health, for example, cultural, economic, political and environmental issues affect QOL, not necessarily HRQOL (Pathak, 1995).

Ping-Pong Method: SG and TTO values can be measured using top-down, bottom-up, or ping-pong method. The latter method is the most commonly used of the three. This method requires respondents to be presented with probabilities that alternate between high and low values until they reach an indifference point between the two alternatives presented, for example, 100%, 0%, 90%, 10%, 80%, 20%...).

Process utility: distinct from the utility of health outcome, refers to the ‘reassurance value’ arising from knowledge of the availability of a test or procedure.

Protest bid: respondent refusal to answer a WTP question because he or she morally objects to being asked their WTP for a health care intervention (Ryan et al, 1997).
**Standard Gamble:** gold standard for measuring utility, QALY weights under risk.

Respondents are given a choice between a health state \( h_i \) with 100% certainty for \( X \) years or a risky treatment. The risky treatment is a gamble between respondent best and worst health states with a probability of \( p \) and \( 1-p \), respectively. Typically most desirable and least desirable health states are predefined as perfect health and death. The treatment if successful will provide the respondent with perfect health (full health) for \( X \) years, but if therapy fails the respondent will die immediately. The probability \( (p) \) is varied until the respondent is indifferent between the gamble and \( h_i \). QALY weight for \( h_i \) is the probability of the indifference point (i.e., \( U(h_i)=p \)) (Blumenschein and Johannesson, 1996).

**Top-down Titration Method:** SG and TTO values can be measured using top-down, bottom-up, or ping-pong method. In the top-down titration method respondents are presented with probabilities starting from 100% in decreasing increments until the respondent is indifferent between the certain and gamble alternatives, for example, 100%, 95%, 90%, 85%, ...). This method will be adopted in this study to acquire SG utilities due to its greater precision (smaller standard deviation), speed and ease of use, in comparison to the ping-pong approach.

**Quality Adjusted Life Years (QALYs):** is a health index measure that incorporates both quality of life \( (Q) \) and quantity of life \( (Y) \) in order to provide a common set of units to describe health effects. The health index is a weighting scheme where \( Q \) or utility is
measured on a scale from worst possible health to perfect health, which are usually predefined as zero and one, respectively. And Q is weighted by the duration of life, Y, typically measured in years (Pathak, 1995).

*Utility:* does not refer to usefulness of the individual, intervention or health state. Utility refers to the desirability or preference of the health state. Utility incorporates two concepts, preference and value. Preference indicates a scenario where good A is favored to good B. Preference indicates direction of desirability of good (i.e., A is preferred over B). Value indicates the intensity or magnitude of that preference. Utility captures both of these components (Donaldson, 1999).

*Use values:* Experienced by individuals that actively use the treatment or intervention (Arrow et al., 1993).

*Uncertainty:* it is not known whether the health outcome will happen or not. The occurrence of the health outcome is associated with a probability.

*User based (scenarios):* assumes respondents are at the point of consumption, actually require intervention for ailment to be tested. In this study respondents will be presented hypothetical scenarios assuming that they will be inflicted with PCNV or breast cancer.
*Visual Analogue Scale:* also known as the rating scale, provides values as opposed to utilities for QALY weight measurement. One end of scale is anchored with the most desirable health state (100) and the other end of the scale is anchored with the least desirable health state (0). As for the SG method the most and least desirable health states are usually predefined as perfect health and death. If respondent marks an intermediate health state \( h_i \) as 70 points, then the QALY weight is estimated as \( 70/100 \) or 0.7 (Blumenschein and Johannesson, 1996).

*Willingness to Accept (WTA):* assuming that a program which the respondent was benefiting from was just removed, WTA is the minimum amount that must be paid to loser to maintain at the utility level existing prior to removal of program. This definition is consistent with the compensating variation definition for WTA for removal of a program resulting in loss of utility (i.e., loser).

*Willingness to Pay (WTP)* is the amount of money an agent would be willing to give up to obtain a change and still be as well off as with his previous entitlement. (Mitchell and Carson, 1989). In economics this is also commonly known as contingent valuation” (O’Brien and Viramontes, 1994). For scenarios presented in the WTP scenarios, the following definition will be used: assuming the addition of new program which the respondent would benefit from, WTP is the maximum amount that must be taken from beneficiary of program (i.e., gainer) to maintain at current (before) utility level. This
definition is consistent with the compensating variation definition for WTP for addition of a program beneficial to respondent.
The purpose of this chapter is to provide a foundation for the research questions listed in the introductory chapter and to provide a basis for the study methods in following chapter. Since the premise of this study is that CUA and CBA are based on the same theoretical foundations, welfare economics, this chapter will first review the theoretical foundations of the two metrics – especially as they apply to QALYs and CV. Second, measurement issues associated with QALYs and CV methods in CUA and CBA are discussed next. This review is followed by a discussion of previous studies attempting to determine the association between the two methods of preference assessment. The chapter concludes with how the literature review impacts study design, objectives and finally why this investigation is important.
Welfare foundations of CUA

Historically, there has been no single theoretical foundation attributed for CUA, however, foundation of CUA has been described as an amalgamation of decision analysis and operations research (Gold et al, 1996; Brouwer and Koopmanschap, 2000; Bleichrodt and Quiggin, 1999; Johannesson, 1995). If the objective is to describe how individuals make decisions decision analysis is referred to as descriptive, and if the objective is to describe how individuals should make decisions it is normative. CUA is regarded as a normative tool (Gold et al, 1996). However CUA advocates do not claim that it adequately describes behavior of decision makers. If welfare economics is assumed to be the underlying theory of CUA, then it would follow that the method used to acquire Q weights should be consistent with the requirements of the welfarist approach – theory of utility.

The neoclassic conceptual framework, classic welfare economics, also known as welfarist approach, has been adopted as the theoretical framework by CUA advocates (Gold, 1996, Gafni, 1997; Birch and Gafni, 1992), and is still regarded as the dominant theory in the economic discipline (Gafni, 1997). The alternative view put forward by Culyer (1991) is referred to as the extra-welfarist approach (Gold, et al, 1996; Gafni 1997; Brouwer, Koopmanschap, 2000). Extra-welfarist approach rejects neoclassical foundations of economics and replaces “utility” with “health” as the primary outcome of evaluation. However, it is unclear what this means in terms of comparing healthcare with other goods and services which are currently valued in economics as utility. In other words, it is not
yet known how extra-welfarist theory fits in alongside other theories in economics (Gafni, 1997).

Welfare economic theory is concerned with the ability to measure welfare, desirability, preference or the individual’s utility of an intervention or program. Four central tenants have been described in welfare economics: (1) utility maximization, individuals can choose rationally among options and aim to maximize their welfare; (2) consumer sovereignty, consumers are the best judges of their own welfare. In health care, this implies that consumer preferences should be acquired from patients or society (depending on the perspective taken), and therefore rejecting the paternalistic approach – benefits measured must accurately reflect individual preferences even if they do not coincide with what the decision maker thinks they should be; (3) consequentialism, only outcomes matter; and (4) welfarism, the value of a program should be based solely on the utility levels obtained for that program (Gafni, 1992; Gafni 1997).

**Expected Utility Theory**

Welfare economics does not require outcomes or benefits to be measured in monetary units; therefore use of QALYs as an outcome measure is not inconsistent with welfare economic theory (Gafni, 1997; Pauly 1995; Birch and Donaldson, 1987). Furthermore, to be consistent with welfare economics, QALY measurement needs to be based on utility theory. Utility theory is actually a family of theories. Expected utility theory (EUT) is the normative standard adopted in health economics for rational decision making under
conditions of uncertainty. EUT, first suggested by Plisker et al (1980) in health care as the theoretical foundation for CUA based on the set of axioms proposed by von Neumann Morgenstern (vNM) (Torrance and Feeny, 1989; Gafni and Birch 1995; Revicki and Kaplan, 1993). EUT is not descriptive, in other words it does not describe how individuals actually make decisions nor does it claim to be (Torrance and Feeny, 1998), however, a theory based on normative principles can be rationalized in healthcare. For example, unhealthy behaviors such as smoking and sedentary lifestyles are not consistent with individuals satisfied with their health status (Gafni and Birch, 1995).

von Neumann Morgenstern Axioms

Rational decision-making refers to behavior consistent with vNM's axioms. The objective of following the axioms is to describe how respondents should make decisions under risk and also to provide a cardinal measure of that preference (Pathak, 1995).

VNM's axiomatization of utility theory consists of three axioms: (1) complete ordering and transitivity, (2) continuity and (3) substitutability, also known as independence (Gafni and Birch 1995; Pathak, 1995; Revicki and Kaplan, 1993). The first assumption assumes that an individual has preferences. For example health outcome A is preferred to health outcome B (A > B) and health outcome B is preferred to health outcome (B > A), then A should be preferred over outcome B. If not the assumption of transitivity has been violated. The second vNM axiom, continuity means that no alternative can be infinitely better than another alternative. For example if a respondent had a choice between health outcome B and a gamble between outcomes A and C there would be
some probability $p$ where the individual would be indifferent between the B and the lottery.

\[ B \sim_{\frac{p}{1-p}} A \]

Third assumption, substitutability assumes that if a decision maker is indifferent between outcomes A and A' (i.e., $A \sim A'$), then the following should also be true.

\[ A \sim_{\frac{p}{1-p}} A' \]

Rational decision-making means that the theory is normative in that it dictates how a person should make decisions under conditions of uncertainty where the outcome is associated with a probability of occurrence. Alternatively, decisions can be measured under certainty – the outcome is deterministic or is assured to happen. However, preference measurement is not necessarily the same when measured under these two conditions. In healthcare, outcomes occur under conditions of uncertainty, therefore, to
be consistent with utility theory and the welfarist approach, individual preferences should be measured under these conditions (Gafni and Birch; 1995).

Assumptions beyond von Neumann Morgenstern Axioms

QALY is a bivariate health related utility function under stringent assumptions beyond those prescribed by vNM's expected utility theory. Pliskin et al (1980) has identified three conditions required for QALYs to be a valid, cardinal measure utility function for health profiles over time. These are (1) constant proportional trade off (2) utility independence as well as mutual utility independence of quality and quantity of health and (3) risk neutrality with respect to time. Only under these conditions is \( U(Y*Q) = Y*U(Q) \).

The first assumption, constant proportional trade off means that quality and quantity of life are traded irrespective of the number of years spent at that state. For example, if a respondent is indifferent between 24 years of perfect health and 32 years of life with migraine then the same respondent should be indifferent between 15 years of perfect health and 20 years of life (i.e., 24/32=15/20=3/4).

The second assumption means that quantity and quality of life should be considered independent of each other. For example, if an individual is indifferent between 17 years of mild pain and a gamble of 24 years of mild pain (probability equal to \( p \)) and 6 years of mild pain (probability equal to 1-\( p \)), then the same individual should also be indifferent
between the two alternatives if the health outcome, mild pain, is substituted for severe pain.

The third assumption of risk neutrality with respect to time holds when the expected value of a gamble is equal to the certainty equivalence value. For example, should be indifferent between 7 years of healthy life and a 50:50 gamble between immediate pain free death versus 14 years of healthy life (i.e., QALY gained = U(death)Y(death) + U(healthy life)Y(healthy life) = (0)(0)+(0.5)(14)=7 QALYs).
A formal description of CUA facilitates comparisons to CBA and its association in welfare economics. CUA usually compares new technology (n) with an already established one (e). The usual CUA decision rule is to proceed with the new intervention if the ratio of added benefit is worth the additional cost, where the added benefit is measured in QALYs provided and costs are assessed in monetary units. If QALYs (utility) provided and cost incurred by the new and established interventions are $U_n$ and $U_e$, and $C_n$ and $C_e$, respectively, this can be presented by equation 2.1a. In other words, the intervention should be adopted if the incremental cost utility ratio does not exceed a specified cutoff value, $g$ (Equation 2.1b), or the specified budget has not been exhausted (Phelps and Mushlin, 1991; Johannesson, 1995).

\[
\frac{U_n - U_e}{C_n - C_e} \geq g \quad \text{Equation 2.1a}
\]

\[
\frac{C_n - C_e}{U_n - U_e} \leq g \quad \text{Equation 2.1b}
\]

The ratio $g$ represents the Cost-QALY ratio of the least desirable intervention currently undertaken (i.e., the highest). Equation 2.1b states that any ratio less than $g$ would be regarded as preferable and represents the maximum permissible cutoff level of cost per QALY (Phelps and Muslin, 1991). Therefore, to optimize resource allocation in health care requires solving for $g$. 
CUA is based on the principle of QALY maximization given a budget constraint. The most common approach to solve the abovementioned equation is to equate the health care budget constraint to $g$. However, in the US, no single health care budget can be identified. In addition to the problem of which budget to adopt, budgets are typically formulated on an annual basis, therefore future health care costs would be ignored (Johannesson, 1995). But, assuming that a particular health care budget could be agreed upon, then solving for $g$ using this method would imply a WTP or monetary worth per QALY.

Implicit WTP per QALY, or acceptable $g$ threshold can also be justified by comparing new technology cost utility ratio to its current competitor, other commonly used health care interventions (league tables), and expert opinion (Garber and Phelps, 1997; Johannesson, 1995; Gold et al, 1996). First, comparisons to current practice assume that current practices are efficient. CUA is not designed to test this assumption. CUA requires a comparison to another intervention to be meaningful. This is more readily explained by equation 2.2a rearranged to give Equation 2.2b. Equation 2.2b states that if the net benefits of the new intervention ($U_n - C_{ng}$) exceed those of the established intervention ($U_e - C_{eg}$) then the new technology should be implemented. $C_{ng}$ represents the opportunity cost of the new intervention — the forgone benefits if the resources were used elsewhere instead of $n$. 

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Second, league tables and expert opinion provide little guidance to finding the optimal cost utility ratio given broad range of g ratios listed from various studies. Typically, g ratios at the higher end are regarded as inefficient and interventions in the domain of $50,000 per additional QALY are regarded as desirable to implement, however, the foundation of this criterion is readily explained by its arbitrary nature, being a round number less than most of the others, than on any well formulated justification.

Unlike CBA, CUA cannot stand-alone. In other words no net benefit can be computed because benefits (QALYs) and costs (monetary units) are computed using different metrics (Equations 3a, 3b and 3c).

\[
\begin{align*}
\text{Incremental QALYs} & \geq g & \text{Equation 2.3a} \\
\text{Incremental Cost} & \\
\text{Incremental QALYs} & \geq g(\text{Incremental Cost}) & \text{Equation 2.3b} \\
\text{Incremental QALYs} - g(\text{Incremental Cost}) & \geq 0 & \text{Equation 2.3c} \\
\text{Net Incremental QALYs} & \geq 0 & \text{Equation 2.3d}
\end{align*}
\]
For this reason CUA has been referred to as an abbreviated form of CBA (Mishan, 1988; Kenkel, 1997). CUA and CBA have also been referred to as different only in terms of their reporting styles of economic analysis (Johannesson, 1995, Garber and Phelps, 1991).

**QALY Measurement**

Weinstein and Stason first operationalized QALYs in 1977. QALY is an index designed to integrate an individual’s health changes in terms of both quantity of life (Y, time measured in years) and quality of life (Q, quality weight for the health state, typically measured on a scale from 0-worst possible health to 1.0-best possible health). For example, if the kidney transplant provided five years of added life and the patient rated their well being (utility) for the transplant as 0.7 out of 1.0, then QALYs = YxQ = 5 years x 0.7 =3.5. While if the dialysis also provided the same number of additional life years but at a lower level of well being, Q= 0.4, then QALYs=5 years x0.4=2.0. Although both treatments provide the same extension of life years, the patient should prefer the transplant since it would provide 1.5 additional QALYs over the dialysis. As can be seen, this outcome measurement assumes that maximization of QALYs is desirable.

How best to measure outcomes in CUA, has been an active area of debate and research (Gold et al, 1998). There have been two main approaches to measure quality weights or denominator for use in CUA: the utility based approach (holistic approach or decision
theory based approach) and the psychometric based approach (decomposed or multi-attribute approach) (Revicki and Kaplan, 1993; Pathak, 1998; Pierson and Pathak, 1998).

Utilities are cardinal measures of an individual’s preference or desirability for a health state under conditions of uncertainty. Holistic approaches used to measure quality weight (Q) in the health care literature include visual analogue scale (VAS), time trade off (TTO), magnitude estimation, categorical estimation, person trade-off and standard gamble (SG). The three holistic approaches most commonly used, VAS, TTO, and SG (Drummond, 1996; Gold et al 1996; Torrance 1982) shall be expanded upon in more detail. Scales are standardized such that perfect health is typically anchored at 1.0 and immediate death is assumed to be the least preferred health state and is anchored at zero. This standardization results in all individuals being equally presented in the health domain. Utility for full health is set equal for all individuals) (Pathak, 1995).

VAS requires the individual to locate the health state (h_i) of interest on a line calibrated from 0 (immediate death) to 100 (full health). To achieve an interval scale, respondents are asked to place the health states on the line such that the distance between the placements reflects the difference between the disease states. The scale is then normalized by dividing h_i by 100 (i.e. Q is equal to h_i/100) (Gold et al, 1996). Although, the VAS lacks a theoretical framework (preferences are measures under conditions of certainty), it is the most commonly used technique for measuring health preferences,
which is attributed mostly to its ease of use (Froberg and Kane, 1989b). Furthermore, VAS has been used in assessing both acute and chronic disease states (Froberg and Kane 1989b).

SG is the classical method for measuring cardinal utilities and is based directly on von Neumann Morgenstern EUT (Drummond text). SG technique (lottery-based) compares a gamble of perfect health of $Y$ years with immediate death to a certain outcome of $h_i$ of $Y$ years. The probability ($p$) is set to full health and $(1-p)$ is set to immediate death. The value for $p$ is varied until the individual is indifferent between the two alternatives. The indifference $p$ value is the assigned $Q$ for $h_i$ (Pathak, 1995). The advantage of the SG method is that it is based on EUT. The disadvantage is that it may be difficult to use. Respondents have difficulties understanding probabilities and the hypothetical scenarios. Furthermore, the scenarios described are not realistic – choices between chronic illness for $Y$ years versus a gamble of immediate death or perfect health rarely occurs, if ever, in real life (Drummond, 1996).

TTO developed by Torrance as a less cognitively demanding alternative to SG (Torrance, 1976). However, whether TTO has met its aim has been questioned (Gold et al, 1996). TTO requires the individual to compare $Y$ years with $h_i$ to $X$ years with perfect health.

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1 If death is not the worst health state, interval preference values can be later transformed to the standardized scale from $-1.0$ to $+1.0$ where death is equal to zero and health states worse than death have negative values (Pathak, 1995; Torrance, 1982, Patrick et al, 1985).
The number $X$ is varied until the individual is indifferent between the two alternatives. $Q$ is equal to dividing $X$ by $Y$ (Pathak, 1995; Bleichrodt and Johannesson, 1997). The advantage of TTO is that SG provides a choice in terms of a trade off, in this case between years of full health versus additional years of life at health state $h_i$. However, it is done so under conditions of certainty, which is not consistent with von Neumann Morgenstern EUT.

Method used to measure $Q$ is not merely of theoretical interest. Different methods used to measure $Q$ result in different preference values. Various studies have compared techniques used to assess $Q$ with results indicating a lack of correlation. For example, an analysis of six different $Q$ techniques including: SG, TTO, VAS, QWB, SIP among patients with chronic renal failure resulted in correlations ranging from 0.09 to 0.52 (Pathak, 1995).

Variation in $Q$ from using different measurement techniques has resulted in the suggestion that a QALY is not equal to a QALY (Revicki, 1995). Typically, for a given health outcome, SG exceed TTO which in turn are greater than VAS values. Given that most individuals are risk averse when the stakes are high (i.e., gamble between perfect health and immediate death), higher utilities are assigned to the intermediate state: $h_i$ (Pathak, 1995; Revicki, 1995). Only SG is consistent with EUT because it measures utility under risk and is therefore regarded as the "gold standard". Therefore, other
holistic techniques listed actually measured *values* not utilities and at best are regarded as approximations of utility (Pathak, 1995; Torrance and Feeny 1989).

Due to difficulties experienced with SG and TTO methods, it has been recommended that the VAS be administered first to familiarize respondents with the health state scenarios and measurement prior to administering SG method. Furthermore, since most individuals have problems comprehending probabilities visual aids have also been found to be helpful – the most popular of which is the probability wheel (Drummond 1996; Torrance 1976a; Furlong et al 1990).

An alternative holistic approach is to use the VAS alone. VAS is quick to administer and easily understood by respondents. Conversion of VAS values to corresponding SG quality weights has been suggested by the use of an appropriate power curve; however, this conversion has met variable success (Drummond, 1996, Torrance 1976a, Torrance et al 1982; Torrance et al 1996).

Psychometric based approach alternatives includes instruments such as the Quality of Well Being Scale (QWB), Crichton Royal Behavioral Scale, Life Satisfaction Index, Index of Health Related Quality of Life, European Quality of Life Instrument (EuroQol), and Health Utility Index (HUI) (Drummond 1996; Revicki and Kaplan 1993; Pierson and Pathak, 1998). However, similar to the holistic approaches the different psychometric approaches provide different Q values (Revicki and Kaplan 1993). Furthermore, this
method also requires assumptions beyond those of QALYs in order to be considered utilities and therefore will not be discussed further.

In addition to the measurement issues of Q addressed above, the issue of whose preferences are appropriate to consider in assessing Q should also be considered (Revicki, 1995). Holistic approaches (and multi-attribute approaches) in the measurement of Q require that the researcher ask an individual with the disease (i.e. the patient) to assess the utility of that disease state (Thompson, 1986; Stavem, 1999). Alternatively, a description of the health-state of interest can be provided to healthy members of the population (Bala, Wood, Zarkin et al, 1999; Flowers et al, 1997; O’Brien, Goeree, Gafni et al, 1998; Olsen and Donaldson, 1998), or the patient’s physician (Johnston, Fries, Banzhaf, 1997). However, patients, their physicians, and healthy members of the population do not all provide the same quality weight assessments for a given disease state. Typically patients assign values to a disease state that are higher than those assigned by healthy individuals and their physicians (Gold et al, 1996). This can be explained by patients (with health state h_i) modifying their expectations for optimal health (Gold et al, 1998). The use of physicians as “surrogate valuers” for QALY measures is not currently favored (Gold et al, 1996), since physicians may assess quality weights based on functional measures with inadequate attention placed on emotional difficulties experienced by the patient (Gold et al, 1998).
Therefore, care should be taken in comparing Q weights from different populations. It would be expected that patients rate Q values higher than healthy members of the population given hypothetical scenarios. Use of quality weights from healthy individuals would not discriminate against patients since it is the change in Q (beneficial result of the intervention) that is used to measure of impact of therapy in CUA, not initial Q values. Therefore, it is expected that the use of healthy volunteers instead of patients would actually predict a more favorable CUA ratio.

It has been argued that only patients should be used to assess utility, since they can be regarded as most qualified to determine the impact of the disease on all dimensions of health. However, when considering the value of an intervention that affects a pool of individuals, both individuals with and without the health state, for example, enrollees in a managed care organization, interviewing all members (or a sample of members) would be considered the preferred approach. This is because the use of such a technique considers the preferences of all those affected by the decision, not just those with the health state (Gold et al., 1996). Although theoretically feasible, to date only the utility of users, i.e. patients receiving treatment, has been considered in CUA (Gold et al 1996, Labelle and Hurley, 1989). Consistent with previous studies, a user-based approach, and consumer sovereignty requirement of welfare economics, a convenience sample of all members of the population\(^2\) will be used in this study as described in chapter three.

\(^2\) To avoid potential respondent distress, only female members of the population with no history of breast cancer or cancer requiring chemotherapy will be included in the study sample.
Welfare Foundations of CBA

CBA is founded on welfare economic theory also known as neo-classical welfare economics, specifically the Potential Pareto Improvement to measure utility gains. CBA, unlike CUA does not require the adherence to the restrictive assumptions of QALY in order to measure utility (Bala et al, 1998; Diener, O'Brien, Gafni, 1888; Mitchell and Carson; 1993). Utility theory is still applicable, however, vNM cardinal EUT is not required. It is generally accepted in economics that the underlying utility theory of CBA is ordinal not cardinal and furthermore, unlike vNM EUT does not require measurement of utility under risk (Dasgupta and Pearce, 1986). The following section will describe the theoretical foundations of CBA starting with axioms and followed by a discussion of Potential Pareto Improvement to measure utility gains.

Axioms

Measurement of preferences or utility in CBA assumes the following four axioms. First, connectedness, this assumes that given two alternatives, x and y, an individual must at a minimum be indifferent between the two. Second, axiom of transitivity is the same as described previously (i.e., if an individual prefers x over y, and y over z, then the same individual should prefer x over z). Third, reflexivity, states that any outcome x can be compared to itself. Lastly, continuity, states that if x is preferred to y, and x is an outcome very close to z, then z should also be preferred to y.
Potential Pareto Improvement

Economics, as described in chapter one, deals with decisions of allocative efficiency — how to allocate a fixed quantity of resources between competing courses of action. It also assumes that resources are scarce and therefore, decisions must be made how best to utilize current resources to optimize utility. Except in CBA utility is measured in monetary terms as opposed to QALYs. Decisions of maximizing utility in CBA are expressed in terms of Pareto Optimality.

Pareto optimum decision (as opposed to a Potential Pareto Optimum decision) is one that makes at least one person better off and no one worse off. Since projects tend to make some people better off while others worse off, the Pareto optimality or "unanimity" rule has been revised, the most well known attempt by Kaldor and Hicks. The Kaldor-Hicks compensation principle, also referred to as the Pareto Improvement (PI) states that:

"social state y is preferred to existing social state x if those that gain from the move to y can compensate those who lose and still have some left over"

(Dasgupta and Pearce, 1986, p57).

In other words there is a resultant net benefit (Dasgupta and Pearce, 1986). The Kaldor-Hicks principle does not require actual compensation from the winners to be paid to the losers, compensation has only to be possible. If beneficiaries do not compensate losers the new program would provide a Potential Pareto Improvement (PPI). The objective of CBA is to identify PPI (Drummond, 1987; Dasgupta and Pearce, 1986). (Figure 2.1)
Utility functions of individuals 1 and 2 (U₁ and U₂) are recorded on 2 axes. GUF describes the maximum possible combinations of utilities, which can be achieved by U₁ and U₂. All points within GUF are obtainable and all points outside GUF are not obtainable.

PO: Pareto Optimality decision – all decisions from A to any point in PI quadrant. A policy that would move state of the economy from A to B would constitute a Pareto Optimal decision, at least one person is better off and no one is worse off (For example, A → B, utility of both individuals increase – a Pareto Improvement)

NC: Noncomparable set – all decisions from A to any point in NC quadrant. Where one person is better off and the other is worse off. For example, a policy that that would move state of the economy from A to G could constitute a PPI (Kaldor-Hicks compensation principle) if this move assumes a potential positive net benefit of the change. That is in the move A → G, the gainer (U₁) can compensate the loser (U₂) and still have some gains left over.

PI: Pareto Inferior decision – any move from A to any point in the null quadrant. A policy that would move state of economy from A to any point within null quadrant constitutes a net loss to the economy.

Figure 2.1: Grand Utility Function (GUF). A simple 2-person world adapted from Dasgupta and Pearce (1986).
In addition, the four central tenants of welfare economics described in CUA also apply to CBA: utility maximization, consumer sovereignty, consequentialism and welfarism (Gafni, 1997)

Formally the purpose of CBA is to identify PPI, where net benefits are greater than zero (Equations 3e and 3f). Thus, compared to Equation 2.3d above for CUA decision rule, an incremental approach is not required for CBA (Equations 3e, 3f, and 3g), however an incremental analysis can be pursued to estimate whether the new technology provides greater consumer surplus than the currently established technology (i.e., greater net benefit, Equation 3h). Therefore, for CBA, unlike CUA, use of the established technology can actually be assessed for efficiency.

\[
\text{Total Benefits} = WTP \geq \text{Total Costs} \quad \text{Equation 3e}
\]

Rearranging to give

\[
\text{Total Benefits} - \text{Total Costs} \geq 0 \quad \text{Equation 3f}
\]

\[
\text{Net Benefits} \geq 0 \quad \text{Equation 3g}
\]

\[
WTP_n - WTP_e \geq \text{Cost}_n - \text{Cost}_e \quad \text{Equation 3h}
\]
The decision rules for CBA seem much simpler, however, its requirement to convert health benefits into a monetary metric has met considerable skepticism by health care professionals (Jones-Lee, 1976; Johannesson, 1996).

CV Measurement

To facilitate the comparison of program gainers to losers the PPI measurement uses money to assess both losses and benefits. As the name CV implies, respondents are asked to value goods, for example, health care interventions, in a contingent or hypothetical market using survey methods. Respondents are asked to provide either their maximum WTP or minimum WTA to receive or forgo an intervention that would result in the same level of overall well being as before the change (Johannesson, Johansson, Jonsson, 1992).

Survey methods used to measure CV can be divided into open-ended and binary questions (Johannesson, 1996). In open-ended questions the researcher tries to measure the respondents maximum WTP and in binary questions respondents either rejects or accepts a bid. The latter is sometimes referred to as the referendum approach. The simplest open-ended question is to directly ask respondents their maximum WTP, however, respondents find it difficult to answer WTP questions about nonmarket goods. This particular method is associated with a poor response rate and lacks reliability. As a result this method is not recommended.
To aid respondents in providing values for nonmarket goods, the bidding game, was developed. The bidding game method resembles an auction. The bid is increased or decreased depending upon the previous response. The bids are continued until the maximum WTP is reached. Main problem with the bidding game approach is that responses can be influenced by the first bid. This gives rise to the starting bid bias where a higher initial bid is associated with a higher mean WTP. However, this starting bid bias can be tested by using two alternative bid algorithms and then comparing the WTP means of the two algorithms (O’Brien, Goeree, Gafni et al, 1998). An example of the bidding game is provided in Figure 2.2. Using algorithm 2 as an example, if respondent was WTP $4,000, bid was increased to $10,000, but if respondent was unwilling to pay $4,000, bid was decreased to $500. Suppose the respondent was WTP $500, next bid offered by researcher would be $2,000. If respondent was unwilling to pay more than $2000 bidding game ceased. This meant that the respondent was WTP a maximum somewhere between $2000 and $4000. If the midpoint of the WTP bid interval was used, the bids could be recorded as interval data (O’Brien, Goeree, Gafni et al, 1998).
Y, willing to pay this bid, N not willing to pay this bid. Persons accepting maximum bid ($20,000) were then asked an open-ended question for the maximum they were willing to pay.

Figure 2.2: Example of bidding game adapted from O'Brien, Goeree, Gafni et al (1998).

An alternative method is the payment card approach, an alternative to the bidding game. This method enables respondents to select a bid from the presented choices, but similar to the bidding game, given choices can influence respondent valuations. Payment card
approach is desirable because it can also be more easily distributed in mailed surveys (Mitchell and Carson, 1996). Example of payment card is provided in Figure 2.3.

<table>
<thead>
<tr>
<th>Amount</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>£0</td>
<td></td>
</tr>
<tr>
<td>£1</td>
<td></td>
</tr>
<tr>
<td>£2</td>
<td>Put a √ next to the amounts that you are sure you would pay.</td>
</tr>
<tr>
<td>£4</td>
<td></td>
</tr>
<tr>
<td>£6</td>
<td></td>
</tr>
<tr>
<td>£8</td>
<td></td>
</tr>
<tr>
<td>£10</td>
<td></td>
</tr>
<tr>
<td>£12</td>
<td>Put a X next to the amounts that you are sure you would not pay.</td>
</tr>
<tr>
<td>£16</td>
<td></td>
</tr>
<tr>
<td>£20</td>
<td></td>
</tr>
<tr>
<td>£30</td>
<td></td>
</tr>
<tr>
<td>£50</td>
<td></td>
</tr>
<tr>
<td>£75</td>
<td>Put a circle around the maximum amount you would be prepared to pay</td>
</tr>
<tr>
<td>£100</td>
<td></td>
</tr>
<tr>
<td>£100+</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.3: Example of payment card approach adapted from Donaldson, Shackley, Abdalla, Miedzybrozka (1995).
Blue Panel (1993) supports the use of the binary or referendum approach (Arrow et al, 1993). The binary method was favored because the referenda are reflective of real life situations. The disadvantage of the referendum method is that a greater sample size would be required in studies because each response provides much less information than in the open-ended questions (Johannesson, 1996). Furthermore, although mail and telephone interviews have been used to acquire CV with some success the Panel recommends use of face-to-face interviews to increase the likelihood of reliable responses (Arrow et al, 1993). Therefore, consistent with the recommendations of the Blue Panel (Arrow et al, 1993), this study will use a face-to-face format utilizing the bidding game method – varying two bidding algorithms randomly in the sample.

In addition to the bid method used to acquire WTP, consideration must be given to the framing of the WTP question. WTP can be measured either as (1) a user-based WTP response also known as point-of-consumption test or (2) an insurance-based test. In the user-based approach patients or a sample of healthy respondents from the community can be used. However, use of healthy respondents will require the construction of hypothetical scenarios explaining the conditions and treatment scenarios. Then study respondents are asked how much are they WTP for treatment, which will result in a preferred health state. Examples of the user-based approach include Thompson (1986) and Bala et al (1998).
Thompson (1986) study asked a convenience sample of rheumatoid arthritic patients to consider all the ways their arthritis affected their lives and their families. Then to assume that there was a cure available for their arthritis that was not covered by their health insurance, therefore, to have access to the treatment they would have to pay for it. If study respondents were WTP as much for the treatment as they are currently paying for arthritis treatment, they were then asked “What percent of your family’s household total monthly income would you be willing to pay on a regular basis for a complete cure of your arthritis?”

Bala et al (1998) used a sample of elderly respondents asking them to assume that they had shingles – rash characterized by intense pain more common in this demographic. Respondents may or may not have had shingles. Hypothetical WTP scenarios asked respondents to assume that they had the condition described providing them with two alternatives, no treatment or treatment.

“For your case of shingles, you can expect the following with near certainty

with no treatment: Mild pain for 2 weeks
With treatment: No pain

Would you be willing to pay $X out-of-pocket for this treatment?”

1. Yes 2. No. (Where X was randomized to equal to $100, $150 or $250).

In the insurance-based scenario, respondents are informed that they have a certain probability of incurring a particular disease, and therefore, how much would they be
WTP in insurance premiums to ensure coverage for the specified disease. An example of a user-based approach is provided in Figure 2.4. Hypothetically, user-based and insurance methods should provide equivalent WTP for disease treatment; however, since individuals are typically risk averse the two methods result in different WTP. Insurance-based approach is expected to provide a higher WTP mean than user-based method (Gafni, 1996); therefore the method selected does matter. Furthermore, since the objective of this study is to compare two preference metrics: CV and QALYs, the user based method will be adopted since it does not make sense to use the insurance based approach to measure QALYs (Bala et al, 1999; O'Brien, Goeree, Gafni et al, 1998).
"If you had the disease the way it was described, what do you think that your quality of life would be? Suppose that a genetic counselor tells you that you have a gene for Gaucher disease. When you visit your doctor you discover that a highly effective treatment is available for Gaucher disease. However, this treatment is not covered by your health insurance. If you begin to experience symptoms from the disease, this treatment will restore you to perfect health. However, the treatment is quite expensive. Most people can only afford it if they purchase an insurance policy that covers the cost of the treatment. If you do not purchase the insurance policy you will not be able to receive the treatment if you need it. Like most insurance policies, this one will not be available to you once you begin to experience symptoms from the disease. When you ask your doctor for more information about your future you discover 5% of people who have the gene for Gaucher disease get a form severe enough to eventually require treatment...think about the value of this medication to you. Consider how much you could realistically afford to pay each month. Would you be willing to pay at least X dollars per month for a policy that would cover the cost of the treatment if you ever needed it?"

Figure 2.4: User-based WTP – respondent does not have the disease but is aware of the probability that he will contract it.
Literature Review of Comparative Studies

Literature search was conducted to identify studies published from 1966 to 2000 attempted to compare CV method, WTP or WTA, with other health care preference measures, QALY or utility measures, in the context of a health outcomes program. Search strategy included computerized databases: MEDLINE, CINAHL, Social Science and Citation Index, EconLit, HealthSTAR and CancerLit using keywords and text words: willingness to pay, willingness to accept, contingent valuation, quality adjusted life years, utility, WTP, WTA, and QALY. In addition, examining article bibliographies, personal files and contacts resulted in locating further studies.

Froberg and Kane (1989a-d) in their comprehensive review of health preference measures noted that no health care studies had directly compared WTP to other preference measures. However, O'Brien and Viramontes conducted the first study to compare CV and alternative HRQOL measures in 1986. Although Thompson (1986) reported CV and health related measures of preference, no direct comparisons were performed between the two metrics (Tables 2.1 and 2.2). Of the remaining seven studies (Blumenschein and Johannesson, 1998; Stavem, 1999; Reed-Johnson, Fries and Banzhaf 1997; Olsen and Donaldson 1998; Bala et al, 1998; O'Brien and Viramontes 1994; and Flowers, 1997), only three (Blumenschein and Johannesson, 1998; Bala et al 1998; O'Brien and Viramontes, 1994) measured CV and utilities under the same level of uncertainty.
<table>
<thead>
<tr>
<th>STUDY</th>
<th>PROGRAM</th>
<th>RATIONALE</th>
<th>N</th>
<th>SETTING</th>
<th>Sociodemographics</th>
<th>Interview method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rheumatoid arthritis cure</td>
<td>↑Q</td>
<td>247</td>
<td>Rheumatoid arthritis patients</td>
<td>Sex, age, education, marital status, number of persons in household, employment status, medical costs for the 6 mo of study, costs of analgesic taken, personal investment income, total household income, costs of analgesic taken and measures of disease state</td>
<td>Face-to-face interview and tape recording</td>
</tr>
<tr>
<td>2.</td>
<td>Lung disease cure</td>
<td>↑Y and ↑Q. 1st study to directly compare WTP and other health measures</td>
<td>102</td>
<td>Convenience sample with chronic lung disease</td>
<td>Sex, age, employment, household income, marital status</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>3.</td>
<td>3 programs:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) helicopter ambulatory service</td>
<td></td>
<td></td>
<td>(1) considerable “option value”, benefit only a few</td>
<td>Sex, age, education, municipality, health status, income (annual), time for interview</td>
<td>Face-to-face (for WTP)</td>
</tr>
<tr>
<td></td>
<td>(2) 80 more CABG</td>
<td></td>
<td></td>
<td>(2) ↑Y and ↑Q</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) 250 more hip replacements</td>
<td></td>
<td></td>
<td>(3) ↑Q only</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2.1: Previous Studies comparing CV and QALY: Study 1 Thompson, 1986 (Study 1), O'Brien and Viramontes, 1994 (Study 2), Olsen and Donaldson, 1998 (Study 3), Bala et al, 1998 (Study 4), Flowers, et al, 1997 (Study 5), Blumenshein and Johannesson, 1998 (Study 6), Reed-Johnson, Fries, Banzhaf, 1997 (Study 7), Stavem, 1999 (Study 8).
Table 2.1 continued.

<table>
<thead>
<tr>
<th>STUDY</th>
<th>PROGRAM</th>
<th>RATIONALE</th>
<th>N</th>
<th>SETTING</th>
<th>Sociodemographics</th>
<th>Interview method</th>
</tr>
</thead>
</table>
| 4.    | 3 programs: varying in duration and intensity of shingles pain avoidance | †TQ  
† WTP with †severity of disease                                         | 114| Community with and without shingles                 | Sex, age, household income (monthly), experience with disease (1st hand/acquaintance) | Face-to-face-computerized interactive interview       |
| 5.    | Moderate Gaucher disease                                                 | †TQ                                                                      | 52 | Healthy volunteers (female, single and educated)     | Sex, age, education children, sex, age, education income.                        | Automated interview, computer interactive, provided video of individual with disease |
| 6.    | Asthma cure                                                              | †TQ                                                                      | 69 | Convenience sample – patients with asthma           | Sex, age, education income.                                                     | Face-to-face                                         |
| 7.    | Reduction in the days or avoidance of: angina, asthma, cough, nausea,    | †TQ  
Used short-term health conditions (i.e. †TQ only) because CBA preferred over CUA. | 53 | Meta-analysis of WTP studies of short-term health    | Assumed for short term health condition that socioeconomic variables are not    | WTP: variable: meta-analysis of literature.          |
|       | throat congestion, sinus congestion, shortness of breath, headache,     | conditions                                                              |    | conditions                                           | important                                                                        | Expert health care professional panel used to acquire utility measures |
|       | chest tightness, eye irritation, head congestion                          |                                                                           |    |                                                     |                                                                                  |                                                      |

Continued
Table 2.1 continued.

<table>
<thead>
<tr>
<th>STUDY PROGRAM</th>
<th>RATIONALE</th>
<th>N</th>
<th>SETTING</th>
<th>Sociodemographics</th>
<th>Interview method</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Assess the value of a new technology to cure epilepsy</td>
<td>59</td>
<td>Random selection of patients with epilepsy</td>
<td>Sex, age, mean duration of epilepsy, seizure history, education, if employment</td>
<td>Interview Face-to-face?</td>
</tr>
<tr>
<td>STUDY</td>
<td>Preference Measures</td>
<td>Method of Payment</td>
<td>WTP method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---------------------</td>
<td>-------------------</td>
<td>------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HRQOL</td>
<td>CV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SG (results not presented)</td>
<td>WTP/ ex-post</td>
<td>Proportion of family's monthly income out-of-pocket (no risk)</td>
<td>Open ended question</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NIMH, QWB, McGill</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SG, VAS and SF-36 correlations</td>
<td>WTP/ex-ante</td>
<td>$X - out-of-pocket not covered by health insurance (risk)</td>
<td>Bidding game - open ended question starting randomly with 1 of 5 bids - to test for starting point bias.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Both SG and WTP presented under conditions of uncertainty for treatment success</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>QALY (Q measure not provided)</td>
<td>WTP (yr)/ Ex-ante / Uncertainty (probability) associated with needing service considered.</td>
<td>Taxation/voluntary donation/private insurance premium</td>
<td>Payment card</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.2: Summarizes: Preference measures, method of payment, and WTP method used. Study 1 Thompson, 1986 (Study 1), O'Brien and Viramontes, 1994 (Study 2), Olsen and Donaldson, 1998 (Study 3), Bala et al, 1998 (Study 4), Flowers, et al, 1997 (Study 5), Blumenschein and Johannesson, 1998 (Study 6), Reed-Johnson, Fries, Banzhaf, 1997 (Study 7), Stavem, 1999 (Study 8).
<table>
<thead>
<tr>
<th>STUDY</th>
<th>HRQOL</th>
<th>Preference Measures</th>
<th>Method of Payment</th>
<th>WTP method</th>
</tr>
</thead>
</table>
| 4     | QALY (SG) | WTP / ex-post  
WTP assuming individual has the disease (no uncertainty) | $X -out-of-pocket (no risk) | Referendum approach |
| 5     | SG     | WTP (month) / Ex-ante (2 independent probabilities; contracting disease (insurance) and success of treatment) | Insurance premium | Bidding game |
| 6     | VAS, TTO, SG, SF-36, Asthma TyPE | WTP (mo) / ex-post | $X -out-of-pocket | Dichotomous choice, bidding game |
| 7     | QWB    | WTP (meta-analysis) | Variable | Variable |
| 8     | VAS, SG and TTO | WTP / ex-post | Single payment-out of pocket (no risk) | Open ended question |
Blumenschein and Johannesson (1998) surveyed patients with asthma, acquiring patient utility values using three different methods and their WTP for a hypothetical asthma cure. Spearman correlation coefficients were reported for Q measures, VAS, TTO, and SG with WTP (Table 2.3). The authors did estimate a WTP for QALY gained to be between $7,000 to $46,000 per QALY gained depending on the method used to estimate Q and WTP (authors used bidding game and referendum approach). Authors did not report a regression equation attempting to predict one metric from another nor correlations between Δ QALY and WTP.

<table>
<thead>
<tr>
<th>Health State Utilities</th>
<th>VAS</th>
<th>TTO</th>
<th>Bid Game</th>
<th>Dichotomous Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
<td>-</td>
<td>0.26*</td>
<td>-0.30*</td>
<td>-0.24*</td>
</tr>
<tr>
<td>TTO</td>
<td>0.26*</td>
<td>-</td>
<td>-0.07</td>
<td>-0.07</td>
</tr>
<tr>
<td>SG</td>
<td>0.18</td>
<td>0.37*</td>
<td>-0.21</td>
<td>-0.14</td>
</tr>
</tbody>
</table>

Table 2.3: Spearman’s correlation coefficients between health state utilities and WTP (n=69). VAS=visual analogue scale, TTO=time trade off, SG=standard gamble.

*P<0.05 (Blumenschein and Johannesson, 1998).
Bala et al (1998) stated that they intended to compare WTP with QALY instead of Q weight, however, estimates of ΔQALY also assumed that the hypothetical cure would result in perfect health (Q=1.0), and given the average age of respondents in this study (65 to 70 years of age) this seems unlikely. Bala and others (1998) asked respondents three sets of WTP treatments, listed as T1, T2 and T3 in Table 2.4. Correlations are listed in Table 2.4, all of which are close to zero and statistically nonsignificant indicating no association between the two metrics. (Positive correlation was expected — gain in QALYs to be associated with increasing WTP for health benefit). Once again authors did not report a regression equation attempting to predict one metric CV from the other. Authors did report that respondents in this study had little trouble understanding the SG and WTP method, administered using point of consumption format with the assistance of a computer interactive interview in addition to cards describing the hypothetical scenarios success. Bala et al (1998) and Blumenschein and Johannesson (1998) studies assumed that death and perfect health were the best and worst health states on a zero to one scale. Although commonly assumed, this assumption does violate the consumer sovereignty assumption of welfare economics — it should be up to the respondent to decide what her worst and best health is.
<table>
<thead>
<tr>
<th>Treatments</th>
<th>Correlation between WTP and ΔAQALY</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Mild pain for 2 weeks.</td>
<td>0.04</td>
</tr>
<tr>
<td>With no treatment</td>
<td>No Pain.</td>
<td></td>
</tr>
<tr>
<td>With treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>Severe pain for 2 weeks followed by mild pain for 1 week.</td>
<td>-0.01</td>
</tr>
<tr>
<td>With no treatment</td>
<td>Mild pain.</td>
<td></td>
</tr>
<tr>
<td>With treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>Severe pain for 2 months followed by mild pain for 1 month.</td>
<td>-0.03</td>
</tr>
<tr>
<td>With no treatment</td>
<td>Severe pain for 2 weeks followed by mild pain for 1 week.</td>
<td></td>
</tr>
<tr>
<td>With treatment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2.4:** Correlations between three different treatment scenarios for ΔAQALY (measured using SG) and WTP (Bala et al, 1998).

O'Brien and Viramontes (1994), similar to Bala et al (1998) and Blumenschein and Johannesson (1998), presented correlations between WTP method (bidding game) and health utility measures, SG and VAS, supporting the reliability and validity of the three metrics (Table 2.5). Authors reported a highly positive statistical association between SG and VAS and a highly negative statistically significant association between SG and WTP. Negative because a poor health state indicated by a low SG weight is expected to correlate with a higher WTP for therapy. The poor relationship between VAS and WTP
is consistent with VAS' lack of theoretical foundation. Test-retest reliability (4 week interval, n=20) was measured using intra-class correlations (ICCs). Acceptable ICCs were reported for: VAS (r=0.61), SG (r=0.82), and WTP (r=0.66). Authors reported good patient understanding of the preference methods used thereby supporting the use of WTP to acquire patient preferences using the bidding game method. Authors did not estimate QALYs.

<table>
<thead>
<tr>
<th>Health State Utility</th>
<th>VAS</th>
<th>SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SG</td>
<td>0.43</td>
<td></td>
</tr>
<tr>
<td>WTP</td>
<td>0.05</td>
<td>-0.46</td>
</tr>
</tbody>
</table>

(Mean per month)

Table 2.5: Pearson r correlations between WTP and health state utilities. All correlations were significant at the 0.05 level (O’Brien and Viramontes, 1994).

Reed-Johnson, Fries and Banzaf (1997) were the only authors to report a regression analysis to predict WTP from a Q measure (Quality of Well Being Scale) for short-term conditions. The authors reviewed available WTP studies to identify CV studies for varying short-term morbidity treatments. QWB was estimated by the use of a panel of experts. Authors regressed WTP onto QWB measure of Q. The authors did not compute
QALY, and therefore did not regress WTP onto QALY. However, the authors did note that the linear specification of the model produced poor fit while the double-log specification produces a large adjusted $R^2$ indicating a good fit to the model. The model of best fit was $\text{Ln}(\text{WTP}) = \text{constant} + \beta_1(\text{QWB}) + \beta_2\text{ln(DAYS)}$ (n=53), indicated that individuals are WTP more to reduce the duration of illness. Income effects, current health, age, gender and education were not considered in the analysis since the authors assumed that for acute conditions, sociodemographic effects would be negligible. However, there is reason to believe that their inclusion could have improved the predictive power of the regression, for example the positive association between WTP and income (O'Brien and Viramontes, 1994, Mitchell and Carson, 1996; Blumenschein and Johannesson, 1998). Furthermore, acquiring preference measures from the same individual (CV and QALY) should also reduce random error and therefore increase the predictive power of the regression.

Summary

Notable omission from the discussion of welfarist description in CUA was that of the Kaldor-Hicks Principle or PPI criterion. Resource allocation decisions require satisfying the PPI criterion. In order to achieve this in CUA, g must be estimated. This study aims to measure g, explicitly, by acquiring respondent WTP for a health care intervention, as opposed to assuming it using league tables or expert opinion. This procedure would convert the technical efficiency question of cost per QALY to one of allocative efficiency, by providing a value to how much a QALY improvement is worth, i.e., an
explicit WTP per QALY or price per QALY. In other words (if costs of the intervention were estimated) converting the CUA to a CBA. This study assumes that ultimately, CUA and CBA aim to answer the same question.

Conclusion

Given the gap in the literature to predict one metric from another, this study aims to acquire WTP and Q values from the same respondents for acute and chronic conditions. Therefore, changes in Q only, Y only, and Q and Y are considered in this study. Literature review indicated that WTP may be preferable over SG in assessing utility for acute conditions, while SG method may be preferable over WTP for assessing chronic conditions. Reed-Johnson, Fries and Banzaf (1997) study used a meta-analysis to predict WTP from Q weights for acute conditions. Q weights were derived from Quality of Well Being Survey (QWB) using expert opinion, and WTP was derived from varying sources using different methods. Furthermore, Reed-Johnson, Fries and Banzaf (1997) meta-analysis did not include respondent age, gender, or economic status in their regression equation – variables reported in the literature to impact WTP. This study attempts to address these contentions. This study will regresses WTP onto QALY as opposed to the Q weight, accounting for respondent age, income and health status (Gender is not included since all respondents in the study will be female). Moreover, chronic in addition to acute conditions will be considered in predicting WTP from QALY. Finally, consistent with consumer sovereignty (welfare economics), Q weights and WTP values will both be obtained from respondents using unified methods.
CHAPTER 3

METHODS

This chapter reviews the methods used: design, target population, sampling plan, treatments, data collection, instrument development and evaluation procedures. Additionally, psychometric evaluation of instruments is explained. Next, the chapter concludes with data analysis for the six research questions listed.
Research Design

A cross sectional descriptive design was used (Spector, 1981) — data were collected at two time points from the same respondents at least one week apart. Therefore, this design falls somewhere between a true cross-sectional design and a longitudinal design, in that measurements are taken over a period of time from each subject but each variable is only measured once (Spector, 1981).

Target Population

The target population consists of all healthy female full-time graduate and graduate professional students, and women aged 22 to 50, with no history of breast cancer or cancer requiring chemotherapy, in the state of Ohio. The frame for the study (accessible population) is all healthy female full-time graduate and graduate professional students, and women aged 22 to 50, with affiliations to The Ohio State University (OSU), Columbus Campus. Women with a history of breast cancer or cancer requiring chemotherapy were excluded from study participation. This frame is consistent with a highly educated population, which was regarded as advantageous due to the cognitively demanding nature of the interviews. Since the health states discussed during the interview process were breast cancer and PCNV, respondents with a history of breast cancer or cancer requiring chemotherapy were excluded from the study to avoid possible emotional discomfort or distress.
Sampling Plan And Data Collection

A convenience sample of 120 female graduate and graduate professional students and women aged 22 to 50 with no history of breast cancer or cancer requiring chemotherapy and with affiliations to OSU, Columbus Campus were recruited by: (1) fliers (Appendix A) posted across OSU campus; (2) word-of-mouth – respondents were invited to inform female colleagues of the study and were offered fliers to distribute and post in their respective departments; (3) fliers posted on various list servers by respondents at OSU including: Grassroots®, graduate professional pharmacy list server, graduate public health list server, and graduate education list server; and (4) a recruitment letter (Appendix B1) forwarded to a random sample of 400 full-time (i.e. registered for greater than 10 credit hours) female graduate and graduate professional students with active E-mail accounts enrolled at the Columbus campus at OSU (Spring quarter/2000) taken out of an estimated 2816 students [Verbal communication, S Noxel, 11/99]. It was initially intended that a random sample of 120 useable student responses from E-mail solicitation would constitute the sample for this study. However, due to poor response (less than a five percent response rate), despite follow-up reminder E-mails, (Appendix C1) the search for participants was expanded to a convenience sample.

Once potential respondents were identified, a recruitment letter was forwarded via E-mail (Appendix B2) providing further information about the study than described in the flier. Potential respondents were requested to participate in two face-to-face interviews at the
College of Pharmacy at OSU, Columbus Campus\(^1\); each interview taking approximately 60 to 90 minutes to complete. Furthermore, respondents completing the two interviews were offered $30 as an incentive to participate in the study. One graduate student conducted all face-to-face interviews. Potential respondents were invited to contact the researchers directly either by telephone or E-mail to schedule an interview or to answer any questions they may have within the next two weeks. Prior to interviewing, participants were contacted by phone to ensure eligibility as described in the informational letter. Telephone enrollment procedure is described in (Appendix D). At the end of the two-week period, if identified potential respondents had not replied, a reminder E-mail was forwarded (Appendix C2). Respondents were forwarded reminders for scheduled appointments two to three days prior to the scheduled appointment day (Appendix E). Potential study respondents were explained that all information provided would remain strictly confidential. At the time of interview, they were required to complete a consent form stating that they agree to participate in the study; understand that participation is completely voluntary, and that they are free to discontinue participation in the study at any time (Appendix F).

To account for the ordering and testing effects\(^2\), first, half the respondents were randomly assigned to complete PCNV survey in the first interview and breast cancer survey in the

\(^1\) With the exception of four women who were interviewed at one local residential address in Columbus, all interviews were conducted at the College of Pharmacy, Room 129B, Columbus Campus. These four respondents were unable to attend interviews at the Columbus campus but were willing to participate in the study.

\(^2\) The testing effect is defined as the effect of administering the same or similar instrument upon subsequent responses. This is also known as the practice effect.
following interview. The remainder of respondents received in the reverse order. The surveys were also split into two interviews spaced at least one week apart to reduce the cognitive load and fatigue of one long interview which would increase the risk of satisficing, and to avoid contamination of utility measurement from the first survey affecting responses for the second survey. Second, respondents agreeing to participate were randomly assigned to one of two WTP protocols (Table 3.1). In addition, respondents were also randomly assigned to one of two WTP algorithms to account for starting point bias. As described in Figure 3.1 once assigned, respondents were designated to the same protocol and WTP algorithm in the second interview.
<table>
<thead>
<tr>
<th>WTP PROTOCOL</th>
<th>PCNV</th>
<th>SURVEY</th>
<th>BREAST CANCER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A. Standard vs. optimal preventative therapy</td>
<td>A. Cure vs. treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. No therapy vs. standard preventative therapy</td>
<td>B. No treatment vs. treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. No therapy vs. optimal preventative therapy</td>
<td>C. No treatment vs. cure</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A. Standard vs optimal preventative therapy</td>
<td>A. Cure vs. treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. No therapy vs. optimal Prevention</td>
<td>C. No treatment vs. cure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. No therapy vs. standard preventative therapy</td>
<td>B. No treatment vs. treatment</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.1. Respondents were randomly assigned to one of two protocols.
Figure 3.1 Sampling Plan.
Scheduling participants took place by consecutively alternating between (1) PCNV and breast cancer surveys as the first interview, (2) WTP protocols 1 and 2 which varied ordering of the three WTP questions, (3) two WTP algorithms which varied starting point of bid, (4) and two different measures rating respondent acceptability of the health utility measures used (standard and graphical positioning scale), in chronological order of scheduled interview. For example, first participant was scheduled first survey PCNV (second survey breast cancer), protocol 1, algorithm 1 and standard assessment; second participant as first survey PCNV, protocol 1, algorithm 1 and graphical positioning scale (GPS); third participant as first survey breast cancer (second PCNV), protocol 1, algorithm 1 and standard assessment; fourth participant as first survey breast cancer, protocol 1, algorithm 1, and GPS; fifth participant first survey PCNV, protocol 2, algorithm 1 and standard assessment; sixth participant as first survey PCNV (second survey breast cancer), protocol 2, algorithm 1 and GPS; seventh participant as first survey breast cancer, protocol 2, algorithm 1 and standard assessment; eighth participant as first survey breast cancer, protocol 2, algorithm 1 and GPS; and ninth participant as first survey, protocol 2, algorithm 2 and standard assessment, and so on.

---

3 Two different measures were used to assess respondent acceptability of the three health utility measures – VAS, SG, and WTP to determine which of the methods provided greater discriminatory power based on a study by Narayana (1977).

4 GPS versus standard assessment scale are not analyzed as part of this dissertation.
Treatments

No clinical treatment or changes to participant drug therapy or health care plan were required, suggested or promoted in this study.

Instrument Development

Each of the two surveys consisted of seven sections (Figure 3.2). One section provided background material regarding the health state condition assessed (i.e., PCNV or breast cancer) and six health state cards representing six health state descriptions. Second section asked respondents to rank the six cards and then assess health state utilities – VAS and SG. Third section recorded sociodemographic information. Fourth section assessed WTP. Fifth section provided respondents with an opportunity to assess the three different methods used to assess utility (VAS, SG, and WTP). Sixth section asked respondents to rate the health state scenarios used in the interview. The final section was interviewer completed assessing the status of the interview. The script used for both the PCNV and breast cancer surveys are presented in Appendix G1 and G2. The remaining description of instrument development is subdivided to explain the formulation of the instruments in chronological order.
<table>
<thead>
<tr>
<th>Section</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Background information</td>
</tr>
<tr>
<td>2</td>
<td>Read, rank and rate six health state vignettes. Assess utility using VAS and SG</td>
</tr>
<tr>
<td>3</td>
<td>Sociodemographics</td>
</tr>
<tr>
<td>4</td>
<td>Three WTP questions</td>
</tr>
<tr>
<td>5</td>
<td>Three methods utility methods (VAS, SG, and WTP) assessed</td>
</tr>
<tr>
<td>6</td>
<td>Rating of health state scenarios (Content Validity)</td>
</tr>
<tr>
<td>7</td>
<td>Assessment of interview status — interviewer completed</td>
</tr>
</tbody>
</table>

Figure 3.2: Seven components of the PCNV and breast cancer surveys.
Section 1: Development Of Health State Scenarios and Background Information

This section describes initial formulation of health state descriptions and background information. This section is divided into five steps. First, a general discussion of health dimensions considered important in the construction of health state scenarios is provided. Second, dimensions considered relevant in the construction of breast cancer and PCNV scenarios are described. The third, construction of non-cancer health state scenarios developed for this study is discussed. The fourth step details a discussion of background material used in the study. These four steps summarize literature review component of instrument development. The fifth step details expert panel input and pilot study procedure used in instrument development and evaluation.

Relevant Components Of Health State Descriptions: Acute And Chronic Scenarios

First, a literature review was conducted using MEDLINE (1966-1999), Social Sciences Citation Index (1990-1999), ABI/INFORM GLOBAL (1971-1999), HealthSTAR (1975-1999) EconLit (1969-1999) CINAHL (1982-1999), and further studies (found by examining article references and through personal contacts with authors) to identify relevant components of health state descriptions (Torrance, 1976; Torrance, 1986; Torrance, 1987; Gerard, Dobson, Hall, 1992; Llewellyn-Thomas, 1984; Llewellyn-Thomas, 1996; Sackett and Torrance, 1978; Patrick, Bush, Chen 1973; Stiggelbout; Kiebert, Kievit et al, 1994; Goldstein, Clarke, Michelson et al, 1994; Kaplan, Bush, Berry, 1976). The search revealed that there was no gold standard for health dimension inclusion into health state descriptions; use of narrative versus bullet point descriptions;
or the use of first, second versus third person phrasing (Torrance, 1987; Llewellyn-Thomas, 1996; Torrance, 1976; Llywellyn-Thomas, Sutherland, Ciampin, 1983). The McMaster group recommend inclusion of physiological, emotional, sensory, cognitive, self care and pain functions (Torrance, 1987). Although, how these different dimensions have been interpreted vary, quality of life dimensions include variations of physical, emotional and social and role functioning. Furthermore, McMaster recommendations (Sackett and Torrance; 1978; Torrance, 1987; Torrance, 1976; Torrance 1986; Torrance 1982) are widely referred to in cancer scenario descriptions (Ashby, O’Hanlon, Buxton, 1994; Gerard, Dobson, Hall, 1992; Stiggelbout, Kiebert, Kievit et al 1994). However, whether only attributes of health specifically affected by the treatment should only be included (i.e., health related quality of life dimensions) versus a broad description of health has been debated. An approach suggested is to consider the purpose of the research question (Llewellyn-Thomas, 1996).

The literature supports hypothetical scenario presentation that minimizes ambiguity while giving consideration to cognitive burden. Since there is potential for respondents to formulate different viewpoints on role and social functioning based on their preconceived perceptions of cancer, these quality of life dimensions although affected by factors extraneous to the health care intervention are also be included in the scenario formulation. Additionally, reducing cognitive burden is addressed by using a point format. Lastly, scenarios are phrased in the second person singular (Torrance, 1976; Llewellyn-Thomas, Sutherland, Ciampin, 1983) to be consistent with the user-based
approach adopted, that is, respondents will be asked to assume that the health state condition described apply to themselves and that they are in current need of a treatment.

Breast Cancer Scenarios

Second, a literature review was conducted to identify studies that investigated quality of life in breast cancer patients both before and after treatment using MEDLINE (1966-1999), Social Sciences Citation Index (1990-1999), ABI/INFORM GLOBAL (1971-1999), HealthSTAR (1975-1999) EconLit (1969-1999) CINAHL (1982-1999), and further studies were found by examining article references and through personal contacts with authors (Ashby, O'Hanlon, Buxton, 1994; APhA, 1999; Curran et al, 1998, Mathe, 1998; Johnston et al, 1998; Hall, Gerard, Salkeld and Richardson, 1992; Gerard, Dobson and Hall, 1992; Ganz, 1999; Jansen, Stiggelbout, Wakker et al, 1998; Bernard et al 1997; Corry and Lenning 1994; Kuchler 1998). Based on the literature searches, four health state scenarios were constructed that focus on women's health states one year after treatment, such that transient effects of radiation, surgery or chemotherapy had dissipated. This approach was taken to avoid contaminating the chronic scenarios with acute effects due to treatment (Ashby, O'Hanlon, Buxton, 1994). Attributes experienced and regarded as important for women with breast cancer based on the literature review included the following dimensions:

- Psychological – depression, fear of recurrence, anxiety regarding diagnosis, fear of death, satisfaction with treatment, body image or concern with their physical

- Physical – acute adverse reactions of treatment include: PCNV; radiation side effects such as heaviness of the breast, sunburn-like changes in the treated area, tenderness, discomfort, stiffness and swelling at the treated area (APhA, 1999; Hall, Gerard, Salkeld, Richardson, 1992); and chronic adverse event include lymphedema which can result in difficulties in dressing (Hall, Gerard, Salkeld, Richardson, 1992; Ganz, 1999).

- Social – isolation, ability to interact with friends and family, lost confidence in sexual relations with partner (Gerard, Dobson and Hall, 1993; Hall, Gerard, Salkeld, Richardson, 1992)

Furthermore a number of quality of life instruments have been developed specifically to investigate the impact of breast cancer treatment. These include FACT-B (breast cancer module for the Functional Assessment of Cancer Therapy) and QLQ-BR23 (breast cancer module for the European Quality of Life Study group). FACT-B focuses on endocrine symptoms, a result of adverse events due to endocrine therapies (anti-estrogens, progestins, hormonal and aromatase inhibitors) (Fallowfield et al 1999). QLQ-BR23 was designed for use in clinical trials and incorporates items to cover the following attributes: body image, sexual functioning, sexual enjoyment, future perspective, systemic therapy side effects, breast symptoms, arm symptoms (lymphedema) and upset by hair loss (i.e. adverse event due to chemotherapy) (EORTC, 1999).
Therefore, consistent with the McMaster approach description of quality of life – physical, emotional and social/role functioning – health state scenarios will emphasize these three health dimensions (Torrance, 1976; Jansen, Stiggelbout, Wakker et al, 1998; Stiggelbout, Kiebert, Kiebert et al, 1994). Each dimension shall list no more than five attributes to reduce cognitive burden (Furlong, Feeney, Torrance, Barr, and Horsman 1990). The first dimension – physical functioning – includes the following attributes:

(i) mobility – to complete the quality of life scenario although mobility is not anticipated to be an issue with this disease, and

(ii) long term side effects of therapy – scenario evaluation will focus on how therapy affects long-term quality of life, e.g., impacts from surgery.

(ii) Sleep – additional attribute added based on recommendations of expert clinical oncology panel. Expert panel input is discussed in detail in the instrument evaluation section.

The second dimension, emotional functioning, focuses on the following attributes based on the literature review:

(i) depression,

(ii) confidence,

(iii) fear of death,

(iv) fear of disease recurrence, and breast loss.
The third dimension, social and role functioning, includes the following attributes:

(i) work

(ii) ability to interact with friends and family,

(iii) interests and hobbies,

(iv) partner support

(v) sexual relations.

The next step of breast cancer hypothetical scenario construction utilized input from clinical oncology practitioners to ensure accuracy of clinical information presented to respondents in study in accordance with current oncology practice at The James Cancer Center, OSU Medical Center in addition to pilot-testing of instruments. This step is described in detail in the section titled instrument evaluation. The result was the formulation of three breast cancer health states designed to follow the preference order:

Situation C > Situation T > Situation R. Situation R describes the outcome for terminal breast cancer recurrence when no therapy or do nothing is selected. Situation T describes the outcome for currently available breast cancer therapy for breast cancer recurrence. Situation C describes the outcomes for a hypothetical cure for breast cancer recurrence.

The three breast cancer scenarios used in the study are presented in Figures 3.3 to 3.5.
Situation C (CANCER CURE)

Physical
Apart from a small scar - your breast looks pretty much the same as before the surgery.
As a side effect of therapy you have arthritis – chronic periodic mild joint pain.
Your mobility is the slightly impaired, e.g., some tasks may involve mild discomfort.
You sleep well.

Emotional
Not anxious or depressed.
You feel confident and in control in your life.
You do not fear breast loss or dying of cancer.
You have occasional concerns that breast cancer will come back.

Social
You are able to work.
Friends and family enjoy visiting and being visited by you.
Interests and hobbies are slightly affected by periods of mild joint pain.
Partner is supportive.
Sexual relations are good.

Figure 3.3: Situation C.
Situation T (CANCER TREATMENT)

Physical
Apart from small scars on the side of both breasts—your breasts look pretty much the same as before the surgery.
Your mobility is the same as before cancer diagnosis.
You sometimes have trouble sleeping.

Emotional
Not anxious or depressed.
Your confidence is shaken.
You have lost feeling of control in your life.
You worry about dying of cancer.
You are relieved that you did not loose your breast.

Social
You are able to work.
Friends and family are able to visit you.
Interests and hobbies have declined.
Partner is supportive.
Sexual relations have declined.

Figure 3.4: Situation T.
Situation R (CANCER RECURRENT)

Physical
- Apart from a small scar, your breast looks pretty much the same as before the surgery.
- You felt a lump in your other breast.
- Your mobility is the same as before cancer diagnosis.
- You do not sleep well.

Emotional
- Anxious and depressed.
- You feel that you no longer have control of your life.
- Overwhelmed by fears of early death.
- Your worst fear of breast cancer recurrence has come true.
- Worried about losing your breast.

Social
- Work is difficult because of concerns about cancer.
- Not able to go out and see people.
- Your interest and hobbies have ceased.
- Partner is not supportive because also feels overwhelmed.
- Sexual relations are nonexistent.

Figure 3.5: Situation R.
Post Chemotherapy Nausea And Vomiting Scenarios

The next literature review conducted was to identify studies that investigated quality of life in PCNV using MEDLINE (1966-1999), Social Sciences Citation Index (1990-1999), ABI/INFORM GLOBAL (1971-1999), HealthSTAR (1975-1999), EconLit (1969-1999) and CINAHL (1982-1999). Further studies were found by examining article references and through personal contacts with authors (Osoba et al, 1997; Grunberg et al, 1996; Osoba, 1997; Zbrozek et al, 1994; Sykes, 1997; Bonneterre et al, 1995; Kirchner, Terry, Alberto, 1997; Needles et al 1999; Kwong and Parasuraman, 1999; Sykes, Kiltie, Stewart, 1997; Rusthoven et al 1998). In addition, quality of life questionnaires are also available for PCNV, for example, Morrow Assessment of Nausea and Vomiting (MANE) (Morrow, 1984). These instruments focus on the frequency, severity, and duration of nausea and vomiting.

Since, prevention of PCNV implies that the patient is receiving chemotherapy, scenarios also described an underlying health state of cancer, which remained constant with and without treatment. Thus, the only attribute that varied in the scenarios was level of nausea and vomiting – described in terms of the frequency, severity and duration (Morrow, 1984). PCNV scenarios formulated were based on the McMaster approach to health state descriptions (Torrance, 1976) and the PCNV literature review. Additionally, in an attempt to prevent crossover effects from chronic scenario descriptions (i.e. breast cancer) the underlying cancer condition for the acute scenarios was kept generic similar to O’Brien, Goeree, Gafni et al (1998). Additional reasons for not specifying underlying
cancer were that since respondents were unlikely to be familiar with different cancer types, avoiding its description reduced the length and complexity of background information required (O'Brien, Goeree, Gafni et al., 1998). Lastly, the PCNV survey was presented at least one week apart from the breast cancer survey.

Parallel to scenarios presented for breast cancer three dimensions – physical, psychological and social – were listed for PCNV scenarios, and each dimension consisted of no more than five attributes to reduce cognitive burden (Furlong, Feeney, Torrance, Barr, and Horsman 1990). The first dimension, physical functioning, included the following four attributes:

(i) mobility,
(ii) side-effects of chemotherapy other than PCNV,
(iii) PCNV – frequency and intensity of nausea and vomiting, and
(iv) diet – due to nausea and vomiting.

This dimension differs the most from the breast cancer scenarios. PCNV scenarios were aimed to capture the acute side effects of chemotherapy, while breast cancer health states focused on long term quality of life issues of breast cancer, omitting the actual treatment phase from the health state scenarios. Similar to quality of life instruments incorporating the impact of PCNV, an attribute describing the frequency and intensity of PCNV was included. As PCNV can have a significant impact on ability to tolerate food, diet was also added as recommended by the expert panel.
The second dimension, emotional functioning is represented by the following attributes:

(i) depression,
(ii) confidence, and
(iii) fear of death.

Since the underlying cancer scenario has been left generic, the other two attributes included in the breast cancer scenarios (fear of disease recurrence and breast lost) were omitted. Underlying cancer states for PCNV were left generic to avoid respondents potentially anchoring health state utility measures to preconceived perceptions of the mentioned health state instead of the PCNV health state described.

The third dimension, social and role functioning, similar to the breast cancer scenarios concentrated on the following areas:

(i) work
(ii) interests and hobbies,
(iii) ability to interact with friends and family,
(iv) partner support, and
(v) sexual relations.

The next step of PCNV scenario construction utilized input from clinical oncology practitioners, to ensure accuracy of clinical information presented to respondents in accordance with current oncology practice at The James Cancer Center, OSU Medical
Center, in addition to pilot-testing of instruments. This step is described in detail in the section titled instrument evaluation and the three PCNV scenarios are presented in Figures 3.6 to 3.8. The result was the formulation of three PCNV health states designed to follow the preference order: Situation NO NV >, Situation Prev NV > Situation NV.

Situation NV describes a health state with no alleviation of chemotherapy-induced nausea and vomiting. Situation Prev NV describes partial alleviation of PCNV and Situation NONV describes complete alleviation of PCNV.
Situation NO NV
(NAUSEA AND VOMITING PREVENTED WITH OPTIMAL THERAPY)

Physical
All other factors (mouth sores, fever, tiredness etc), remain unchanged.
You have no vomiting and no nausea episodes immediately after anti-cancer drugs.
Your mobility is not limited.
You enjoy a varied diet.

Emotional
Not depressed or anxious.
Your confidence is shaken but you feel that you have control of your life.
You have some concerns about your future.

Social
You are able to work from home.
Friends and family enjoy visiting and being visited by you.
Interests and hobbies have declined.
There is mutual support with partner.
Sexual relations are good.

Figure 3.6: Situation NO NV
Situation Prev NV  
(NAUSEA AND VOMITING ALLEVIATED WITH STANDARD THERAPY)  

**Physical**  
All other factors (mouth sores, fever, tiredness etc) remaining unchanged.  
On average you have 1 vomiting episode per day and ongoing nausea immediately after anti-cancer drugs.  
Your mobility is not limited.  
Due to nausea and vomiting your diet is bland (e.g., cereal, potatoes, chicken).  

**Emotional**  
Somewhat depressed and anxious.  
You do not feel confident and in control of your life.  
Concerned with fear of death.  

**Social**  
You are unable to go to work due to illness.  
Friends and family are able to visit you.  
You have interests and hobbies.  
There is mutual support with partner.  
Sexual relations are declined.

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**Figure 3.7: Situation Prev NV**
Situation NV (NAUSEA AND VOMITING)

Physical
All other factors (mouth sores, fever, tiredness etc) remain unchanged.
On average you have 2 vomiting episodes per day and ongoing nausea immediately after anti-cancer drugs.
Your mobility is limited.
Due to nausea and vomiting your diet is crackers and clear fluids.

Emotional
Somewhat depressed and anxious.
You do not feel confident and in control of your life.
Concerned by fear of death.

Social
You are unable to go to work due to illness.
Interests and hobbies have declined.
Only close friends and family can visit you.
Partner is supportive.
Sexual relations are nonexistent.

Figure 3.8: Situation NV

Development of health state scenarios – non-cancer states.

After consideration of format used for cancer health state scenarios, the third step of health state development was formulating the three non-cancer health state descriptions (perfect health, death, and current health) for each survey. To enable comparisons between utility measures for PCNV and breast cancer surveys perfect health, death and current health state descriptions were identical for the two surveys. Perfect health and
death were designed to be the anchor health states (Torrance, 1976; Sackett and Torrance, 1978). Current health state and death health state descriptions used were from the McMaster group (Sackett and Torrance, 1978; Feeny and Torrance, 1989). Perfect health state description used in this study was an adaptation of that by Ashby, O’Hanlon and Buxton (1994), which was based on work by Torrance and others, modified to include attributes affiliated with cancer (Figure 3.9). This health state was modified for this study to a three dimensional framework.

In the best state of health for her age. She had not had cancer.

Occasionally concerned by the possibility of developing breast cancer.

Feels confident and control of her life.

Friends and family enjoy visiting and being visited by her.

Has interests and hobbies.

There is mutual support with partner.

Sexual relations are good.

Figure 3.9. Healthy State baseline used as model for this study (Ashby, O’Hanlon and Buxton, 1994)
Similar to other hypothetical scenarios used in this study, three non-cancer health state scenarios were also reviewed by the panel of experts as described in the instrument evaluation section and are presented in Figure 3.10. The panel did not recommend any changes for the three non-cancer health state scenarios.

**PERFECT HEALTH**

**Physical**
- In the best state of health for your age.
- You have not had cancer.

**Emotional**
- Not depressed or anxious.
- You feel confident and in control of your life.
- Occasionally concerned by the possibility of developing cancer.

**Social**
- You are able to go to work and find it rewarding.
- Friends and family enjoy visiting and being visited by you.
- Have interests and hobbies.
- There is mutual support with partner.
- Sexual relations are good.

**DEATH**
Imagine that you will die, without pain, in your sleep.

**YOUR HEALTH**
Your current health state.

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Figure 3.10. Three non-cancer health states: perfect health (Situation P), death (Situation D), and your health (Situation Y).
**Background Information**

Use of background information sheets in this study was modeled on success reported by Gafni (1997) with the use of decision boards – visual aids designed to help physicians or interviewers present medical information to study respondents, patients and healthy volunteers, in an efficient and standardized manner (Gafni, 1997; O’Brien, Goeree, Gafni et al, 1998). Prior to acquiring SG and WTP utility measures, use of decision boards has been reported as helpful in informing respondents of hypothetical cancer health state scenarios or therapy options for cancer patients, including breast cancer (O’Brien, Goeree, Gafni et al, 1998; Whelan, Levine, Gafni et al, 1995; Sebban, Browman, Gafni et al 1995; Elit, Levine, Gafni et al 1996; Whelan, Levine, Gafni et al, 1999).

Background informational sheets and health state scenario cards were developed concurrently to ensure that therapy options described on the informational sheets matched health state scenario cards, incorporating a literature review of breast cancer therapy and PCNV and input from a panel of experts. Background information assumed respondents, a relatively healthy female population of graduate students at OSU, were not familiar with breast cancer and its treatment including chemotherapy or its side effects such as PCNV. Therefore, the background sheets were designed to provide medical information to the layperson assumed to be unfamiliar with cancer.

A literature review was conducted using MEDLINE (1966-1999), Social Sciences Citation Index (1990-1999), HealthSTAR (1975-1999), CINAHL (1982-1999), and

In addition, websites designed to provide laypersons self-help information were also reviewed. The search identified three website — CancerNet®, a service provided by the National Cancer Institute (NIH, 1999), FDA Consumer Magazine (FDA Consumer, 1999), and American Cancer Society — designed to provide up-to-date information to cancer patients, their families and health care professionals. These website publications were used to assist in phrasing technical terms in layperson language.

Integration of the literature review and input from panel of experts were used to finalize informational sheets in addition to and health state scenario cards. For PCNV the first sheet (8 ½" x 11") was divided into the following sections:

- Cancer
- What is chemotherapy
- Chemotherapy induced nausea and vomiting
The second PCNV sheet (8 ½" x 11") is a flow diagram describing the sequence of events for a non-specified cancer therapy, focusing on chemotherapy and its side effects with emphasis on PCNV. Lastly, respondents are asked to consider how cancer and anti-cancer drugs will affect other aspects of their life in terms of: fear of death, relationship with friends and family, disruption of their usual activities, ability to work, interests in hobbies, and leisure activities.

First background informational sheet (8 ½" x 11") for breast cancer is divided into the following sections:

- Breast cancer
- Treatments for breast cancer – three were listed
  
  (1) Lumpectomy
  (2) Radiation
  (3) Chemotherapy
  (4) Patient quotes
  
  (5) Introduction to the next sheet – role play – imagine you have cancer

The second breast cancer sheet (8 ½" x 11") is a flow diagram describing the sequence of events for breast cancer therapy. Starting with an initial breast cancer diagnosis, two
options are presented: no therapy or standard therapy (lumpectomy and radiation).

Respondents were then asked to assume that two years go by and they have breast cancer recurrence (Situation R), that is, they find a lump in the ipsilateral breast. Options now presented are breast cancer cure (Situation C) — breast cancer vaccine — or breast cancer treatment (Situation T) — lumpectomy complemented by chemotherapy. Chemotherapy is described to last for six months. Respondents are then asked to assume that another six months goes by which is enough time for the side effects of the chemotherapy to have subsided and to focus on the long term effects, that is, how cancer and anti-cancer drugs will affect other aspects of their life in terms of: fear of death, relationship with friends and family, disruption of their usual activities, ability to work, interests in hobbies, and leisure activities.

Background information was printed on two 8½” x 11” (A4 size) sheets for each of the breast cancer and PCNV surveys. Identical color coding and laminating was used for the background information sheets to match health state scenario cards (i.e., pale pink for breast cancer and pale green for PCNV). Non-cancer health state scenarios were also presented in pale pink or pale green to match their respective survey use. Primary use for color-coding was to assist the survey administrator in matching appropriate survey with health state scenarios. Lastly, similar to the health state scenario cards, background information sheets were phrased in the second person singular to be consistent with the user-based approach adopted in this study.
Instrument Evaluation

PANEL OF EXPERTS

A panel of experts with clinical, research, statistical and health economic training were asked to review all interviewing materials and questionnaires used in the study. The panel included three clinical oncology practitioners from the James Cancer Center, OSU Medical Center, three faculty members from OSU (Pharmacy and Health Systems Management and Policy) and one professor from McMaster University (Center of Health Economics and Policy Analysis), one researcher from industry, and five graduate students from OSU (three pharmacists from pharmaceutical administration department, one from education department, and one physician from Health Systems Management and Policy).

The expert panel included three clinicians knowledgeable about patients' experiences with PCNV and breast cancer, specifically two registered nurses with 29 years of experience between them in clinical oncology (Patient Care Resource Managers), and one pharmacist with over 20 years of clinical experience with oncology patients at The James Cancer Center. The clinical practitioners were asked to review the PCNV and breast cancer surveys in terms of the: (1) background information (2) health state scenarios, and (3) clinical components of the WTP scenarios to be used in the face-to-face interview process to ensure accuracy, appropriateness, clarity, realism and credibility of clinical information presented to study respondents in accordance with current oncology practice at The James Cancer Center.
Background informational sheets, health state scenario cards, and clinical components of WTP scenarios were formulated by first providing the expert clinical panel with draft versions based on literature review and input from other members of the expert panel. Next, clinician input utilized “key informant interviews⁵”. Background informational sheets, health state scenarios, and clinical components of WTP scenarios were modified consistent with clinical panel recommendations until a consensus was met between the three clinical oncology panel members.

Health state scenarios were designed in anticipation of the following preference order for the PCNV survey: Perfect health >⑥ Your health >Situation NONV >Situation Prev PCNV >Situation NV > Death, and for the breast cancer survey: Perfect health > Your health >Situation C >Situation T > Situation R > Death.

The PCNV and breast cancer scenarios were refined until the three clinical oncology practitioners ranked the two sets of vignettes in the abovementioned order. This was then reviewed by the remaining expert panel and checked in the pilot study – testing the instrument on seven graduate students representative of the sample population. As a

⁵ Key informant interviews are indepth interviews with patients or clinicians selected because of their extensive experience with patients and ability to explain issues from their perspective. Interviewing is continued until no new ideas emerge - sampling to redundancy.

⁶ Where “>” represents “in preference to.”
result slight modifications were made to the scenarios the pilot study until the health state scenarios were interpreted in the desired preference order described above (Figures 3.3 to 3.8 overview six cancer health state scenarios used in this study).

PILOT STUDY

Subsequent to inclusion of expert panels’ recommendations, the interviewing schedule and accompanying instrument were tested on a convenience sample of seven female graduate students at the OSU (two from department of Education and four from Pharmacy and one from Health Systems Management and Policy) using face-to-face interviews to detect problems with the questionnaire or technique used in the study. Respondent comments were noted and addressed accordingly by making minor modifications to the face-to-face instruments.

During the pilot study one interview was not completed of the 11 attempted due to technical difficulties. SG method required the computer and at the time of the interview the system was not functioning. This problem was rectified for future interviews. Of the remaining 10 interviews the average time required to complete the survey ranged from 45 to 60 minutes with a mean of 57.5 minutes.

Section 2: Health state utilities

Health state utilities, or Q weights, were elicited using two techniques in the following order: VAS first, and then the SG method. Prior to administering the VAS and SG
methods, respondents were first provided with background material regarding the health state condition (i.e., PCNV or breast cancer) and were then asked to read and rank six health state conditions. This section starts with the ranking procedure, followed by the VAS and SG methods used in this study.

### Ranking

After reading the background material and the six health state descriptions (described in section 1), respondents were asked to rank the six health state description cards. The health state descriptions were presented to respondents on colored laminated cards: pale pink and pale green for breast cancer and PCNV scenarios, respectively. Each card represented a different health problem except for two cards: Situation P (Perfect Health) and possibly Situation Y (Your Health).

Scenarios were designed in anticipation of the following preference order for PCNV survey: Perfect Health > Situation Y > Situation NONV > Situation Prev NV > Situation NV > Death and for Breast Cancer survey: Perfect Health > Situation Y > Situation C > Situation T > Situation R > Death. Perfect health and death were not predefined as the most and least desirable health states in this study, respectively. Consistent with the welfare rule of consumer sovereignty, different preference orders were permitted. However, participants responding in a different preference order were asked to explain their ranking to ensure that they had understood the procedure and had read through the
cards carefully. Additionally, ranking of certain health states as equivalent was permissible if this was perceived as consistent with respondent preferences. Respondents were also provided the opportunity to change their rankings prior to moving on to the VAS.

Script used in the ranking procedure for PCNV and breast cancer surveys are presented in Figures 3.11 and 3.12, respectively. Respondents were first presented with assumptions for the procedure prior to being asked to rank health states, as recommended by Mc Master group (Furlong et al, 1990). The assumption presented for the two surveys are notable for their different time frames:

1. **PCNV survey**: one to five days with an average of three days for PCNV – consistent with literature review and expert opinion.

2. **Breast cancer survey**: until the age of 74 years for breast cancer – consistent with life expectancy for young female population interviewed and the McMaster approach for estimating health utilities for chronic conditions (National Center for Health Statistics, 1999; Furlong, Feeney, Torrance, Barr, Horsman, 1990). The same set of assumptions was used for VAS and SG questions.
What we have everyone do in this part is compare each of the cards and rank them according to how undesirable each card would be if you were to have the state of health described on the card for 1 to 5 days with an average of 3 days.

- Now that you have read all of the six health states, please rank the descriptions from best to worst situation assuming that: You will be in the condition for 1 to 5 days with an average of 3 days (except for death).
- What happens after that is not known and should not be taken into account.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Please rank the descriptions from best to worst situation.

Now that you have completed the ranking, are you sure that these rankings are in order from best to worst situation?

Figure 3.11; Script used in ranking of PCNV scenarios.
What we have everyone do in this part is compare each of the cards and rank them according to how undesirable each card would be if you were to have the state of health described on the card for the rest of your life.

Now that you have read all of the six health states, please rank the descriptions from best to worst situation assuming that:

- You will be in the condition the rest of your life, until you are 74 years old.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Please rank the descriptions from best to worst situation.

Now that you have completed the ranking, are you sure that these rankings are in order from best to worst situation?

Figure 3.12: Script used in ranking of Breast cancer scenarios.

Visual Analogue Scale

A feeling thermometer (Figure 3.13) was used to acquire VAS values as recommended by Furlong et al (1990). The feeling thermometer, administered after the ranking is a vertical, calibrated interval scale labeled with anchors zero and 100 for the least and most desirable health states, respectively. Respondents were asked to designate their most desirable and
Figure 3.13: Feeling Thermometer (Furlong et al, 1990)
least desirable health states as zero and 100 using marked arrows. The remaining four health states were assigned values by respondents in chronological order – from second most preferred health state to the fifth most preferred health state using the remaining four arrows.

As a validity check, the ordering of the arrows for the six different health states was compared to the ranking responses for consistency. If preference ordering was reversed this was considered irrational and the discrepancy was brought to the respondent’s attention. At this time the respondent was free to change either the VAS or the ranking to ensure consistency of responses. If respondent was unable to make the change to provide consistent answers the interview was terminated.

Since the feeling thermometer, is designed to be an interval scale, magnitude of the distances between the arrows placed on the thermometer can be compared. Therefore to be consistent with an interval scale, respondents were also reminded to place the arrows on the scale such that the distances between the arrows reflected the differences perceived between the health states. Similar to the ranking, respondents were provided first with assumptions and, at the end of the VAS procedure, the opportunity to change their responses prior to moving on to the SG section. As an example, feeling thermometer instructions are provided in Figure 3.14 for PCNV survey.
This is a visual aid called a thermometer scale. It helps us to measure people’s feelings about things. In this interview, we are going to use the thermometer scale to measure your preferences for different health states. The thermometer scale endpoints have the values 0 and 100. The most desirable health state has a value of 100 and the least desirable health state has a value of 0.

[Ask respondent to place an arrow next to 100 and label it with appropriate Health State, similarly, place an arrow next to 0 and label it with the appropriate Health State]

Using the arrows provided, each of the six health states will be assigned a value. This is how it works. The more preferable you feel a health state (or card), the closer it should be to the top of the thermometer, and the less preferable you feel a health state to be the closer it should be to the bottom of the thermometer.

As before assume that:
- You will be in the condition for 1 to 5 days with an average of 3 days.
- What happens after that is not known and should not be taken into account.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Place health states on thermometer such that the distance between the arrows reflects the differences you perceive between the health states. Any questions? Shall we start?

Figure 3.14: Feeling thermometer instructions for PCNV survey.

Preferences derived from the 0 to 100 point feeling thermometer were converted to a zero (0.0 to 1.0) scale by dividing the number by 100 to facilitate comparisons between
preferences acquired using VAS and SG. Expected utility theory dictates that death corresponds to zero and perfect health to 1.0. Since it is expected that not all respondents will rate death as the worst health state, and there is no lower boundary for scores worse than death (Patrick, Starks, Cain, Uhlmann, Pearlman, 1994), a linear transformation will be used allowing for negative preference values for health states worse than death. The linear transformation to be used when death is not regarded as the worst health state is described by Equation 3.1 (Patrick, Starks, Cain, Uhlmann, Pearlman, 1994). An example is provided in Figure 3.15.

\[ VAS_{\text{hi-new}} = \frac{(VAS_{\text{hi-raw}} - VAS_{\text{death}})}{(1 - VAS_{\text{death}})} \quad \text{Equation 3.1} \]

Since the distribution provided using this translation is highly skewed, Patrick and colleagues (1994) recommend the following additional transformation for negative values

\[ VAS_{\text{hi-new'}} = \frac{VAS_{\text{hi-new}}}{(1 - VAS_{\text{hi-new}})} \quad \text{Equation 3.2} \]

This additional transformation results in preferences that range from −1.0 to 1.0, with equal distances in both the positive and negative direction for death. Without the transformation negative utilities can exceed |−1.0| that can have significant impact when comparing mean preference values. The transformation produced from equation 3.2 results in values that are much less skewed, however, transformed values (resulting from equations 3.1 and 3.2) can no longer be regarded as utilities (Patrick, Starks, Cain, Uhlmann, Pearlman, 1994).
If, VAS_{situation} = 0, VAS_{death} = 0.58, and VAS_{perfect health} = 1.0 (VAS raw scores are already divided by 100)

Using equation 3.1
\[ \text{VAS}_{situation\ raw} = (\text{VAS}_{situation\ raw} - \text{VAS}_{death})/(1-\text{VAS}_{death}) \]
\[ = (0 - 0.58)/(1-0.58) = -1.38 \]
Therefore, where death=0 and perfect health=1.0, Situation R=-1.38

Using equation 3.2
\[ \text{VAS}_{situation\ raw} = \text{VAS}_{situation\ raw} / (1 - \text{VAS}_{situation\ raw}) \]
\[ = (-1.38)/(1- [-1.58]) = -0.57 \]

Figure 3.15: Example of linear translation for negative preference values.

**Standard Gamble**

The top-down titration method was used to elicit standard gamble (SG) utilities due to its greater efficiency and precision compared to the more commonly used ping-pong approach. Greater standard deviations reported with the ping-pong approach, up to four times larger, would have required a substantial increase in sample size to detect differences in SG utility (Clarke et al, 1997; Lenert et al, 1997; Lenert, Cher, Goldstein et al, 1998). The top-down titration SG method was used for PCNV and breast cancer scenarios.
The SG method was presented graphically on computer using Microsoft PowerPoint 2000. The SG question used same six health state descriptions presented in the ranking and feeling thermometer. The most and least desirable health states, as defined by the respondent, were used as the anchor health states (similar to VAS). Respondents were presented with a series of four sets of slides for the four intermediate health state descriptions in chronological preference order from most to least desirable. For example, in breast cancer survey, if a respondent ranked health states in the following order:

Perfect health > Your health > Situation T > Situation C > Situation R > Death, then perfect health and death would be defined as anchors, and SG utilities would be acquired for the remaining four health state descriptions. However, if a respondent ranked health states in the following order: Perfect health > Your health > Situation T > Situation C > Death > Situation R then perfect health and Situation R would be defined as anchors, and SG utilities would be acquired for the remaining four health state descriptions. The SG procedure used for expected preference order will be described first (i.e., death and perfect health are least and most desired health states), followed by the SG procedure used when death is not regarded as the worst health state.

_Death And Perfect Health = Least And Most Desirable Health States_

Respondents were provided with two choices. Choice A involved risk, a gamble between respondent's best and worst health states. Choice B was an intermediate health state \( h_i \) that occurred with 100% certainty and therefore did not involve risk. The first slide
presented choice A with perfect health at 100% chance (0% chance of death) versus choice B - a less preferred health state. This question was a validity check to test respondent understanding of probabilities. The logical response would be to choose choice A since perfect health would be guaranteed and is preferred over a less preferred health state. To assist respondents with the concept of probabilities, it was explained that 100% chance of perfect health was explained to mean that if 100 respondents like yourself selected choice A, you would expect all of the respondents to have perfect health for the rest of their life and no one (i.e., zero percent) to die (breast cancer survey). An example of the first SG question for Situation R is provided in Figure 3.16.
CHANCE BOARD

CHOICE A

CHOICE B

Would you take the treatment if there was a 100% chance of perfect health but a 0% chance that you would die, or would you prefer to stay in your present state (situation R)?

Figure 3.16: SG options Choice A (gamble between perfect health and immediate death) versus chronic health state Choice B (Situation R).
Risk of death for choice A was subsequently increased until the respondent was no longer willing to gamble. Risk of death was increased in 2% increments in slides from 100% chance of perfect health (0% chance of death) to 80% chance of perfect health (20% chance of death), and in 5% increments thereafter to a 5% chance of perfect health. This is explicated for Situation R health state in Figure 3.17. Figure 3.18 presents one example of the SG slides for Situation R – 80% chance that health is elevated to perfect health for the rest of her life (best health state) and a 20% chance that she will die immediately without pain in her sleep (worst health state) or respondent can choose to remain in Situation R for the rest of her life.

The SG procedure started with repetition of the assumptions and an explanation of the gamble. Two and five percent increments were selected based on the results of the pilot test. Using five percent increments throughout the SG procedure lacked discriminatory power and use one percent increment slides was tiresome for respondents and would not be feasible for low utilities (i.e., 50 slides for utility of 0.50). To improve accuracy of results, when the respondent was no longer willing to risk death, the respondent was asked if she would take the gamble using one percent increments. For example, if respondent was willing to gamble 14% chance of death, but not 16%, respondent was asked if she would take choice A if the risk of death was 15%.
As before, I am going to show you a series of slides with two choices. Choice "B" is certain, so Situation R occurs with 100% certainty and choice "A" involves risk—a gamble between Situation D (death) and Situation P (Perfect Health).

As before, also assume that
- You will be in the condition for the rest of your life (until you are 74 years old).
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let’s begin.

Remember, that choice B (Situation R) is the 1st preferred health state from your ranking form.

Imagine that you are in Situation R. You can choose to either remain in your current health state (Situation R) for the rest of your life (until you are 74 years old) or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health (until you are 74 years old) [Point to Situation P on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will die immediately [Point to Situation D on screen].

Given the choice would you take the treatment?
[Choice A - start with perfect health 100%, death 0%. If respondent does not select gamble, response regarded as invalid – question respondent. If respondent does not regard perfect health as preferred option discontinue interview and note on survey].

If YES,
Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would die, or would you prefer to stay in your present state of health (situation R)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e.] Would you take the treatment if there was a 98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70, 65, 60, 55, 50, 45, 40, 35, 30, 25, 20, 15, 10, 5, 0 of perfect health but a 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98 chance that you would die?

Figure 3.17: SG script for Situation R (breast cancer survey).
Would you take the treatment if there was a 80% chance of perfect health but a 20% chance that you would die, or would you prefer to stay in your present state (situation R)?

Figure 3.18: SG options Choice A (gamble between perfect health and immediate death) versus chronic health state Choice B (Situation R).
Death ≠ Least Desirable Health States

Similar format to when death and perfect health were the least and most desirable health states. Respondents were still provided with two choices. Choice A involved risk and choice B was an intermediate health state ($h_i$) that occurred with 100% certainty. Choice A was a gamble between respondent’s best health state (perfect health) and worst health state, except now the worst health state was not death, but Situation R (breast cancer survey) or Situation NV (PCNV survey). Two examples are provided for scripts used for health states worse than death. Figure 3.19 describes script used for Situation C (Breast cancer survey) when Situation R is regarded as the worst health state and Figure 3.20 describes the script used for Situation D (PCNV survey) when Situation NV was perceived as the least desirable health state. Formats used for health states worse than death were based on Patrick and colleagues (1994) and McMaster approach (Torrance, 1982; Furlong, Feeny, Torrance, Barr and Horsman, 1990).

Similar conversions were also used as for VAS preference values for health states worse than death as described in equations 3.1 and 3.2, substituting VAS preferences for SG utility values (Patrick, Starks, Cain, Uhlmann, Pearlman, 1994; Helene Starks, verbal communication, 4/2000).
Imagine that you are in Situation C [Point to Sit C on screen]. You can choose to either remain in your current health state (Situation C) for the rest of your life (until you are 74 years old) or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health (until you are 74 years old) [Point to Situation P on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will be in Situation R for the rest of your life [Point to Situation R on screen].

Figure 3.19. Worst health state Situation R – measuring utility of Situation C

Imagine that you have a rapidly progressing terminal disease, which if left unattended will lead rapidly to death. You can choose to either remain in your current health state (Situation D) or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for 1 to 5 days with an average of 3 days [Point to Situation P on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will be in Situation NV for 1 to 5 days with an average of 3 days [Point to Situation NV on screen].

Figure 3.20: Worst health state Situation NV – measuring utility of Situation D
Section 3: Sociodemographics

Sociodemographic questions were placed half way in the survey – between health utility measures and WTP – for two reasons. First, simple questions provided a mental break for respondents after the cognitively demanding SG method. Second, the items in this section were designed to remind respondents of factors affecting their discretionary income, important consideration for WTP. Sociodemographic information was collected in the first of the two interviews. In the second interview, this information was provided for respondent review prior to WTP section.

Sociodemographic questions were self administered and included: age, marital status, US citizenship, achieved education level, occupation, income level (gross combined annual household income), and, if a student at OSU, their college, major, degree working towards, income level, and whether they are a full-time or part-time student. Number of children and age at birth of first child was also noted since number in the household is a factor that should be considered prior to responding to WTP questions (i.e., it affects discretionary income), and age of mother when first child was born also is a risk factor for breast cancer (Incidence of breast cancer is lower for women who have their first child prior to their 30th birthday). Respondent attitude towards risk was reported in terms

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7 Many students have student loans, some being financed 100%, therefore asking respondents WTP for a good assuming that they could not take out loans did not make sense to these respondents. This would mean that they have up to zero income. As a result income was recorded as annual gross combined household income including any student loans over the past 12 months that contributed to their discretionary income (i.e., not tuition, since graduate teaching assistants and graduate administrative assistants do not include their tuition waiver as part of their household income).
of smoking history (Gerard, Johnson, Brown, 1999). Smoking is also a risk factor for breast cancer was reported in terms of smoking history (smoker, ex-smoker or non-smoker).

Respondents' prior knowledge of PCNV and breast cancer was acquired by asking: if they have ever been diagnosed with cancer, if anyone in their family had been diagnosed with cancer? If anyone they know outside of their family had been diagnosed with cancer? In addition respondents were asked if they have any history of health problems. Given the personal nature of the last question (and income level question) respondents were free not to respond to these questions, complete the remainder of the interview and not forfeit incentive payment for their participation. No respondents refused to answer these questions.

The basis for most sociodemographic variables are motivated by general utility theory. It is anticipated that (a) individuals in poorer health will be WTP more (b) individuals with a higher income will be WTP more (c) WTP decreases with age (d) the longer the interview the greater the WTP. It is thought that education level matters, but direction for its affect is unclear a priori. (Olsen and Donaldson, 1998)

**Section 4: Willingness to Pay**

WTP section utilized the same health state scenarios used in the ranking, VAS and SG methods. Providing the WTP questions after ranking, VAS and SG questions gave
respondents time to carefully consider the different health states in terms of quality of life – a construct probably more familiar to respondents than WTP – prior to asking respondents to compare their preferences for health states in monetary terms. This assumption was confirmed qualitatively during the pilot study and final data collection by a number of respondents commenting that they were pleased that feeling board and chance board were presented prior to the WTP method.

WTP questions measured utility using a compensating variation technique, a method more easily understood than equivalent variation by respondents (O’Brien and Gafni, 1996) and the bidding game approach (O’Brien et al, 1998). The bidding game is efficient, (i.e., requires a smaller sample size compared to other alternatives), easily understood by respondents and not as long compared to other techniques. The disadvantage of the bidding game is that maximum WTP is affected by the first bid in the bidding game – stating point bias. To account for starting point bias, two alternative bid algorithms were used (for PCNV and breast cancer surveys). Hypothetical scenarios for PCNV and breast cancer were presented using the consumption based or user-based approach since it is not meaningful to measure holistic utility measures (VAS and SG) using the insurance-based scenarios (Bala et al, 1998).

Respondents were presented with three WTP questions in each interview. Similar to the previous utility measures, each respondent was first provided with a set of assumptions. Figure 3.21 describes the assumptions stated for the three PCNV questions, the first
prefaced by the following statement "This section uses the same scenarios that you read before, but here we will compare them in a different way."

Imagine that you are in Situation NV [show respondent scenario card, i.e... Also assume that
• You will be in the condition for 1 to 5 days with an average of 3 days, and treatment is expected once a month for 6 months (i.e. 6 cycles).
• The scenarios apply to you at your current age.
• Your affairs are in order and you have made all preparations for the possibility of your death.

Figure 3.21. Assumptions for PCNV WTP question.

WTP health state assumptions were followed by reminding respondents of assumed initial health state – Situation NV (PCNV survey) or Situation R (PCNV survey) – by presentation of respective health state scenario cards. Respondents were then presented with two therapy choices resulting in two different outcomes: one completely covered by health insurance while the more desirable therapy one was not. If respondent preferred the health state with the more desirable outcome, and it was worth more than zero dollars, the bidding algorithm was initiated to estimate how much more.
For example, the first PCNV WTP scenario presented an incremental WTP question, a comparison of standard with optimal preventative therapy (Table 3.1: Protocol 1A and 2B). Therefore, Situation Prev NV and Situation NoNV health state cards were presented to respondents for comparison after assumptions were read (Figure 3.21). Outcome Situation Prev NV was available without any additional out-of-pocket expenses; however, Situation NoNV (intended as the preferred alternative) was not covered by health insurance.

"Additional bills for optimal therapy (i.e. medication and its administration to prevent nausea and vomiting) are not covered by your health insurance."

Respondents were then asked which health state was preferred (Situation NoNV was preferred over Situation Prev NV by all respondents). If respondent was WTP more than zero dollars for Situation NoNV the assigned bidding algorithm was initiated after presentation of instructions and assumptions (Figure 3.22). The first WTP bid was (algorithm 1)

"Are you WTP $100 each month for the optimal therapy for the next 6 months?"

Bids continued using the bidding vector described in Appendix G1. For example, if respondent said yes the next bid was

"Are you WTP $175 each month for the optimal therapy for the next 6 months?"

If respondent said no, bid was reduced, and so forth. When the respondent had reached their maximum WTP – the bidding game provided a range for example, suppose the respondent was WTP an amount between $175 and $200. This would be followed by:
"OK, so this means that you are willing to pay an amount between $175 and $200 each month for the optimal therapy *for the next 6 months.*"

Next an exact amount was acquired from the respondent. Suppose it was $180 per month. The respondent was then informed how much this would be for 6 months (i.e., $180 times 6 is equal to $1080 to be paid over the next 6 months) to ensure that they had considered their discretionary income in bidding\(^8\). Respondent was able to modify her bid if she felt that it unaffordable.

Finally, to ensure the respondent had carefully thought through her bid she was asked to state where the money would come from: discretionary income, savings, or other assets. If at this time the respondent reconsidered her prior bid, she was again permitted to do so.

*PCNV Bid Vector:* The bid vector for the first WTP question ranged from $100 to $300 (100, 125, 150, 175, 200, 250, 300) and for do-nothing versus standard preventative therapy ranged from $25 to $200 (25, 50, 75, 100, 125, 150, 200). The third bid vector for do-nothing versus optimal preventative therapy was initially set to range from $100 to $350 for study respondents, however, since 11 of the first 14 interviewees exceeded $350 bid, the bid vector was expanded to $800 (i.e., 100, 125, 150, 200, 250, 300, 350, 400, 500, 600, 800). Respondents WTP more than largest bid offered in the bidding game.

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\(^8\) Time frame for all PCNV WTP questions was WTP per month for the next six months because (1) chemotherapy is usually provided on monthly cycle to enable immune recovery and (2) respondents included in the study are typically paid monthly therefore, it was expected that monthly payments would most likely fit into their current budget scheme.
were asked an open-ended question to determine how much more. Cost of oral ondansetron 16mg dose ($50), opinion of female graduate student (part of the expert panel) in addition to pilot study were used to determine what bid vector to use similar to Kartman, Andersson, Johannesson (1996) and Appel and colleagues (1990).

Since, your health insurance will not pay for the new optimal preventative therapy for nausea and vomiting, you will have to pay for it yourself. Bear in mind that the money you would pay for the preventative therapy would reduce what you have left to spend on yourself and/or your family. Also assume that the money you pay will be based on your current household earnings and that no one will lend you any money – including family and financial institutions.

For the following series of questions please consider your discretionary income after tax – that is the money you have after payment for basic necessities such as food, clothing, and housing. And you may also consider your savings and other assets you may have when answering the following questions.

Now I am going to ask you a series of questions (about 3 to 6) to determine the maximum your household would be willing to pay for optimal preventative therapy to completely alleviate 1 to 5 days (with an average of 3 days) of chemotherapy induced nausea and vomiting. Remember you expect to incur chemotherapy induced nausea and vomiting six times (six cycles of chemotherapy in six months)

Figure 3.22: Instructions and assumptions presented for first PCNV WTP scenario.
The time frame for Q weights for PCNV matched the time frame for WTP questions: one to five days with an average of three, therefore WTP questions asked respondents to provide a monetary value for a fixed time frame – consistent with how long benefits of therapy were expected to last. However, breast cancer Q weights, as recommended by McMaster group, were estimated assuming the six health states would last for the rest of their lives, except for death. This assumption was consistent with benefits for hypothetical breast cancer cure, but not for breast cancer treatment and recurrence. Based on the expert opinion of clinical oncology practitioners and literature, the expected survival for breast cancer treatment and recurrence would be two and 12 years, respectively (Miles et al, 1999). Therefore, three WTP questions for breast cancer were: incremental WTP question, a comparison of treatment (average of 12 years of life) with cure (expected to live until the age of 74) do-nothing with treatment (i.e., 10 additional years of life); and do-nothing with cure (Table 3.1: Protocol 1A and 2B).

Payment time frame for breast cancer WTP questions was also different to PCNV monthly payments. A single payment was selected as the time frame for breast cancer therapy. Although in a real life situation, a patient could borrow reasonably against future earnings or borrow from friends and family this was not permitted for any of the WTP items in this study. The unique population included in this study – young females with little or no experience in loans, justifies this. Therefore, low monetary payments are expected for breast cancer treatment scenarios for the primarily graduate student.
sample in this study. Although allowance for loans would probably result in much higher bids, there is no evidence to support that allowing respondents to borrow against future earnings would provide more meaningful bids (Allan Randall, verbal communication, 4/17/2000). This is supported by comments from a graduate student panel (n=6). They felt that inclusion of loans was too difficult a question to answer given the level of uncertainty in their futures both professionally (career path) and personally (e.g., marriage, children, and payment of student loans).

**Breast Cancer Bid Vectors:** The bid vector for the first breast cancer question ranged from $500 to $40,000 (500, 1K, 2K, 5K, 7,500, 10K, 15K, 20K, 25K, 30K, 40K), for do-nothing versus treatment ranged from $250 to $10,000 (250, 500, 750, 1,000, 2,000, 5,000, 10,000), and for do-nothing versus cure ranged from $1,000 to $60,000 (i.e., 1K, 2K, 5K, 7,500, 10K, 15K, 20K, 25K, 30K, 40K, 60K). Respondents WTP more than largest bid in vector were asked an open-ended question to determine how much more. Opinion of female graduate students (expert panel) and pilot study were used to determine what bid vector to use (Kartman, Andersson, and Johannesson 1996).

Section 5: Assessment of three utility methods

Section 5 of the study was used to assess respondent attitude towards the three utility measures – VAS, SG and WTP – by utilizing one of two approaches: standard assessment scale (STDAS) and graphic positioning scale (GPS). GPS has been reported

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*Not part of research objectives. Added as separate question, not relevant for desired objectives of this dissertation.*
to provide superior quality of data and discriminating power to that of the STD in addition to reducing time of survey completion in marketing research (Narayana, 1977). To the researchers' knowledge, the value of GPS has not been tested in the pharmacy literature. The objective of section 5 is acquiring respondent attitudes towards three utility measures (VAS, SG and WTP) by comparing the quality of data provided by GPS versus STDAS in health care.

Participants on STDAS and GPS responded to four items on an equally spaced, nine point Likert scale (midpoint labeled as “indifferent”). Nine categories were selected since “the magic number seven plus or minus two” (Italics added to indicate intention of author) falls within these limits in accordance with recommendation by Miller (1957) as reported by Streiner and Norman (1995). In addition the odd number of categories for the attitudinal scale also permitted a midpoint – labeled as “indifferent.” (Streiner and Norman, 1995).

Participants randomized to receive the STDAS responded to four questions for each of the three utility measures (i.e., 12 questions in total):

"Now that you have used the (thermometer/chance board method/ willingness to pay method) to rate six different levels of health, we would like you to rate the method by responding to the following questions. How would you rate the (thermometer/chance board method/ willingness to pay method) in terms of:"

1. Difficulty of making decisions? (All decisions easy to All decisions difficult),
2. Clarity of text (Very clear to very unclear),

3. Reasonableness for decision making (Very reasonable to very unreasonable)

4. Comfort for use in decision making (Very comfortable to very uncomfortable)

Respondents randomized to the GPS responded to four questions for each of the three utility measures (i.e., four questions in total).

"Now that you have used the willingness to pay method, chance board (computer slides) and thermometer (blue felt board) to rate choices in healthcare, we would like you to compare the different methods.

For example, suppose you were asked which of the three methods willingness to pay (W), chance board (C), and thermometer (T) required the most technology to perform. If you believe that T and W are of equal rating with C requiring a higher level of technology you may respond the following way."

<table>
<thead>
<tr>
<th>Most</th>
<th>Least</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology use</td>
<td>C</td>
</tr>
</tbody>
</table>

"Using the following abbreviations willingness to pay (W), chance board (C), and thermometer (T) in your comparisons please compare the three methods for the following four questions."

Respondents were then presented with the same four questions mentioned responding to the items using symbols (W, C and T) instead of check marks. GPS reduced the length of
the survey (one sheet instead of three), allowed respondents to rate three utility measures equally if desired or to differentiate depending on preferences.

Four items selected for this study were modeled from Flowers and others (1997) attitudinal ratings of WTP (Flowers, Garber, Bergen, Lenert, 1997). Respondent attitudes towards difficulty of making WTP decisions, clarity of WTP text, reasonableness of WTP for decision-making, and comfort in using WTP for decision-making were reported on 4-point Likert scales. The same items were used to allow for comparison to the Flowers and others study, which used endorsed the WTP method in medical decision making (Flowers et al, 1997). Additionally, expanding these items for VAS and SG utility method would provide information of respondent utility method preferences in health care. Respondents at the completion of the section were offered the opportunity to comment on the three utility methods.

Section 6: Rating of health state scenarios

Respondent interpretation of health state scenarios was by asking respondents to rate the three dimensions — physical, emotional, and social — for each of the health states, on a 10-point Likert scale (Poor=1 to 10=Excellent, with the center labeled as average). Respondent interpretations were later compared to researcher ratings as part of content validity check of specially constructed health state descriptions used for this study (Gerard, Johnston, and Brown, 1999). This will be discussed in more detail in content validity section of chapter 3.
Section 7: Interviewer Evaluation

Interviewer evaluation items were adapted from Mitchell and Carson national freshwater quality improvements study (Mitchell and Carson, 1993, pages 317-340), based on recommendations by the Blue Panel (Arrow et al, 1993). The Panel states

"Specifically if a CV survey suffered from any of the following maladies, we would judge its findings unreliable: inadequate responsiveness to the scope of the environmental insult; lack of understanding of the task by respondents; and lack of belief in the full restoration scenario." (Arrow et al, 1993, page 4614).

Lack of respondent understanding and belief was reviewed by interviewer response to the items adapted from Mitchell and Carson study (1993). Comparing responses for the second and third WTP questions in PCNV and breast cancer surveys tests scope effects. Reliability and validity of the surveys used will be discussed in detail in the following section.

Psychometric Criteria For Judging Preference Based Measures.

This section will discuss three components considered important for judging preference based measures on health related quality of life: practicality, reliability and validity (Brazier and Deverill, 1999). Each will be discussed in turn.
Practicality

An instrument must be acceptable to survey participants and interested parties. Therefore, consideration must be given to the length of the time required to administer or complete the instrument successfully as this will affect the feasibility of the study, cost, responder fatigue and thus reliability and validity of responses (Brazier and Deverill, 1999). Furthermore, time required to complete survey was also recorded as an indicator of the overall budget constraint effect. The faster the individual provides a WTP estimate the more likely it is that the individual's budget constraint will come into affect (Olsen and Donaldson, 1998).

Additionally, as recommended by Torrance (1976), in this study feasibility is assessed by the use of proxy measures. That is, responder acceptability of the survey is determined by percent of respondents that completed the interview successfully or broke-off the interview, the ease/difficulty encountered in responding to items, and the duration of the interview (Brazier and Deverill, 1999).

Of the 119 interviews completed in this study mean interview duration was within the expected time frame of 60 to 90 minutes (i.e., similar to pilot study). Mean time for PCNV and breast cancer survey completion was 57.71 minutes (SD=11.78) and 59.32 minutes (SD=13.28), respectively.
Study participation required completion of two interviews. Of 126 respondents interviewed, one did not complete the first interview and two did not complete their second interviews. The first mentioned interview was discontinued due to apparent distress observed by the interviewer. Breast cancer survey was being administered and respondent's mother had recently died of breast cancer. The remaining two respondents did not keep scheduled second interview. Of the remaining 123 respondents completing interviews four respondents were dropped due to lack of understanding in health utility measures used and belief in the hypothetical scenarios. In addition, one of these four did not appear to believe the stated purpose of the study and questioned its use for market research; therefore, responses had potential for strategic bias. Therefore, of the 252 interviews completed (i.e. 126 respondents each completing 2 interviews), 238 interviews (i.e. 119 respondents each completing 2 interviews) were completed successfully and included in study for analysis.

In summary, 93.7% of interviews were completed successfully (238/252*100=94.4%) and on average interviews were completed within 60 minutes indicating that surveys were regarded as acceptable by respondents (Torrance, 1976) and practical (Brazier and Deverill, 1999).

Reliability

A measure is reliable if it is relatively free of measurement error. Reliability is concerned with the ability of the measure to produce consistent results (Froberg and Kane 1989a-d;
Validity

Validity refers to the extent an instrument measures what it is supposed to measure and does not measure what it is not intended to measure. In other words, validation refers to the extent to which the instrument serves the purpose for which it was intended (Brazier and Deverill 1999; Stewart, 1988). Since no gold standard exists to verify health preferences, and it is not possible to compare stated WTP with revealed WTP, criterion validity cannot be readily established (Stewart, 1988; Giesler et al, 1999). The following section shall review content, construct and convergent validity checks used in this study.

CONTENT VALIDITY

Content validity (face validity) is concerned with whether the items and scenarios used in the study were sensible and appropriate (Brazier and Deverill, 1999). To establish the face validity of the instruments in this study, the face-to-face interview instruments were reviewed by the expert panel as described previously.
In addition, content validity for health state scenarios was measured by asking respondents to rate on a 10-point Likert scale three dimensions - physical, emotional, and social - for each of the breast cancer and PCNV health state scenarios, excluding death (Section 6 of survey). The health state scenarios used in this study are the basis for preference values acquired in this study. Therefore, validation of how health states specially constructed for use in this study were perceived is an important component of the validation process. (Gerard, Johnston, and Brown, 1999).

It was intended that the PCNV scenarios (excluding death) were interpreted as follows for each of the three dimensions (physical/emotional/social): perfect health (10/10/10); your health (variable responses expected – anticipate values ranging between 7 and 10 with most between 8 and 9 for each of the dimensions); situation No NV (7/7/7); situation Prev NV (4/3/4); and situation NV (2/3/2). Emotional dimension for Situation PrevNV and Situation NV was identical, however, respondents perceived the emotional dimension for the Situation PrevNV as preferable (Table 3.3). One sample runs test for ordinal data (Siegal and Castellan, 1988) was run using SPSS 10.0\(^{10}\) indicated no significant difference between observed and estimated values supporting the content validation test that health state scenarios were perceived by respondents as intended (Table 3.3). Furthermore, respondents were also asked how long they perceived the PCNV to last for in the health state scenarios. A mean response of three days was expected. PCNV was reported to last a mean of 3.88 days (SD=1.04), with a range of

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\(^{10}\) All statistical tests are run using SPSS 10.0 at the 0.05 level of significance unless otherwise stated.
<table>
<thead>
<tr>
<th>Health State</th>
<th>Respondent Mean (SD)</th>
<th>Median</th>
<th>Expected Value*</th>
<th>Asymptotic. Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Situation P</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>9.96 (0.18)</td>
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</tr>
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<td>Social</td>
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<td>10</td>
<td>0.546</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>8.68 (0.97)</td>
<td>9</td>
<td>1-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Emotional</td>
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<td>1-10</td>
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</tr>
<tr>
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<td>1-10</td>
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<td>7</td>
<td>0.238</td>
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<tr>
<td>Physical</td>
<td>4.38 (1.52)</td>
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<td>4</td>
<td>0.316</td>
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<tr>
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<tr>
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<td>0.646</td>
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<td><strong>Situation NV</strong></td>
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</tr>
<tr>
<td>Physical</td>
<td>2.41 (1.27)</td>
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<td>2.54 (1.33)</td>
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<td>0.495</td>
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</tbody>
</table>

*1=poor, 10=excellent

**Table 3.3: Content Validity: confirmation of interpretation of PCNV health state scenarios.**
one to seven days (3 of 119 perceived duration of PCNV as greater than 5 days). Given
that 97.5 percent (116 of 119) of respondents perceived duration of PCNV as intended,
between one to five days, duration of PCNV is assumed to be perceived as intended by
researchers.

Researchers intended that breast cancer scenarios are interpreted as follows for each of
the three dimensions (physical/emotional/social): perfect health (10/10/10); your health
(variable responses expected – anticipate values ranging between 5 and 10 with most
between 8 and 9 for each of the dimensions); situation C (7/8/8); situation T (7/5/6); and
situation R (5/2/2) (Table 3.4). One sample runs test for ordinal data (Siegal and
Castellan, 1988) indicated no significant difference between observed and estimated
values supporting the content validation test that health state scenarios were perceived by
respondents as intended (Table 3.4).
<table>
<thead>
<tr>
<th>Health State</th>
<th>Respondent Mean (SD)</th>
<th>Median</th>
<th>Expected Value*</th>
<th>Asymptotic Significance</th>
</tr>
</thead>
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<td>Physical</td>
<td>9.98 (0.13)</td>
<td>10</td>
<td>10</td>
<td>0.830</td>
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<tr>
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<td>9.73 (0.53)</td>
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</tr>
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<td>Social</td>
<td>9.94 (0.33)</td>
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<td>0.615</td>
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<tr>
<td>Physical</td>
<td>8.68 (0.97)</td>
<td>9</td>
<td>1-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Emotional</td>
<td>8.47 (1.24)</td>
<td>9</td>
<td>1-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Social</td>
<td>8.59 (1.33)</td>
<td>9</td>
<td>1-10</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Situation C</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>7.01 (1.43)</td>
<td>7</td>
<td>7</td>
<td>0.062</td>
</tr>
<tr>
<td>Emotional</td>
<td>7.78 (1.14)</td>
<td>8</td>
<td>8</td>
<td>0.167</td>
</tr>
<tr>
<td>Social</td>
<td>8.05 (1.25)</td>
<td>8</td>
<td>8</td>
<td>0.327</td>
</tr>
<tr>
<td><strong>Situation T</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>6.60 (1.65)</td>
<td>7</td>
<td>7</td>
<td>0.428</td>
</tr>
<tr>
<td>Emotional</td>
<td>4.99 (1.55)</td>
<td>5</td>
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<tr>
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<td>5.47 (1.57)</td>
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<td><strong>Situation R</strong></td>
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<td></td>
</tr>
<tr>
<td>Physical</td>
<td>3.94 (1.27)</td>
<td>4</td>
<td>5</td>
<td>0.331</td>
</tr>
<tr>
<td>Emotional</td>
<td>2.48 (1.31)</td>
<td>2</td>
<td>2</td>
<td>0.603</td>
</tr>
<tr>
<td>Social</td>
<td>2.14 (1.17)</td>
<td>2</td>
<td>2</td>
<td>0.196</td>
</tr>
</tbody>
</table>

*1=poor, 10=excellent.

**Table 3.4:** Content Validity: confirmation of interpretation of breast cancer health state scenarios.
CONSTRUCT VALIDITY

Construct validity investigates whether the measure relates with other metrics in hypothesized ways. Convergent validity, a type of construct validity, states that the measure should correlate with other measures of the same concept in a predictable way (Stewart, 1990).

Construct validity for WTP utility measures in this study will be explored based on two propositions from economic theory (Drummond, 1987; O'Brien and Viramontes, 1994) also supported by the Blue Panel — NOAA Panel on Contingent Valuation (Arrow et al, 1993), and psychometric theory (Brazier and Viramontes, 1994). Construct validity, consistent with its definition will be evaluated by testing whether WTP measures increase in the predicted direction. First, proposition from economic theory tests whether WTP increases with increasing ability to pay (i.e. increased household income status). According to economic theory, normal goods have positive income elasticity given all other things being equal, higher incomes should correspond to higher WTP (Drummond, 1988). Therefore, in this study as a test of construct validity we predict that mean WTP values will increase with increased ability to pay for each of the health improvements. Construct validity is tested using 2-tailed independent samples t-test at the 0.05 level of significance (Table 3.5). As hypothesized, higher income resulted in statistically significant higher WTP bids for higher income groups in all WTP scenarios.
<table>
<thead>
<tr>
<th>WTP Questions</th>
<th>Income Level ($US)</th>
<th>T Statistic</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;$20,000 (n=66)</td>
<td>≥ $20,000 (n=53)</td>
<td></td>
</tr>
<tr>
<td>PCNV</td>
<td>135.64</td>
<td>250.19</td>
<td>2.608</td>
</tr>
<tr>
<td>Do-nothing versus standard preventative therapy</td>
<td>293.35</td>
<td>551.04</td>
<td>4.134</td>
</tr>
<tr>
<td>Do-nothing versus optimal preventative therapy</td>
<td>230.35</td>
<td>408.35</td>
<td>3.634</td>
</tr>
<tr>
<td>Standard preventative therapy versus optimal preventative therapy</td>
<td>230.35</td>
<td>408.35</td>
<td>3.634</td>
</tr>
<tr>
<td>Breast Cancer</td>
<td>6,129.92</td>
<td>18,764.15</td>
<td>2.883</td>
</tr>
<tr>
<td>Do-nothing versus treatment</td>
<td>9,226.5</td>
<td>40,226.41</td>
<td>4.044</td>
</tr>
<tr>
<td>Do-nothing versus cure</td>
<td>8,458.33</td>
<td>36,731.13</td>
<td>3.183</td>
</tr>
<tr>
<td>Treatment versus cure</td>
<td>8,458.33</td>
<td>36,731.13</td>
<td>3.183</td>
</tr>
</tbody>
</table>

**Table: 3.5: Construct validity: effect of income on WTP bids.**

**Statistically significant at 0.01 level.**
The second proposition from economic theory states that the availability of more of a normal good (or more positively valued good) should correlate with greater WTP, even though it is anticipated that marginal utility for additional units decreases. The Blue Panel refers to this as the scope effect. Consistent with the scope effect is testing if WTP increases with greater disease severity, or reduced risk of side effects with therapy, controlling for income. For example, persons with greater disease should be WTP more for an equivalent health benefit for a given income status. Extent of health benefit can be varied to measure the scope effect (Johannesson et al, 1996; Kartman et al, 1996, Stalhammer and Johannesson, 1996; O’Brien et al, 1997). In this study scope test for breast cancer WTP question is comparison of mean WTP for do-nothing versus breast cancer treatment with mean WTP for do-nothing versus breast cancer cure. Second scope test compares mean WTP for do-nothing versus standard preventative therapy with mean WTP for do-nothing versus optimal preventative therapy (Table 3.6). Mean WTP are compared using 2-tailed paired samples t-test. As hypothesized, results showed statistically significant difference at the 0.05 level, providing further construct validation support.
<table>
<thead>
<tr>
<th>Scope Test</th>
<th>Mean WTP (US$)</th>
<th>Median WTP (US$)</th>
<th>T Statistic</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PCNV</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>do-nothing versus standard preventative therapy</td>
<td>186.66 (224.75)</td>
<td>150.00</td>
<td>11.14</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>with</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>do-nothing versus optimal preventative therapy</td>
<td>408.12 (337.23)</td>
<td>310.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Breast Cancer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>do-nothing versus treatment</td>
<td>11,756.93 (16,625.20)</td>
<td>6,500</td>
<td>2.63</td>
<td>0.01*</td>
</tr>
<tr>
<td>with</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>do-nothing versus cure</td>
<td>23,033 (4,573.38)</td>
<td>10,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3.6: Construct Validity: Scope test for PCNV and breast cancer WTP scenarios.**

*Statistically significant at 0.01 level.
CONVERGENT VALIDITY

Third validity test, convergent validity, measures whether WTP converges with other preference measures (SG and VAS) that measure the same construct. This can be tested by correlating WTP with health utility measures (SG and VAS) and noting if regression weights move in the predicted direction. It is predicted that WTP is negatively correlated with utility (O'Brien and Viramontes, 1994). In other words, higher WTP is expected to be associated with lower Q weights. In addition, since SG and VAS estimate health utility it is also expected that they are positively associated. Convergent validity tests performed in this study estimate correlations for (1) WTP with SG and VAS for PCNV survey (Table 3.7) and breast cancer survey (Table 3.8) and (2) SG with VAS for PCNV (Table 3.9) and breast cancer survey utility measures (Table 3.10).

Tables 3.7 and 3.8 present Pearson r correlation coefficients and spearman rank order correlation coefficients between WTP with SG and VAS metrics. The latter was added due to the highly skewed nature of the distributions. Nature of the relationship as indicated by the negative sign of spearman rank order correlation coefficients is in the predicted direction, however, magnitude of correlation coefficients is low and not statistically significant. Nonsignificant results for these correlations have also been reported in other studies (Blumenschein and Johannesson, 1998).
Table 3.7: Convergent validity: measured by correlation coefficients (r=product moment Pearson correlation and \( r_s \)=spearman rank order correlation coefficient) for PCNV survey.

**Key:**\( WTP_{\text{PrevNV-NV}} \) (Do nothing versus standard preventative therapy), \( WTP_{\text{NoNV-NV}} \) (Do nothing versus optimal preventative therapy), \( WTP_{\text{NoNV-PrevNV}} \) (incremental improvement in WTP of optimal versus standard preventative therapy), \( SG_{\text{NV}} \) (standard gamble utility measure for PCNV – do nothing scenario), \( SG_{\text{PrevNV}} \) (standard gamble utility measure for standard preventative therapy), \( VAS_{\text{NV}} \) (visual analogue scale preference measure for PCNV – do nothing scenario), and \( VAS_{\text{PrevNV}} \) (visual analogue scale preference measure for standard preventative therapy).

<table>
<thead>
<tr>
<th>( WTP_{\text{PrevNV-NV}} )</th>
<th>( SG_{\text{NV}} ) ( r/r_s )</th>
<th>( VAS_{\text{NV}} ) ( r/r_s )</th>
<th>( SG_{\text{PrevNV}} ) ( r/r_s )</th>
<th>( VAS_{\text{PrevNV}} ) ( r/r_s )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.009/-0.042</td>
<td>0.016/-0.013</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>0.034/-0.068</td>
<td>0.018/-0.055</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>0.061/-0.034</td>
<td>0.013/-0.095</td>
<td>0.010/-0.077</td>
<td>0.077/-0.014</td>
<td></td>
</tr>
</tbody>
</table>
Table 3.8: Convergent validity: measured by correlation coefficients ($r=$product moment Pearson correlation and $r_s=$spearman rank order correlation coefficient) for breast cancer survey.

Key: $WTP_{T-R}$ (Do nothing versus breast cancer treatment), $WTP_{C-R}$ (Do nothing versus breast cancer cure), $WTP_{C-T}$ (Incremental improvement in $WTP$: breast cancer cure versus treatment), $SG_R$ (standard gamble utility measure for breast cancer recurrence – do nothing scenario), $SG_T$ (standard gamble utility measure for breast cancer treatment), $VAS_R$ (visual analogue scale preference measure for breast cancer recurrence – do nothing scenario), and $VAS_T$ (visual analogue scale preference measure for breast cancer treatment).
<table>
<thead>
<tr>
<th>SG vs VAS</th>
<th>r_s</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation Y</td>
<td>0.348**</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Situation NoNV</td>
<td>0.060</td>
<td>0.546</td>
</tr>
<tr>
<td>Situation PrevNV</td>
<td>0.180*</td>
<td>0.050</td>
</tr>
<tr>
<td>Situation NV</td>
<td>0.390**</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Table 3.9:** Convergent validity: measured by r_s = Spearman rank order correlation coefficient for PCNV survey. *Statistically significant at 0.05 level. **Statistically significant at 0.01 level.

<table>
<thead>
<tr>
<th>SG vs VAS</th>
<th>r_s</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation Y</td>
<td>0.646**</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Situation C</td>
<td>0.175</td>
<td>0.057</td>
</tr>
<tr>
<td>Situation T</td>
<td>0.290**</td>
<td>0.001</td>
</tr>
<tr>
<td>Situation R</td>
<td>0.563**</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Table 3.10:** Convergent validity: measured by r_s = Spearman rank order correlation coefficient for breast cancer survey. **Statistically significant at 0.01 level.
Tables 3.9 and 3.10 present spearman rank order correlation coefficients between SG and VAS metrics. Nature of the relationship as indicated by the positive sign of spearman rank order correlation coefficients is in the predicted direction (Tables 3.9 and 3.10). Moderate positive significant association is reported for Situation Y (PCNV survey) and Situation NV (Table 3.9). Substantial association is reported for Situation Y (Breast cancer survey) and Situation R, while moderate and low association was reported for Situations T and C respectively. Lack of substantive relationships reported for Situations NoNV, T and C can be explained by the lack of variability in SG and VAS values reported for these health states by respondents. These correlations are comparable to those spearman correlation coefficients, 0.18 to 0.37, reported by Blumenschein and Johannesson (1998).

Additional validity tests conducted to address performance of VAS and SG as utility measures in the absence of a gold standard (Furlong et al, 1990; Giesler et al, 1999) are described below. First, order of scenario vignettes based on values obtained from the VAS (i.e., feeling thermometer) and SG methods should be consistent with the initial ranking of health states. All VAS and SG preference measures obtained in this are consistent.

Second, ranking of scenarios by respondents are ranked in a manner consistent with that of a rational decision maker. Given that each study required ranking of six health states, hypothetically, 720 different possible combinations are possible (i.e., 6x5x4x3x2x1) for
Based on interviews with three clinical pharmacists, the following preferences are assumed rational for the PCNV survey: Situation P > Situation NO NV > Situation Prev NV > Situation NV and Situation P > Situation Y > Death. With Situation Y inserted at any point in the preference ranking. As indicated, respondent's own health and perfect health can be regarded as equivalent. This ranking does not exclude death from not being the least desirable health state.

Most anticipated preference ranking for the Breast cancer scenarios is Situation P > Situation Y > Situation C > Situation T > Situation R > Situation D, however, the following are also regarded as rational modifications: Situation R ≤ Situation D and Situation C ≤ Situation T. Situation Y can be inserted at any preference point although it is expected that most respondents will perceive Situation P > Situation Y. Furthermore, it is not expected for either survey that any respondents will rank Situation Y ≤ Situation D.

Once again, ranking perfect health equivalent to one's own health was acceptable and it was also regarded as rational to rank situation R as worse than death. In addition, given that it is possible that the sample included in this study may be suffering from a chronic condition (such as the arthritis described in situation C), preference reversal of Situation C with Your health was permitted. Also because active individuals may feel that limitation of mobility (situation C) would create great disutility (despite positive social and emotional health described in the remaining two dimensions), preference reversal
between situations C and T was permitted from the initial ranking protocol described above.

All responses reported are consistent with pre-defined rational preference orders. Three respondents ranked Situation NV as worse than death, and 17 respondents ranked Situation R as worse than death. These responses were included in the analysis using the linear transformation described in Equation 3.1 to allow for negative utilities for health states worse than death with death re-defined as zero.

Research Questions and Analysis

This section lists the six research questions and discusses their corresponding hypotheses.

Research Question 1

Does breast cancer treatment versus do nothing (i.e., QALY_T - QALY_R) result in more QALYs than PCNV standard preventative therapy versus do nothing (i.e., QALY_{Prev NV} - QALY_{NV})?

The two hypotheses tested are as follows:

Hypothesis 1.1

The mean $\Delta$QALY-SG for PCNV standard preventative therapy ($QALY\text{-}SG_{Prev\; NV} - QALY\text{-}SG_{NV}$) is less than the mean $\Delta$QALY-SG for breast cancer treatment ($QALY\text{-}SG_{T} - QALY\text{-}SG_{R}$)
Hypothesis 1.2

The mean $\Delta$QALY-VAS for PCNV standard preventative therapy $(QALY-VAS_{Prev_{NV}} - QALY-VAS_{NV})$ is less than the mean $\Delta$QALY-VAS for breast cancer treatment $(QALY-VAS_{T} - QALY-VAS_{R})$.

Research Question 2

Does breast cancer cure versus treatment (i.e. $QALY_{c} - QALY_{T}$) result in more QALYs than PCNV optimal versus standard preventative therapy (i.e., $QALY_{Non_{NV}} - QALY_{Prev_{NV}}$)?

Research questions 1,2 and 5 are analyzed using two 2x2 repeated measures analysis of variance (ANOVA) factorial design (one for VAS and the other for SG utilities). The two main effects are survey (SURVEY), measured at two levels: acute (PCNV) and chronic (breast cancer), and incremental therapy approach (INCREMENT), measured at two levels: (1) comparison of do nothing with a therapy that provides partial response and (i.e., breast cancer treatment or standard preventative therapy), and (2) comparison of a new therapy with status quo (i.e., breast cancer treatment with cure or standard with optimal preventative therapy). The analysis will test for the main effects, SURVEY and INCREMENT, and their interaction, SURVEY x INCREMENT. It is hypothesized that breast cancer treatment versus do nothing (i.e., $QALY_{T} - QALY_{R}$) will result in more QALYs than PCNV standard preventative therapy versus do nothing (i.e. $QALY_{Prev_{NV}} - QALY_{NV}$) and that breast cancer cure versus treatment (i.e. $QALY_{c} - QALY_{T}$) will result
in more QALYs than PCNV optimal versus standard preventative therapy (i.e.,
\(\text{QALY}_{\text{NoNV}} - \text{QALY}_{\text{PrevNV}}\)). The two hypotheses are as follows:

**Hypothesis 2.1**

The mean \(\Delta\text{QALY-SG}\) for PCNV optimal preventative therapy

\((\text{QALY-SG}_{\text{NoNV}} - \text{QALY-SG}_{\text{PrevNV}})\)

is less than the mean \(\Delta\text{QALY-SG}\) for breast cancer hypothetical cure

\((\text{QALY-SG}_{\text{C}} - \text{QALY-SG}_{\text{T}})\).

**Hypothesis 2.2**

The mean \(\Delta\text{QALY-VAS}\) for PCNV optimal preventative therapy

\((\text{QALY-VAS}_{\text{NoNV}} - \text{QALY-VAS}_{\text{PrevNV}})\)

is less than the mean \(\Delta\text{QALY-VAS}\) for breast cancer hypothetical cure

\((\text{QALY-VAS}_{\text{C}} - \text{QALY-VAS}_{\text{T}})\).

**Research questions 3**

Does WTP for breast cancer treatment versus do nothing (i.e., \(\text{WTP}_{\text{T-R}}\)) result in greater WTP than for PCNV standard preventative therapy versus do nothing (i.e., \(\text{WTP}_{\text{PrevNV-NV}}\))?

**Hypothesis 3.1**

The mean \(\text{WTP}_{\text{T-R}}\) is greater than the mean \(\text{WTP}_{\text{PrevNV-NV}}\).

**Research Question 4**

Does WTP for breast cancer cure versus treatment (i.e. \(\text{WTP}_{\text{C-T}}\)) result in greater WTP than for PCNV optimal versus standard preventative therapy (i.e., \(\text{WTP}_{\text{NoNV-PrevNV}}\))?
Hypothesis 4.1

The mean $WTP_{C-T}$ is greater than the mean $WTP_{NoNV-PrevNV}$.

The third and fourth research questions evaluate the same changes in utility as research questions 1 and 2, but these research questions use WTP instead of QALYs to assess preferences. A 2x2 repeated measures ANOVA design is used. The two main effects are SURVEY, measured at two levels (acute and chronic), and incremental therapy approach (INCREMENT), measured at two levels as described in research question 2. The analysis will test for the main effects, SURVEY and INCREMENT, and their interaction, THERAPY x INCREMENT. It is hypothesized that mean WTP for breast cancer treatment versus do nothing (i.e., $WTP_{T-R}$) will be greater than mean WTP for PCNV standard preventative therapy versus do nothing (i.e., $WTP_{PrevNV-NV}$) and mean WTP for breast cancer cure versus treatment (i.e. $WTP_{C-T}$) will be greater than mean WTP for PCNV optimal versus standard preventative therapy (i.e., $WTP_{NoNV-PrevNV}$). It is anticipated that the difference in WTP for acute and chronic condition interventions will be substantively smaller than the difference in change in QALYs noted in research questions 1 and 2, since QALYs are more sensitive to duration of illness ($Y$), while WTP is more sensitive to $Q$. Thus, the hypothesis tested is as follows:

---

11 The hypothetical breast cancer cure level was added to address construct validity (i.e. scope effect as recommended by Blue Panel report [Arrow et al., 1993]). A validity test for "scope effect" hypothesizes that WTP should increase with increasing size of intervention. Therefore, it is hypothesized that a hypothetical cure (do nothing versus cure) will result in a greater WTP than treatment (do nothing versus treatment). Scope effect is presented in construct validity section.
Research Question 5

To what extent is (1) incremental $\Delta$QALYs breast cancer cure (i.e. $[\text{QALY}_C - \text{QALY}_T]$) greater than incremental $\Delta$QALYs breast cancer treatment (i.e., $[\text{QALY}_T - \text{QALY}_R]$) and (2) incremental $\Delta$QALYs for PCNV optimal preventative therapy (i.e. $[\text{QALY}_{\text{NonNV}} - \text{QALY}_{\text{PrevNV}}]$) different to incremental $\Delta$QALYs PCNV standard prevention (i.e., $[\text{QALY}_{\text{PrevNV}} - \text{QALY}_{\text{NV}}]$)?

Research question 5 hypothesizes that incremental $\Delta$QALYs for breast cancer cure (i.e. $\text{QALY}_C - \text{QALY}_T$) will result in more QALYs than incremental $\Delta$QALYs for treatment (i.e., $\text{QALY}_T - \text{QALY}_R$), because the cure increases both Y and Q, while treatment increases only Y. To avoid multiple testing of means, two 2x2 repeated measures analysis of variance (ANOVA) factorial design is used (i.e. one for VAS and one for SG methods to measure QALYs). The one-tailed planned post hoc tests (for simple main effects) will be used to test the following hypotheses.

---

12 Construct validity test for QALYs will involve comparisons of Q values (not change in Q) since it is expected that cure of disease should provide greater Q than treatment which in turn should provide greater Q than the disease state for both acute and chronic conditions, respectively. A similar comparison will be conducted using CV as part of the construct validity test, as recommended by Arrow et al (1993).
Hypothesis 5.1

The mean $\Delta QALY-VAS$ for breast cancer cure ($QALY-VAS_c - QALY-VAS_T$) is greater than the mean $\Delta QALY-VAS$ for breast cancer treatment ($QALY-VAS_{TR} - QALY-VAS_R$).

Hypothesis 5.2

The mean $\Delta QALY-SG$ for breast cancer cure ($QALY-SG_c - QALY-SG_T$) is greater than the mean $\Delta QALY-SG$ for breast cancer treatment ($QALY-SG_{TR} - QALY-SG_R$).

However, the relationship between incremental $\Delta QALY$s for PCNV cure and treatment (i.e. $[QALY_{NoNV} - QALY_{PrevNV}]$ versus $[QALY_{PrevNV} - QALY_{NV}]$) is uncertain since $Y$ is unaffected. Therefore, two-tailed post hoc tests (for simple main effects) will be conducted to measure this relationship, i.e.

Hypothesis 5.3

The mean incremental $\Delta QALY-VAS$ for optimal preventative therapy ($QALY-VAS_{NoNV} - QALY-VAS_{PrevNV}$) is equal to the mean incremental $\Delta QALY-VAS$ for standard preventative therapy ($QALY-VAS_{PrevNV} - QALY-VAS_{NV}$).

Hypothesis 5.4

The mean incremental $\Delta QALY-SG$ for optimal preventative therapy ($QALY-SG_{NoNV} - QALY-SG_{PrevNV}$) is equal to the mean incremental $\Delta QALY-SG$ for standard preventative therapy ($QALY-SG_{PrevNV} - QALY-SG_{NV}$).
Research question 6

What proportion of variance of WTP is accounted for by ΔQALYs resulting from (1) breast cancer treatment versus do nothing (i.e., QALY_T - QALY_R), (2) PCNV standard preventative therapy versus do nothing (i.e. QALY_{Prev NV} - QALY_{NV}), (3) breast cancer cure versus treatment (i.e. QALY_C - QALY_T) and (4) PCNV optimal preventative therapy versus standard preventative therapy (i.e., QALY_{NoNV} - QALY_{PCNV Prev}), accounting for age, economic status, and health status?

As defined in the study, the purpose of research question 6 is to design a regression model enabling the conversion of QALYs acquired due to treatment or cure to a monetary preference measure (WTP) in the given two disease states. WTP will be regressed onto the health utility measures (QALY-SG and QALY-VAS), controlling for sociodemographic variables using ordinary least squares regression (OLS) analysis. The eight hypotheses designed to answer this research question are:

Hypothesis 6.1

The proportion of variance of WTP_{T-R} explained by ΔQALYs (QALY-SG_T - [QALY-SG_R]), age, income and health problems, is zero.

Hypothesis 6.2

The proportion of variance of WTP_{T-R} explained by ΔQALYs ([QALY-VAS_T] - [QALY-VAS_R]), age, income and health problems, is zero.
Hypothesis 6.3

The proportion of variance of $\text{WTP}_{\text{PrevNV-NV}}$ explained by $\Delta\text{QALYs}$

$$([\text{QALY-SG}_{\text{PrevNV}}] - [\text{QALY-SG}_{\text{NV}}])$$, age, income and health problems, is zero.

Hypothesis 6.4

The proportion of variance of $\text{WTP}_{\text{PrevNV-NV}}$ explained by $\Delta\text{QALYs}$

$$([\text{QALY-VAS}_{\text{PrevNV}}] - [\text{QALY-VAS}_{\text{NV}}])$$, age, income and health problems, is zero.

Hypothesis 6.5

The proportion of variance of $\text{WTP}_{\text{C-T}}$ explained by $\Delta\text{QALYs}$

$$([\text{QALY-SG}_{\text{C}}] - [\text{QALY-SG}_{\text{T}}])$$, age, income and health problems, is zero.

Hypothesis 6.6

The proportion of variance of $\text{WTP}_{\text{C-T}}$ explained by $\Delta\text{QALYs}$

$$([\text{QALY-VAS}_{\text{C}}] - [\text{QALY-VAS}_{\text{T}}])$$, age, income and health problems, is zero.

Hypothesis 6.7

The proportion of variance of $\text{WTP}_{\text{NoNV-PrevNV}}$ explained by $\Delta\text{QALYs}$

$$([\text{QALY-VAS}_{\text{NoNV}}] - [\text{QALY-VAS}_{\text{PrevNV}}])$$, age, income and health problems, is zero.

Hypothesis 6.8

The proportion of variance of $\text{WTP}_{\text{NoNV-PrevNV}}$ explained by $\Delta\text{QALYs}$

$$([\text{QALY-VAS}_{\text{NoNV}}] - [\text{QALY-VAS}_{\text{PrevNV}}])$$, age, income and health problems, is zero.
Analysis

**QALY Estimates**

QALYs were estimated for PCNV scenarios by multiplying Q weight for each of the respective health states by a constant, 0.008 years (3/365 days), since PCNV was expected to last for one to five days with an average of 3 days. QALYs were estimated for the following breast cancer scenarios using the following formulae for:

**Situation R:** $QALY_R = Q_R \times Y_R$, where $Y_R = 2$ years, and $Q_R = $ respondent Q weight for breast cancer recurrence (VAS or SG)

**Situation T:** $QALY_T = Q_T \times Y_T$, where $Y_T = 12$ years, and $Q_T = $ respondent Q weight for breast cancer treatment (VAS or SG)

**Situation C:** $QALY_C = Q_C \times Y_C$, where $Y_C = (74 - $ Respondent age) years, and $Q_C = $ respondent Q weight for breast cancer cure (VAS or SG)

Changes in QALYs were measured by using VAS and SG, and multiplying these values by $\Delta Y$, measured in years. Examples are provided in Figures 3.23 and 3.24 and PCNV and breast cancer scenarios, respectively.
Utility

\[ Q_{\text{NoNV}} \quad \text{Optimal therapy} \]
\[ Q_{\text{PCNV PRE}} \quad \text{Standard therapy} \]
\[ Q_{\text{PCNV}} \quad \text{Do Nothing} \]

**Time (years)**

**Key**
- \( Q_{\text{NoNV}} \): QALYs with standard preventative therapy
- \( Q_{\text{PCNV PRE}} \): QALYs without preventative therapy (do nothing)
- \( Q_{\text{PCNV}} \): QALYs with optimal preventative therapy
- \( Q_{\text{NV}} \): PCNV optimal preventative therapy
- \( Q_{\text{PCNV PRE}} \): PCNV standard preventative therapy
- \( Q_{\text{NV}} \): PCNV (i.e., do nothing)
- 1.0: Perfect Health
- 0: Death

\[ *3/365\text{days}=0.008 \text{ years} \]

\[ \Delta \text{QALYs for PCNV are estimated as follows:} \]

Change in QALY for standard preventative therapy versus do nothing:

\[ \Delta \text{QALY}_{\text{PRENV-NV}} = (Q_{\text{PRENV}} - Q_{\text{NV}}) \times 0.008 \text{ years}. \]

Change in QALY for optimal versus standard preventative therapy:

\[ \Delta \text{QALY}_{\text{NONNV-PRENV}} = (Q_{\text{NONNV}} - Q_{\text{PRENV}}) \times 0.008 \text{ years} \]

Change in QALY for optimal versus do nothing:

\[ \Delta \text{QALY}_{\text{NONNV-NV}} = (Q_{\text{NONNV}} - Q_{\text{NV}}) \times 0.008 \text{ years} \]

**Figure 3.23:** Acute scenarios - \( \Delta \text{QALYs}. \)
ΔQALYs for breast cancer are estimated follows:

Change in QALY for breast cancer treatment versus do nothing =

\[ \Delta QALY_{T-R} = (Q_T)(12 \text{ years}) - (Q_R)(2 \text{ years}) \]

Change in QALY for breast cancer cure versus treatment =

\[ \Delta QALY_{C-T} = (Q_C)(74 \text{ years} - \text{Respondent Age}) - (Q_T)(12 \text{ years}) \]

Change in QALY for breast cancer cure versus do nothing =

\[ \Delta QALY_{C-R} = (Q_C)(74 \text{ years} - \text{Respondent Age}) - (Q_R)(2 \text{ years}) \]

Figure 3.24: Chronic scenarios -ΔQALYs.
Sample Size

Sample size estimates are based on primary research question of this study (research question 6), OLS regressing WTP onto QALY and accounting for age, health status, income level. Two methods were used to estimate sample size. First method estimates minimal required sample size of 60 to 80 for a reliable regression equation for social science research with four independent variables (i.e., 15 to 20 subjects per independent variable) (Stevens, 1992, Hair, Anderson, Tatham and Black, 1995).

Second method, used Cohen and Cohen (1983) recommendations for a needed sample size (n*). Required sample size estimate is based on the following equation:

\[ n^* = \frac{L}{f^2} + k_B + 1 \]  

Equation 3.3

where, \( L = \) value provided in Table E1 and E2 (Cohen and Cohen, 1983, p 526-7), \( f^2 = \) effect size, \( k_B = \) number of independent variables in regression equation. Providing an 80 percent probability of rejecting the null hypothesis (power=0.80) at \( \alpha \) at 0.05 and assuming a medium effect size of 0.15, a required \( n \) of 85 is estimated. Required \( n \) for \( \alpha \) at 0.05, medium effect size of 0.15 and power=0.90 is 107. Lastly, a required sample size estimate for smaller type 1 error (\( \alpha = 0.01 \)), higher power (power=0.90), and medium effect size is \( n^* = 117 \). Effect size of 0.15 is also supported by 0.20 increment to \( R^2 \) based on OLS regression by Johnson, Fries and Banzhaf (1997). The more conservative estimate of \( n^* = 117 \) is assumed for this study.

\[ ^{13} \text{Small}=0.02, \text{medium}=0.15, \text{large}=0.35 \] (Cohen and Cohen, 1983)
As a result 146 interviews were scheduled with the expectation that 15 percent of interviewees would not keep scheduled appointments and 5 percent of responses would be nonuseable (i.e., \(146 \times 0.85 \times 0.95 = 117\) useable responses are expected).
CHAPTER 4

RESULTS

First, this chapter will present questionnaire response rate and background characteristics of respondents. Next, impact of survey ordering is evaluated first on Q weights, and second on mean WTP bids. This is followed by a discussion of the additional impact of protocols and algorithms on mean WTP bids. Lastly, results of the six research questions are presented.
Response Rate

Data were collected from March 31, 2000 to June 28, 2000. Of the 146 interviewees scheduled, 20 cancelled their interviews (13.6 percent) claiming unavailability due to other commitments. Of the remaining 126 respondents interviewed, 7 were dropped from the study for reasons provided below, resulting in the inclusion of 119 respondents in the study.

a. One interview was discontinued due to apparent distress observed by the interviewer. The respondent's mother had recently died of breast cancer.
b. Two respondents did not keep their scheduled second interviews.
c. Four respondents were dropped due to lack of understanding in health utility measures used and belief in the hypothetical scenarios. In addition, one of these four did not appear to believe the stated purpose of the study and questioned its use for market research; therefore, responses had potential for strategic bias.

Thus, of the 252 interviews completed (i.e. 126 respondents each completing 2 interviews), 238 interviews (i.e. 119 respondents each completing 2 interviews) were completed included in study for analysis.

Study participation required completion of two interviews separated by at least one week. On average respondent interviews were administered a median of 8 days apart (mean=11.34 days, SD=2.82 days).
The effect of survey ordering (ORDER: whether PCNV survey were administered first or breast cancer survey was administered first) and interview duration (TIME: interview 1 versus interview 2) for the two respondent interviews was analyzed using a mixed design analysis of variance (ANOVA). Analysis of the main effects TIME and ORDER and their interaction are presented in Table 4.1. As anticipated, the main effect TIME was significant $F(1,117)=5.33$, $p<0.05$ and the main effect ORDER was not $F(1,117)=0.076$, $p=0.789$. The interaction term was significant $F(1,117)=76.748$, $p<0.05$. Figure 4.1 provides an explanation of results. On average interview 1 was longer than interview 2, independent of survey order. The disordinal interaction can be explained by the possibly more cognitively challenging breast cancer survey requiring more time to complete (than the PCNV survey when administered first) but a combination of the learning effect with the less cognitively challenging PCNV survey (administered second) resulted in a shorter second interview for ORDER 2 than ORDER 1 in Figure 4.1.
<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORDER</td>
<td>13.658</td>
<td>1</td>
<td>13.658</td>
<td>0.076</td>
<td>0.783</td>
</tr>
<tr>
<td>S/ORDER</td>
<td>20978.804</td>
<td>117</td>
<td>179.306</td>
<td>0.023*</td>
<td>0.023*</td>
</tr>
<tr>
<td>TIME</td>
<td>446.310</td>
<td>1</td>
<td>446.310</td>
<td>5.333</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>TIME*ORDER</td>
<td>6422.781</td>
<td>1</td>
<td>6422.781</td>
<td>76.748</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>ORDER*S/TIME</td>
<td>9791.328</td>
<td>117</td>
<td>83.687</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1: ANOVA summary table investigating two main effects TIME and ORDER and their interaction on mean interview duration. *Significant at 0.05 level.
Effect of TIME and ORDER on interview duration

Figure 4.1: Interaction ORDER X INTERVIEW, where, ORDER 1=PCNV survey is administered first and breast cancer survey is administered second and ORDER 2 = breast cancer survey is administered first and PCNV survey is administered second.
Sociodemographics

Table 4.2 presents sociodemographic variables for respondents. The majority of respondents were young, single, American, full-time students with incomes in the lower socioeconomic bracket (less than or equal to $20,000 per year). This salary range is as expected given that many graduate students are graduate teaching assistants or graduate administrative assistants. In addition, majority of respondents do not have children (84%) and are nonsmokers (88%).

Table 4.3 describes the distribution of colleges and majors of full time student study participants. The table reports a broad representation of female students from across campus. Of the twenty-three graduate colleges listed for OSU, 17 (73.9%) are represented in this study. The majority of full-time students were graduate students (86 of 97) almost evenly divided between masters and doctorate programs. The remaining respondents are non-students and are categorized by highest education level earned and occupation (Table 4.4). Overall, Tables 4.3 and 4.4 show that the sample represents a group of highly educated young women with affiliations with OSU.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>29.40 (7.34)</td>
</tr>
<tr>
<td>Range</td>
<td>21 to 59</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>72 (60.5%)</td>
</tr>
<tr>
<td>Married/cohabitating</td>
<td>42 (35.3%)</td>
</tr>
<tr>
<td>Widowed/divorced/</td>
<td>5 (4.2%)</td>
</tr>
<tr>
<td>Separated</td>
<td></td>
</tr>
<tr>
<td><strong>US Citizen</strong></td>
<td>100 (84.0%)</td>
</tr>
<tr>
<td><strong>Full-Time Student</strong></td>
<td></td>
</tr>
<tr>
<td>(Enrolled &gt;10 credits)</td>
<td>97 (81.5%)</td>
</tr>
<tr>
<td><strong>Annual Pretax household Income</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;$10,000</td>
<td>10 (8.4%)</td>
</tr>
<tr>
<td>$10,000-$19,000</td>
<td>56 (47.1%)</td>
</tr>
<tr>
<td>$20,000-$29,000</td>
<td>13 (10.9%)</td>
</tr>
<tr>
<td>$30,000-$39,000</td>
<td>9 (7.6%)</td>
</tr>
<tr>
<td>$40,000-$49,000</td>
<td>6 (5.0%)</td>
</tr>
<tr>
<td>$50,000-$59,000</td>
<td>8 (6.7%)</td>
</tr>
<tr>
<td>&gt;$60,000</td>
<td>17 (14.3%)</td>
</tr>
<tr>
<td><strong>Parents n (%)</strong></td>
<td>19 (15.60%)</td>
</tr>
<tr>
<td><strong>First child &lt;30 years</strong></td>
<td>12 (10.08%)</td>
</tr>
<tr>
<td><strong>Families with</strong></td>
<td></td>
</tr>
<tr>
<td>No children</td>
<td>100 (84.0%)</td>
</tr>
<tr>
<td>One child</td>
<td>7 (5.9%)</td>
</tr>
<tr>
<td>Two children</td>
<td>10 (8.4%)</td>
</tr>
<tr>
<td>Three children</td>
<td>2 (1.7%)</td>
</tr>
<tr>
<td><strong>Smoker</strong></td>
<td></td>
</tr>
<tr>
<td>Nonsmoker</td>
<td>104 (87.4%)</td>
</tr>
<tr>
<td>Smoker</td>
<td>4 (3.4%)</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>11 (9.2%)</td>
</tr>
</tbody>
</table>

Table 4.2: Sociodemographic variables for respondents (n=119).
<table>
<thead>
<tr>
<th>College</th>
<th>N=97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allied Medical Professions</td>
<td>1 (1.0%)</td>
</tr>
<tr>
<td>Speech and hearing</td>
<td></td>
</tr>
<tr>
<td>Arts and Sciences</td>
<td>1 (1.0%)</td>
</tr>
<tr>
<td>Psychology</td>
<td></td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>5 (5.2%)</td>
</tr>
<tr>
<td>Biochemistry</td>
<td></td>
</tr>
<tr>
<td>Business</td>
<td>2 (2.1%)</td>
</tr>
<tr>
<td>Operations management</td>
<td></td>
</tr>
<tr>
<td>Dentistry</td>
<td>1 (1.0%)</td>
</tr>
<tr>
<td>Education</td>
<td>19 (19.6%)</td>
</tr>
<tr>
<td>Higher Education, Special Education, Psychology,</td>
<td></td>
</tr>
<tr>
<td>Mathematics Education</td>
<td></td>
</tr>
<tr>
<td>Counseling Education</td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td>2 (2.1%)</td>
</tr>
<tr>
<td>Electrical</td>
<td></td>
</tr>
<tr>
<td>Human Ecology</td>
<td>1 (1.0%)</td>
</tr>
<tr>
<td>Human Development and family science</td>
<td></td>
</tr>
<tr>
<td>Humanities</td>
<td>10 (10.3%)</td>
</tr>
<tr>
<td>Education, English, History</td>
<td></td>
</tr>
<tr>
<td>Journalism and Communication</td>
<td>1 (1.0%)</td>
</tr>
<tr>
<td>Medicine and Public Health</td>
<td>9 (9.3%)</td>
</tr>
<tr>
<td>Audiology</td>
<td></td>
</tr>
<tr>
<td>Health behavior and promotion</td>
<td></td>
</tr>
<tr>
<td>Health management and Policy, Public Health</td>
<td></td>
</tr>
<tr>
<td>Epidemiology, Medicine</td>
<td></td>
</tr>
<tr>
<td>Nursing</td>
<td>6 (6.2%)</td>
</tr>
<tr>
<td>Optometry</td>
<td>3 (3.1%)</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>24 (2.5%)</td>
</tr>
<tr>
<td>Pharmacology, Hospital Pharmacy</td>
<td></td>
</tr>
<tr>
<td>Pharmacy Administration</td>
<td></td>
</tr>
<tr>
<td>Psychology</td>
<td>3 (3.1%)</td>
</tr>
<tr>
<td>Social and Behavioral Sciences</td>
<td>6 (6.2%)</td>
</tr>
<tr>
<td>Sociology, Counseling Psychology, Economics</td>
<td></td>
</tr>
<tr>
<td>Social Work</td>
<td>3 (3.1%)</td>
</tr>
<tr>
<td>Aimed Degree</td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td>11 (11.3%)</td>
</tr>
<tr>
<td>BA, BS</td>
<td></td>
</tr>
<tr>
<td>Masters</td>
<td>41 (42.3%)</td>
</tr>
<tr>
<td>MA, MS, MSN, MSW, MHA, MH, MEd</td>
<td></td>
</tr>
<tr>
<td>Doctorate</td>
<td>45 (46.4%)</td>
</tr>
<tr>
<td>MD, OD, PhD, PharmD, DDS</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.3: Colleges and Majors for full-time students (n=97).
<table>
<thead>
<tr>
<th>Employed</th>
<th>N (%)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>High school</td>
<td>3 (13.6%)</td>
</tr>
<tr>
<td>College</td>
<td>9 (40.9%)</td>
</tr>
<tr>
<td>Graduate School</td>
<td>10 (45.5%)</td>
</tr>
<tr>
<td>Other</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unskilled</td>
<td>2 (9.1%)</td>
</tr>
<tr>
<td>Homemaker</td>
<td>1 (4.5%)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>1 (4.5%)</td>
</tr>
<tr>
<td>Nonhealthcare</td>
<td>12 (54.5%)</td>
</tr>
<tr>
<td>Healthcare</td>
<td>2 (9.1%)</td>
</tr>
<tr>
<td>Research</td>
<td>4 (18.3%)</td>
</tr>
</tbody>
</table>

Table 4.4: Non-student respondents: education and employment status (n=22).

Respondent knowledge of persons with cancer and their own history of cancer and in particular PCNV and breast cancer are reported in Table 4.5. Table reports that the majority of respondents knew someone with cancer: either a family member (64.5%) or outside of their family (73.1%). Approximately twice as many respondents reported having a family member with breast cancer (42%) than PCNV (17.6%). Some respondents may have been motivated by the nature of the study. Therefore, the convenience sample surveyed may be reflective of educated women with a particular interest in women’s issues – breast cancer. This is also supported by numerous
comments made by respondents upon arrival to the effect that they always make a point to support such studies.

<table>
<thead>
<tr>
<th>Exposure to Cancer</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous cancer diagnosis</td>
<td>116 (97.5%)</td>
</tr>
<tr>
<td>No</td>
<td>3 (2.5%)</td>
</tr>
<tr>
<td>Yes (Two cases melanoma, and one case of precancerous cells on cervix)</td>
<td></td>
</tr>
<tr>
<td>Family history of cancer diagnosis</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>42 (35.3%)</td>
</tr>
<tr>
<td>Yes</td>
<td>77 (64.7%)</td>
</tr>
<tr>
<td>Relationship to family member</td>
<td></td>
</tr>
<tr>
<td>Unit family (e.g., parents, siblings)</td>
<td>21 (17.6%)</td>
</tr>
<tr>
<td>Extended family</td>
<td>56 (47.1%)</td>
</tr>
<tr>
<td>Family history of Breast Cancer</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>27 (22.7%)</td>
</tr>
<tr>
<td>Yes</td>
<td>50 (42.0%)</td>
</tr>
<tr>
<td>Family history of PCNV</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>31 (26.1%)</td>
</tr>
<tr>
<td>Yes</td>
<td>21 (17.6%)</td>
</tr>
<tr>
<td>Don't Know</td>
<td>25 (21.0%)</td>
</tr>
<tr>
<td>Knowledge of persons outside family diagnosed with cancer</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>31 (26.1%)</td>
</tr>
<tr>
<td>Yes</td>
<td>87 (73.1%)</td>
</tr>
<tr>
<td>Don't Know</td>
<td>2 (1.0%)</td>
</tr>
<tr>
<td>Breast Cancer</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>40 (33.6%)</td>
</tr>
<tr>
<td>Yes</td>
<td>49 (41.2%)</td>
</tr>
<tr>
<td>PCNV</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>12 (10.1%)</td>
</tr>
<tr>
<td>Yes</td>
<td>49 (41.2%)</td>
</tr>
<tr>
<td>Don't Know</td>
<td>27 (22.7%)</td>
</tr>
</tbody>
</table>

Table 4.5: Family history of cancer, knowledge of persons outside of family with cancer
Health Problems experienced by respondent

<table>
<thead>
<tr>
<th>Type</th>
<th>N</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>61</td>
<td>51.3%</td>
</tr>
<tr>
<td>Chronic</td>
<td>43</td>
<td>36.1%</td>
</tr>
<tr>
<td>Irritable Bowel Syndrome, Arthritis, Hypothyroidism, Endometriosis, Hypertension, Depression, Asthma, Back Pain, Allergies, Skin cancer, IGA nephropathy, Chrons disease, Carpet Tunnel syndrome, Possible multiple sclerosis diagnosis, Chronic Fatigue Syndrome, eczema, epilepsy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>10</td>
<td>8.4%</td>
</tr>
<tr>
<td>Migraines, gastritis, acid reflux, surgery, fainting spells</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute and Chronic</td>
<td>5</td>
<td>46.2%</td>
</tr>
</tbody>
</table>

Table 4.6: Respondent personal history of health problems.

Table 4.6 lists health conditions defined as problematic by respondents. An even number of respondents reported no health problems as those that reported either acute or chronic health conditions. The majority of respondents reporting health problems (36%) indicated various chronic conditions to be problematic which are listed in Table 4.6.
Survey ordering and Q weights

Researchers expected survey order to have no effect on mean Q weights observed (Table 4.7). This hypothesis was tested using 2-tailed independent t-tests at 95 percent confidence level comparing mean Q weights for surveys administered in either ORDER 1 (PCNV survey administered first, breast cancer survey second) or ORDER 2 (breast cancer survey administered first and PCNV survey second). Perfect health and death are not presented because by definition they are 1.0 and 0.0, respectively (Equation 3.1 and 3.2). Results show no statistical significant difference (no effect) of survey ordering for nine of the 16 Q weights (Table 4.7). For the remaining five Q weights, ordering did not produce a consistent effect in Q weights: three were lower in ORDER 1 and the remaining two were higher in ORDER 2. For three of the five Q weights regardless of the statistical significance, the actual difference in mean Q weight was less than 0.05 units and hence the differences were not operationally significant. For the remaining two of the five significant P values in Table 4.7, mean differences greater than five percent were detected for Situation NV_{SG} and Situation R_{VAS}, which are 0.76 versus 0.86, and 0.20 versus 0.17, respectively for ORDER 1 and ORDER 2. This can be attributed to the larger number of negative Q weights reported for ORDER 1 for Situation NV_{SG} (3 versus 0) and larger number of negative Q weights reported for ORDER 2 for Situation R_{VAS} (12 versus 4). Thus, the ORDER effect was assumed to be minimal and further analysis merged Q weights obtained from both surveys.
<table>
<thead>
<tr>
<th>SURVEY</th>
<th>ORDER 1 (n=66)</th>
<th>ORDER 2 (n=53)</th>
<th>T value (df=117)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCNV</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your Health</td>
<td>0.99 (0.03)</td>
<td>0.97 (0.12)</td>
<td>0.851</td>
<td>0.397</td>
</tr>
<tr>
<td>NoNV</td>
<td>0.92 (0.13)</td>
<td>0.96 (0.06)</td>
<td>2.086</td>
<td>0.04*</td>
</tr>
<tr>
<td>PrevNV</td>
<td>0.87 (0.20)</td>
<td>0.93 (0.08)</td>
<td>2.049</td>
<td>0.043*</td>
</tr>
<tr>
<td>NV</td>
<td>0.76 (0.38)</td>
<td>0.86 (0.13)</td>
<td>2.118</td>
<td>0.037*</td>
</tr>
<tr>
<td>VAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your Health</td>
<td>0.95 (0.05)</td>
<td>0.93 (0.13)</td>
<td>1.199</td>
<td>0.233</td>
</tr>
<tr>
<td>NoNV</td>
<td>0.66 (0.21)</td>
<td>0.73 (0.17)</td>
<td>1.826</td>
<td>0.070</td>
</tr>
<tr>
<td>PrevNV</td>
<td>0.43 (0.22)</td>
<td>0.47 (0.18)</td>
<td>1.043</td>
<td>0.299</td>
</tr>
<tr>
<td>NV</td>
<td>0.24 (0.20)</td>
<td>0.27 (0.18)</td>
<td>0.784</td>
<td>0.435</td>
</tr>
<tr>
<td>Breast Cancer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your Health</td>
<td>0.98 (0.03)</td>
<td>0.97 (0.08)</td>
<td>1.793</td>
<td>0.076</td>
</tr>
<tr>
<td>Cure</td>
<td>0.94 (0.11)</td>
<td>0.92 (0.11)</td>
<td>0.723</td>
<td>0.471</td>
</tr>
<tr>
<td>Treatment</td>
<td>0.89 (0.15)</td>
<td>0.84 (0.18)</td>
<td>1.670</td>
<td>0.098</td>
</tr>
<tr>
<td>Recurrence</td>
<td>0.63 (0.34)</td>
<td>0.40 (0.54)</td>
<td>2.726</td>
<td>0.007**</td>
</tr>
<tr>
<td>VAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your Health</td>
<td>0.94 (0.05)</td>
<td>0.94 (0.07)</td>
<td>0.099</td>
<td>0.921</td>
</tr>
<tr>
<td>Cure</td>
<td>0.71 (0.17)</td>
<td>0.75 (0.16)</td>
<td>1.228</td>
<td>0.222</td>
</tr>
<tr>
<td>Treatment</td>
<td>0.52 (0.20)</td>
<td>0.49 (0.21)</td>
<td>0.997</td>
<td>0.321</td>
</tr>
<tr>
<td>Recurrence</td>
<td>0.20 (0.19)</td>
<td>0.17 (0.20)</td>
<td>2.569</td>
<td>0.011*</td>
</tr>
</tbody>
</table>

Table 4.7: Independent t-test (α=0.05 level, 2-tailed) comparing mean Q weights by survey order (Order 1 = PCNV survey first, breast cancer survey second, Order 2 = breast cancer survey first, PCNV survey second).

* Statistically significant at 0.05 level.

**Statistically significant at 0.01 level.
Survey ordering, protocol and algorithm effects on WTP bids

Inflation of type 1 error (α) on dependent variables (WTP estimates) by using multiple t-tests was avoided by the use of six 1 2x2x2 ANOVA analyses performed to test main effects: ORDER (Order 1 = PCNV survey first, breast cancer survey second, Order 2 = breast cancer survey first, PCNV survey second), ALGORITHM (WTP algorithm 1 or 2), and PROTOCOL (WTP protocol 1 and 2) and their respective interactions. The results of the 2x2x2 between subjects ANOVAs are presented in Tables 4.8 to 4.13. As shown by the small F values, no main effects or interactions are statistically significant at the 0.05 level (Tables 4.8 to 4.13). Therefore, effects of ORDER, ALGORITHM and PROTOCOL are assumed to be negligible and analyses for research questions were conducted by merging data from different algorithms, protocols and orders. Table 4.14 summarizes mean WTP bids for entire sample (n=119).

---

1 One ANOVA table was constructed for each of the six WTP questions included in this study: \( WTP_{\text{PCNV-NV}} \), \( WTP_{\text{NoNV-PN}} \), \( WTP_{\text{NoNV-NV}} \), \( WTP_{\text{C-R}} \), \( WTP_{\text{C-T}} \), and \( WTP_{\text{T-R}} \).
Table 4.8: Dependent variable: $WTP_{prev\,NV - NV}$. No statistically significant p values shown with 2x2x2 ANOVA between subjects design ($\alpha = 0.05$).

<table>
<thead>
<tr>
<th>Source</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ALGORITHM</td>
<td>1</td>
<td>3505.885</td>
<td>3505.885</td>
<td>0.067</td>
</tr>
<tr>
<td>PROTOCOL</td>
<td>1</td>
<td>1196.422</td>
<td>1196.422</td>
<td>0.023</td>
</tr>
<tr>
<td>ORDER</td>
<td>1</td>
<td>1436.320</td>
<td>1436.320</td>
<td>0.028</td>
</tr>
<tr>
<td>ALGORITHM*PROTOCOL</td>
<td>1</td>
<td>20213.583</td>
<td>20213.583</td>
<td>0.387</td>
</tr>
<tr>
<td>ALGORITHM*ORDER</td>
<td>1</td>
<td>47627.857</td>
<td>47627.857</td>
<td>0.912</td>
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<tr>
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<td>1</td>
<td>84200.587</td>
<td>84200.587</td>
<td>1.612</td>
</tr>
<tr>
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<td>1</td>
<td>1822.875</td>
<td>1822.875</td>
<td>0.035</td>
</tr>
<tr>
<td>S/ALGORITHM<em>PROTOCOL</em>ORDER</td>
<td>111</td>
<td>5796720.170</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.9: Dependent variable: $WTP_{No\,NV - NV}$. No statistically significant p values shown with 2x2x2 ANOVA between subjects design ($\alpha = 0.05$).

<table>
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<tr>
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</tr>
</thead>
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<td>424525.539</td>
<td>424525.539</td>
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<tr>
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<td>18904.616</td>
<td>18904.616</td>
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</tr>
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<td>1</td>
<td>161982.277</td>
<td>161982.277</td>
<td>1.446</td>
</tr>
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<td>ALGORITHM*PROTOCOL</td>
<td>1</td>
<td>133864.630</td>
<td>133864.630</td>
<td>1.195</td>
</tr>
<tr>
<td>ALGORITHM*ORDER</td>
<td>1</td>
<td>2827.041</td>
<td>2827.041</td>
<td>0.025</td>
</tr>
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<td>231087.286</td>
<td>231087.286</td>
<td>2.063</td>
</tr>
<tr>
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<td>1</td>
<td>16494.447</td>
<td>16494.447</td>
<td>0.147</td>
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193
<table>
<thead>
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<td>ALGORITHM</td>
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</tr>
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<td>PROTOCOL</td>
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<td>103884.040</td>
<td>103884.040</td>
<td>1.588</td>
</tr>
<tr>
<td>ORDER</td>
<td>1</td>
<td>154244.169</td>
<td>154244.169</td>
<td>2.357</td>
</tr>
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<td>1</td>
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<td>107375.733</td>
<td>1.641</td>
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<td>ALGORITHM*ORDER</td>
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<td>9988.035</td>
<td>9988.035</td>
<td>0.153</td>
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<tr>
<td>PROTOCOL*ORDER</td>
<td>1</td>
<td>219322.579</td>
<td>219322.579</td>
<td>3.352</td>
</tr>
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<td>1608.182</td>
<td>1608.182</td>
<td>0.025</td>
</tr>
<tr>
<td>S/ALGORITHM<em>PROTOCOL</em>ORDER</td>
<td>11</td>
<td>7262655.855</td>
<td></td>
<td></td>
</tr>
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</table>

**Table 4.10:** Dependent variable: \( \text{WTP}_{\text{NoNV-PrevNV}} \). No statistically significant p values shown with 2x2x2 ANOVA between subjects design \((\alpha = 0.05)\).

<table>
<thead>
<tr>
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<th>MS</th>
<th>F</th>
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</thead>
<tbody>
<tr>
<td>ALGORITHM</td>
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<td>751726183.115</td>
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<tr>
<td>ORDER</td>
<td>1</td>
<td>23886458.1715</td>
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<td>0.084</td>
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<td>1</td>
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<tr>
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<td>212882345.004</td>
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<tr>
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<td>1</td>
<td>26443154.1564</td>
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<td>0.093</td>
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<tr>
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<td>11</td>
<td>31428564115.355</td>
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</tbody>
</table>

**Table 4.11:** Dependent variable: \( \text{WTP}_{\text{T-R}} \). No statistically significant p values shown with 2x2x2 ANOVA between subjects design \((\alpha = 0.05)\).
Table 4.12: Dependent variable: \( WTP_{C-A} \). No statistically significant p values shown with 2x2x2 ANOVA between subjects design (\( \alpha = 0.05 \)).

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
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<td>88645306.626</td>
<td>88645306.626</td>
<td>0.035</td>
</tr>
<tr>
<td>ORDER</td>
<td>1</td>
<td>1174782331.950</td>
<td>1174782331.950</td>
<td>0.459</td>
</tr>
<tr>
<td>ALGORITHM*PROTOCOL</td>
<td>1</td>
<td>1349536497.112</td>
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<td>0.528</td>
</tr>
<tr>
<td>ALGORITHM*ORDER</td>
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<td>0.442</td>
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<tr>
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<td>3586155716.262</td>
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<td>1.402</td>
</tr>
<tr>
<td>ALGORITHM<em>PROTOCOL</em>ORDER</td>
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<td>1383989494.486</td>
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<td>0.542</td>
</tr>
<tr>
<td>S/ALGORITHM<em>PROTOCOL</em>ORDER</td>
<td>11</td>
<td>283824873433.394</td>
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<td>-</td>
</tr>
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</table>

Table 4.13: Dependent variable: \( WTP_{C-T} \). No statistically significant p values shown with 2x2x2 ANOVA between subjects design (\( \alpha = 0.05 \)).

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<tr>
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</thead>
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<td>1400092021.056</td>
<td>1400092021.056</td>
<td>0.549</td>
</tr>
<tr>
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<td>16180713.763</td>
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<td>0.006</td>
</tr>
<tr>
<td>ORDER</td>
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<td>1488055228.406</td>
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<td>0.584</td>
</tr>
<tr>
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<td>1242327239.937</td>
<td>1242327239.937</td>
<td>0.487</td>
</tr>
<tr>
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<td>849846133.123</td>
<td>849846133.123</td>
<td>0.333</td>
</tr>
<tr>
<td>PROTOCOL*ORDER</td>
<td>1</td>
<td>3691384709.827</td>
<td>3691384709.827</td>
<td>1.448</td>
</tr>
<tr>
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<td>0.451</td>
</tr>
<tr>
<td>S/ALGORITHM<em>PROTOCOL</em>ORDER</td>
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<td>282901572678.571</td>
<td>282901572678.571</td>
<td>-</td>
</tr>
</tbody>
</table>

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Table 4.14: WTP bids from all surveys were merged. Mean, median and standard deviations of WTP bids for PCNV and breast cancer surveys.

Table 4.14 is notable for its large standard deviations, which in some cases exceeded the mean WTP bids. PCNV survey WTP bids showed as expected highest mean bid for payment of PCNV optimal preventative therapy when the alternative was no therapy (WTP_{NoNV-NV}), and the second highest bid was for optimal PCNV preventative therapy over standard preventative therapy (WTP_{NoNV-PrevNV}). Breast cancer survey in comparison was notable for its anticipated much higher bids. The lowest of which was for cancer treatment over do-nothing (WTP_{RT}). Although, similar to PCNV survey a much higher bid was expected for breast cancer cure versus no therapy (WTP_{Ca}) than breast cancer cure versus treatment (WTP_{CT}), a possible ceiling effect was observed. This can be
explained by the nature of the good: extension of life. Respondents were willing to liquidate all their assets to extend their life. Therefore breast cancer WTP bids may be more sensitive to budget constraint effects than the much smaller bids observed for PCNV WTP questions.

Results Of Hypotheses Tests

Results of hypotheses tests are presented in the following section. Since it was more expedient to answer more than one research question with one statistical analysis, analyses conducted dictated order of research questions discussed. Research questions 1, 2 and 5 are first presented, followed by research questions 2, 3, 4 and lastly research question 6.

Research Questions 1, 2 and 5

Research Question 1

Does breast cancer treatment versus do nothing (i.e., QALY_T - QALY_R) result in more QALYs than PCNV standard preventative therapy versus do nothing (i.e., QALY_{prevNV} - QALY_{NV})?

The two hypotheses tested are as follows:

Hypothesis 1.1

The mean ΔQALY-SG for PCNV standard preventative therapy (QALY-{SG_{prevNV}} - QALY-{SG_{NV}}) is less than the mean ΔQALY-SG for breast cancer treatment (QALY-{SG_{T}} - QALY-{SG_{R}})
Hypothesis 1.2
The mean $\Delta QALY$-VAS for PCNV standard preventative therapy
$(QALY$-$VAS_{\text{Prev} NV}$-$QALY$-$VAS_{NV})$ is less than the mean $\Delta QALY$-VAS for
breast cancer treatment $(QALY$-$VAS_{T}$-$QALY$-$VAS_{R})$.

Research Question 2
Does breast cancer cure versus treatment (i.e. $QALY_{C}$-$QALY_{T}$) result in more QALYs
than PCNV optimal versus standard preventative therapy
(i.e., $QALY_{NoNV}$-$QALY_{PrevNV}$)?

Hypothesis 2.1
The mean $\Delta QALY$-SG for PCNV optimal preventative therapy
$(QALY$-$SG_{NoNV}$-$QALY$-$SG_{PrevNV})$ is less than the mean $\Delta QALY$-SG for breast
cancer hypothetical cure $(QALY$-$SG_{C}$-$QALY$-$SG_{T})$.

Hypothesis 2.2
The mean $\Delta QALY$-VAS for PCNV optimal preventative therapy
$(QALY$-$VAS_{NoNV}$-$QALY$-$VAS_{PrevNV})$ is less than the mean $\Delta QALY$-VAS for
breast cancer hypothetical cure $(QALY$-$VAS_{C}$-$QALY$-$VAS_{T})$.

To what extent is (1) incremental $\Delta QALY$s breast cancer cure (i.e. $[QALY_{C}$-$QALY_{T}]$)
greater than incremental $\Delta QALY$s breast cancer treatment (i.e., $[QALY_{T}$-$QALY_{R}]$) and
(2) incremental $\Delta QALY$s for PCNV optimal preventative therapy (i.e. $[QALY_{NoNV}$-$QALY_{PrevNV}]$ different to incremental $\Delta QALY$s PCNV standard prevention (i.e.,
$[QALY_{PrevNV}$-$QALY_{NV}]$)?

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Hypothesis 5.1

The mean ΔQALY-VAS for breast cancer cure (QALY-VAS<sub>c</sub> - QALY-VAS<sub>t</sub>) is greater than the mean ΔQALY-VAS for breast cancer treatment (QALY-VAS<sub>t</sub> - QALY-VAS<sub>r</sub>).

Hypothesis 5.2

The mean ΔQALY-SG for breast cancer cure (QALY-SG<sub>c</sub> - QALY-SG<sub>t</sub>) is greater than the mean ΔQALY-SG for breast cancer treatment (QALY-SG<sub>t</sub> - QALY-SG<sub>r</sub>).

Hypothesis 5.3

The mean incremental ΔQALY-VAS for optimal preventative therapy (QALY-VAS<sub>NoNV-QALY-VAS<sub>PrevNV</sub></sub>) is equal to the mean incremental ΔQALY-VAS for standard preventative therapy (QALY-VAS<sub>PrevNV-QALY-VAS<sub>PrevNV</sub></sub>).

Hypothesis 5.4

The mean incremental ΔQALY-SG for optimal preventative therapy (QALY-SG<sub>NoNV-QALY-SG<sub>PrevNV</sub></sub>) is equal to the mean incremental ΔQALY-SG for standard preventative therapy (QALY-SG<sub>PrevNV-QALY-SG<sub> PrevNV</sub></sub>).

Prior to conducting analyses, a table summarizing mean changes in QALY-SG and QALY-VAS was constructed (Table 4.15). As anticipated mean QALY-SG were statistically significant and higher than mean QALY-VAS for all comparisons (Table
4.15). In addition, mean QALY for PCNV were close to zero, while for breast cancer scenarios they were much higher than zero, except for situation R.

Two 2x2 factorial ANOVA were used to address research questions 1, 3 and 5: one for research questions 1.1, 2.1, 5.2 and 5.4 (i.e., changes in QALY-SG); and the other for research questions 1.2, 2.2, 5.1 and 5.3 (i.e. changes in QALY-VAS). The first 2x2 within subjects ANOVA (two factor pure within subjects design) is presented in table 4.16. The two factors are measured at two levels: SURVEY factor represents PCNV or breast cancer survey; and INCREMENT factor represents either a low expected increment in QALY(QALY-SG\textsubscript{Prev-NV} - QALY-SG\textsubscript{NV} and QALY-SG\textsubscript{r} - QALY-SG\textsubscript{R}) or a high expected increment in (QALY-SG\textsubscript{NoNV} - QALY-SG\textsubscript{Prev-NV} and QALY-SG\textsubscript{C} - QALY-SG\textsubscript{r}). Main effects SURVEY F(1,118)=1069.612 and INCREMENT F(1,118)=3076.869 and interaction SURVEY X INCREMENT F(1,118)=1069.630 are statistically significant at 0.01 level (Figure 4.2). As expected mean ΔQALY-SG were consistently higher for breast cancer than PCNV scenarios and the difference also varied depending on the type of incremental change in health evaluated. Post hoc tests (Fisher LSD) for simple main effects showed QALY-SG\textsubscript{C} - QALY-SG\textsubscript{r} to be greater than QALY-SG\textsubscript{r} - QALY-SG\textsubscript{R} and incremental ΔQALY-SG for both breast cancer scenarios measured to be greater than those for PCNV, but the difference between QALY-SG\textsubscript{NoNV} - QALY-SG\textsubscript{Prev-NV} and QALY-SG\textsubscript{Prev-NV} - QALY-SG\textsubscript{NV} was not statistically significant (LSD=0.465 at α=0.05).
<table>
<thead>
<tr>
<th>HEALTH</th>
<th>QALY-SG MEAN (SD)</th>
<th>QALY-VAS MEAN (SD)</th>
<th>T VALUE</th>
<th>P VALUE</th>
</tr>
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<tbody>
<tr>
<td>PCN V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Situation NO NV</td>
<td>7.516 X 10^3 (0.8305 X 10^3)</td>
<td>5.528 X 10^3 (1.562 X 10^3)</td>
<td>0.005956</td>
<td>12.465  &lt;0.001</td>
</tr>
<tr>
<td>Situation PREV</td>
<td>7.166 X 10^3 (1.284 X 10^3)</td>
<td>3.607 X 10^3 (1.648 X 10^3)</td>
<td>0.003600</td>
<td>22.889  &lt;0.001</td>
</tr>
<tr>
<td>Situation NV</td>
<td>6.448 X 10^3 (2.391 X 10^3)</td>
<td>2.054 X 10^3 (1.539 X 10^3)</td>
<td>0.001760</td>
<td>22.242  &lt;0.001</td>
</tr>
<tr>
<td>Breast Cancer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Situation C</td>
<td>41.658 (8.316343)</td>
<td>32.823 (9.366961)</td>
<td>35.70</td>
<td>11.868  &lt;0.001</td>
</tr>
<tr>
<td>Situation T</td>
<td>10.364 (1.9608)</td>
<td>6.074 (2.4835)</td>
<td>6.60</td>
<td>17.452  &lt;0.001</td>
</tr>
<tr>
<td>Situation R</td>
<td>0.817 (1.7356)</td>
<td>0.335 (0.4013)</td>
<td>0.34</td>
<td>3.421   0.001</td>
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</table>

Table 4.15: Presentation of QALYs used in research questions 1, 2, 5 and 6. Paired samples t-test (α=0.01, 2-tailed) comparing QALY-VAS with QALY-SG
### TABLE 4.16: ANOVA summary table investigating impact of two main effects:

SURVEY, INCREMENT, and interaction SURVEY X INCREMENT on mean ΔQALY-SG (Research questions 1.1, 2.1, 5.2 and 5.4)

<table>
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<tr>
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<td>14070.429</td>
<td>1069.612**</td>
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<td>49618.383</td>
<td>3076.869**</td>
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<td>S</td>
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<td>1903.092</td>
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</tr>
<tr>
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<td>14071.379</td>
<td>14071.379</td>
<td>1069.630**</td>
</tr>
<tr>
<td>SURVEY * S</td>
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<td>13.155</td>
<td></td>
</tr>
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<td>INCREMENT * S</td>
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<td>16.126</td>
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<td>13.155</td>
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Figure 4.2: Interaction of INCREMENT X SURVEY: research questions 1.1, 2.1, and 5.2 and 5.4 (QALY-SG).
Second of 2x2 factorial ANOVA is used to address research questions 1.2, 2.2, 5.1 and 5.3 (i.e. changes in QALY-VAS). Two factors are measured on two levels are SURVEY (PCNV or breast cancer survey) and INCREMENT (low or high). Analogous to the previous analysis INCREMENT represents either a low expected increment in $QALY(QALY-VAS_{prev-NV} - QALY-VAS_{NV}$ and $QALY-VAS_T - QALY-VAS_R$) or a high expected increment in $QALY(QALY-VAS_{NoNV} - QALY-VAS_{prev-NV}$ and $QALY-VAS_C - QALY-VAS_T$). Similar to previous analysis main effects SURVEY $F(1,118)=867.344$ and INCREMENT $F(1,118)=1456.128$ and interaction SURVEY X INCREMENT $F(1,118)=867.452$ are statistically significant at 0.01 level (Figure 4.3).

As expected mean $\Delta QALY-VAS$ were consistently higher for breast cancer than PCNV scenarios and the difference also varied depending on the type of incremental change in health evaluated. Post hoc tests (Fisher LSD) for simple main effects showed $QALY-VAS_C - QALY-VAS_T$ to be greater than $QALY-VAS_T - QALY-VAS_R$ and incremental $\Delta QALY-VAS$ for both breast cancer scenarios measured to be greater than those for PCNV, but the difference between $QALY-VAS_{NoNV} - QALY-VAS_{prev-NV}$ and $QALY-VAS_{prev-NV} - QALY-VAS_{NV}$ is not statistically significant. This is not unexpected given that the $\Delta QALY-VAS$ for PCNV scenarios were very close to zero (LSD=0.499 at $\alpha=0.05$).

Thus, in summary the results support hypotheses tested for research questions 1,2 and 5. Mean $\Delta QALY$ for chronic conditions (i.e., change in Y) were consistently greater than
mean ΔQALY for acute conditions (i.e., no change in Y) whether QALYs was measured using SG or VAS scale (research question 1.1, 1.2, 2.1 and 2.2). Furthermore, as anticipated from the literature, ΔQALYs produced using VAS (feeling thermometer – does not incorporate risk) were consistently greater than those using SG gamble method, which does incorporates risk (Figure 4.15). ΔQALY for health intervention resulting increased Q and Y – breast cancer cure – was greater than ΔQALY for health benefit which predominantly increased Y – breast cancer treatment (research questions 5.1 and 5.2). Finally, ΔQALY for incremental benefits for an acute condition (i.e., no increase in Y) produced increases in QALY close to zero (research question 5.3 and 5.4).

<table>
<thead>
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<td>1786.256</td>
<td>15.138</td>
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</table>

Table 4.17: ANOVA summary table investigating impact of two main effects: SURVEY, INCREMENT, and interaction SURVEY X INCREMENT on mean ΔQALY-VAS (Research questions 1.2, 2.2, 5.1 and 5.3).
Figure 4.3: Interaction of INCREMENT X SURVEY: research questions 1.2, 2.2, and 5.1 and 5.3 (QALY-VAS).
Research questions 3 and 4

Research questions 3

Does WTP for breast cancer treatment versus do nothing (i.e., WTP_{T-R}) result in greater WTP than for PCNV standard preventative therapy versus do nothing (i.e., WTP_{Prev_NV-NV})?

Hypothesis 3.1

The mean WTP_{T-R} is greater than the mean WTP_{Prev_NV-NV}.

Research Question 4

Does WTP for breast cancer cure versus treatment (i.e. WTP_{C-T}) result in greater WTP than for PCNV optimal versus standard preventative therapy (i.e., WTP_{NoNV-PrevNV})?

Hypothesis 4.1

The mean WTP_{C-T} is greater than the mean WTP_{NoNV-PrevNV}.

Research questions 3 and 4 measure the same changes in health benefits presented in research questions 1, 2 and 5, but instead of using QALYs, the same increments in health benefits are measured using a monetary metric. Third 2x2 pure within-subjects factorial ANOVA presented to address research questions is presented in Table 4.18. The same two factors SURVEY (PCNV or breast cancer survey) and INCREMENT (low or high). Mirroring the previous analysis INCREMENT represents either a low expected increment in WTP (WTP_{Prev-NV} – WTP_{NV} and WTP_{T} – WTP_{R}) or a high expected increment in (WTP_{NoNV} – WTP_{Prev-NV} and WTP_{C} – WTP_{T}). Main effects SURVEY F(1,118) =
4.807, p=0.03 and \( INCREMENT \ F(1,118)= 37.482, p<0.001 \) are statistically significant at an \( \alpha \) level of 0.05, as is the interaction \( SURVEY \times INCREMENT \ F(1,118)= 4.558, p=0.035 \) are statistically significant at 0.01 level (Figure 4.4). Figure 4.4 mirrors Figures 4.1 and 4.2 and results presented in Figure 4.4 are anticipated. That is, mean WTP were consistently higher for breast cancer than PCNV scenarios and the difference also varied depending on the type of incremental change in health evaluated. Post hoc tests (Fisher LSD) for simple main effects showed WTP \( c - t \) to be greater than WTP \( t - r \) and incremental WTP for both breast cancer scenarios to be greater than those for PCNV (i.e., WTP \( c - t \), is greater than WTP \( \text{NoNV} - \text{NV} \) and WTP \( t - r \) is greater than WTP \( \text{PrevNV} - \text{NV} \), but the difference between WTP \( \text{NoNV} - \text{PrevNV} \) and WTP \( \text{PrevNV} - \text{NV} \) is not statistically significant. (This nonstatistically significant result is presented as it is readily computed in this analysis, however, no predetermined hypothesis was made for this comparison (LSD=\$3,006.73, \( \alpha=0.05 \)).

For the third 2x2 factorial analysis, ANOVA assumptions of normality and homogeneity of variance are violated based on Greenhouse-Geisser (GG) and Huynh-Feldt (HF) test and viewed distribution of dependent variable. Fortunately, violation of normality assumption has minimal effect on type 1 error especially if distributions are skewed in the same direction, which is the case here. Distributions are leptokuric (peak, flat tailed); this results in a more powerful test. Violation of sphericity was addressed by use of larger critical F value to reduce leniency of F test with new \( F_{\text{critical}} = (df_{\text{num}} = \text{factor}, df_{\text{denom}} = n-1) \). Despite more stringent requirement with new critical \( F(1,120)=3.92 \) at \( \alpha \) level of 0.05
(Keppell, 1983, Table A1, p502-508), the two main effects and interaction remained significant at \( \alpha \) level of 0.05.

In summary, the results support hypotheses tested for research questions 3 and 4. Mean WTP for health benefits for long-term conditions were consistently greater than mean WTP for acute conditions (research question 3 and 4). Mean WTP for health intervention, which increased \( Q \) and \( Y \) – breast cancer cure – was greater than mean WTP for health benefit, which predominantly increased \( Y \).

Furthermore, WTP was more sensitive measuring health benefits where \( Q \) only was affected – changes in health benefits for acute conditions. Benefits measured in \( \Delta QALY \) metric for acute conditions approached zero, indicating that operationally the intervention was of no benefit. However, measuring the same intervention with WTP produced mean WTP values substantively greater than zero, indicating that WTP is a more sensitive measure than QALY for estimating health benefits for acute conditions.
<table>
<thead>
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**Table 4.18:** ANOVA summary table investigating impact of two main effects: SURVEY, INCREMENT, and interaction SURVEY X INCREMENT on mean WTP (Research questions 3.1 and 4.1). Statistically significant at 0.05* and 0.01** level
Figure 4.4: Interaction of INCREMENT X SURVEY: research questions 3.1 and 4.1 (WTP).
Research question 6

What proportion of variance of WTP is accounted for by ΔQALYs resulting from (1) breast cancer treatment versus do nothing (i.e., QALY_T – QALY_R), (2) PCNV standard preventative therapy versus do nothing (i.e. QALY_{Prev \text{ NV}} – QALY_{NV}) (3) breast cancer cure versus treatment (i.e. QALY_C – QALY_T) and (4) PCNV optimal preventative therapy versus standard preventative therapy (i.e., QALY_{No\text{ NV}} – QALY_{PCNV \text{ Prev}}), accounting for age, income and health problems?

**Hypothesis 6.1**

The proportion of variance of $WTP_{T-R}$ explained by ΔQALYs

$(QALY_{-SG_T} - [QALY_{-SG_R}])$, accounting for age, income and health problems is zero.

**Hypothesis 6.2**

The proportion of variance of $WTP_{T-R}$ explained by ΔQALYs

$([QALY_{-VAS_T]} - [QALY_{-VAS_R}])$, accounting for age, income and health problems is zero.

**Hypothesis 6.3**

The proportion of variance of $WTP_{Prev\text{ NV}-NV}$ explained by ΔQALYs

$([QALY_{-SG_{Prev\text{ NV}}}- [QALY_{-SG_{NV}}])$, accounting for age, income and health problems is zero.
Hypothesis 6.4
The proportion of variance of $WTP_{\text{prevNV-NV}}$ explained by $\Delta\text{QALYs}$

$([\text{QALY-VAS}_{\text{prevNV}}] - [\text{QALY-VAS}_{\text{NV}}])$, accounting for age, income and health problems is zero.

Hypothesis 6.5
The proportion of variance of $WTP_{C-T}$ explained by $\Delta\text{QALYs}$

$([\text{QALY-SG}_{C}] - [\text{QALY-SG}_{T}])$, accounting for age, income and health problems is zero.

Hypothesis 6.6
The proportion of variance of $WTP_{C-T}$ explained by $\Delta\text{QALYs}$

$([\text{QALY-VAS}_{C}] - [\text{QALY-VAS}_{T}])$, accounting for age, income and health problems is zero.

Hypothesis 6.7
The proportion of variance of $WTP_{\text{nonNV-NV}}$ explained by $\Delta\text{QALYs}$

$([\text{QALY-SG}_{\text{nonNV}}] - [\text{QALY-SG}_{\text{prevNV}}])$, accounting for age, income and health problems is zero.

Hypothesis 6.8
The proportion of variance of $WTP_{\text{nonNV-prevNV}}$ explained by $\Delta\text{QALYs}$
([QALY-VAS_{No\,NV}] - [QALY-VAS_{Prev\,NV}]), accounting for age, income and health problems, is zero.

All analyses for Research question 6 consist of the following format: one continuous dependent variable, WTP, and four independent variables. Four predictors accounted for in the regression equation are:

1. **AGE**: respondent age continuous variable measured in years.
2. **INCOME2**: respondent annual gross combined household income, measured categorically at two levels, coded $0 = \text{income less than } \$20K$, and $1 = \text{income greater than or equal to } \$20K$, and
3. **HLTHPRBS**: respondent history of health problems, measured categorically at two levels, coded $0 = \text{no health problems}$, and $1 = \text{health problems}$, and
4. **Δ QALY**: for respective WTP benefit.

Inclusion of four independent variables: AGE, INCOME2, HLTHPRBS, and QALY in OLS regression equation was based on previous work by Bala et al. (1998), Johnson, Fries and Banzhaf (1997), and Blumenschein and Johannesson (1998).

Research questions 6.1 to 6.4 in this section are each represented by six OLS regression equations of the functional form: $y_i = \beta_1 + \beta_2 x_i + \beta_3 x_i + \beta_4 x_i + \epsilon_i$ to explain how the dependent variable ($y$) changes as the independent variables change ($x$'s) and to predict $y_o$ given an $x_o$ with changes in $y$ (dependent variable WTP). Reason for this is twofold. First, Johnson, Fries and Banzhaf (1997), study which this research question is based
upon, reported good statistical fit with the OLS regression using double natural log
models – natural log of WTP and natural log of duration of condition (Y and Q weights
were inputted into their model separately, not as QALY). Second, OLS regression
assumes the following set of assumptions:

1. The correct form of the model is presented
2. If, Model: \( y_i = \beta_1 + \beta_2 x_i + \beta_3 x_i + \beta_4 x_i + e_i \), then \( \text{E}(e_i) = 0 \) (i.e., the average value
   of the error, e term, is zero), then
3. Fitted equation: \( y_i = \beta_1 + \beta_2 x_i + \beta_3 x_i + \beta_4 x_i \)
4. Linearity between criterion variables (independent variables) and dependent
   variable
5. Independent variable \( x \) does not equal a constant.
6. Homogeneity of variance: \( \text{var}(y/x) = \sigma^2 = \text{var}(e) \) This implies that the dispersion of
   values about the mean of \( y \) do not change as the \( x \) changes. Violation of this
   assumption is called heteroskedasticity (Homoskedastic variance is when this
   assumption is met).
7. Optional: The values of \( e \) are normally distributed about their mean \( e \sim N(0, \sigma^2) \) if
   the values of \( Y \) are normally distributed about their mean

Testing of underlying assumptions revealed violations of normality (tested with P-P plot
for normality), linearity and heteroskedasticity (tested with scatter plots of \( x \) versus \( Y \) and
plots of predicted \( Y \) values versus its residual). Violations of assumptions are not
uncommon in social science research (Cohen and Cohen, 1983) and can be solved with
the use of transformations of independent variable or dependent variable or both,
depending on the nature of the violation and the relationship between the variables.

Nonlinear relationships can be solved with the use of an appropriate transformation to
permit a nonlinear relationship to approximate a linear one. Recommendation of
transforming x only is recommended when homoskedasticity is not violated.

Nonnormality and heteroskedasticity often go together which is the case in this study.
Transformation of Y only can not only remedy these two violations but also linearize a
nonlinear relation between the dependent and independent variables. Monotonic
transformations have been reported to be successful with monetary variables (Cohen and
Cohen, 1983). Therefore, natural log transformations are also used in this study as
supported by the literature (Johnson, Fries and Banzhaf, 1996; Cohen and Cohen, 1983)
and also to enable comparisons between Johnson, Fries and Banzhaf (1996) and model
produced from this study.

Hypotheses 6.1 and 6.2

Hypothesis 6.1

The proportion of variance of WTP_{T-R} explained by ΔQALYs
(QALY-SG_{T} - [QALY-SG_{R}]), accounting for age, income and health problems,
is zero.
**Hypothesis 6.2**

The proportion of variance of WTP\textsubscript{T-R} explained by $\Delta$QALYS

$$([\text{QALY-VAS}_T] - [\text{QALY-VAS}_R]),$$
accounting for age, income and health
problems, is zero.

Results of OLS regression analysis for hypotheses 6.1 and 6.2 are summarized in Table 4.19. RAW – RAW regression models describe equations when neither independent nor dependent variables have been transformed. LN – RAW models describe regression equations when only the dependent variable WTP has been transformed using natural log (LN). Lastly, LN – LN models list regression equations when $\Delta$QALY term and WTP term have both been transformed. Tables 4.20 to 4.25 list standardized regression coefficients (beta weights) for models addressing hypothesis 6.1 (equations 6.1a, 6.1b and 6.1c) and hypothesis 6.2 (equations 6.2a, 6.2b and 6.2c).

Results were analyzed using multiple regression analysis (Tables 4.19 to 4.25) and bivariate correlations (Table 4.26) as recommended by Hatcher and Stepanski (1997). The proportion of variance of WTP accounted for by a linear combination of the four independent variables (predictors) is described by the coefficient of variation ($R^2$ or $R^2$). $R^2$ in sample is positively biased. It consistently overestimates the $R^2$ in the population since it increases with the number of independent variables included in the equation. Therefore, adjusted $R^2$ (shrunken $R^2$): $R^2$-squared adjusted downward accounting for degrees of freedom, was used when comparing models in this study.
For the three models listed for hypothesis 6.1 (models 6.1a-c), all adjusted R-squared models were statistically significant at the 0.05 level. Adjusted R-squared was lowest (Adj $R^2 = 0.151, p<0.001$) for the untransformed model and highest for the two transformed models with the LN-RAW and LN-RAW models accounting for approximately 25.5 percent of the variance in WTP with a linear combination of four independent variables. Similarly, for the three models listed for hypothesis 6.2 (models 6.2a-c), all adjusted R-squared models were statistically significant at the 0.05 level. Adjusted R-squared was lowest (Adj $R^2 = 0.163, p<0.001$) for the untransformed model and highest for the two transformed models with the LN-RAW (Adj $R^2 = 0.26, p<0.001$) and LN-RAW (Adj $R^2 = 0.25, p<0.001$). Based on adjusted R-squared value, untransformed models are poor. Transformed models are an improvement over the untransformed models but the improvement in $R^2$ of LN-LN model over the LN-RAW models results in minimal or no $R^2$ for both hypotheses. Given that the LN-LN models are more complicated and therefore difficult to interpret and do not appear to add substantively to the percent of variance explained in WTP the more parsimonious model LN-RAW is preferred (equations 6.1b and 6.2b).

Standardized regression coefficients (beta weights) are presented for each of the six regression equations in tables 4.20 to 4.21. Beta weights enable comparisons for relative importance of predictor variables. Of the four predictors, only INCOME2 was statistically significant at 0.48 and 0.49 for equations 6.1b and 6.2b respectively.
As anticipated, beta weight for INC0ME2 had the highest positive value, indicating that it was the most important variable in predicting WTP and was statistically significant \((p<0.001\), for equations 6.1b and 6.2b) and positive. This means that we would expect to see a higher WTP for group with higher income (i.e., a household income greater than $20,000 per year, INC0ME2=1). Increased ability to pay has been well established to be associated with increased WTP, so this result is consistent with economic theory.

Support for models 6.1b and 6.2b is also provided by the bivariate correlation coefficients (Table 4.26). Bivariate correlations revealed two predictor variables INC0ME2 \((r=0.516, p=0.002)\) and AGE \((r=0.337, p<0.001)\) that were significantly related to LN(WTP). INC0ME2 and AGE were also highly correlated to each other \((r=0.519, p<0.001)\), possibly explaining why both variables were not significant in explaining variance in the dependent variable. Pearson r correlation between ΔQALY-VAS and LN(WTP) ΔQALY-SG and LN(WTP) approached zero and were not statistically significant. Uniqueness indices were computed for ΔQALY-VAS and ΔQALY-SG indicating that its inclusion in the model did not contribute significantly to variance explained in R-squared (less than one percent unique variance in either model, F(1, 114)=0.25.

In summary, addressing hypothesis 6.1, the equation describing the most proportion of the variance in the criterion (equation 6.1b) was:

\[
\text{LN(WTP)} = 0.099[\text{AGE}] + 0.477[\text{INC0ME2}] - 0.076[\text{HLTHPRBS}] + 0.033[\text{ΔQALY-VAS}]
\]
Since the model was statistically significant at the 95 percent confidence interval, the null hypothesis \( H_0: R^2 = 0 \) is rejected. The linear combination of the four criterion variables: AGE, INCOME2, HLTHPRBS and ΔQALY-SG explained 25.4 percent of the variance in the criterion WTP. \( F(4, 114) = 10.958, p < 0.001 \).

Addressing hypothesis 6.2, the equation describing the most proportion of the variance in the criterion (equation 6.2b) was:

\[
\ln(\text{WTP}) = 0.083(\text{AGE}) + 0.492(\text{INCOME2}) - 0.082(\text{HLTHPRBS}) + 0.093(\Delta\text{QALY-VAS})
\]

Since the model was statistically significant at the 95 percent confidence interval, the null hypothesis \( H_0: R^2 = 0 \) is rejected. The linear combination of the four criterion variables: AGE, INCOME2, HLTHPRBS and ΔQALY-SG is statistically significant and explained 26.2 percent of the variance in the criterion WTP, \( F(4, 114) = 11.361, p < 0.001 \).

Lastly, given the high significant positive correlation between AGE and INCOME2 \((r = 0.522, p < 0.001)\), inclusion of both variables in either model was possibly redundant. It would be expected that older study respondents had higher incomes, either because their household income was increased due to their partner or an already established income source, prior to undertaking graduate studies. Furthermore, since HLTHPRBS was correlated with INCOME2 \((r = 0.187, p = 0.042)\) it may also be redundant. Given that HLTHPRBS was not correlated to the criterion variable but INCOME2 and AGE were correlated with criterion variable, HLTHPRBS would be the most likely contender for
exclusion from the model. Its importance in explaining its unique contribution to explaining the variance in the criterion could be tested using the uniqueness index (hierarchical regression). Although inclusion of all three confounders may appear redundant, they were kept in the model since their inclusion was based on theory.

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<td>ΔLN(QALY-VAS)</td>
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<td></td>
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<tr>
<td>ΔLN(QALY-SG)</td>
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<tr>
<td>R</td>
<td>0.424</td>
<td>0.438</td>
<td>0.529</td>
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<tr>
<td>R Square</td>
<td>0.180</td>
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<td>0.279</td>
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<td>Adj R2</td>
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<td>P value</td>
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Table 4.19: Summary of six regressions presented in Tables 4.20 to 4.25 for research questions 6.1 and 6.2. Beta weights are presented in the main matrix.
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<th>P value</th>
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<td>AGE</td>
<td>0.190</td>
<td>1.907</td>
<td>0.059</td>
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<td>INCOME2</td>
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Table 4.20: RAW-RAW model: 6.1a

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<td>AGE</td>
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<td>∆LN(QALY-SG)</td>
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Table 4.21: RAW-RAW model: 6.2a
### Table 4.22: LN-RAW Model: 6.1a

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### Table 4.23: LN-RAW model: 6.2b

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223
### Table 4.24: LN-LN Model: 6.1c

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<td>&lt;0.001</td>
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<td>0.366</td>
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<td>ΔQALY-VAS</td>
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<tr>
<td>ΔQALY-SG</td>
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<td>—</td>
</tr>
<tr>
<td>ΔLN(QALY-VAS)</td>
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<td>—</td>
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### Table 4.25: LN-LN model: 6.2c

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<th>P value</th>
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<td>ΔQALY-SG</td>
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</tr>
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<td>1. HLTHPRBS</td>
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<td></td>
</tr>
<tr>
<td>2. INCOME2</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. AGE</td>
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<td>0.522</td>
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<tr>
<td></td>
<td>(0.184)</td>
<td>(&lt;0.001)</td>
<td></td>
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<tr>
<td>4. LN(WTP T,R)</td>
<td>0.024</td>
<td>0.516</td>
<td>0.337</td>
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<tr>
<td></td>
<td>(0.397)</td>
<td>(&lt;0.001)</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>5. ΔQALY-VAS T,R</td>
<td>-0.082</td>
<td>0.040</td>
<td>-0.082</td>
</tr>
<tr>
<td></td>
<td>(0.189)</td>
<td>(0.335)</td>
<td>(0.188)</td>
</tr>
<tr>
<td>6. ΔQALY-SG T,R</td>
<td>0.063</td>
<td>0.043</td>
<td>-0.048</td>
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<tr>
<td></td>
<td>(0.248)</td>
<td>(0.321)</td>
<td>(0.304)</td>
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</table>

Table 4.26: Bivariate correlations (Pearson r correlation coefficients reported for interval data correlations and Phi coefficient reported for categorical associations. P values provided in parentheses.

225
Hypotheses 6.3 and 6.4

Hypothesis 6.3

The proportion of variance of $\text{WTP}_{\text{PrevNV}-\text{NV}}$ explained by $\Delta\text{QALYs}$ 

$([\text{QALY-SG}_{\text{PrevNV}}] - [\text{QALY-SG}_{\text{NV}}])$, accounting for age, income and health problems, is zero.

Hypothesis 6.4

The proportion of variance of $\text{WTP}_{\text{PrevNV}-\text{NV}}$ explained by $\Delta\text{QALYs}$ 

$([\text{QALY-VAS}_{\text{PrevNV}}] - [\text{QALY-VAS}_{\text{NV}}])$, accounting for age, income and health problems, is zero.

Results of OLS regression analysis for hypotheses 6.3 and 6.4 are summarized in Table 4.27 for RAW – RAW, LN – RAW and LN – LN models. Tables 4.28 to 4.33 list beta weights for models addressing hypothesis 6.3 (equations 6.3a, 6.3b and 6.3c) and hypothesis 6.4 (equations 6.4a, 6.4b and 6.4c). Results were analyzed using multiple regression analysis (Tables 4.28 to 4.33) and bivariate correlations (Table 4.34) as recommended by Hatcher and Stepanski (1997).

In contrast to the low INCREMENT described in health for chronic condition for hypotheses 6.1 and 6.2 (i.e. breast cancer treatment versus do nothing), the increment in health benefit described for hypothesis 6.3 and 6.4 estimates proportion of variance described in the criterion variable $[\text{WTP or LN(WTP)}]$ for an acute condition.
Contrasting the statistically significant models presented for hypotheses 6.1 and 6.2, only one of the six models listed in Table 4.27 were statistically significant equation 6.4b (LN-RAW), addressing research question 6.4, Adjusted $R^2 = 0.054$, $F(4,114) = 2.685$, $p = 0.035$. However, significant adjusted $R^2$ was low for equation 6.4b. Model 6.4c (LN-LN) was statistically nonsignificant (Adjusted $R^2 = 0.045$, $F(4,114) = 2.400$, p value borderline at $p = 0.054$). Both of these models used $\Delta$QALY-VAS as opposed to $\Delta$QALY-SG. None of the models addressing research question 6.3 were statistically significant.

Similar to results obtained for hypothesis 6.1 and 6.2, RAW-RAW models (equations 6.3a and 6.4a) accounted for the least percent of variance in the criterion and given that these models were not statistically significant indicates that the linear combination of predictors did not significantly contribute to WTP. In other words, they were poor models.

The transformed models explained maximum proportion of variance. Again, there was negligible difference between the LN-LN and LN-RAW models (i.e., less than 0.9 percent) indicating that the additional transformation of the predictor LN($\Delta$QALY$_{prevNV-NV}$) did not contribute in correcting for assumptions violated in RAW-RAW models and was probably not necessary. Therefore, the preferred models are LN-RAW for hypotheses 6.3 and 6.4, based on adjusted $R^2$ and being the most parsimonious of the LN_RAW and LN-LN models.
Examination of the beta weights shows INCOME2 as statistically significant at an \( \alpha \) level of 0.05 for all six models (Tables 4.28 - 4.33), thereby supporting the inclusion of INCOME2 in the regression equations.

Evaluation of the bivariate correlation coefficients between criterion and predictor variables (Table 4.34) supports the inclusion of INCOME2 (\( r=0.261, \ p=0.004 \)) in the regression equations (bivariate correlations described in first three lines of table are identical to previous bivariate table (Table 4.34). However, correlations between the predictor variables of interest \( \ln(\Delta QALY-VAS_{\text{Prev}NV-NV}) \) and \( \ln(\Delta QALY-SG_{\text{Prev}NV-NV}) \) with transformed WTP (criterion variable) were poor. The combination of poor bivariate correlations and nonsignificant beta weights for \( \ln(\Delta QALY-VAS_{\text{Prev}NV-NV}) \) and \( \ln(\Delta QALY-SG_{\text{Prev}NV-NV}) \) indicates that the predictor of interest (\( \Delta QALY \)) did not contribute significantly to the model.

Lastly, similar for hypotheses 6.1 and 6.2 given the high significant positive correlation between AGE and INCOME2 (\( r=0.522, \ p<0.001 \)), inclusion of both variables in either model was possibly redundant, although they were both correlated with criterion variable. AGE correlation with WTP (transformed), \( r=0.189 (p=0.39) \) was significant, however, since the association is low and AGE is highly correlated with INCOME2, exclusion of AGE should be considered. Again, HLTHPRBS did not correlate significantly with the criterion variable (\( r=0.011, \ p=\text{NS} \)). Although inclusion of all four dependent variables
may appear redundant, they were maintained in the model since their inclusion was based on support from the literature.

In summary, addressing hypothesis 6.3, the equation describing the most proportion of the variance in the criterion was (equation 6.3b):

$$\ln(\text{WTP}_{\text{PrevNV-NV}}) = 0.704[\text{AGE}] + 0.234[\text{INCOME2}] - 0.036[\text{HLTHPRBS}] + 0.026[\Delta \text{QALY-SG}_{\text{PrevNV-NV}}]$$

However, since the model was not statistically significant at the 95 percent confidence interval, we fail to reject the null hypothesis ($H_0: R^2 = 0$) and conclude that the four criterion variables including $\Delta \text{QALY-SG}_{\text{PrevNV-NV}}$ did not explain a significant proportion of the variance in $\text{WTP}_{\text{PrevNV-NV}}$, $F(4, 114) = 2.291, p = 0.064$.

In summary, addressing hypothesis 6.4, the equation describing the most proportion of the variance in the criterion (equation 6.4b) was:

$$\ln(\text{WTP}_{\text{PrevNV-NV}}) = 0.055[\text{AGE}] + 0.231[\text{INCOME2}] - 0.013[\text{HLTHPRBS}] + 0.115[\Delta \text{QALY-VAS}_{\text{PrevNV-NV}}]$$

Since the model was statistically significant at the 95 percent confidence interval, the null hypothesis ($H_0: R^2 = 0$) is rejected. Therefore, the linear combination of the four criterion variables: AGE, INCOME2, HLTHPRBS and $\Delta \text{QALY-SG}_{\text{PrevNV-NV}}$ explained 5.4 percent of the variance in the criterion $\text{WTP}_{\text{PrevNV-NV}}$, $F(4, 114) = 2.685, p < 0.001$. 

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Table 4.27: Summary of six regressions presented in Tables 4.28 to 4.33 for research questions 6.3 and 6.4.
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<th>P value</th>
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<td>0.424</td>
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<td>AGE</td>
<td>0.061</td>
<td>0.575</td>
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</tr>
<tr>
<td>INCOME2</td>
<td>0.223</td>
<td>2.073</td>
<td>0.040</td>
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<tr>
<td>HLTHPRBS</td>
<td>0.041</td>
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<td>0.663</td>
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<td>ΔQALY-VAS</td>
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Table 4.28: RAW-RAW model: 6.3a

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Table 4.29: RAW-RAW model: 6.4a
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<td>0.438</td>
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<td>INCOME2</td>
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Table 4.30: LN-RAW model: 6.3b

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<td>2.173</td>
<td>0.032</td>
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<tr>
<td>HLTHPRBS</td>
<td>-0.013</td>
<td>-0.136</td>
<td>0.892</td>
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<tr>
<td>△QALY-VAS</td>
<td>0.115</td>
<td>1.239</td>
<td>0.218</td>
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<tr>
<td>△QALY-SG</td>
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<td>—</td>
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<tr>
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Table 4.31: LN-RAW model: 6.4b
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<td>AGE</td>
<td>0.339</td>
<td>-0.786</td>
<td>0.434</td>
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<tr>
<td>INCOME2</td>
<td>-0.043</td>
<td>2.474</td>
<td>0.016</td>
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<tr>
<td>HLTHPRBS</td>
<td>-0.073</td>
<td>-0.369</td>
<td>0.713</td>
</tr>
<tr>
<td>AQALY-VAS</td>
<td>-0.043</td>
<td>-0.278</td>
<td>0.781</td>
</tr>
<tr>
<td>AQALY-SG</td>
<td>-0.064</td>
<td>0.693</td>
<td>0.489</td>
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Table 4.32: LN-LN model: 6.3c

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<td>AGE</td>
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<td>0.641</td>
<td>0.523</td>
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<tr>
<td>INCOME2</td>
<td>-0.026</td>
<td>2.183</td>
<td>0.031</td>
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<tr>
<td>HLTHPRBS</td>
<td>-0.073</td>
<td>-0.278</td>
<td>0.781</td>
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<tr>
<td>AQALY-VAS</td>
<td>-0.043</td>
<td>-0.278</td>
<td>0.781</td>
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<td>AQALY-SG</td>
<td>-0.064</td>
<td>0.693</td>
<td>0.489</td>
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Table 4.33: LN-LN model: 6.4c
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<tbody>
<tr>
<td>1. HLTHPRBS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. INCOME2</td>
<td>0.187</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. AGE</td>
<td>0.123</td>
<td>0.522</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.184)</td>
<td>(&lt;0.001)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. LN(WTP&lt;sub&gt;prev&lt;/sub&gt;-NV)</td>
<td>0.011</td>
<td>0.261</td>
<td>0.189</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.903)</td>
<td>(0.004)</td>
<td>(0.039)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. ΔQALY-VAS&lt;sub&gt;prev&lt;/sub&gt;-NV</td>
<td>-0.223</td>
<td>0.041</td>
<td>0.135</td>
<td>0.135</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.661)</td>
<td>(0.143)</td>
<td>(0.143)</td>
<td></td>
</tr>
<tr>
<td>6. ΔQALY-SG&lt;sub&gt;prev&lt;/sub&gt;-NV</td>
<td>-0.206</td>
<td>-0.174</td>
<td>-0.115</td>
<td>-0.016</td>
<td>0.097</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.059)</td>
<td>(0.213)</td>
<td>(0.866)</td>
<td>(0.292)</td>
</tr>
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Table 4.34: Bivariate correlations (Pearson r correlation coefficients reported for interval data correlations and Phi coefficient reported for categorical associations. P values provided in parentheses.)
Hypotheses 6.5 and 6.6

*Hypothesis 6.5*

The proportion of variance of $WTP_{C-R}$ explained by $\Delta QALY$s 
$([QALY-SG_c] - [QALY-SG_T])$, accounting for age, income and health problems, is zero.

*Hypothesis 6.6*

The proportion of variance of $WTP_{C-R}$ explained by $\Delta QALY$s 
$([QALY-VAS_c] - [QALY-VAS_T])$, accounting for age, income and health problems, is zero.

Results of OLS regression analysis for hypotheses 6.5 and 6.6 are summarized in Table 4.35. Tables 4.36 to 4.41 list standardized regression coefficients (beta weights) for models addressing hypothesis 6.5 (equations 6.5a, 6.5b and 6.5c) and hypothesis 6.6 (equations 6.6a, 6.6b and 6.6c).

Results were analyzed using multiple regression analysis (Tables 4.36 to 4.41) and bivariate correlations (Table 4.42) as recommended by Hatcher and Stepanski (1997). Table 4.33 was notable in that all six regression equations were statistically significant at the 0.05 level. Like previous results, the RAW-RAW models were poor predictors of $WTP$ – neither of these equations were statistically significant. Adjusted R-squared for the remaining models ranged between 22.9 to 25.2 percent, and were highest for the LN-LN models.
In addressing hypothesis 6.5 the optimal model was determined to be LN-LN model (Equation 6.5c). This conclusion was made based on the following observations:

1. Although both models were statistically significant, model 6.5c had a slightly higher adjusted R-squared of one percent than model 6.5b (24.5 versus 23.4 percent). Whether it was statistically higher than model 6.5b is unlikely. Operationally their R-squared values can probably be considered equivalent.

2. Meeting required statistical assumptions. Comparison of the Normal P-P plots for the two models noted no observed difference, but the residual plots (test for homogeneity of variance and linearity) appeared preferable for the LN-LN model.

3. Beta weights: INCOME was statistically significant in both models (equation 6.5b, $\beta=0.439$, $p<0.001$ and equation 6.5c, $\beta=0.419$, $p<0.001$). AGE was not statistically significant at 0.05 level in either analysis although it was borderline for LN-LN model ($\beta=0.398$, $p=0.056$). QALY-SG and its LN transformation were not statistically significant in either model.

Although the LN-LN models are more complicated and difficult to interpret and did not appear to add substantively to the percent of variance explained in WTP, due to its consistency with regression assumptions this model was preferred. In summary, addressing hypothesis 6.5, since the model was statistically significant at the 95 percent confidence interval, the null hypothesis ($H_0:R^2=0$) is rejected. The proportion of variance...
explained by the linear combination of four independent variables: AGE, INCOME2, HLTHPRBS and LN[ΔQALY-SG C-T] is 24.5 percent F(4,114)=10.56, p<0.01. The equation describing the most proportion of the variance in the criterion (equation 6.5c): 

\[
\text{LN(WTP C-T)} = 0.398(\text{AGE}) + 0.419(\text{INCOME2}) - 0.001(\text{HLTHPRBS}) + 0.303(\text{LN\DeltaQALY-VAS T-R})
\]

In addressing hypothesis 6.6 the optimal model was determined to be LN-LN model (Equation 6.6c). This conclusion was made based on the following observations:

1. Although both models were statistically significant, model 6.6c had a slightly higher adjusted R-squared (25.2 versus 22.9 percent).

2. Meeting required statistical assumptions. Comparison of the Normal P-P plots for the two models (Plot of cumulative proportions against cumulative proportions of a normal distribution testing assumption of normality of distribution of LN[WTP]) indicated that Model 6.6c appeared to meet this criterion better than its competitor.

3. Beta weights: AGE (β=0.246, p=0.033) and INCOME (β=0.417, p<0.001) were both statistically significant in model 6.6c (Table 4.4). AGE was not statistically significant in LN-RAW model (β=0.184, p=0.141). Although ΔQALY-VAS was not statistically significant in model 6.6c at the 0.05 level, its much larger positive weight is more consistent with expectations.

4. Bivariate correlation coefficients. Given the similar correlations for both models correlations were not helpful in differentiating between the models but they did support the inclusion of AGE (r=0.342, p=0.001) and INCOME2 (r=0.495, p<0.001), which were substantially correlated with LN(WTP) in the predicted
direction (i.e., positive correlations). Correlation between HLTHPRBS and LN(WTP) was not statistically significant \((r=0.081, p=384)\), indicating that it was not an important variable for model inclusion. Low association was reported for \(\text{LN(\Delta QALY-VAS)} \ r=0.191, p=0.038\) and for \(\Delta QALY-VAS \ (r=-0.179, QALY-VAS \ p=0.051)\), the correlation was not statistically significant and was not in the expected direction.

In summary for hypothesis 6.6, the null hypothesis was rejected (equation 6.6c). The proportion of variance accounted for in LN(WTP \(_{c-T}\)) by a linear combination of the four predictor variables: AGE, INCOME2, HLTHPRBS, and LN(\(\Delta QALY-VAS\)) is 25.2 percent. Equation 6.6c describing this relationship is:

\[
\text{LN(WTP }_{c-T})=0.276[\text{AGE}]+0.415[\text{INCOME2}] + 0.010[\text{HLTHPRBS}]+0.216[\text{\(\Delta QALY-VAS\) }_{c-T}]
\]
<table>
<thead>
<tr>
<th>Independent variables</th>
<th>RAW - RAW MODELS</th>
<th>LN - RAW MODELS</th>
<th>LN-LN MODELS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.5a WTP</td>
<td>6.6a WTP</td>
<td>6.5b LN(WTP)</td>
</tr>
<tr>
<td>AGE</td>
<td>0.330</td>
<td>0.187</td>
<td>0.127</td>
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<tr>
<td>INCOME2</td>
<td>0.211</td>
<td>0.200</td>
<td>0.439</td>
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<tr>
<td>HLTHPRBS</td>
<td>0.054</td>
<td>0.057</td>
<td>-0.15</td>
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<tr>
<td>ΔQALY-VAS</td>
<td>0.078</td>
<td></td>
<td>0.097</td>
</tr>
<tr>
<td>ΔQALY-SG</td>
<td>0.216</td>
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<td>0.013</td>
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<tr>
<td>ΔLN(QALY-VAS)</td>
<td></td>
<td></td>
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<tr>
<td>ΔLN(QALY-SG)</td>
<td></td>
<td></td>
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<tr>
<td>R</td>
<td>0.318</td>
<td>0.314</td>
<td>0.505</td>
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<td>Adj R2</td>
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<td>P value</td>
<td>0.016</td>
<td>0.018</td>
<td>&lt;0.001</td>
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Table 4.35: Summary of six regressions presented in Tables 4.36 to 4.41 for research questions 6.5 and 6.6. Beta weights are presented in the main matrix.
### Table 4.36: RAW-RAW model 6.5a

<table>
<thead>
<tr>
<th>Independent variables</th>
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<tbody>
<tr>
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<tr>
<td>AGE</td>
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<td>1.288</td>
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<td>INCOME2</td>
<td>0.211</td>
<td>2.004</td>
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<tr>
<td>HLTHPRBS</td>
<td>0.054</td>
<td>0.591</td>
<td>0.555</td>
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<tr>
<td>ΔQALY-VAS</td>
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<td></td>
<td></td>
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<tr>
<td>ΔQALY-SG</td>
<td>0.216</td>
<td>0.848</td>
<td>0.398</td>
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<td>ΔLN(QALY-VAS)</td>
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### Table 4.37: RAW-RAW model 6.6a

<table>
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<th>Independent variables</th>
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<th>P value</th>
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<td>AGE</td>
<td>0.187</td>
<td>1.367</td>
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<td>INCOME2</td>
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<td>HLTHPRBS</td>
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<td>0.622</td>
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<td>ΔQALY-VAS</td>
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<td>0.628</td>
<td>0.531</td>
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<td>ΔQALY-SG</td>
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<tr>
<td>ΔLN(QALY-VAS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent variables</td>
<td>Beta coefficients</td>
<td>t</td>
<td>P value</td>
</tr>
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<td>------------------</td>
<td>-------</td>
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</tr>
<tr>
<td>Constant</td>
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<tr>
<td>AGE</td>
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<td>0.588</td>
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<tr>
<td>INCOME2</td>
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<td>4.573</td>
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<td>HLTHPRBS</td>
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<td>0.856</td>
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<td>ΔQALY-VAS</td>
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</tr>
<tr>
<td>ΔQALY-SG</td>
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<td>0.954</td>
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<tr>
<td>ΔLN(QALY-VAS)</td>
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Table 4.38: LN-RAW model 6.5b

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<td>0.141</td>
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<td>INCOME2</td>
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<td>HLTHPRBS</td>
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<td>-0.060</td>
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<td>ΔQALY-VAS</td>
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<td>0.868</td>
<td>0.387</td>
</tr>
<tr>
<td>ΔQALY-SG</td>
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<td>—</td>
<td>—</td>
</tr>
<tr>
<td>ΔLN(QALY-VAS)</td>
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Table 4.39: LN-RAW model 6.6b
<table>
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<th>P value</th>
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<td>AGE</td>
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<td>0.056</td>
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<tr>
<td>INCOME2</td>
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<tr>
<td>ΔQALY-SG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔLN(QALY-VAS)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ΔLN(QALY-SG)</td>
<td>0.303</td>
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Table 4.40: LN-LN model 6.5c

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<th>P value</th>
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<tr>
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<td>0.033</td>
</tr>
<tr>
<td>INCOME2</td>
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<td>4.390</td>
<td>&lt;0.001</td>
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<tr>
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</tr>
<tr>
<td>ΔQALY-SG</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ΔLN(QALY-VAS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔLN(QALY-SG)</td>
<td>0.216</td>
<td>1.861</td>
<td>0.065</td>
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</table>

Table 4.41: LN-LN model 6.6c

242
Table 4.42: Bivariate correlations (Pearson r correlation coefficients reported for interval data correlations and Phi coefficient reported for categorical associations. P values provided in parentheses.)
Hypotheses 6.7 and 6.8

*Hypothesis 6.7*

The proportion of variance of $\text{WTP}_{\text{NonV-PrevNV}}$ explained by $\Delta QALY$s 

$([\text{QALY-SG}_{\text{NonNV}}] - [\text{QALY- SG}_{\text{PrevNV}}])$, age, income and health problems, is zero.

*Hypothesis 6.8*

The proportion of variance of $\text{WTP}_{\text{NonV-PrevNV}}$ explained by $\Delta QALY$s 

$([\text{QALY-VAS}_{\text{NonNV}}] - [\text{QALY-VAS}_{\text{PrevNV}}])$, age, income and health problems, is zero.

Results of OLS regression analysis for hypotheses 6.7 and 6.8 are summarized in Table 4.43. Results were analyzed using multiple regression analysis (Tables 4.44 to 4.49) and bivariate correlations (Table 4.50) as recommended by Hatcher and Stepanski (1997).

Tables 4.44 to 4.49 list standardized regression coefficients (beta weights) for models addressing hypothesis 6.7 (equations 6.7a, 6.7b and 6.7c) and hypothesis 6.8 (equations 6.8a, 6.8b and 6.8c).

Table 4.43 was notable in that five of the six regression equations (equation 6.7c, LN-LN model was borderline in statistical significance) were statistically significant at the 0.05 level. In contrast to previous hypotheses, the RAW-RAW models had higher $R^2$ values, however, caution should be exercised when basing the predictive power of regression models purely on $R^2$ (Hatcher and Stepanski, 1997). RAW-RAW models exhibited heteroskedasticity and nonlinearity. Furthermore, examination of the residual plots for
the nonstatistically significant LN-LN model (equation 6.7c) indicated evidence of nonlinearity. LN-RAW model graphs for QALY-SG variable suggests satisfactory correction of heteroskedasticity and nonlinearity observed in the RAW-RAW models, indicating that the double-log transformation over-corrected for assumption violations.

**Hypothesis 6.7**

In addressing hypothesis 6.7, only the RAW-RAW and LN RAW models were statistically significant at the 0.05 level: equation 6.7a $F(4,114)=0.124$, $p<0.001$ and equation 6.7b $F(4,114)=0.089$, $p=0.005$). Although it is tempting to select model 6.7a as the preferred model of the two since it explained a greater proportion of the variance in WTP (12.4 versus 8.9 percent). Evaluation of residual plots to check for linearity, homoskedasticity and outliers revealed that model 6.7b was preferred. Residual plot for RAW-RAW model indicated heteroskedasticity and nonlinearity. These violations were corrected in the LN-RAW model, therefore hypothesis 6.7 ($H_0: \beta^2=0$) is rejected. For model 6.7b, the proportion of variance explained by the linear combination of four independent variables: AGE, INCOME2, HLTHPRBS and ∆QALY-SG NonNV-PrevNV in LN(WTP NonNV-PrevNV) is 8.9 percent $F(4,114)=3.872$, $p=0.005$. Inclusion of INCOME2 in model 6.7b is also supported by the statistically significant beta coefficient: INCOME2 $\beta = 0.270$, $p=0.012$ (Table 4.46). Beta coefficients for AGE, HLTHPRBS and ∆QALY NonNV-PrevNV variables were not statistically significant. This is to be expected given the poor correlations between LN(WTP) and the three remaining predictor variables. Equation 6.7b describing this relationship is:

245
Hypothesis 6.8

In addressing hypothesis 6.8, all three models, RAW-RAW, LN RAW and LN-LN models were statistically significant at the 0.05 level: equation 6.8a $F(4,114)=5.610$, $p<0.001$, equation 6.8b $F(4,114)=3.831$, $p=0.006$, and equation 6.8c $F(4,114)=4.239$, $p=0.003$). Again model 6.8a had highest adjusted R-squared value of the three models, but was not selected as the preferred model due to assumption violations. Satisfactory corrections for nonlinearity and heteroskedasticity were observed in the transformed models: LN-RAW and LN-LN. Model 6.8c was selected as preferred of the transformed models since it explained a greater proportion of the variance in $\ln(\text{WTP}_{\text{NonNV-PrevNV}})$ (10.0 versus 8.0 percent). Inclusion of INCOME2 in model 6.8c was also supported by the statistically significant beta coefficient INCOME $\beta=0.284$, $p=0.012$ (Table 4.48). Beta coefficients for remaining variables in equation were not statistically significant at 0.05 level. This is to be expected given the poor correlations between $\ln(\text{WTP}_{\text{NonNV-PrevNV}})$ and the three predictor variables. Therefore, hypothesis 6.8 ($H_0:R^2=0$) is rejected.

For model 6.8c, the proportion of variance explained by the linear combination of four independent variables: AGE, INCOME2, HLTHPRBS and $\Delta\text{QALY-VAS}_{\text{NonNV-PrevNV}}$ is 10.0 percent $F(4,114)=4.239$, $p=0.003$. The equation describing the most proportion of the variance in the criterion (equation 6.8c):

\[
\ln(\text{WTP}_{\text{NonNV-PrevNV}}) = 0.270(\text{AGE}) + 0.128(\text{INCOME2}) - 0.105(\text{HLTHPRBS}) + 0.088\Delta\text{QALY-VAS}_{\text{NonNV-PrevNV}}
\]
In summary, hypotheses 6.7 and 6.8 are rejected: the proportion of variance explained in WTP is not zero. For hypothesis 6.7: the proportion of variance explained in the WTP (transformed) is 8.9 percent by a linear combination of the four predictor variables: age, economic status, health status, and QALY, $F(4,114)=3.872$, $p=0.005$. For hypothesis 6.8, the proportion of variance explained in WTP (transformed) is 10 percent by a linear combination of the four predictor variables: age, economic status, health status, and QALY (transformed), $F(4,114)=4.239$, $p=0.003$.
### Table 4.43: Summary of six regressions presented in Tables 4.44 to 4.49 for research questions 6.7 and 6.8. Beta weights are presented in the main matrix.

<table>
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<tr>
<th>Independent variables</th>
<th>6.7a WTP</th>
<th>6.8a WTP</th>
<th>6.7b LN(WTP)</th>
<th>6.8b LN(WTP)</th>
<th>6.7c LN(WTP)</th>
<th>6.8c LN(WTP)</th>
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<td>AGE</td>
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<td>0.209</td>
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<td>0.128</td>
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<td>0.262</td>
<td>0.375</td>
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<td>HLTHPRBS</td>
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<td>ΔLN(QALY-VAS)</td>
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<td></td>
</tr>
<tr>
<td>ΔLN(QALY-SG)</td>
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<td>R</td>
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<td>0.088</td>
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Table 4.44: RAW-RAW Model 6.7a

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<td>ΔLN(QALY-VAS)</td>
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Table 4.45: RAW-RAW Model 6.8a

249
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Table 4.46: LN-RAW Model 6.7b

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Table 4.47: LN-RAW Model 6.8b
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<td>∆QALY-SG</td>
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Table 4.48: LN-LN Model 6.7c

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Table 4.49: LN-LN Model 6.8c
Table 4.50: Bivariate correlations (Pearson r correlation coefficients reported for interval data correlations and Phi coefficient reported for categorical associations. P values provided in parentheses.)

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<td>1. HLTHPRBS</td>
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<td>4. LN(WTPNonV-PrevV)</td>
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<td>5. ΔQALY-VASNonV-PrevV</td>
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<td>6. ΔQALY-SGNonV-PrevV</td>
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<td></td>
<td>(0.199)</td>
<td>(0.016)</td>
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<td>(0.675)</td>
<td>(0.322)</td>
<td>(0.697)</td>
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CHAPTER 5

DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

This chapter begins by describing the approach and underlying rational used in designing the study. Then it summarizes the results and draws conclusions based on the results of this study and the literature. The discussion is organized around the six research questions in order of analysis. Research questions 1, 2 and 5 are first discussed (i.e., \( \Delta QALY \): acute versus chronic conditions) followed by research questions 3 and 4 (i.e., WTP: acute versus chronic conditions). Finally research question 6, the primary objective of this study is discussed. In addition to the discussion of results, study limitations are discussed. The chapter concludes by offering suggestions for future research.

Approach and underlying rational of study

Health care resources are scarce. There are not enough resources available to satisfy all human health care wants completely. Therefore tough decisions must be made to determine how and where health care dollars should best be allocated to meet society
needs. Health economics, namely CUA and CBA are tools used by decision makers to explicitly present the costs and outcomes of choosing one intervention over another.

The outcome measure used in CUA is typically quality adjusted life years (QALY), and CBA explicates treatment benefit in monetary units. Both metrics measure the trade-offs or cost in dollars. Currently QALYs are recommended for use in health care allocation decisions, while in almost every other discipline WTP is used as the standard metric in resource allocation decisions to measure health benefits (e.g., benefits of safety belts and value of installing smoke detector devices). This would be of little consequence if the use of QALYs or WTP resulted in the same decision. However, there is evidence to support that QALYs discriminate against acute conditions; therefore metric selection has policy consequences.

QALYs measure benefits of a health intervention incorporating quality (Q) and quantity of life (Y) by multiplying the duration of treatment benefit in years by its improvement in quality of life. Since Q is represented on a scale from 1.0 (full health) to zero (death), the impact of Q on QALY formula is limited. Therefore, even if a therapy provided complete relief for acute excruciating pain (e.g., shingles), certainly a therapy of value, benefit measured in QALYs would be miniscule because QALY is insensitive to changes in quality of life. This would suggest therapy for temporary conditions such as acute excruciating pain, is of little value. In contrast, the monetary metric, WTP is considered
to be sensitive to measuring health benefits that only affect quality of life (Bala and Zarkin, 1999, Pathak, 1995).

The main objectives of this study were two fold. The first objective was to quantify the effects of changes in quality of life only, quantity of life only, and both quality and quantity of life on WTP and QALY measures of health benefits. This was accomplished by measuring changes in health benefits for an acute condition and a chronic condition. The acute condition only considered changes in quality of life. The chronic condition considered changes in longevity for a treatment and changes in duration of life and quality of life for a cure. The changes in quality and quantity of life are summarized in Figure 5.1 along with expected changes in QALYs produced from the interventions. The design permitted four comparisons between the acute and chronic health states: (1) ΔQ with ΔQ; (2) ΔQ with ΔY; (3) ΔY with ΔQ and ΔY; and (4) ΔQ with ΔQ and ΔY. Figure 5.1 depicts the interventions used for acute and chronic conditions for variable changes in quality (Q) and quantity (Y) of life. Figure 5.2 shows the research questions addressed in the 2x2 table for the described changes: research questions 1, 2 and 5: changes in QALYs.

Research questions 3 and 4, measured benefits in health for the same scenarios used in the previous research questions but using WTP as the outcome measure. Figure 5.3 depicts anticipated WTP values for these same interventions.

255
### TYPE OF HEALTH CONDITION

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<td>Breast cancer cure versus treatment</td>
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Figure 5.1: Interventions used to measure WTP and changes in QALY.

Research questions 1 to 5, summarized in Figures 5.2 and 5.3, provides a backdrop for the focal point of this study: WTP and QALYs are reported to be based on the same underlying theoretical foundations. If both metrics are founded in welfare economics then it should be possible to regress WTP onto QALYs. In other words, predict WTP from changes in quality adjusted life years. Research 6 addressed this issue and is presented in Figure 5.4. Establishing such a relationship would not only give credence to the underlying foundations of QALYs in utility theory, but also potentially advance the field of health economic program evaluation by providing a value to QALYs.

256
### TYPE OF HEALTH CONDITION

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</tr>
<tr>
<td></td>
<td>Large ΔQ Medium ΔQ Very Large ΔY</td>
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</tr>
<tr>
<td><strong>High Health Benefit</strong></td>
<td>Cell 2,1 Miniscule ΔQALY</td>
<td>Cell 2,2 Very large ΔQALY</td>
</tr>
<tr>
<td></td>
<td>RQ: 2.1 &amp; 2.2</td>
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</tr>
</tbody>
</table>

**Figure 5.2:** ΔQALY measurements investigated in this study explained by changes in Q and Y for research questions 1, 2 & 5.
### TYPE OF HEALTH CONDITION

<table>
<thead>
<tr>
<th>Intervention</th>
<th>ACUTE</th>
<th>CHRONIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small health benefit</td>
<td>Moderate WTP</td>
<td>Large WTP</td>
</tr>
<tr>
<td>Large ΔQ</td>
<td>Small ΔQ</td>
<td>Medium ΔQ &amp; Very Large ΔY</td>
</tr>
<tr>
<td>High Health Benefit</td>
<td>Moderate WTP</td>
<td>Very large WTP</td>
</tr>
</tbody>
</table>

**Figure 5.3:** WTP values investigated in this study explained by changes in Q and Y for research questions 3 and 4. (Blank arrows were not specific research questions).
<table>
<thead>
<tr>
<th>TYPE OF HEALTH CONDITION</th>
<th>INTERVENTION</th>
<th>ACUTE</th>
<th>CHRONIC</th>
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<td></td>
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<td>Cell 1,2</td>
</tr>
<tr>
<td>SMALL HEALTH BENEFIT</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Standard preventative therapy versus do nothing for PCNV</td>
<td>Breast cancer treatment versus do nothing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate WTP</td>
<td>Large WTP</td>
<td></td>
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<tr>
<td>Miniscule ΔQALY</td>
<td>Large Δ QALY</td>
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<tr>
<td>RQ 6.3 and 6.4</td>
<td>RQ 6.1 and 6.2</td>
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<tr>
<td>HIGH HEALTH BENEFIT</td>
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<td>Optimal versus Standard preventative therapy for PCNV</td>
<td>Breast cancer cure versus treatment</td>
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<td>Miniscule ΔQALY</td>
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</tr>
<tr>
<td>RQ 6.7 and 6.8</td>
<td>RQ 6.5 and 6.6</td>
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</table>

*Figure 5.4: Regression of WTP onto ΔQALY: Research question 6*
AQALY: acute versus chronic conditions

Health economics is concerned with the efficient allocation of resources given limited resources. This means making choices to optimize health care resources. Two tools used to assist in this decision are CUA and CBA. Both of these metrics are recommended for pharmacoeconomic assessment of acute and chronic conditions (Gold et al, 1989; Bala, Mauskopf, and Wood, 1999; Blumenschein and Johannesson, 1996). However, due to convention, CUA has been accepted as the method of choice for conducting outcomes research. In other words, QALY estimation is the standard metric employed to assess the health benefit or outcome of the health care intervention. QALY is computed by simply multiplying Q (utility or desirability of the health state, standardized on a scale where death=0 and perfect health=1) by Y (duration of time in years). The result of this computation is acute conditions are expected to be discriminated against in favor of interventions for chronic conditions when CUA is the economic method used to assess programs. The result of instituting CUA for prioritization of health care interventions is probable exclusion of interventions for the treatment of acute conditions because QALY estimation is sensitive to Y not Q (Pathak, 1995). Therefore, treatment for a chronic condition will produce a greater number of QALY then that for a short-term condition, despite the level of disutility incurred due the acute condition (Ganz, 1994).

Research questions, 1, 2 and 5 estimated ΔQALYs for acute and chronic conditions.

Acute condition selected was PCNV due to its substantive effect on quality of life (i.e. Q) but minimal duration (i.e. Y=0.008 years).
Two incremental ΔQALYs for acute condition (PCNV) were estimated: (1) low level increment in health (INCREMENT=1): ΔQALYs for do nothing versus partial alleviation of PCNV (ΔQALY_{PrevNV-NV}); (2) and second was for a high level benefit (INCREMENT=2) for ΔQALYs for partial alleviation of PCNV versus complete alleviation of PCNV (ΔQALY_{NONV-PrevNV}). All QALY measurements were for the same time duration therefore ΔQALY was expected to estimate effect of ΔQ only.

Two incremental ΔQALYs for chronic condition (breast cancer recurrence) were estimated:

(1) Lower incremental health benefit (INCREMENT=1), ΔQALYs for do nothing versus breast cancer treatment (ΔQALY_{T-R}), was designed to predominately measure the effect of ΔY and;

(2) Higher incremental health benefit (INCREMENT=2), ΔQALY breast cancer treatment versus breast cancer cure (ΔQALY_{C-T}), was designed to estimate ΔQALY for the effect of ΔY and ΔQ

As predicted ΔQALY estimation for chronic condition interventions were much higher than for acute conditions for both the low and high incremental health benefits, supporting the hypothesis that QALY is sensitive to changes in Y. This idiosyncrasy of QALY measurement was further supported by the lack of statistically significant
difference between ΔQALY estimates for high versus low incremental benefits in health — these different interventions varied substantively in quality of life but not duration of life. As anticipated, QALY is an insensitive metric to interventions that only affect quality of life. As hypothesized, interventions that essentially affect Y only produce significantly more QALY and those that affect Q and Y even more so.

Cost figures from the literature were used to estimate cost per QALY for the acute and chronic interventions. Assuming breast cancer has an incremental cost for treatment of $16,000 (Trippoli, Becagli, and Messori, 1997) and assuming a benefit of 9.6 QALYs (i.e. 10.4 -0.8: ΔQALY-SĜT-R̂, Table 4.15), would result in a cost of $1,667 per additional QALY. If $50,000 per QALY (Garber and Phelps, 1997) is used as the threshold criterion for prioritization, then the breast cancer treatment at under $2000 per QALY is consistent with optimizing resource use.

A similar estimate for the acute health state intervention would produce 0.00034 QALYs. If therapy cost was assumed to be equivalent to the Red Book 1999 list price for ondansetron ($50 per does) and metoclopramide ($2.25 per dose), grossly underestimate the cost of administering the antinauseants, the cost per QALY is $141,176 per QALY ($48/0.00034 QALYs). Therefore, the cost per QALY for the acute intervention, does not appear to be cost-effective. The cost per QALY values estimated above are similar to those reported in the literature. Cost per QALY reported for breast cancer in was $1,255
per QALY (Trippoli, Becagli, Messori, 1997) and for PCNV therapy was $168,391 per QALY (Zbrozek, et al, 1994).

QALYs produced for acute condition interventions were miniscule. The largest QALY (SG) was reported for Situation $_{0NOV} = 0.006$ QALY. The small QALY estimates for the acute condition can be attributed not only to the short lived nature of the intervention (i.e., $Y = 0.008$ years), but also due to respondent unwillingness to gamble death for an acute condition for QALYs estimated using SG. In other words, respondents were risk averse. As expected QALY-SG measurements were consistently higher than QALY-VAS for each respective health scenario for both chronic and acute conditions. However, lack of risk neutrality had a greater impact on acute health states. During the face-to-face interview process 25 of the 119 (21%) respondents were not willing to accept any chance of death for the possibility of perfect health for the acute health states. When asked why, respondents provided the following explanations:

"Can't take risk because only for 5 days, therefore not worth it, if it was for if it was for the rest of my life I would."

"Because a week with an average of three days is not worth risking death over. Death is permanent, nausea and vomiting isn't"
“Because only for one to five days, with a maximum of five days. I can handle illness for that long. By gambling death I am giving away my life too easily.”

“Rather be sick for 5 days then worry about if I am going to die or not. Did not gamble because of time frame and there is no guarantee that I will get perfect health if I do.”

“I won’t risk death for three to five days. I can do anything for three to five days”

Impact of time frame on Q weight measurement for the acute conditions was also supported by asking a sample of respondents (n=19) at the completion of the PCNV survey to re-rank and rate the PCNV health states assuming the condition endured for the rest of their lives, until the age of 74\(^1\). Two of the 19 respondents changed their initial ranking from death as the worst health state to Situation \(_{NV}\) as the worst health state. Except for one respondent, the remaining 18 were willing to take a greater chance of death for the possibility of perfect health using the SG method. VAS Q weights were also reduced when health condition was assumed to last until the age of 74. The abovementioned quotes and exploratory study indicate two violations of the required assumptions for QALY metric to be a measurement of utility: risk neutrality and utility independence. Focus of respondents on death in utility assessment of acute conditions indicated that respondents were not risk neutral and for the utility independence

\(^1\) Additional study results not presented since not part of research objectives.
assumption to hold Q weight should be the same regardless of the time horizon in question.

Measurement of acute conditions required respondents to assume that they will be in the condition for one to five days with an average of three, and what happens after that is not known and therefore should not be taken into account. Acute conditions were phrased generically in an attempt to avoid an associated prognosis being attached to the health outcomes thereby confounding utility measurement. However, a number of respondents had difficulty deciding on how much they were willing to risk death for without knowledge of their prognosis for the hypothetical scenarios presented. For example, respondents quoted the following:

“What sort of cancer is it?”

“How long will I live for without taking the treatment?”

“Your ability to gamble would depend on the prognosis. So if you knew you were going to die then I would take the risk of death to improve my quality of life”

---

2 Nineteen respondents underwent SG procedure assuming acute condition was for the rest of their lives. Q weights were lower when time frame was assumed to be longer. These results are not presented.
As indicated by respondent quotes, consideration of long-term outcomes was a natural part of health care decision making. Therefore, being asked to ignore the prognosis of the hypothetical health state was a departure from reality. Given the high stakes with SG method, chance of death, an obviously permanent condition, common sense would dictate consideration of the risk of death without accepting treatment. However the SG method used to estimate Q weights for acute conditions did not allow this.

Furthermore, respondents included in this study, well-educated young women, were considered ideal given the cognitively challenging utility measures used. Utility measurement was also optimized by the use of face-to-face interviews with one interviewer to avoid inter-rater variations. Overall, respondents did appear to understand the SG method as indicated by no violations of transitivity assumptions, however a number commented on the difficulty of thinking in terms of probability for health care decisions. Respondents stated that they did not think in terms of probabilities in regards to their health care decisions. Furthermore, general lack of familiarity with what probabilities meant required explanation of probability terms to respondents. For example, “A one percent chance of death and 99 percent chance of perfect health means that if 100 women like yourself took the treatment you would expect 99 to be in perfect health for the rest of their lives, but one woman to die.” Clarification of the meaning of probabilities was felt to be necessary and provided to all respondents, despite the fact that 72 percent of respondents were graduate students (which by definition requires some
knowledge of statistics) and more than 25 percent of respondents were from the health care field (pharmacy, medicine, nursing and dentistry). For example:

"Chance board was difficult because of cognitive load of manipulating probabilities"

"Gambling is unrealistic and therefore did not make much sense."

This poses several questions: how practical is SG method to acquire Q weights in the general population? Is SG method appropriate for measuring utility in acute conditions? Research in both fields is ongoing. Acceptability of SG method in the general population is varied. For example, Leslie Lenert and colleagues (Lenert et al, 1995) have reported success acquiring SG utility measures on the World Wide Web, but by definition the group acquired utility values from computer literate individuals.

As mentioned, high Q weights reported for acute scenarios (SG) appeared to be primarily due to directly gambling death with an intermediate short-lived health state. In the PCNV survey, one respondent stated:

"Chance board [SG] this time is much harder than last time [breast cancer survey] because death is forever and nausea and vomiting is only for one to five days."

(Comments in parenthesis added by researcher for clarification).

Attempts to correct this problem have been attempted with the use of the "chaining method". Chaining method is a two-step SG procedure. Health states compared include,
perfect health, death, intermediate health state of interest (h_i), and an undesirable health state considered worse than h_i by respondents but preferable to death (i.e., an alternative anchor health state scenario: second least desirable health state). First gamble is h_i versus perfect health and second least desirable health state. Second gamble is second least desirable health state versus death and perfect health. Thus, h_i is indirectly compared to death (Jansen et al, 1998, Johnston et al, 1998; LaLonde et al, 1999). However, it is not without problems. The chaining method requires respondents to the alternative anchor state as the second least desirable health state to work. Furthermore, the use of chaining method results in a scaling problem (Amiram Gafni, Personal Communication, 11/1999).

Moreover, some respondents reported discomfort with the use of the chance board (SG): the method was explicit in describing chance of death: using numbers and diagrammatically with use of probability wheel. One respondent quoted:

"Probable lack of discomfort with chance board may be due to relative lack of explicit statements from health care professionals about percentage chance of death versus the abundance of practitioners who speak in terms of money"

However, some respondents appreciated the explicit nature of SG.

In summary, in this study, the SG method was shown to be problematic when used to measure utility for acute conditions. One fifth of respondents were unwilling to risk death for the possibility of perfect health to avoid temporary health states. This problem was not evidenced with chronic health state scenarios, suggesting that SG is more
appropriate for utility assessment for chronic health states. Asking respondents to gamble death for acute conditions did not seem realistic to many with some respondents stating that it was obvious that no one would risk death, appearing puzzled that they were asked such an outrageous question. Furthermore, the high cost per QALY ratio for the acute conditions clearly indicates, as anticipated, CUA favors chronic over acute health state interventions.

Willingness to Pay

Research questions 3 and 4 estimated benefits using a monetary metric for the same health care interventions used in research questions 1, 2 and 5. Rational for research questions 3 and 4 were that WTP, unlike QALY, was a sensitive measure of disutility and therefore, was not expected to discriminate against health care interventions for acute ailments.

"Even with its limitations, the WTP methodology may have a better chance of leading us to optimal treatment decisions that the QALY methodology for acute self-limiting conditions, where diminished quality of life is known to last only for a short period of time." (Bala and Zarkin, 1999, page 13)

As anticipated very large WTP values were reported for interventions involving the chronic conditions: mean $\text{WTP}_{C-T} = $21,050 and mean $\text{WTP}_{T-R} = $11,756. The mean WTP for acute interventions were: $\text{WTP}_{\text{PrevNV-NV}} = $186.66 and $\text{WTP}_{\text{NoNV-PrevNV}} = $309.86. For many respondents mean WTP values exceeded 20 percent of their gross monthly income. In contrast to the $\Delta$QALY for the acute conditions, which approached
zero, mean WTP values for acute health state interventions were much greater than zero. These results add evidence to the body of literature questioning the appropriateness of CUA for acute health care intervention assessment. CUA assessment of the acute intervention indicated negligible health benefits. WTP metric for the same intervention showed that therapy did have utility for respondents. Furthermore, WTP was easier and quicker to administer, and was not as cognitively challenging when assessing acute health care interventions. Respondents commented:

"WTP [in health care] is what you hear about most"

"This chance taking was more difficult than willingness to pay"

"This method [WTP] was by far the most thought provoking and made me look at the issue head on. When I had to consider what I would pay and from where I would get it, this method for me gave the most realistic answers"

"Had no problem making choices within the current level of income [compared to breast cancer survey] probably because amounts to be spent were lower than the previous time"

Respondent comments indicated that WTP method was consistent with how they actually made decisions in real life. Respondent did not appear to have difficulty understanding
the method. Only one respondent was dropped from the study due to possible protest bids. WTP for acute health state conditions, unlike SG, did not involve direct comparisons to death, which seemed shocking and unrealistic to some respondents. However, for the chronic conditions, use of WTP method for some was more challenging:

"This method [WTP] seemed to make the most sense [compared to SG and VAS] but financial constraints [in reference to breast cancer survey] made it frustrating – but most realistic."

"I liked this approach because I felt that I could make the decision based on my values, experiences and etc. I felt that I had control and the outcome was not based on chance"

Respondent comments for use of WTP to measure health care interventions that increased Y or Y and Q was one of frustration. Overall, respondents, mostly American citizens (84%) did not think it unreasonable to have to pay for health benefits, including one that prolonged life. However, they appeared to have trouble quantifying in monetary terms such a large benefit. Cognitively more difficult to consider was the maximal WTP for an intervention that prolongs life. The result of which was budget constraint effect and possibly an effective measure of respondent ability to save. More than half of the respondents (63 of 119) reported \( WTP_{C-R} \geq WTP_{C-T} \). Study participants stated that they simply liquidated all their assets and many were disappointed that they could not go into debt and pay more.
In summary, in contrast to CUA, WTP method appeared superior for assessing health benefits for acute interventions. Use of WTP method for assessing large health gains when respondents are not permitted to borrow is probably an effective measure of respondent wealth rather than utility. However, allowing respondents to borrow reasonably against future earnings, does not guarantee more meaningful WTP bids [Alan Randall, Verbal Communication, 5/2000]. Questioning a number of respondents after the two interviews regarding loans revealed that single respondents felt that there was much uncertainty in their futures. For example, they did not know if they would marry or have children – factors that affect income. Furthermore their general unfamiliarity with loans would make it difficult for them to estimate WTP under such conditions.

Despite budget constraint limitations the study supported the use of WTP in health care. Scope effects for both chronic and acute interventions tested successfully indicating that health state scenarios were believable to respondents. Respondents were not averse or offended by WTP questions in health care. For acute scenarios study participants responded with greater ease and less distress than the SG.

Moreover, using the same cost per QALY examples provided above, it would be feasible to translate the technical efficiency question to one of allocative efficiency. With a mean $WTP_{NoNV-NV} = 309.86$ and $\Delta QALY = 0.0003$, an additional QALY is worth $1,030,000$ to the respondent for the acute health care intervention. In CBA terms if the cost is $48,
and the monetary benefit is $310, for a group of 100 patients, based on these figures the acute intervention results in a net benefit of $262,000. Since the benefit exceeds the cost, prioritizing the acute intervention appears consistent with a PPI. For the chronic health intervention if WTP $T-R = $11,756 and cost=$16,000, then treating 100 patients would result in a net loss of $424,400. The resultant loss for the chronic health state is due to the lower value assigned to breast cancer QALYs (i.e. $11,756 per 9.5 QALYs equates to a breast cancer treatment QALY = $1,237.5). This discrepancy occurs because an acute health care intervention QALY does not equal a QALY produced by a chronic condition. Summarizing, these results support previous literature discussions.

"The net effect of this inherent limitation of the QALY method is that it underestimates the potential value of health care technologies for acute conditions" (Pathak, 1995, page 20).

CUA has been widely supported tool in health care decision making, in the US and internationally. In the US CUA has been supported by the Panel of Cost Effectiveness in Health Care and Medicine, a nonfederal panel with expertise in CEA (Gold et al, 1996). Internationally, CUA has been advocated by Canadian and Australian Guidelines, recommending the use of QALYs in health policy assessment. However, allocative efficiency is one factor in health care spending decisions, not the only criterion. Growing disease prevalence (e.g., AIDS), popularity (e.g., Alzheimer's disease and the Reagans) and equity also play an important role. In terms of application, the results of this study suggest that prior to advocating CUA or CBA as the optimal method for use in health care policy making consideration must first be made to the strengths and weaknesses of
either method. The results of this study indicated that QALYs discriminates against acute interventions, while WTP was sensitive to changes in Q. Furthermore, WTP can be problematic in assessing large health care benefits, while QALY does not suffer from this constraint. Therefore, consideration should be given to the type of health benefit question asked prior to selection of health economic tool used in utility assessment.

**Regressing WTP onto ΔQALY**

The underlying premise of research question 6 was that ΔQALY and WTP were based on the same theoretical foundations of welfare economics. That is both metrics are measures of utility. Regression equations were statistically significant at the 0.05 level, the beta coefficients and bivariate correlations in the equations provided support for inclusion of the income variable, consistent with economic theory, and in some cases respondent age (AGE), which was consistent with prior research and economic theory (Bala, Wood, Zarkin et al, 1998; Johnson, Fries and Banzhaf, 1997; Blumeschein and Johannesson, 1998). Respondent history of health problems was revealed not to be statistically significant. This could be attributed to lack of sensitivity of the measure since this variable was measured on a dichotomous scale; the homogenous nature of the population – greater variability if required for significance in regression; or simply because it was not important.

Furthermore, one of the assumptions of OLS regression is that the correct functional form has been selected and that all the important variables have been included. Lack of
important criterion variables would have decreased percent of variance explained in the dependent variable.

QALY metric is only a measure of utility if assumptions beyond those of vNM are met. If assumptions of risk neutrality and constant proportional trade off property (i.e., independence between Q and Y) are not met, then QALY is no longer a utility function. In other words it is not a pure measure of respondent utility. This would explain the lack of correlation between the two metrics. Assuming risk neutrality, utility function for QALY is written as \( U(Y,Q) = Y \cdot U(Q) \). If risk neutrality is not assumed the utility function is more complicated (less appealing) and takes on the following form which requires estimates of risk (r) to compute QALY:

\[
U(Y,Q) = \frac{1}{r} \left\{ [Y \cdot U_r(Q)] - 1 \right\} + r, \text{ where } r \neq 0 \text{ (Pathak, 1995).}
\]

Furthermore, measurement of utility using QALY was constrained not just in the acute setting due to risk neutrality but also in the chronic setting due to budget, both of which explain lack of correlation of QALY with WTP. These results would support the inclusion of risk in QALY computations, especially for acute health state interventions.

However, the variable of interest QALY (or its transformations) was found not to correlate significantly with the criterion, and beta coefficients revealed that it was not an important predictor of WTP with the possible exception of the LN-LN model for the chronic intervention of breast cancer cure versus breast cancer treatment measuring Q using VAS (Hypothesis 6.6c). The proportion of variance accounted for in LN(WTP c-T)

275
by a linear combination of the four predictor variables: AGE, INCOME\textsuperscript{2}, HLTHPRBS, and $\ln(\Delta QALY-VAS)$ was 25.2 percent. AGE ($\beta=0.246$, $p=0.033$) and INCOME ($\beta=0.417$, $p<0.001$) were both statistically significant in model 6.6c at the 0.05 level. Furthermore, the transformed QALY-VAS variable approached significance ($\beta=0.216$, $p=0.065$) with the beta coefficient in the expected direction, i.e., a larger change in QALY is expected to produce a greater WTP (Table 4.41). These results of higher beta coefficient for this regression equation can be explained by several factors (1) Double natural log equation corrected heteroskedasticity and linearity violations in the RAW model (2) VAS does not incorporate risk in utility assessment and (3) the chronic condition assessed, breast cancer cure over treatment was less prone to risk avoidance than other health states assessed.

Limitations.

Primary study limitations are as follows. First, study participants in this study were a convenience sample of young healthy educated women. Therefore Q weights and $\Delta QALY$s and WTP values obtained cannot be generalized to the US population. However, it was not the objective of this study to provide Q weights and WTP values for CUA or WTP prioritization in for a healthcare assessment. The goal was to compare preference measures for QALY and WTP from the same respondent. Therefore, lack of random sampling is not regarded as relevant in order to address the six research questions listed in this dissertation.
Second, information bias – responses are influenced by how information is presented. In this study this issue was addressed by initial review of instruments by an expert panel and use of a pilot study to make appropriate changes. Additionally, the effect of survey ordering (ORDER: whether acute condition was presented in first interview or the chronic condition), ordering of WTP questions presented to respondents (PROTOCOL), and starting point bias (ALGORITHM, effect of initial bid on final WTP value) was tested to address this issue (Chapter 3). Analysis showed no statistically significant effect of these three factors in information presentation in this study. However, the budget constraint posed by framing of WTP questions for chronic conditions resulted in a ceiling effect for breast cancer interventions. Consideration had been given to alternative WTP questions, e.g., borrowing against future earnings, however it was not known whether this would provide more meaningful WTP values in a population unfamiliar with loans (Alan Randall, Verbal Communication, 4/17/2000).

Third, interviews averaged approximately 60 minutes, which would increase the risk of satisficing. However, this is regarded to be less of a problem in a face-to-face interview format, especially with regard to open-ended questions (Jon Krosnick, 2000).

Fourth, also related to a face-to-face interview format is interviewer bias: participants provide responses they perceive the interviewer would desire or would “help” the results (Mitchell and Carson, 1997). However, it is unclear whether respondents would perceive higher or lower values as preferable.
Fifth, interviewer induced bias due to implementation. This can result when interviewer does not like a method so presents it poorly to respondents biasing the results. Pilot testing which included graduate students with a background in research methods and use of an interview script, also reviewed by a panel of experts does not support presence of implementation bias.

Lastly, hypothetical bias, respondent perceives scenarios as unrealistic. Seven of 126 respondents (five percent) were unable to accept hypothetical scenarios used in this study as believable and were subsequently excluded from the analysis. Of the remaining 238 interviews (119 respondents), the results of the scope effect indicate WTP values are consistent with economic theory (i.e., an increase in WTP with a diminishing increase with the quantity of the good). Additionally, the content validity check of the health state scenarios (comparison of respondent versus researcher intended interpretation of health states), support that scenarios were interpreted as intended.
Future Studies

The results of this study suggest consideration of a true experimental 2 x 2 design to investigate the effect of ΔQ and ΔY on utility measurement. Where group one would receive an intervention that did not affect Q and Y; group 2, would receive an intervention that affected Y only; group 3, would receive an intervention that affected Q only; and group four would receive an intervention that affected both Q and Y.

Another future study could compare the use of the top-down titration method for SG utility assessment versus the ping-pong method - the standard in utility assessment for utility measurement in acute conditions for “chaining method” versus traditional SG method. As yet, to the best of the authors’ knowledge, this study has not been published in the health care literature. The 2x2 design would enable comparisons between the resultant four SG methods.

Another study yet to be published, to the best of the authors knowledge, is to compare utility values produced from folding back a tree to utility values reported from holistic scenarios. CUA assumes utility values used in folding back decision trees is equivalent to utility values produced from holistic scenarios, however, this has not been tested. Such a study would investigate the effect of process utility in CUA assessment [Amiram Gafni; Verbal Communication 11/1999].
In conclusion, research in utility assessment is abundant with opportunity. Before the best method can be determined to evaluate health outcome decision making, much work needs to be done to better understand the limitations of currently used methods.
APPENDIX A

FLYER
Women: Receive $30 for Health-Related Survey

Who:
Female OSU Graduate Students or women aged 22 to 50

Why:
Assist Ph.D. student in dissertation work that could impact future medical research and treatment

Details:
- Two interviews required (each about 1 to 1-1/2 hours)
- Each interview scheduled according to your availability
- If you choose to complete both interviews, you receive $30 in cash as an expression of gratitude

Interviews Location:
College of Pharmacy, Room 129 B
Parks Hall (Corner of Cannon Drive and 12th Avenue)

Interested?
For more information contact
Duska Franic
Ph.D. Candidate, Pharmaceutical Administration
Phone: 614.292.3907 E-mail: Franic.1@osu.edu
APPENDIX B1

INTRODUCTORY INFORMATIONAL E-MAIL LETTER
Subject: SURVEY IN HEALTH - $30 OFFERED FOR STUDY PARTICIPATION

[Date]

Dear Graduate Student:

In partial fulfillment for the requirement of Ph.D. dissertation of my advisee, we are conducting a survey of female graduate students enrolled at the OSU campus. Difficult health care decisions regarding selecting the best therapy for yourself or your family are a fact of life in our current health care environment. The objective of this study is to obtain your preferences for different therapy alternatives. We hope that the results of this study will impact future medical research and treatment.

Participation in the study would require two face-to-face interviews. Each interview will require approximately one to one and a half hours of your time. During the survey, you will be asked (1) questions about your preferences for different treatments (2) to assume that you have a certain condition or illness and then to rate the severity of illnesses using different questions. For example, one question will ask you to rate desirability of health conditions on a scale from 0 to 100. Another question will ask you to value your health by stating the maximum amount of money you might pay to avoid the illness. If you choose to participate and complete the two interviews, we will offer you $30 at the end of the second interview as an expression of gratitude. Therefore, if interested in participating in the study, please be sure you are available for both interviews since payment cannot be made for completion of one interview. Women with a history of breast cancer or any cancer requiring chemotherapy (anti-cancer drugs) will be excluded.

Your participation is completely voluntary, and your responses to all questions will remain strictly confidential. We are interested in your personal opinions.

Your assistance is most appreciated. If you are interested in participating in the study or would like to learn more about it, please feel free to contact Duska Franic either by E-mail at franic.l@osu.edu or by phone at (614) 292-3907. If interested in participating, please contact her within two weeks.

Thank you very much for your help!

Sincerely,
Dev S Pathak, DBA
Merrell Dow Professor
Director, Center for Health Outcomes, Policy and Evaluation Studies (HOPES)
Phone: (614) 292-6415  E-mail: pathak.l@osu.edu

Duska Franic
Ph.D. Candidate in Pharmaceutical Administration
Phone: (614) 292-3907  E-mail: franic.l@osu.edu
APPENDIX B2

INTRODUCTORY INFORMATIONAL E-MAIL LETTER
Subject: SURVEY IN HEALTH - $30 OFFERED FOR STUDY PARTICIPATION

[Date]

Dear INSERT NAME HERE:

In partial fulfillment for the requirement of Ph.D. dissertation of my advisee, we are conducting a survey of female graduate students enrolled at the OSU campus or women aged 22 to 50 years. Difficult health care decisions regarding selecting the best therapy for yourself or your family are a fact of life in our current health care environment. The objective of this study is to obtain your preferences for different therapy alternatives. We hope that the results of this study will impact future medical research and treatment.

Participation in the study would require two face-to-face interviews. Each interview will require approximately one to one and a half hours of your time. During the survey, you will be asked (1) questions about your preferences for different treatments (2) to assume that you have a certain condition or illness and then to rate the severity of illnesses using different questions. For example, one question will ask you to rate desirability of health conditions on a scale from 0 to 100. Another question will ask you to value your health by stating the maximum amount of money you might pay to avoid the illness. If you choose to participate and complete the two interviews, we will offer you $30 at the end of the second interview as an expression of gratitude. Therefore, if interested in participating in the study, please be sure you are available for both interviews since payment cannot be made for completion of one interview. Women with a history of breast cancer or any cancer requiring chemotherapy (anti-cancer drugs) will be excluded.

Your participation is completely voluntary, and your responses to all questions will remain strictly confidential. We are interested in your personal opinions.

Your assistance is most appreciated. If you are interested in participating in the study or would like to learn more about it, please feel free to contact Duska Franic either by E-mail at franci.l@osu.edu or by phone at (614) 292-3907. If interested in participating, please contact her within two weeks.

Thank you very much for your help!

Sincerely,

Dev S Pathak, DBA
Merrell Dow Professor
Director, Center for Health Outcomes, Policy and Evaluation Studies (HOPES)
Phone: (614) 292-6415 E-mail: pathak.l@osu.edu

Duska Franic
Ph.D. Candidate in Pharmaceutical Administration
Phone: (614) 292-3907 E-mail: franci.l@osu.edu
APPENDIX C1

REMINDER E-MAIL
Subject: REMINDER SURVEY IN HEALTH - $30 OFFERED FOR STUDY PARTICIPATION

[Date]

Dear Graduate Student:

If you have already responded to our last E-mail, thank you. You do not have to respond to this E-mail. However, if you have not responded, could you please consider participating in this study – a survey of female graduate students enrolled at OSU campus – as part of my Ph.D. dissertation research. Difficult health care decisions about selecting the best therapy for yourself or your family are a fact of life in our current health care environment. The objective of this study is to obtain your preferences for different therapy alternatives. We hope the results of this study will be useful in future medical research and treatment.

Participation in the study would require two face-to-face interviews. Each interview will require approximately one to one and a half hours of your time. During the survey, you will be asked (1) questions about your preferences for different treatments (2) to assume that you have a certain condition or illness and then to rate the severity of illnesses using different questions. For example, one question will ask you to rate desirability of health conditions on a scale from 0 to 100. Another question will ask you to value your health by stating the maximum amount of money you might pay to avoid the illness. If you choose to participate and complete the two interviews, we will offer you $30 at the end of the second interview as an expression of gratitude. Therefore, if interested in participating in the study, please be sure you are available for both interviews since payment cannot be made for completion of one interview. Women with a history of breast cancer or any cancer requiring chemotherapy (anti-cancer drugs) will be excluded.

Your participation is completely voluntary, and your responses to all questions will remain strictly confidential. We are interested in your personal opinions.

Your assistance is most appreciated. If you are interested in participating in the study or would like to learn more about it, please feel free to contact me by E-mail at franic.l@osu.edu or by phone at (614) 292-3907. Alternatively, you may contact my adviser, Dr. Dev Pathak by E-mail at pathak.l@osu.edu or by phone at (614) 292-6415. If interested in participating, please contact us within two weeks.

Thank you very much for your help!

Sincerely,

Duska Franic
Ph.D. Candidate in Pharmaceutical Administration
Phone: (614) 292-3907 E-mail: franic.l@osu.edu
APPENDIX C2

REMINDER E-MAIL
Subject: REMINDER SURVEY IN HEALTH - $30 OFFERED FOR STUDY PARTICIPATION

[Date]

Dear INSERT NAME HERE:

If you have already responded to our last E-mail, thank you. You do not have to respond to this E-mail. However, if you have not responded, could you please consider participating in this study – a survey of female graduate students enrolled at OSU campus or women aged 22 to 50 – as part of my Ph.D. dissertation research. Difficult health care decisions about selecting the best therapy for yourself or your family are a fact of life in our current health care environment. The objective of this study is to obtain your preferences for different therapy alternatives. We hope the results of this study will be useful in future medical research and treatment.

Participation in the study would require two face-to-face interviews. Each interview will require approximately one to one and a half hours of your time. During the survey, you will be asked (1) questions about your preferences for different treatments (2) to assume that you have a certain condition or illness and then to rate the severity of illnesses using different questions. For example, one question will ask you to rate desirability of health conditions on a scale from 0 to 100. Another question will ask you to value your health by stating the maximum amount of money you might pay to avoid the illness. If you choose to participate and complete the two interviews, we will offer you $30 at the end of the second interview as an expression of gratitude. Therefore, if interested in participating in the study, please be sure you are available for both interviews since payment cannot be made for completion of one interview. Women with a history of breast cancer or any cancer requiring chemotherapy (anti-cancer drugs) will be excluded.

Your participation is completely voluntary, and your responses to all questions will remain strictly confidential. We are interested in your personal opinions.

Your assistance is most appreciated. If you are interested in participating in the study or would like to learn more about it, please feel free to contact me by E-mail at franic.l@osu.edu or by phone at (614) 292-3907. Alternatively, you may contact my adviser, Dr. Dev Pathak by E-mail at pathak.l@osu.edu or by phone at (614) 292-6415. If interested in participating, please contact us within two weeks.

Thank you very much for your help!

Sincerely,

Duska Franic
Ph.D. Candidate in Pharmaceutical Administration
Phone: (614) 292-3907  E-mail: franic.l@osu.edu
APPENDIX D

TELEPHONE ENROLLMENT SCHEDULE:
INTERVIEW SCHEDULING AND Q&A
Hello. This is Duska Franic I am a graduate student calling from The College of Pharmacy at OSU. May I please speak with______________?

[If the phone is transferred to another person] Hello, my name is Duska Franic. I am a graduate student from The College of Pharmacy at OSU

I am calling in regard to the E-mail/phone conversation that I had sent you about participating in a study that we are conducting at the College of Pharmacy. The E-mail was titled Survey In Health - $30 Offered For Study Participation. Cash payment of $30 will be made at the end of the second interview. Unfortunately, we are unable to reimburse you if both interviews are not completed. The topics we will be discussing will be about your attitudes about cancer and its treatment. The interviews will take place on campus at The College of Pharmacy. Are you still interested in participating in the study?

[IF YES] Thank you very much
[Confirm that inclusion criteria have been met]
Before we proceed to set up interview times I would like to ask you two or three questions to make sure that you meet our study inclusion criteria.

1. Have you ever been diagnosed with breast cancer? □ Yes □ No
2a. Have you ever been diagnosed with cancer? □ Yes □ No
2b. If yes, did you receive chemotherapy (anti-cancer drugs)? □ Yes □ No
[If respondent answers yes to 1 and 2b exclude from study]

[If inclusion criteria are met - proceed to set up date and time convenient for the participant]

[If inclusion criteria are not met – YES to 1, 2a and 2b].
This study excludes women with a history of breast cancer or any cancer requiring chemotherapy (anti-cancer drugs), therefore we cannot include you in the study. Thank you for your time.

[IF NO] Okay. Thank you for your time. Would you mind telling me why you did not want to participate?
[Respondent is free not to provide reason - discontinue interview].
Record reason for not participating if possible

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

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Thank you for your time.

[Respond to questions from potential participants as follows]

How did you get my name?
I received a listing of female graduate students from the Registrars’ Office, department of Student Enrollment Reporting and Research Services. Your E-mail address is also listed on the OSU student website.

Why did you select students for your study?
Students were selected for study participation because of feasibility and access reasons since the study requires face-to-face interviews.

How can I be sure this is authentic?
I am a graduate student at the OSU conducting research under the supervision of my advisor Dr Dev Pathak at 292-6415.

[If further information is requested you can contact the other two members of my dissertation committee: Professor Joe Dasta at 292-6335 or Dr Sharon Schweikhart at 292-6814. Any of these three persons will vouch for the authenticity of this study. My status as a graduate student is also listed on the OSU website].
APPENDIX E

INTERVIEW APPOINTMENT REMINDER
Subject: HEALTH STUDY REMINDER

Date:

INSERT NAME,

This is just a reminder for our interview scheduled for DAY MONTH DATE, at TIME at The College of Pharmacy room 129B (Lloyd M Parks Hall) at the corner of Cannon Drive and 12th Ave.
Thank you for your support.

Sincerely,

Duska Franic, PharmD, MS
The Ohio State University
College of Pharmacy
Lloyd M. Parks Hall Rm 129B
500 West 12th Ave
Columbus, Ohio 43210
Ph: (614) 292-3907
Fax: (614) 292-0815
E-mail: franic.1@osu.edu
APPENDIX F

CONSENT FORM
CONSENT FORM

QUALITY OF LIFE SURVEY

I consent to participate in the study entitled: Relating quality adjusted life years to contingent valuation: acute and chronic illnesses.

Dev S. Pathak or Duska M. Franic
(Advisor) (Ph.D. Candidate -authorized representative)

has explained the purpose of the study, the procedures to be followed, and the expected duration of my participation.

I acknowledge that I received an informational letter about the survey, and I understand that I will have the opportunity to have my questions about the survey answered. I also understand that I am free to choose not to participate in the survey at any time.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: ___________________________ Name: ___________________________

Signed: ___________________________ (Advisor or authorized representative) Signed: ___________________________ (Participant)

Questions about this study can be directed to:
Duska M. Franic
Ph.D. Candidate in
Pharmaceutical Administration
Phone: (614) 292-3907
E-mail: franic.1@osu.edu
APPENDIX G1

FACE-TO-FACE

INTERVIEW SCHEDULE

POST CHEMOTHERAPY NAUSEA AND VOMITING
BACKGROUND DATA

[INTERVIEWER COMPLETED]

ID#: ________________ 
Name: ________________ Telephone: (614) ____-______
[Included to ensure each respondent is provided alternate survey in interview 2]

Time started: ____________________
Date of interview: ___/___/00

Survey Type:    □ BrCa        □ PCNV
Interview #     □ First        □ Second

If this is the second interview which survey was provided first?
□ BrCA
□ PCNV

Which WTP algorithm was used?
□ Algorithm 1    □ Algorithm 2

Which WTP protocol was used?
□ Protocol 1    □ Protocol 2
PART 1 INTRODUCTION

[INTERVIEW 1 ONLY]

Hello, my name is Duska Franic I am a graduate student at the College of Pharmacy at OSU. I would like to thank you for agreeing to be interviewed. As I explained in the E-mail you received, we are interested in learning more about the best way to measure benefits of different health treatments.

The information that you provide will be kept confidential. You are not obligated to participate in the study and you may choose not to participate now, or at any time during the interview. If you choose to complete the two interviews, we will give you $30 at the end of the second interview as an expression of our gratitude.

Before we get started I need to ask you to complete a consent form. This form means that you have agreed to participate in the study voluntarily. Please take your time to read it over.

[INTERVIEW 2 ONLY]

Hello, thank you for agreeing to meet with me again. As before the information that you provide will be kept confidential. You are not obligated to participate in the study and you may choose not to participate now, or at any time during the interview. If you choose to complete the second interview today, we will give you $30 as an expression of our gratitude.

The format for the interview will be similar to last time except that now we will be discussing Post Chemotherapy Nausea and Vomiting. Shall be get started? [SKIP CONSENT FORM]
Before we get started I would like to ask you a few background questions about your exposure to cancer and its treatment. Shall we get started?

<table>
<thead>
<tr>
<th>Have you ever been diagnosed with cancer?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes □ No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Has anyone in your family been diagnosed with cancer?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes □ No □ Don’t Know</td>
</tr>
<tr>
<td>If yes, please state relationship (e.g. mother, cousin, uncle...)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If yes, was it breast cancer?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes □ No □ Don’t Know</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If yes, was nausea and/or vomiting after chemotherapy (i.e., after taking anti-cancer drugs) experienced?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes □ No □ Don’t Know</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Has anyone you know, outside of your family, been diagnosed with cancer?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes □ No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If yes, was it breast cancer?</th>
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</tr>
</thead>
<tbody>
<tr>
<td>□ Yes □ No □ Don’t Know</td>
</tr>
</tbody>
</table>

Since your experience with illness can affect how you respond to questions regarding health, we would also like to know if you have a history of any health problems.

<table>
<thead>
<tr>
<th>Do you have or have had any health problems?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes □ No □ REFUSED</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If yes, what are they?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
PART III  NAUSEA AND VOMITING

A  INTRODUCTION

The remainder of the interview is divided into two parts. In the first part, I will provide you with some background information, then I will ask you to read several imaginary scenarios. In the second part we will use three different survey methods to measure how you value different treatments. Then I will ask you to rate the different methods. Please try to answer the questions as carefully as possible.

Would you like to begin the interview?

[If yes continue]
[If NO ask if there are any questions? Respondent is free to discontinue interview. If possible record respondent reason for interview termination]
Respondent refused interview because...

B  BACKGROUND

Here is some background information about chemotherapy induced nausea and vomiting. The background information is divided into the following sections:

- Cancer
- What is chemotherapy?
- Chemotherapy induced nausea and vomiting which includes some general information, quotes from patients experiencing nausea and vomiting, then I am going to ask you to imagine that you have this condition.

Please take your time to read through the information.
B BACKGROUND

Cancer
- Disease that affects various body tissues.
- If not treated, it can spread and be fatal.
- Some treatments are successful in curing cancer.

What is chemotherapy (anti-cancer drugs)?
- General name for drugs that try to kill cancer – anticancer drugs.
- Chemotherapy has many side effects.
- Two side effects of chemotherapy most feared by cancer patients are nausea and vomiting. While these side effects are not fatal, they can be so severe that some patients refuse further treatment for their cancer.

Chemotherapy induced nausea and vomiting
1) General
- On average this side effect lasts for 1 to 5 days with an average of 3 days.
- Important to prevent nausea and vomiting because uncontrolled nausea and vomiting can lead to:
  - loss of nutrients and electrolytes (chemical changes in the body).
  - loss of appetite.
  - physical and mental problems.
  - torn esophagus (food tube).
  - broken bones.
  - reopening of surgical wounds.

2) As described by cancer patients

"I can't cook for my husband"
I've learned to cook ahead of time so when I get home after my chemo I just microwave instead of cooking. The smell of cooking nauseates me"

"I don't feel like I can do anything – every movement, every smell, even light meals makes my nausea worse"

"I went to call my nurse as soon as I felt nauseated, before I could reach the button I threw up"

3) Role Play: imagine you have cancer
- Assume that you have cancer and need chemotherapy.
- Following diagram explains sequence of events.
POST CHEMOTHERAPY NAUSEA AND VOMITING

CANCER

Treatment varies depending on cancer and patient

Focusing on drug therapy

ANTI-CANCER DRUGS (CHEMOTHERAPY)
- Administered once a month for 6 months
- Given by 10-15 minute injection at clinic each month
- Clinic visit takes 2-3 hours
- Follow up visits every 2 months for next 2 years

Side effects of Chemotherapy
- Alleviate nausea and vomiting with medication

NAUSEA VOMITING
- Most feared side effects
- Affects 60-100% of cancer patients
- Starts within 24 hours after chemotherapy
- Lasts an average of 3 days (Range 1 to 5 days)

Feeling
- Mouth
- Tired
- Sores
- Temporary
- Loss of hair
- Disorder
- Sleep
- Pain
- Chills
- Sweats
- Fever
- Infection
- Anemia

Cancer complications

Cancer and anti-cancer drugs can also affect other aspects of your life
- Fear of death
- Relationship with friends and family
- Disruption (e.g., hospital visits)
- Work
- Ability to interest in leisure
- To your usual activities

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C1 IMAGINARY HEALTH STATES

Instructions for respondents: The following cards represent six health state descriptions.

[Spread out six cards describing health situations in front of respondent].

Each card describes a different health problem with the exception of this card [point to situation P — Perfect health] and possibly this card — Your Health. When thinking about the profile of health described on each card, imagine that it will last for 1 to 5 days (an average of 3 days), except for death. What happens after that is not known and should not be taken into account.

While reading the imaginary scenarios please consider how the health situation will affect your daily activities, for example,

- How you feel about your self, your body, and your sexuality.
- Your relationships with others.
- Inconvenience for you.

C2 IMAGINARY SCENARIOS

[Present respondent with 6 scenario flashcards]
PART III  DIFFERENT MEASURES OF HEALTH INTERVENTIONS

A  WARM UP: RANKING FORM

[Spread out six cards describing health situations in front of respondent].

What we have everyone do in this part is compare each of the cards and rank them according to how undesirable each card would be if you were to have the state of health described on the card for 1 to 5 days with an average of 3 days.

Now that you have read all of the six health states, please rank the descriptions from best to worst situation assuming that:
- You will be in the condition for 1 to 5 days with an average of 3 days (except for death).
- What happens after that is not known and should not be taken into account.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.  [Instructions apply to rankings, thermometer, and chance board – not WTP].

Please rank the descriptions from best to worst situation.

Now that you have completed the ranking, are you sure that these rankings are in order from best to worst situation?

[Check validity of the order in the following manner]
You have indicated that you prefer Situation #1 than situation #2 for 1 to 5 days with an average of 3 days - is this correct?
You have indicated that you prefer Situation #2 than situation #3 for 1 to 5 days with an average of 3 days - is this correct?
You have indicated that you prefer Situation #3 than situation #4 for 1 to 5 days with an average of 3 days - is this correct?
You have indicated that you prefer Situation #4 than situation #5 for 1 to 5 days with an average of 3 days - is this correct?
You have indicated that you prefer Situation #5 than situation #6 for 1 to 5 days with an average of 3 days - is this correct?  [Make corrections if necessary]
B THERMOMETER SCALE
[Use thermometer visual aid: felt board with scale 0 – 100, place velcro backed arrows alongside situation flash cards already placed in order by respondent]

B1 Instructions for respondents: This is a visual aid called a thermometer scale. It helps us to measure people's feelings about things. In this interview, we are going to use the thermometer scale to measure your preferences for different health states. The thermometer scale endpoints have the values 0 and 100. The most desirable health state has a value of 100 and the least desirable health state has a value of 0.

[Ask respondent to place an arrow next to 100 and label it with appropriate Health State, similarly, place an arrow next to 0 and label it with the appropriate Health State]
Using the arrows provided, each of the six health states will be assigned a value. This is how it works. The more preferable you feel a health state (or card), the closer it should be to the top of the thermometer, and the less preferable you feel a health state to be the closer it should be to the bottom of the thermometer.

As before assume that:
• You will be in the condition for 1 to 5 days with an average of 3 days.
• What happens after that is not known and should not be taken into account.
• The scenarios apply to you at your current age.
• You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
• Your affairs are in order and you have made all preparations for the possibility of your death.

Place health states on thermometer such that the distance between the arrows reflects the differences you perceive between the health states. Any questions? Shall we start?

QUESTIONS
1. What value do you assign to your second preferred state in the ranking form? Please signify your value by pointing an arrow to the appropriate value on the thermometer scale.
2. Now, what value do you assign to your third preferred state in the ranking form?
3. Now, what value do you assign to your fourth preferred state in the ranking form?
4. Now, what value do you assign to your fifth preferred state in the ranking form?

Are there any values you would like to change?
[Give respondent time to review choices. Remind respondent to consider distances between arrows. For example if the value for the 5th preferred health state was 40 (Sit R), the 4th was 60 (Sit T) and the 3rd was 80 (Sit C), this would mean that a cure provides twice as much benefit than treatment (C-R=40, T-R=20, 40/20=2)].
[Validity Check 1: Thermometer values should be consistent with rankings from previous section. If not, bring this to the participant's attention and review to ensure that they match, i.e. either change the rankings or change the ordering of the thermometer. It is acceptable for the respondent to say that 2 situations are equally bad].

### B2 [Record results]

<table>
<thead>
<tr>
<th>Health Condition Description</th>
<th>Value (0 to 100)</th>
<th>Utility (0 to 1.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RANKING</strong></td>
<td><strong>THERMOMETER</strong></td>
<td><strong>SG</strong></td>
</tr>
<tr>
<td>1. Situation</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2. Situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Situation</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
C  CHANCE BOARD

[Present health states in order from best to worst as ranked by respondent. Section C1 to C4 to be used if respondent ranks perfect health and death #1 and #6. If Death is not ranked as the worst health state use Section C5 to C8].

C1  CHANCE BOARD: Situation Y

Now I am going to show you a series of slides on the computer with two choices, but three descriptions of health. Choice “B” is for certain, so Situation Y occurs with 100% certainty and choice “A” involves risk - a gamble between Situation D (death) and Situation P (Perfect Health).

As before, assume that
• You will be in the condition for 1 to 5 days with an average of 3 days (except for death).
• What happens after that is not known and should not be taken into account.
• The scenarios apply to you at your current age.
• You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
• Your affairs are in order and you have made all preparations for the possibility of your death.

Let’s begin.

Remember, that Situation Y is the nd/rd/th preferred health state from your ranking form.

Imagine that you are in Situation Y. [Point to Sit Y on screen]. You can choose to either remain in your current health state (Situation Y) for 1 to 5 days with an average of 3 days, or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for 1 to 5 days with an average of 3 days [Point to Sit PH on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will die immediately [Point to Sit D on screen].

Given the choice would you take the treatment?

[Choice A - start with perfect health 100%, situation Death 0%. If respondent does not select gamble, response regarded as invalid – question respondent. If respondent does not regard perfect health as preferred option discontinue interview and note on survey – unless Sit Y is preferred over Sit P].

Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would die, or would you prefer to stay in your present state of health (situation Y)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..]

Would you take the treatment if there was a 98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70..... 10, 5, 0 of perfect health but a 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30..... 90, 95, 100 chance that you would die?
As before, I am going to show you a series of slides with two choices. Choice "B" is for certain, so Situation NO NV occurs with 100% certainty and choice "A" involves risk – a gamble between Situation D (death) and Situation P (Perfect Health).

As before, also assume that
- You will be in the condition for 1 to 5 days with an average of 3 days.
- What happens after that is not known and should not be taken into account.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let's begin.

Imagine that you are in Situation No NV (Point to Sit NO NV on screen). You can choose to either remain in your current health state (Situation No NV) for 1 to 5 days with an average of 3 days, or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for 1 to 5 days with an average of 3 days (Point to Sit P on screen). If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will die immediately (Point to Sit D on screen).

Given the choice would you take the treatment?

If YES, Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would die, or would you prefer to stay in your present state of health (situation No NV)?

If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e.]

Would you take the treatment if there was a 98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70..., 10, 5, 0 of perfect health but a 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30,...90, 95, 100 chance that you would die?
VALIDITY CHECK FOR PREFERENCE REVERSAL

[Similar to the validity check used to ensure rankings were consistent with values obtained with the feeling thermometer.

Present each SG scenario in ranked order from highest to lowest #2 - #5 at the end of each SG session – check to ensure that \( U(#2) > U(#3) \) and \( U(#3) > U(#4) \), and \( U(#4) > U(#5) \) (By definition \( U(#1)=100 \) and \( U(#6)=0 \)). If preference reversal – double check with respondent and provide opportunity to modify response(s). If respondent responses violate transitivity of preferences ask respondent for explanation]

[If violation of transitivity occurs]... This means that you are willing to accept a greater risk of death for [present problem choice]

- #2 than #3, but before you said that you preferred #2 over #3. Is that what you meant?
- #3 than 4, but before you said that you preferred #3 over #4. Is that what you meant?
- #4 than 5, but before you said that you preferred #4 over #5. Is that what you meant?
- #5 than 6, but before you said that you preferred #5 over #6. Is that what you meant?

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As before, I am going to show you a series of slides with two choices. Choice “B” is for certain, so Situation Prev NV occurs with 100% certainty and choice “A” involves risk - a gamble between Situation D (death) and Situation P (Perfect Health).

As before, also assume that
- You will be in the condition for 1 to 5 days with an average of 3 days (except death)
- What happens after that is not known and should not be taken into account.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let’s begin.

Remember, that Situation Prev NV is the **nd/rd/th preferred health state from your ranking form.**

Imagine that you are in Situation Prev NV. You can choose to either remain in your current health state (Situation Prev NV) for 1 to 5 days with an average of 3 days, or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for 1 to 5 days with an average of 3 days. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will die immediately.

Given the choice would you take the treatment?

[Choice A - start with perfect health 100%, situation Death 0%. If respondent does not select gamble, response regarded as invalid – question respondent. If respondent does not regard perfect health as preferred option discontinue interview and note on survey].

If YES, Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would die, or would you prefer to stay in your present state of health (situation Prev NV)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..]

Would you take the treatment if there was a 98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70,... 10, 5, 0 of perfect health but a 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30,...90, 95, 100 chance that you would die?
C4  CHANCE BOARD: Situation NV

As before, I am going to show you a series of slides with two choices. Choice “B” is for certain, so Situation NV occurs with 100% certainty and choice “A” involves risk—a gamble between Situation D (death) and Situation P (Perfect Health).

As before, also assume that
- You will be in the condition for 1 to 5 days with an average of 3 days.
- What happens after that is not known and should not be taken into account.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let’s begin.

Remember, that Situation NV is the _____ nd/rh/th preferred health state from your ranking form.

Imagine that you are in Situation NV. Point to Sit NV on screen. You can choose to either remain in your current health state (Situation NV) for 1 to 5 days with an average of 3 days, or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for 1 to 5 days with an average of 3 days [Point to Sit P on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But if the treatment fails you will die immediately [Point to Sit D on screen].

Given the choice would you take the treatment?
[Choice A - start with perfect health 100%, situation Death 0%. If respondent does not select gamble, response regarded as invalid—question respondent. If respondent does not regard perfect health as preferred option discontinue interview and note on survey].

If YES, Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would die, or would you prefer to stay in your present state of health (situation NV)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..]

Would you take the treatment if there was a

98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70,... 10, 5, 0 of perfect health but a

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30,...90, 95, 100 chance that you would die?
C5 - CHANCE BOARD: Situation Y

Now I am going to show you a series of slides on the computer with two choices, but three descriptions of health. Choice “B” is for certain, so Situation Y occurs with 100% certainty and choice “A” involves risk – a gamble between Situation NV and Situation P (Perfect Health).

As before, assume that
- You will be in the condition for 1 to 5 days with an average of 3 days (except for death).
- What happens after that is not known and should not be taken into account.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let’s begin.

Remember, that Situation Y is the __nd/rd/th preferred health state from your ranking form.

Imagine that you are in Situation Y. [Point to Sit Y on screen]. You can choose to either remain in your current health state (Situation Y) for 1 to 5 days with an average of 3 days, or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for 1 to 5 days with an average of 3 days [Point to Sit PH on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will be in Situation NV for 1 to 5 days with an average of 3 days [Point to Sit NV on screen].

Given the choice would you take the treatment?

[Choice A - start with perfect health 100%, situation NV 0%. If respondent does not select gamble, response regarded as invalid - question respondent. If respondent does not regard perfect health (Choice A) as preferred option discontinue interview and note on survey].

Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would be in Situation NV, or would you prefer to stay in your present state of health (situation Y)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..]

Would you take the treatment if there was a 98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70... 10, 5, 0 of perfect health but a

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30... 90, 95, 100 chance that you would be in Sit NV?
C6 CHANCE BOARD: Situation No NV

Now I am going to show you a series of slides on the computer with two choices, but three descriptions of health. Choice “B” is for certain, so Situation Y occurs with 100% certainty and choice “A” involves risk – a gamble between Situation NV and Situation P (Perfect Health).

As before, assume that
• You will be in the condition for 1 to 5 days with an average of 3 days (except for death).
• What happens after that is not known and should not be taken into account.
• The scenarios apply to you at your current age.
• You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
• Your affairs are in order and you have made all preparations for the possibility of your death.

Let’s begin.

Remember, that Situation No NV is the _____ nd/rd/th preferred health state from your ranking form.

Imagine that you are in Situation No NV [Point to Sit Y on screen]. You can choose to either remain in your current health state (Situation Y) for 1 to 5 days with an average of 3 days, or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for 1 to 5 days with an average of 3 days [Point to Sit PH on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will be in Situation NV for 1 to 5 days with an average of 3 days [Point to Sit NV on screen].

Given the choice would you take the treatment?

[Choice A - start with perfect health 100%, Situation NV 0%. If respondent does not select gamble, response regarded as invalid – question respondent. If respondent does not regard perfect health (Choice A) as preferred option discontinue interview and note on survey.]

Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would be in Situation NV, or would you prefer to stay in your present state of health (Situation No NV)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..]

Would you take the treatment if there was a

98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70, 65, 60, 55, 50, 45, 40, 35, 30, 25, 20, 15, 10, 5, 0 of perfect health but a

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98% chance that you would be in Sit NV?
Now I am going to show you a series of slides on the computer with two choices, but three descriptions of health. Choice “B” is for certain, so Situation Y occurs with 100% certainty and choice “A” involves risk — a gamble between Situation NV and Situation P (Perfect Health).

As before, assume that
- You will be in the condition for 1 to 5 days with an average of 3 days (except for death).
- What happens after that is not known and should not be taken into account.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let's begin.

Remember, that Situation Prev NV is the ____nd/rd/th preferred health state from your ranking form.

Imagine that you are in Situation Prev NV [Point to Sit Y on screen]. You can choose to either remain in your current health state (Situation Y) for 1 to 5 days with an average of 3 days, or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for 1 to 5 days with an average of 3 days [Point to Sit PH on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will be in Situation NV for 1 to 5 days with an average of 3 days [Point to Sit NV on screen].

Given the choice would you take the treatment?

[Choice A - start with perfect health 100%, Situation NV 0%. If respondent does not select gamble, response regarded as invalid – question respondent. If respondent does not regard perfect health (Choice A) as preferred option discontinue interview and note on survey].

Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would be in Situation NV, or would you prefer to stay in your present state of health (Situation Prev NV)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..]

Would you take the treatment if there was a

98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70, ..., 10, 5, 0 of perfect health but a

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30, ..., 90, 95, 100 chance that you would be in Sit NV?
Now I am going to show you a series of slides on the computer with two choices, but three descriptions of health. Choice "B" is for certain, so Situation Y occurs with 100% certainty and choice "A" involves risk—a gamble between Situation NV and Situation P (Perfect Health).

As before, assume that
- You will be in the condition for 1 to 5 days with an average of 3 days (except for death).
- What happens after that is not known and should not be taken into account.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let's begin.

Remember, that Situation D is the ___ nd/rd/th preferred health state from your ranking form.

Imagine that you have a rapidly progressing terminal disease, which if left unattended will lead rapidly to death. You can choose to either remain in your current health state (Situation D) or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for 1 to 5 days with an average of 3 days [Point to Sit PH on screen]. If your health is elevated to perfect health, this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will be in Situation NV for 1 to 5 days with an average of 3 days [Point to Sit NV on screen].

Given the choice, would you take the treatment?

[Choice A - start with perfect health 100%, Situation NV 0%. If respondent does not select gamble, response regarded as invalid—question respondent. If respondent does not regard perfect health (Choice A) as preferred option, discontinue interview and note on survey.]

Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would be in Situation NV, or would you prefer to stay in your present state of health (Situation D)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e.] Would you take the treatment if there was a

98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70... 10, 5, 0 of perfect health but a

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30...90, 95, 100 chance that you would be in Sit NV?
D1 WARM UP: WILLINGNESS TO PAY METHOD [Interview 1 only]
Before we move on to the next section I would like to ask you some questions about yourself.
[If second interview show respondent answers from 1st interview]

<table>
<thead>
<tr>
<th><strong>What is your age:</strong> ______ (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Are you:</strong></td>
</tr>
<tr>
<td>□ never been married</td>
</tr>
<tr>
<td>□ married/cohabiting</td>
</tr>
<tr>
<td>□ separated/divorced/widowed</td>
</tr>
</tbody>
</table>

| **Do you have:**                    |
| □ Student Health (Central Benefits) |
| □ Other, please specify--------------|

<table>
<thead>
<tr>
<th><strong>Are you a US Citizen?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes □ No</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th><strong>Education</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>High school or less □</td>
</tr>
<tr>
<td>college □</td>
</tr>
<tr>
<td>graduate degree □</td>
</tr>
<tr>
<td>Other □ (please specify)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Occupation:</strong></th>
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<tbody>
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<td>______________</td>
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<table>
<thead>
<tr>
<th><strong>If you are a student:</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>What College are you from at OSU?</strong></td>
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<tr>
<td>__________________________</td>
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</table>

<table>
<thead>
<tr>
<th><strong>What is your major?</strong></th>
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<td>________________________</td>
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<table>
<thead>
<tr>
<th><strong>What degree are you working toward?</strong></th>
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<tbody>
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<td>_______________________________</td>
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<table>
<thead>
<tr>
<th><strong>Are you a full-time student (Registered for &gt;10 hours this quarter)</strong></th>
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<tbody>
<tr>
<td>□ Yes □ No</td>
</tr>
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<table>
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<tr>
<th><strong>How did you find out about this study?</strong></th>
</tr>
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<tbody>
<tr>
<td>________________________________________</td>
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<table>
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<tr>
<th><strong>Are you a:</strong></th>
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<tbody>
<tr>
<td>□ Smoker</td>
</tr>
<tr>
<td>□ Nonsmoker</td>
</tr>
<tr>
<td>□ Ex-smoker</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Do you have any children?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Yes □ No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>If yes, how many:</strong> children</th>
</tr>
</thead>
<tbody>
<tr>
<td>____________________________</td>
</tr>
</tbody>
</table>

| **If yes, how old were you when you had your first child:** ______ years. |
Annual Income Level [Interview 1 only]
Which of these income groups represents your total gross combined household income, that is before taxes, for the past 12 months? Include all income from all sources such as wages, salaries, pensions, family allowances, rents from properties, gifts, and so forth. (Please exclude tuition waivers from your gross income). Once again, I would like to remind you that this interview is completely confidential and your name will never be associated with your answers. (Check one box)

- [ ] less than $10,000
- [ ] $10,000 – 19,999
- [ ] $20,000 – 29,999
- [ ] $30,000 – 39,999
- [ ] $40,000 – 49,999
- [ ] $50,000 – 59,999
- [ ] $60,000 AND OVER
- [ ] REFUSED
- [ ] DON'T KNOW

If respondent refused or does not know, say, imagine that your gross earnings are $10,000 – 19,000 which is the middle range of incomes for graduate students. Now, please answer the following questions assuming that this is your gross income.

In this next section of the questionnaire, I am going to ask you how much it is worth to you in real dollars to achieve a health improvement. Of course, you will not be required to actually pay that amount of money.
D2 WILLINGNESS TO PAY: OPTIMAL PREVENTATIVE THERAPY VS STANDARD PREVENTATIVE THERAPY

This section uses the same scenarios that you read before, but here we will compare them in a different way.

Imagine that you are in Situation NV. Also assume that

• You will be in the condition for 1 to 5 days with an average of 3 days, and treatment is expected once a month for 6 months (i.e. 6 cycles).
• The scenarios apply to you at your current age.
• Your affairs are in order and you have made all preparations for the possibility of your death.

### Situation NV (NAUSEA AND VOMITING)

#### Physical
All other factors (mouth sores, fever, tiredness etc) remain unchanged.

- On average you have 2 vomiting episodes per day and ongoing nausea immediately after anti-cancer drugs.
- Your mobility is limited.
- Due to nausea and vomiting your diet is crackers and clear fluids.

#### Emotional
- Somewhat depressed and anxious.
- You do not feel confident and in control of your life.
- Concerned by fear of death.

#### Social
- Unable to go to work due to illness.
- Interests and hobbies have declined.
- Only close friends and family can visit you.
- Partner is supportive.
- Sexual relations are nonexistent.

You have two alternatives to prevent nausea and vomiting.

#### Standard Preventative Therapy
- **Partial alleviation of nausea and vomiting** by swallowing a pill once that does not have any side effects - effective immediately. This would mean that your health state would be Situation Prev NV for 1 to 5 days with an average of 3 days.
- Periodic visits to your doctor for cancer.
- All these medical bills are covered by your health insurance.

#### Optimal Preventative Therapy
- **Complete alleviation of nausea and vomiting** by swallowing a pill once that did not have any side effects - effective immediately. This would mean that your health state would be Situation No NV for 1 to 5 days with an average of 3 days.
- Periodic visits to your doctor for cancer - these medical bills are covered by your health insurance.
- Additional bills for optimal therapy (i.e. medication and its administration to prevent nausea and vomiting) are not covered by your health insurance.

(show No NV and Prev NV cards).
Which alternative do you prefer? □ Situation Prev NV □ Situation No NV

[Validity Check: If respondent prefers no treatment – probe to ensure respondent understood scenario– this is treated as an illogical response]

Would you be willing to pay more than $0 for this complete alleviation of 1 to 5 days (with an average of 3 days) of nausea and vomiting? □ Yes □ No

Since, your health insurance will not pay for the new optimal preventative therapy for nausea and vomiting, you will have to pay for it yourself. Bear in mind that the money you would pay for the preventative therapy would reduce what you have left to spend on yourself and/or your family. Also assume that the money you pay will be based on your current household earnings and that no one will lend you any money – including family and financial institutions.

For the following series of questions please consider your discretionary income after tax – that is the money you have after payment for basic necessities such as food, clothing, and housing. And you may also consider your savings and other assets you may have when answering the following questions.

Now I am going to ask you a series of questions (about 3 to 6) to determine the maximum your household would be willing to pay for optimal preventative therapy to completely alleviate 1 to 5 days (with an average of 3 days) of chemotherapy induced nausea and vomiting. Remember you expect to incur chemotherapy induced nausea and vomiting six times (six cycles of chemotherapy in six months)
Are you WTP $X each month for the **optimal therapy for the next 6 months**?

[Go through bidding game procedure with respondent either use algorithm 1 or algorithm 2. Respondents will be alternated between the two regimes].

### Bidding Game

<table>
<thead>
<tr>
<th>Algorithm 1</th>
<th>Algorithm 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Start</td>
</tr>
<tr>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>125</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>150</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
</tr>
<tr>
<td>175</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>200</td>
<td></td>
</tr>
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<td></td>
<td>Y</td>
</tr>
<tr>
<td>250</td>
<td></td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td></td>
</tr>
</tbody>
</table>

[If respondent reaches $300 bid]

Are you willing to pay more than $300? □ Yes □ No □ Don't Know

If Yes, what is the **maximum** your household would be willing to for complete alleviation 1 to 5 days (with an average of 3 days) of nausea and vomiting? $_____

OK, so this means that you are willing to pay an amount between $______ and $______ each month for the optimal therapy for the next 6 months.

How much exactly would that be?$_____

[If respondent unsure, use mean] OK so that is $______ x 6 = ____ for 6 months

### If you had to pay for this out-of-pocket how much are you willing to pay out of:

<table>
<thead>
<tr>
<th></th>
<th>$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual discretionary take home income—after tax— (i.e., your take-home pay after payment for basic necessities)</td>
<td>$</td>
<td>%</td>
</tr>
<tr>
<td>Savings</td>
<td>$</td>
<td>%</td>
</tr>
<tr>
<td>Other Assets (Home, car, etc.)</td>
<td>$</td>
<td>%</td>
</tr>
<tr>
<td>Final Bid Amount</td>
<td>$</td>
<td>100%</td>
</tr>
</tbody>
</table>

[If respondent WTP amount from bidding game is greater than final bid amount reassess 'exact' amount they would be willing to pay until 'final bid amount' = 'exact' amount].
D3 WILLINGNESS TO PAY: 
NO PREVENTATIVE THERAPY VS STANDARD PREVENTATIVE THERAPY

This section uses the same scenarios that you read before, but here we will compare them in a different way.

Imagine that you are in **Situation NV** (show respondent scenario card, i.e...

**Also assume that**
- You will be in the condition for 1 to 5 days with an average of 3 days, and treatment is expected once a month for 6 months (i.e. 6 cycles).
- The scenarios apply to you at your current age.
- Your affairs are in order and you have made all preparations for the possibility of your death.

**Situation NV (NAUSEA AND VOMITING)**

**Physical**
All other factors (mouth sores, fever, tiredness etc) remain unchanged.
On average you have 2 vomiting episodes per day and ongoing nausea immediately after anti-cancer drugs.
Your mobility is limited.
Due to nausea and vomiting your diet is crackers and clear fluids.

**Emotional**
Somewhat depressed and anxious.
You do not feel confident and in control of your life.
Concerned by fear of death.

**Social**
Unable to go to work due to illness.
Interests and hobbies have declined.
Only close friends and family can visit you.
Partner is supportive.
Sexual relations are nonexistent.

You have two alternatives.

**No Preventative Therapy**
- No alleviation of nausea and vomiting. This would mean that you remain in the same condition, Situation NV for 1 to 5 days with an average of 3 days
- Periodic visits to your doctor for cancer— all medical bills covered by your health insurance.

**Standard Preventative Therapy**
- Partial alleviation of nausea and vomiting by swallowing a pill once that does not have any side effects – effective immediately. This would mean that your health state would be Situation Prev NV for 1 to 5 days with an average of 3 days
- Periodic visits to your doctor for cancer— these medical bills are covered by your health insurance.
- Additional bills for standard therapy (i.e. medication and its administration to prevent nausea and vomiting) are not covered by your health insurance.

[Show PrevNV and NV cards]
Which alternative do you prefer? □ Situation NV □ Situation Prev NV

[Validity Check: If respondent prefers no treatment – probe to ensure respondent understood scenario- this is treated as an illogical response]

Would you be willing to pay more than $0 for this alleviation of 1 to 5 days (with an average of 3 days) of nausea and vomiting? □ Yes □ No

Since, your health insurance will not pay for the new preventative therapy for nausea and vomiting, you will have to pay for it yourself. Bear in mind that the money you would pay for the therapy would reduce what you have left to spend on yourself and/or your family. Also assume that the money you pay will be based on your current household earnings and that no one will lend you any money – including family and financial institutions.

For the following series of questions please consider your discretionary income after tax – that is the money you have after payment for basic necessities such as food, clothing, and housing. And you may also consider your savings and other assets you may have when answering the following questions.

Now I am going to ask you a series of questions (about 3 to 6) to determine the maximum your household would be willing to pay for standard therapy to alleviate 1 to 5 days (with an average of 3 days of chemotherapy induced nausea and vomiting. Remember you expect to incur chemotherapy induced nausea and vomiting six times (six cycles of chemotherapy in six months)

Are you WTP $X each month for the treatment for the next 6 months?

[Go through bidding game procedure with respondent either use algorithm 1 or algorithm 2. Respondents will be alternated between the two regimes].

Bidding Game

<table>
<thead>
<tr>
<th></th>
<th>Algorithm 1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>75</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>125</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>
[If respondent reaches $200 bid]

Are you willing to pay more than $200? [ ] Yes [ ] No [ ] Don’t Know

If Yes, what is the maximum your household would be willing to for
alleviation of 1 to 5 days (with an average of 3 days) of nausea and vomiting?$_____

OK, so this means that you are willing to pay an amount between $_______ and
$_______ each month for the standard therapy for the next 6 months.

How much exactly would that be?$_____

[If respondent unsure, use mean] OK so that is $____ x 6 = ______ for 6 months

<table>
<thead>
<tr>
<th>If you had to pay for this out-of-pocket how much are you willing to pay out of:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual discretionary take home income - after tax (i.e., your take home pay after payment for basic necessities)</td>
<td>$</td>
</tr>
<tr>
<td>Savings</td>
<td>$</td>
</tr>
<tr>
<td>Other Assets (Home, car, etc.)</td>
<td>$</td>
</tr>
<tr>
<td>Final Bid Amount</td>
<td>$</td>
</tr>
</tbody>
</table>

[If respondent WTP amount from bidding game is greater than final bid amount reassess 'exact' amount they would be willing to pay until 'final bid amount' = 'exact' amount].
D4 WILLINGNESS TO PAY: NO PREVENTATIVE THERAPY VS OPTIMAL PREVENTATIVE THERAPY

This section uses the same scenarios that you read before, but here we will compare them in a different way.

Imagine that you are in Situation NV [show respondent scenario card, i.e....]
Also assume that
- You will be in the condition for 1 to 5 days with an average of 3 days, and treatment is expected once a month for 6 months (i.e. 6 cycles).
- The scenarios apply to you at your current age.
- Your affairs are in order and you have made all preparations for the possibility of your death.

**Situation NV (NAUSEA AND VOMITING)**

**Physical**
- All other factors (mouth sores, fever, tiredness etc) remain unchanged.
- On average you have 2 vomiting episodes per day and ongoing nausea immediately after anti-cancer drugs.
- Your mobility is limited.
- Due to nausea and vomiting your diet is crackers and clear fluids.

**Emotional**
- Somewhat depressed and anxious.
- You do not feel confident and in control of your life.
- Concerned by fear of death.

**Social**
- Unable to go to work due to illness.
- Interests and hobbies have declined.
- Only close friends and family can visit you.
- Partner is supportive.
- Sexual relations are nonexistent.

You have two alternatives.

**No Preventative Therapy**
- No alleviation of nausea and vomiting.
  - This would mean that you remain in same condition, Situation NV 1 to 5 days with an average of 3 days.
- Periodic visits to your doctor for cancer—all medical bills covered by your health insurance.

**Optimal Preventative Therapy**
- Complete alleviation of nausea and vomiting by swallowing a pill once that did not have any side effects - effective immediately. This would mean that your health state would be Situation No NV for 1 to 5 days with an average of 3 days
- Periodic visits to your doctor for cancer—these medical bills are covered by your health insurance.
- Additional bills for optimal therapy (i.e. medication and its administration to prevent nausea and vomiting) are not covered by your health insurance. [show No NV and Prev NV cards].
Which alternative do you prefer? □ Situation NV □ Situation No NV

[Validity Check: If respondent prefers no treatment – probe to ensure respondent understood scenario- this is treated as an illogical response]

| Would you be willing to pay more than $0 for this complete alleviation of 1 to 5 days (with an average of 3 days) of nausea and vomiting? □ Yes □ No |

Since, your health insurance will not pay for the new preventative therapy for nausea and vomiting alleviation, you will have to pay for it yourself. Bear in mind that the money you would pay for the therapy would reduce what you have left to spend on yourself and/or your family. Also assume that the money you pay will be based on your current household earnings and that no one will lend you any money – including family and financial institutions.

For the following series of questions please consider your discretionary income after tax – that is the money you have after payment for basic necessities such as food, clothing, and housing. And you may also consider your savings and other assets you may have when answering the following questions.

Now I am going to ask you a series of questions (about 3 to 6) to determine the maximum your household would be willing to pay to completely alleviate 1 to 5 days (with an average of 3 days) of chemotherapy induced nausea and vomiting. Remember you expect to incur chemotherapy induced nausea and vomiting six times (six cycles of chemotherapy in six months)
Are you WTP $X each month for the *optimal therapy for the next 6 months*?

[Go through bidding game procedure with respondent either use algorithm 1 or algorithm 2. Respondents will be alternated between the two regimes].

---

**Bidding Game**

<table>
<thead>
<tr>
<th>Algorithm 1</th>
<th>Algorithm 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>Y</td>
</tr>
<tr>
<td>125</td>
<td>Y</td>
</tr>
<tr>
<td>150</td>
<td>N</td>
</tr>
<tr>
<td>200</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>Y</td>
</tr>
<tr>
<td>300</td>
<td>Y</td>
</tr>
<tr>
<td>350</td>
<td>Y</td>
</tr>
<tr>
<td>400</td>
<td>Y</td>
</tr>
<tr>
<td>500</td>
<td>N</td>
</tr>
<tr>
<td>600</td>
<td>Y</td>
</tr>
<tr>
<td>800</td>
<td></td>
</tr>
</tbody>
</table>
[If respondent reaches $800 bid]

Are you willing to pay more than $800? □ Yes □ No □ Don’t Know

If Yes, what is the maximum your household would be willing to pay for 1 to 5 days (with an average of 3 days) of nausea and vomiting?$____

OK, so this means that you are willing to pay an amount between $____ and $____ each month for the optimal therapy for the next 6 months.

How much exactly would that be?$____

[If respondent unsure, use mean] OK so that is $____x6 = _____ for 6months

| If you had to pay for this out-of-pocket how much are you willing to pay out of: |  |
| --- | --- | --- |
| Annual discretionary take home income - after tax – (i.e., your take home pay after payment for basic necessities) | $ | % |
| Savings | $ | % |
| Other Assets (Home, car, etc.) | $ | % |
| Final Bid Amount | $ | 100% |

[If respondent WTP amount from bidding game is greater than final bid amount reassess 'exact' amount they would be willing to pay until 'final bid amount' = 'exact' amount].
D5  VALIDITY CHECK (scope effect)

Comparison of 'do nothing' versus 'standard preventative therapy' and 'do nothing' versus 'optimal preventative therapy'

Rational choice would indicate that if respondent is WTP anything, she should be WTP more for optimal than standard preventative therapy. If respondent indicated that she would pay more for standard than optimal therapy seek reason for response]
### E1 RATING OF THERMOMETER (blue felt board) [RESPONDENT COMPLETED]

Now that you have used the thermometer to rate six different levels of health, we would like you to rate the method by responding to the following questions:

How do you rate the thermometer in terms of:

<table>
<thead>
<tr>
<th></th>
<th>All decisions</th>
<th>Most decisions</th>
<th>Indifferent</th>
<th>Most decisions</th>
<th>All decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty of making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>decisions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Clear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somewhat Clear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indifferent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somewhat Unclear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Unclear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity of text</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Reasonable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somewhat Reasonable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indifferent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somewhat Unreasonable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Unreasonable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reasonableness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for decision making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Comfortable</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Somewhat Comfortable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Indifferent</td>
<td></td>
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</tr>
<tr>
<td>Somewhat Uncomfortable</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Very Uncomfortable</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Comfort for use in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>decision making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Any Comments?


E2 RATING OF CHANCE BOARD (Computer slides)

Now that you have used the chance board method to rate three different levels of health, we would like you to rate the method by responding to the following questions:

How do you rate the chance board in terms of:

<table>
<thead>
<tr>
<th></th>
<th>All decisions</th>
<th>Most decisions</th>
<th>Indifferent</th>
<th>Most decisions</th>
<th>All decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty of making</td>
<td>easy</td>
<td>easy</td>
<td>Indifferent</td>
<td>difficult</td>
<td>difficult</td>
</tr>
<tr>
<td>decisions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity of text</td>
<td>Very Clear</td>
<td>Somewhat Clear</td>
<td>Indifferent</td>
<td>Somewhat Unclear</td>
<td>Very Unclear</td>
</tr>
<tr>
<td>Reasonableness for</td>
<td>Very Reasonable</td>
<td>Somewhat</td>
<td>Indifferent</td>
<td>Somewhat</td>
<td>Very</td>
</tr>
<tr>
<td>decision making</td>
<td></td>
<td>Reasonable</td>
<td></td>
<td>Unreasonable</td>
<td>Unreasonable</td>
</tr>
<tr>
<td>Comfort for use in</td>
<td>Very Comfortable</td>
<td>Somewhat</td>
<td>Indifferent</td>
<td>Somewhat</td>
<td>Very</td>
</tr>
<tr>
<td>decision making</td>
<td></td>
<td>Comfortable</td>
<td></td>
<td>Uncomfortable</td>
<td>Uncomfortable</td>
</tr>
</tbody>
</table>

Any Comments?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
E3  RATING OF WTP METHOD (Payment scenarios)

Now that you have used the willingness to pay method to rate three choices in healthcare, we would like you to rate the method by responding to the following questions:

How do you rate the willingness to pay method in terms of:

<table>
<thead>
<tr>
<th></th>
<th>All decisions</th>
<th>Most decisions</th>
<th>Indifferent</th>
<th>Most decisions</th>
<th>All decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty of making</td>
<td>easy</td>
<td>easy</td>
<td></td>
<td>difficult</td>
<td>difficult</td>
</tr>
<tr>
<td>decisions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Clear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity of text</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reasonableness for</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>decision making</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Comfort for use in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>decision making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Any Comments?

________________________________________________________________
________________________________________________________________
________________________________________________________________
E4 RATING OF THERMOMETER, CHANCE BOARD AND WILLINGNESS TO PAY METHOD

Now that you have used the willingness to pay method, chance board (computer slides) and thermometer (blue felt board) to rate choices in healthcare, we would like you to compare the different methods.

For example, suppose you were asked which of the three methods willingness to pay (W), chance board (C), and thermometer (T) required the most technology to perform. If you believe that T and W are of equal rating with C requiring a higher level of technology you may respond the following way.

<table>
<thead>
<tr>
<th>Most Technology use</th>
<th>C</th>
<th>T, W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Using the following abbreviations willingness to pay (W), chance board (C), and thermometer (T) in your comparisons please compare the three methods for the following four questions.

<table>
<thead>
<tr>
<th></th>
<th>All decisions</th>
<th>Most decisions</th>
<th>Most decisions</th>
<th>All decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty of making decisions</td>
<td>easy</td>
<td>easy</td>
<td>Indifferent</td>
<td>difficult</td>
</tr>
<tr>
<td>Clarity of text</td>
<td>Very Clear</td>
<td>Somewhat Clear</td>
<td>Indifferent</td>
<td>Somewhat Unclear</td>
</tr>
<tr>
<td>Reasonableness for decision making</td>
<td>Very Reasonable</td>
<td>Somewhat Reasonable</td>
<td>Indifferent</td>
<td>Somewhat Unreasonable</td>
</tr>
<tr>
<td>Comfort for use in decision making</td>
<td>Very Comfortable</td>
<td>Somewhat Comfortable</td>
<td>Indifferent</td>
<td>Somewhat Uncomfortable</td>
</tr>
</tbody>
</table>
VALIDATION OF SCENARIOS
[RESPONDENT COMPLETED]

How would you rate each of these health components for the following health states?

<table>
<thead>
<tr>
<th></th>
<th>Poor</th>
<th>Average</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perfect Health</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Your Health**        |      |         |           |
| Physical               | 1 2 3 4 5 6 7 8 9 10 |         |           |
| Emotional              | 1 2 3 4 5 6 7 8 9 10 |         |           |
| Social                 | 1 2 3 4 5 6 7 8 9 10 |         |           |

| **No Nausea & Vomiting** |      |         |           |
| Physical               | 1 2 3 4 5 6 7 8 9 10 |         |           |
| Emotional              | 1 2 3 4 5 6 7 8 9 10 |         |           |
| Social                 | 1 2 3 4 5 6 7 8 9 10 |         |           |

| **Prev NV**            |      |         |           |
| Physical               | 1 2 3 4 5 6 7 8 9 10 |         |           |
| Emotional              | 1 2 3 4 5 6 7 8 9 10 |         |           |
| Social                 | 1 2 3 4 5 6 7 8 9 10 |         |           |

| **Nausea & Vomiting**  |      |         |           |
| Physical               | 1 2 3 4 5 6 7 8 9 10 |         |           |
| Emotional              | 1 2 3 4 5 6 7 8 9 10 |         |           |
| Social                 | 1 2 3 4 5 6 7 8 9 10 |         |           |

When you evaluated the health states, how many days did you perceive the nausea and vomiting to last for? ____ days.
That completes all the questions for the interview. Thank you for giving us your time and help. We appreciate your assistance very much.

<table>
<thead>
<tr>
<th>Time ended:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of interview: minutes</td>
</tr>
</tbody>
</table>

Status of Interview

- Completed □
- Subject ineligible □
- Broken off □
- Refused □

If ineligible, broken off or refused, why?

________________________________________________________________________________________

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**INTERVIEWER'S EVALUATION**

*INTERVIEWER COMPLETED*

*INTERVIEWER: complete these questions as soon as possible after the interview*

In your judgment how well did the respondent understand what she was asked to do in the WTP questions?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Understood completely</td>
</tr>
<tr>
<td>2</td>
<td>Understood a great deal</td>
</tr>
<tr>
<td>3</td>
<td>Understood somewhat</td>
</tr>
<tr>
<td>4</td>
<td>Understood a little</td>
</tr>
<tr>
<td>5</td>
<td>Did not understand very much</td>
</tr>
<tr>
<td>6</td>
<td>Did not understand at all</td>
</tr>
<tr>
<td>7</td>
<td>Other (SPECIFY)</td>
</tr>
</tbody>
</table>

Which of the following descriptions best describe the degree of effort the respondent made to arrive at a value for the WTP scenarios?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gave the questions prolonged consideration in an effort to arrive at the best possible value</td>
</tr>
<tr>
<td>2</td>
<td>Gave the questions careful consideration but the effort was not prolonged</td>
</tr>
<tr>
<td>3</td>
<td>Gave the questions some consideration</td>
</tr>
<tr>
<td>4</td>
<td>Gave the questions very little consideration</td>
</tr>
<tr>
<td>5</td>
<td>Other (SPECIFY)</td>
</tr>
</tbody>
</table>

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APPENDIX G2

FACE-TO-FACE

INTERVIEW SCHEDULE

BREAST CANCER
BACKGROUND [Interviewer Completed]

ID#: ______________________
Name:______________________ Telephone: (614) _______
[Included to ensure each respondent is provided alternate survey in interview 2]

Time started: 
Date of interview: __/__/00

Survey Type:  □ BrCa  □ PCNV

Interview #  □ First  □ Second

If this is the second interview which survey was provided first?
□ BrCa  □ PCNV

Which WTP algorithm was used?
□ Algorithm 1  □ Algorithm 2

Which WTP protocol was used?
□ Protocol 1  □ Protocol 2
Hello, my name is Duska Franic. I am a graduate student at the College of Pharmacy at OSU. I would like to thank you for agreeing to be interviewed. As I explained in the E-mail you received, we are interested in learning more about the best way to measure benefits of different health treatments.

The information that you provide will be kept confidential. You are not obligated to participate in the study and you may choose not to participate now, or at any time during the interview. If you choose to complete the two interviews, we will give you $30 at the end of the second interview as an expression of our gratitude.

Before we get started, I need to ask you to complete a consent form. This form means that you have agreed to participate in the study voluntarily. Please take your time to read it over.

Hello, thank you for agreeing to meet with me again. As before, the information that you provide will be kept confidential. You are not obligated to participate in the study and you may choose not to participate now, or at any time during the interview. If you choose to complete the second interview today, we will give you $30 in cash as an expression of our gratitude.

The format for the interview will be similar to last time except that now we will be discussing breast cancer. Shall we get started? [SKIP CONSENT FORM]
PART II BREAST CANCER

A INTRODUCTION

The remainder of the interview is divided into two parts. In the first part, I will provide you with some background information, then I will ask you to read several imaginary scenarios. In the second part we will use three different survey methods to measure how you value different outcomes. I will also be asking you to rate the different methods. Please try to answer the questions as carefully as possible.

Would you like to begin the interview?

[If yes continue, if NO ask if there are any questions? Respondent is free to discontinue interview. If possible record respondent reason for interview termination]

Interview refused because...

________________________________________

________________________________________

________________________________________

________________________________________

B BACKGROUND

Here is some background information about breast cancer. Information is divided into the following sections:

- Breast Cancer
- Treatments for breast cancer – 3 are listed
- Quotes from patients with breast cancer about how it affected their lives, then I am going to ask you to imagine that you have this condition.

Please take your time to read through the information.
B BACKGROUND

Breast Cancer
- Most common cancer found in women.
- May be treated in a variety of ways.
- Some treatments are successful in curing cancer.

Treatments for breast cancer
Can involve combinations of the following

1. Lumpectomy (Breast conserving surgery)
   - This involves a removal of a small part of the breast.
   - Requires surgery – there will be a small scar.
   - Breast looks pretty much the same as before.

2. Radiation (x-rays)
   - Typically complements lumpectomy – helps to stop the cancer from coming back.
   - Treatment schedule is 5 days a week for 5 weeks.
   - Actual treatment, given by radiation therapist only takes a few minutes.
   - Requires regular physical exams and blood tests.
   - Side effects usually resolve 4 ½ months after therapy.

3. Chemotherapy
   - General name for drugs that try to kill cancer – anticancer drugs.
   - Help destroy any cancer cells that may remain after surgery and/or radiation therapy.
   - Helps destroy cancer if it recurs (comes back).
   - Chemotherapy has many side effects.
   - Side effects usually resolve one month after therapy.

4. As described by breast cancer patients

   “I feel I can not make certain long term commitments. I don’t feel I can plan too far ahead.”

   “From one check up to the next you can’t help but wonder or worry if it is back.”

   “I know that I can’t make any decisions – I don’t know if I’m going to be alright.”

Scenario: imagine you have breast cancer
- Assume that you have breast cancer.
- Following diagram explains sequence of events.
BREAST CANCER
You found a lump in your breast

NO TREATMENT
- Cancer will spread.
- Periodic visits to clinic to manage pain, nausea and vomiting.

TREATMENT

Lumpectomy
(Removal of lump) + Radiation Therapy
(X-rays)

2 years later...

Recurrence of breast cancer in opposite breast

CURE

Breast Cancer Vaccine
- You receive a new breast cancer vaccine once by injection.
- Your breast cancer is cured.
- As a side effect of the vaccine you incur arthritis - chronic periodic mild joint pain.
- You are required to visit your doctor every 6 months for cancer check-ups.

TREATMENT

Lumpectomy

ANTI-CANCER DRUGS
(CHEMOTHERAPY)
- Administered once a month for 6 months
- Given by 10-15 minute injection at clinic
- Clinic visit takes 2-3 hours
- After treatment, you are required to visit the doctor every month for a check-up.

6 months later (1 year after recurrence)

Cancer and its treatment/cure can affect other aspects of your life

Fear of death

Relationship with friends and family

Disruption (e.g., hospital visits) to your usual activities

ability to work

Interest in hobbies

Leisure
C1  IMAGINARY HEALTH STATES

Instructions for respondents: The following cards represent six health state descriptions.

Spread out six cards describing health situations in front of respondent.

Each card describes a different health problem with the exception of this card [point to situation P – Perfect health] and possibly this card – Your Health. When thinking about the profile of health described on each card, imagine that it will last for the rest of your life, except for death.

While reading the imaginary scenarios please consider how the health situation will affect your daily activities, for example,

• How you feel about your self, your body, and your sexuality.
• Your relationships with others.
• Inconvenience for you.

C2  IMAGINARY SCENARIOS

Present respondent with 6 scenario flashcards
PART III  DIFFERENT MEASURES OF HEALTH INTERVENTIONS

A  WARM UP: RANKING FORM
[Spread out six cards describing health situations in front of respondent].

What we have everyone do in this part is compare each of the cards and rank them according to how undesirable each card would be if you were to have the state of health described on the card for the rest of your life.

Now that you have read all of the six health states, please rank the descriptions from best to worst situation assuming that:
- You will be in the condition the rest of your life, until you are 74 years old.
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.
   [Instructions apply to rankings, thermometer, and chance board, not WTP].

Please rank the descriptions from best to worst situation.

Now that you have completed the ranking, are you sure that these rankings are in order from best to worst situation?

[Check validity of the order in the following manner]
You have indicated that you prefer Situation #1 than situation #2 for the rest of your life- is this correct?
You have indicated that you prefer Situation #2 than situation #3 for the rest of your life- is this correct?
You have indicated that you prefer Situation #3 than situation #4 for the rest of your life - is this correct?
You have indicated that you prefer Situation #4 than situation #5 for the rest of your life - is this correct?
You have indicated that you prefer Situation #5 than situation #6 for the rest of your life- is this correct?
[Make corrections if necessary]
B THERMOMETER SCALE
[Use thermometer visual aid: felt board with scale 0 – 100, place velcro backed arrows alongside situation flash cards already placed in order by respondent]

B1 Instructions for respondents: This is a visual aid called a thermometer scale. It helps us to measure people’s feelings about things. In this interview, we are going to use the thermometer scale to measure your preferences for different health states. The thermometer scale endpoints have the values 0 and 100. The most desirable health state has a value of 100 and the least desirable health state has a value of 0.

[Ask respondent to place an arrow next to 100 and label it with appropriate Health State, similarly, place an arrow next to 0 and label it with the appropriate Health State] Using the arrows provided, each of the six health states will be assigned a value. This is how it works. The more preferable you feel a health state (or card), the closer it should be to the top of the thermometer, and the less preferable you feel a health state to be the closer it should be to the bottom of the thermometer.

As before assume that:
• You will be in the condition for the rest of your life, until you are 74 years old.
• The scenarios apply to you at your current age.
• You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
• Your affairs are in order and you have made all preparations for the possibility of your death.

Place health states on thermometer such that the distance between the arrows reflects the differences you perceive between the health states. Any questions? Shall we start?

QUESTIONS
1. Now, what value do you assign to your second preferred state in the ranking form? Please signify your value by pointing an arrow to the appropriate value on the thermometer form.

2. Now, what value do you assign to your third preferred state in the ranking form?

3. Now, what value do you assign to your fourth preferred state in the ranking form?

4. Now, what value do you assign to your fifth preferred state in the ranking form?

Are there any values you would like to change?
[Give respondent time to review choices. Remind respondent to consider distances between arrows. For example if the value for the 5th preferred health state was 40 (Sit R), the 4th was 60 (Sit T) and the 3rd was 80 (Sit C), this would mean that a cure provides twice as much benefit than treatment (C-R=40, T-R=20, 40/20=2)].
Validity Check 1:
Thermometer values should be consistent with rankings from previous section. If not, bring this to the participant's attention and review to ensure that they match, i.e., either change the rankings or change the ordering of the thermometer. It is acceptable for the respondent to say that 2 situations are equally bad.

B2 (Record results)

<table>
<thead>
<tr>
<th>Health Condition Description</th>
<th>Value (0 to 100)</th>
<th>Utility (0 to 1.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RANKING THERMOMETER</td>
<td>SG</td>
<td></td>
</tr>
<tr>
<td>1. Situation</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2. Situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Situation</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
[Present health states in order from best to worst as ranked by respondent]

C1  CHANCE BOARD: Situation Y

Now I am going to show you a series of slides on the computer with two choices, but three
descriptions of health. Choice “B” is for certain, so Situation Y occurs with 100% certainty and
choice “A” involves risk – a gamble between Situation D (death) and Situation P (Perfect
Health).

As before, also assume that
- You will be in the condition for the rest of your life (until you are 74 years old).
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for
  any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let’s begin.

Remember, assume that choice B (Situation Y) is the ___nd/rd/th preferred health state from your ranking
form.

Imagine that you are in Situation Y (Point to Situation Y on screen). You can choose to either
remain in your current health state (Situation Y) for the rest of your life (until you are 74 years
old) or take the new treatment. This new treatment is a pill that is taken only once. If the new
treatment succeeds in you, your health will improve and you will live in perfect health (until you
are 74 years old) (Point to Situation P on screen). If your health is elevated to perfect health this
will not affect your income or the amount of money you spend on healthcare. But, if the
treatment fails you will die immediately (Point to Situation D on screen).

Given the choice would you take the treatment?

[Choice A - start with perfect health 100%, situation D 0%. If respondent does not select gamble, response
regarded as invalid – question respondent. If respondent does not regard perfect health as preferred
option discontinue interview and note on survey].

If YES,
Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that
you would die, or would you prefer to stay in your present state of health (situation Y)?
[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until
respondent says NO or is indifferent between Choice A and Choice B i.e..]

Would you take the treatment if there was a

98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70... 10, 5, 0 of perfect health but a

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30... 90, 95, 100 chance that you would die?
VALIDITY CHECK FOR PREFERENCE REVERSAL

[Similar to the validity check used to ensure rankings were consistent with values obtained with the feeling thermometer,

Present each SG scenario in ranked order from highest to lowest #2 - #5 at the end of each SG session — check to ensure that $U(\#2) > U(\#3)$ and $U(\#3) > U(\#4)$, and $U(\#4) > U(\#5)$ (By definition $U(\#1)=100$ and $U(\#6)=0$). If preference reversal - double check with respondent and provide opportunity to modify response(s). If respondent responses violate transitivity of preferences ask respondent for explanation]

[If violation of transitivity occurs]... This means that you are willing to accept a greater risk of death for [present problem choice]

- #2 than #3, but before you said that you preferred #2 over #3. Is that what you meant?
- #3 than 4, but before you said that you preferred #3 over #4. Is that what you meant?
- #4 than 5, but before you said that you preferred #4 over #5. Is that what you meant?
- #5 than 6, but before you said that you preferred #5 over #6. Is that what you meant?
C2 CHANCE BOARD: Situation C

As before, I am going to show you a series of slides with two choices. Choice “B” is for certain, so Situation C occurs with 100% certainty and choice “A” involves risk – a gamble between Situation D (death) and Situation P (Perfect Health).

As before, also assume that
- You will be in the condition for the rest of your life (i.e., expect to live until 74 years of age).
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let’s begin.

Remember, that choice B (Situation C) is the nd/rd/th preferred health state from your ranking form.

Imagine that you are in Situation C [Point to Sit C on screen]. You can choose to either remain in your current health state (Situation C) for the rest of your life (until you are 74 years old) or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health (until you are 74 years old) [Point to Sit P on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will die immediately [Point to Sit D on screen].

Given the choice would you take the treatment?
[Choice A - start with perfect health 100%, situation D 0%. If respondent does not select gamble, response regarded as invalid – question respondent. If respondent does not regard perfect health as preferred option discontinue interview and note on survey].

If YES, Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would die, or would you prefer to stay in your present state of health (situation C)?
[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..]

Would you take the treatment if there was a
98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70, .. 10, 5, 0 of perfect health but a
2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30, .. 90, 95, 100 chance that you would die?
C3  CHANCE BOARD: Situation T

As before, I am going to show you a series of slides with two choices. Choice "B" is for certain, so Situation T occurs with 100% certainty and choice "A" involves risk – a gamble between Situation D (death) and Situation P (Perfect Health).

As before, also assume that
• You will be in the condition for the rest of your life (until you are 74 years old).
• The scenarios apply to you at your current age.
• You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
• Your affairs are in order and you have made all preparations for the possibility of your death.

Let's begin.

Remember, that choice B (Situation T) is the nd/rd/th preferred health state from your ranking form.

Imagine that you are in Situation T [Point to Sit T on screen]. You can choose to either remain in your current health state (Situation T) for the rest of your life (until you are 74 years old) or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health (until you are 74 years old) [Point to Sit P on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will die immediately [Point to Sit D on screen].

Given the choice would you take the treatment?

[Choice A - start with perfect health 100%, situation D 0%. If respondent does not select gamble, response regarded as invalid – question respondent. If respondent does not regard perfect health as preferred option discontinue interview and note on survey].

If YES,
Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would die, or would you prefer to stay in your present state of health (situation T)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..] Would you take the treatment if there was a 98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70.... 10, 5, 0 of perfect health but a 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30.....90, 95, 100 chance that you would die?
C4 CHANCE BOARD: Situation R

As before, I am going to show you a series of slides with two choices. Choice "B" is for certain, so Situation R occurs with 100% certainty and choice "A" involves risk – a gamble between Situation D (death) and Situation P (Perfect Health).

As before, also assume that
• You will be in the condition for the rest of your life (until you are 74 years old).
• The scenarios apply to you at your current age.
• You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
• Your affairs are in order and you have made all preparations for the possibility of your death.

Let's begin.

Remember, that choice B (Situation R) is the ___nd/rd/th preferred health state from your ranking form.

Imagine that you are in Situation R. [Point to Situation R on screen]
You can choose to either remain in your current health state (Situation R) for the rest of your life (until you are 74 years old) or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health (until you are 74 years old) [Point to Situation P on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will die immediately [Point to Situation D on screen].

Given the choice would you take the treatment?
[Choice A - start with perfect health 100%, death 0%. If respondent does not select gamble, response regarded as invalid – question respondent. If respondent does not regard perfect health as preferred option discontinue interview and note on survey].

If YES,
Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would die, or would you prefer to stay in your present state of health (situation R)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e.]
Would you take the treatment if there was a
98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70.... 10, 5, 0 of perfect health but a
2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30....90, 95, 100 chance that you would die?
C5 -C8 If respondent worst health state is not death, substitute death for worst health state (i.e., Situation R) for the same time frame as Situation P. Set-up mirrors PCNV SG questions for health states worse than death. Situation Y provided below – same format to be used for Situations C, T and R. Situation R explained in C8, over page.

C5 CHANCE BOARD: Situation Y
As before, I am going to show you a series of slides with two choices. Choice "B" is for certain, so Situation Y occurs with 100% certainty and choice “A” involves risk – a gamble between Situation R (breast cancer recurrence) and Situation P (Perfect Health).

As before, also assume that
• You will be in the condition for the rest of your life (until you are 74 years old).
• The scenarios apply to you at your current age.
• You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
• Your affairs are in order and you have made all preparations for the possibility of your death.

Let's begin.
Remember, that choice B (Situation Y) is the nd/rd/th preferred health state from your ranking form.

Imagine that you are in Situation Y [Point to Situation R on screen] You can choose to either remain in your current health state (Situation Y) for the rest of your life (until you are 74 years old) or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health (until you are 74 years old) [Point to Situation P on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will be in Situation R for the rest of your life (until you are 74 years. [Point to Situation R on screen].

Given the choice would you take the treatment?
[Choice A - start with perfect health 100%, death 0%. If respondent does not select gamble, response regarded as invalid – question respondent. If respondent does not regard perfect health as preferred option discontinue interview and note on survey].

If YES, Would you take the treatment if there was a 98 % chance of perfect health but a 2% chance that you would be in Situation R, or would you prefer to stay in your present state of health (situation Y)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..] Would you take the treatment if there was a

98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70.... 10, 5, 0 of perfect health but a

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30.....90, 95, 100 chance that you would be in Situation R?
Now I am going to show you a series of slides on the computer with two choices, but three descriptions of health. Choice “B” is for certain, so Situation Y occurs with 100% certainty and choice “A” involves risk—a gamble between Situation R and Situation P (Perfect Health).

As before, assume that:
- You will be in the condition for the rest of your life (until you are 74 years old).
- The scenarios apply to you at your current age.
- You have complete medical insurance so that you will not have out-of-pocket expenses for any treatments.
- Your affairs are in order and you have made all preparations for the possibility of your death.

Let's begin.

Remember, that Situation D is the nd/rd/th preferred health state from your ranking form.

Imagine that you have a rapidly progressing terminal disease, which if left unattended will lead rapidly to death. You can choose to either remain in your current health state (Situation D) or take the new treatment. This new treatment is a pill that is taken only once. If the new treatment succeeds in you, your health will improve and you will live in perfect health for the rest of your life (until you are 74 years old) [Point to Situation P on screen]. If your health is elevated to perfect health this will not affect your income or the amount of money you spend on healthcare. But, if the treatment fails you will be in Situation R for the rest of your life (until you are 74 years old) [Point to Situation R on screen].

Given the choice would you take the treatment?

[Choice A - start with perfect health 100%, Situation R 0%. If respondent does not select gamble, response regarded as invalid—question respondent. If respondent does not regard perfect health (Choice A) as preferred option discontinue interview and note on survey].

Would you take the treatment if there was a 98% chance of perfect health but a 2% chance that you would be in Situation R, or would you prefer to stay in your present state of health (Situation D)?

[If YES, continue in decreasing increments (of 2% until Sit PH=80% then 5% increments) until respondent says NO or is indifferent between Choice A and Choice B i.e..]

Would you take the treatment if there was a

98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 75, 70... 10, 5, 0 of perfect health but a

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30... 90, 95, 100 chance that you would be in Sit R?
Before we move on to the next section I would like to ask you some questions about yourself.

<table>
<thead>
<tr>
<th>Question</th>
<th>Response Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your age: ______ (years)</td>
<td></td>
</tr>
<tr>
<td>Are you:</td>
<td>□ never been married</td>
</tr>
<tr>
<td></td>
<td>□ married/cohabiting</td>
</tr>
<tr>
<td></td>
<td>□ separated/divorced/widowed</td>
</tr>
<tr>
<td>Do you have</td>
<td>□ Student Health (Central Benefits)</td>
</tr>
<tr>
<td></td>
<td>□ Other, please specify</td>
</tr>
<tr>
<td>Are you a US Citizen?</td>
<td>□ Yes</td>
</tr>
<tr>
<td></td>
<td>□ No</td>
</tr>
<tr>
<td>Education</td>
<td>High school or less □ college □</td>
</tr>
<tr>
<td></td>
<td>graduate degree □ Other (please specify)</td>
</tr>
<tr>
<td>Occupation:</td>
<td></td>
</tr>
<tr>
<td>If you are a student:</td>
<td>What College are you from at OSU?</td>
</tr>
<tr>
<td></td>
<td>What is your major?</td>
</tr>
<tr>
<td></td>
<td>What degree are you working toward?</td>
</tr>
<tr>
<td>Are you a full-time student □ Yes □ No (Registered for &gt;10 hours this quarter)</td>
<td></td>
</tr>
<tr>
<td>How did you find out about this study?</td>
<td></td>
</tr>
<tr>
<td>Are you a:</td>
<td>□ Smoker</td>
</tr>
<tr>
<td></td>
<td>□ Nonsmoker</td>
</tr>
<tr>
<td></td>
<td>□ Ex-smoker</td>
</tr>
<tr>
<td>Do you have any children □ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>If yes, how many: ______ children</td>
<td></td>
</tr>
<tr>
<td>If yes, how old were you when you had your first child: ______ years.</td>
<td></td>
</tr>
</tbody>
</table>
Annual Income Level [Interview 1 only]

Which of these income groups represents your total gross combined household income, that is before taxes, for the past 12 months? Include all income from all sources such as wages, salaries, pensions, family allowances, rents from properties, gifts, and so forth. (Please exclude tuition waivers from your gross income). Once again, I would like to remind you that this interview is completely confidential and your name will never be associated with your answers. (Check one box)

☐ less than $10,000
☐ $10,000 – 19,999
☐ $20,000 – 29,999
☐ $30,000 – 39,999
☐ $40,000 – 49,999
☐ $50,000 – 59,999
☐ $60,000 AND OVER
☐ REFUSED
☐ DON'T KNOW

If respondent refused or does not know, say, imagine that your gross earnings are $10,000 – 19,000 which is the middle range of incomes for graduate students. Now, please answer the following questions assuming that this is your gross income.

In this next section of the questionnaire, I am going to ask you how much it is worth to you in real dollars to achieve a health improvement. Of course, you will not be required to actually pay that amount of money.
D2 WILLINGNESS TO PAY: CURE vs TREATMENT

This section uses the same scenarios that you read before, but here we will be comparing them in a different way.

Imagine that you are in Situation R. [show respondent scenario card]

Also assume that
- You will be in the condition for the rest of your life.
- The scenarios apply to you at your current age.
- Your affairs are in order and you have made all preparations for the possibility of your death.

**Situation R (CANCER RECURRENT)**

**Physical**
- You expect to live for an average of 2 years.
- Apart from a small scar - your breast looks pretty much the same as before the surgery.
- You felt a lump in your other breast.
- Your mobility is the same as before cancer diagnosis.
- You do not sleep well.

**Emotional**
- Anxious and depressed.
- You feel that you no longer have control of your life.
- Overwhelmed by fears of early death.
- Your worst fear of breast cancer recurrence has come true.
- Worried about losing your breast.

**Social**
- Work is difficult because of concerns about cancer.
- Not able to go out and see people.
- Your interest and hobbies have ceased.
- Partner is not supportive because he also feels overwhelmed.
- Sexual relations are nonexistent.

You have two alternatives.

---

**Treatment**
- Treatment involves swallowing a pill once a month for 6 months that does not have any side effects – effective immediately.
- Remain in Situation T for the rest of your life.
- Expect to live for an average of 12 years.
- (i.e., an additional 10 years over no treatment)
- You are required to visit your doctor every month for a check-up.
- All medical bills covered by your health insurance.
[show card T]

**Cure**
- Complete cure by swallowing a pill once that has side effects (arthritis) but is effective immediately.
- Remain in Situation C for the rest of your life.
- Expect to live until you are 74 years old.
- You are required to visit your doctor every 6 months for a check-up – these medical bills are covered by your health insurance.
- Additional bills for cure (i.e. medication and its administration) are not covered by your health insurance.
[show card C]

---
Which alternative do you prefer? □ Situation T □ Situation C

Validity Check: If respondent prefers Situation T – probe to ensure respondent understood scenario and check for compelling reason

Would you be willing to pay more than $0 for this breast cancer cure? □ Yes □ No

Since, your health insurance will not pay for the new treatment you will have to pay for the cure yourself. Bear in mind that the money you would pay for a cure would reduce what you have left to spend on yourself and/or your family. Also assume that the money you pay will be based on your current household earnings and that no one will lend you any money – including family and financial institutions.

For the following series of questions please consider your discretionary income after tax – that is the money you have after payment for basic necessities such as food, clothing, and housing. And you may also consider your savings and other assets you may have when answering the following questions.

Now I am going to ask you a series of questions (about 3 to 6) to determine the maximum your household would be willing to pay once for the breast cancer cure?
Are you WTP $X once for the breast cancer cure?

[Go through bidding game procedure with respondent either use algorithm 1 or algorithm 2. Respondents will be alternated between the two regimes].

Bidding Game

<table>
<thead>
<tr>
<th>Algorithm 1</th>
<th>Algorithm 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Start</td>
</tr>
<tr>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>2,000</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>5,000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>7,500</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
</tr>
<tr>
<td>10,000</td>
<td>Start</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>15,000</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>20,000</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>25,000</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>40,000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

[If respondent reaches $40,000 bid]
Are you willing to pay more than $40,000? [ ] Yes [ ] No [ ] Don't Know
If Yes, what is the maximum your household would be willing to pay once for breast cancer cure $______
OK, so this means that you are willing to pay an amount between $_________ and $_________ once for the breast cancer cure.

How much exactly would that be? $_________
[If respondent unsure, use mean]

<table>
<thead>
<tr>
<th>If you had to pay for this out-of-pocket how much are you willing to pay out of:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual discretionary take home income - after tax - (i.e., your take home pay after payment for basic necessities)</td>
<td>$</td>
</tr>
<tr>
<td>Savings</td>
<td>$</td>
</tr>
<tr>
<td>Other Assets (Home, car, etc.)</td>
<td>$</td>
</tr>
<tr>
<td>Final Bid Amount</td>
<td>$</td>
</tr>
</tbody>
</table>

[If respondent WTP amount from bidding game is greater than final bid amount reassess 'exact' amount they would be willing to pay until 'final bid amount' = 'exact' amount].
This section uses the same scenarios that you read before, but here we will be comparing them in a different way.

Imagine that you are in Situation R. [show respondent scenario card, i.e...] Also assume that
- You will be in the condition for the rest of your life.
- The scenarios apply to you at your current age.
- Your affairs are in order and you have made all preparations for the possibility of your death.

**Situation R (Cancer Recurrence)**

**Physical**
- You expect to live for an average of 2 years.
- Apart from a small scar - your breast looks pretty much the same as before the surgery.
- You felt a lump in your other breast.
- Your mobility is the same as before cancer diagnosis.
- You do not sleep well.

**Emotional**
- Anxious and depressed.
- You feel that you no longer have control of your life.
- Overwhelmed by fears of early death.
- Your worst fear of breast cancer recurrence has come true.
- Worried about losing your breast.

**Social**
- Work is difficult because of concerns about cancer.
- Not able to go out and see people.
- Your interest and hobbies have ceased.
- Partner is not supportive because he also feels overwhelmed.
- Sexual relations are nonexistent.

You have two alternatives.

**No Treatment**
- Remain in same condition for the rest of your life - Situation R.
- Expect to live for an average of 2 years.
- You are required to visit your doctor every month for a check-up.
- All medical bills are covered by your health insurance.

**Treatment**
- Treatment involves swallowing a pill once a month for 6 months that does not have any side effects – effective immediately.
- Remain in Situation T for the rest of your life.
- Expect to live for an average of 12 years.
  (i.e., additional 10 years over no treatment).
- You are required to visit your doctor every month for a check-up – these medical bills are covered by your health insurance.
- Additional bills for treatment (i.e., medication and its administration) are not covered by your health insurance.
Which alternative do you prefer?  □ Situation R  □ Situation T

[Validity Check: If respondent prefers no treatment – probe to ensure respondent understood scenario and check for compelling reason]

Would you be willing to pay more than $0 for this breast cancer treatment?  □ Yes  □ No

Since, your health insurance will not pay for the new treatment you will have to pay for the treatment yourself. Bear in mind that the money you would pay for the treatment would reduce what you have left to spend on yourself and/or your family. Also assume that the money you pay will be based on your current household earnings and that no one will lend you any money – including family and financial institutions.

For the following series of questions please consider your discretionary income after tax – that is the money you have after payment for basic necessities such as food, clothing, and housing. And you may also consider your savings and other assets you may have when answering the following questions.

Now I am going to ask you a series of questions (about 3 to 6) to determine the maximum your household would be WTP once for the 6 month breast cancer treatment?
Are you WTP $X once for the 6 month breast cancer treatment?

[Go through bidding game procedure with respondent alternated to use either use algorithm 1 or algorithm 2. Respondents will be alternated between the two regimes].

**Bidding Game**

<table>
<thead>
<tr>
<th>Algorithm 1</th>
<th>Algorithm 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Start</td>
</tr>
<tr>
<td>250 Y</td>
<td>Y</td>
</tr>
<tr>
<td>500 Y</td>
<td>N</td>
</tr>
<tr>
<td>750 N</td>
<td>N</td>
</tr>
<tr>
<td>1,000</td>
<td>Start</td>
</tr>
<tr>
<td>2,000 Y</td>
<td>N</td>
</tr>
<tr>
<td>5,000 Y</td>
<td>Y</td>
</tr>
<tr>
<td>10,000 Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

[If respondent reaches $10,000 bid]
Are you willing to pay more than $10,000? ☐ Yes ☐ No ☐ Don't Know
If Yes, what is the maximum your household would be willing to pay once for the 6 month breast cancer treatment? $_____
OK, so this means that you are willing to pay an amount between $_______ and $_______ once for the breast cancer treatment.

How much exactly would that be?$________
[If respondent unsure, use mean]

<table>
<thead>
<tr>
<th>If you had to pay for this out-of-pocket how much are you willing to pay out of:</th>
<th>$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual discretionary take home income - after tax — (i.e., your take home pay after payment for basic necessities)</td>
<td>$</td>
<td>%</td>
</tr>
<tr>
<td>Savings</td>
<td>$</td>
<td>%</td>
</tr>
<tr>
<td>Other Assets (Home, car, etc.)</td>
<td>$</td>
<td>%</td>
</tr>
<tr>
<td>Final Bid Amount</td>
<td>$</td>
<td>100%</td>
</tr>
</tbody>
</table>

[If respondent WTP amount from bidding game is greater than final bid amount reassess ‘exact’ amount they would be willing to pay until ‘final bid amount’ = ‘exact’ amount].
D4 WILLINGNESS TO PAY: NO TREATMENT VS CURE

This section uses the same scenarios that you read before, but here we will be comparing them in a different way.

Imagine that you are in Situation R. [show respondent scenario card, i.e...] Also assume that
- You will be in the condition for the rest of your life
- The scenarios apply to you at your current age
- Your affairs are in order and you have made all preparations for the possibility of your death

**Situation R (CANCER RECURRENCE)**

**Physical**
- You expect to live for an average of 2 years.
- Apart from a small scar - your breast looks pretty much the same as before the surgery.
- You felt a lump in your other breast.
- Your mobility is the same as before cancer diagnosis.
- You do not sleep well.

**Emotional**
- Anxious and depressed.
- You feel that you no longer have control of your life.
- Overwhelmed by fears of early death.
- Your worst fear of breast cancer recurrence has come true.
- Worried about losing your breast.

**Social**
- Work is difficult because of concerns about cancer.
- Not able to go out and see people.
- Your interest and hobbies have ceased.
- Partner is not supportive because he also feels overwhelmed.
- Sexual relations are nonexistent.

You have two alternatives.

**No Treatment**
- Remain in same condition for the rest of your life - Situation R.
- Expect to live for an average of 2 years.
- You are required to visit your doctor every month for a check-up.
- All medical bills covered by your health insurance.
  [show card R]

**Cure**
- Complete cure by swallowing a pill once that has side effects (arthritis) but is effective immediately.
- Remain in Situation C for the rest of your life.
- Expect to live until you are 76 years old.
- You are required to visit your doctor every 6 months for a check-up - these medical bills are covered by your health insurance.
- Additional bills for cure (i.e. medication and its administration) are not covered by your health insurance.
  [show card C]
Would you be willing to pay more than $0 for this breast cancer cure? □ Yes □ No

Since, your health insurance will not pay for the new treatment you will have to pay for the cure yourself. Bear in mind that the money you would pay for a cure would reduce what you have left to spend on yourself and/or your family. Also assume that the money you pay will be based on your current household earnings and that no one will lend you any money— including family and financial institutions.

For the following series of questions please consider your discretionary income after tax—that is the money you have after payment for basic necessities such as food, clothing, and housing. And you may also consider your savings and other assets you may have when answering the following questions.

Now I am going to ask you a series of questions (about 3 to 6) to determine the maximum your household would be willing to pay once for the breast cancer cure?

Are you WTP $X once for the breast cancer cure?

[Go through bidding game procedure with respondent either use algorithm 1 or algorithm 2. Respondents will be alternated between the two regimes].
Bidding Game

Algorithm 1

Start

1,000

2,000

5,000

7,500

10,000

15,000

20,000

25,000

30,000

40,000

60,000

Algorithm 2

Start

1,000

2,000

5,000

7,500

10,000

15,000

20,000

25,000

30,000

40,000

60,000

[If respondent reaches $60,000 bid]
Are you willing to pay more than $60,000? □ Yes □ No □ Don't Know
If Yes, what is the maximum your household would be willing to pay for the breast cancer cure? $_________
OK, so this means that you are willing to pay an amount between $_______ and $_______ once for the breast cancer cure.

How much exactly would that be?$__________
[If respondent unsure, use mean]

<table>
<thead>
<tr>
<th>If you had to pay for this out-of-pocket how much are you willing to pay out of:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual discretionary take home income - after tax - (i.e., your take home pay after payment for basic necessities)</td>
<td>$</td>
</tr>
<tr>
<td>Savings</td>
<td>$</td>
</tr>
<tr>
<td>Other Assets (Home, car, etc.)</td>
<td>$</td>
</tr>
<tr>
<td>Final Bid Amount</td>
<td>$</td>
</tr>
</tbody>
</table>

[If respondent WTP amount from bidding game is greater than final bid amount reassess 'exact' amount they would be willing to pay until 'final bid amount' = 'exact' amount].
D5 VALIDITY CHECK (scope effect)
Comparison of 'do nothing' versus 'treatment' and 'do nothing' versus 'cure'

Rational choice would indicate that if respondent is WTP anything, she should be WTP more for cure than treatment. If respondent indicated that she would pay more for treatment than cure seek reason for response.

s

\[
\begin{array}{c}
S\\ \\
V\\ \\
S\\ \\
R
\end{array}
\]

C

T
E1 RATING OF THERMOMETER (blue felt board) [RESPONDENT COMPLETED]

Now that you have used the thermometer to rate six different levels of health, we would like you to rate the method by responding to the following questions:

How do you rate the thermometer in terms of:

<table>
<thead>
<tr>
<th></th>
<th>All decisions</th>
<th>Most decisions</th>
<th>Indifferent</th>
<th>Most decisions</th>
<th>All decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty of making decisions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity of text</td>
<td>Very Clear</td>
<td>Somewhat Clear</td>
<td>Indifferent</td>
<td>Somewhat Unclear</td>
<td>Very Unclear</td>
</tr>
<tr>
<td>Reasonableness for decision making</td>
<td>Very Reasonable</td>
<td>Somewhat Reasonable</td>
<td>Indifferent</td>
<td>Somewhat Unreasonable</td>
<td>Very Unreasonable</td>
</tr>
<tr>
<td>Comfort for use in decision making</td>
<td>Very Comfortable</td>
<td>Somewhat Comfortable</td>
<td>Indifferent</td>
<td>Somewhat Uncomfortable</td>
<td>Very Uncomfortable</td>
</tr>
</tbody>
</table>

Any Comments?

______________________________________________________________________________

______________________________________________________________________________
E2 RATING OF CHANCE BOARD (Computer slides)

Now that you have used the chance board method to rate three different levels of health, we would like you to rate the method by responding to the following questions:

How do you rate the chance board in terms of:

<table>
<thead>
<tr>
<th>Difficulty of making decisions</th>
<th>All decisions easy</th>
<th>Most decisions easy</th>
<th>Indifferent</th>
<th>Most decisions difficult</th>
<th>All decisions difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Easy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somewhat Easy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indifferent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somewhat Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indifferent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Utterly Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clarity of text</th>
<th>Very Clear</th>
<th>Somewhat Clear</th>
<th>Indifferent</th>
<th>Somewhat Unclear</th>
<th>Very Unclear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasonableness for decision making</td>
<td>Very Reasonable</td>
<td>Somewhat Reasonable</td>
<td>Indifferent</td>
<td>Somewhat Unreasonable</td>
<td>Very Unreasonable</td>
</tr>
<tr>
<td>Comfort for use in decision making</td>
<td>Very Comfortable</td>
<td>Somewhat Comfortable</td>
<td>Indifferent</td>
<td>Somewhat Uncomfortable</td>
<td>Very Uncomfortable</td>
</tr>
</tbody>
</table>

Any Comments?

______________________________
______________________________
______________________________
### E3  RATING OF WTP METHOD (Payment scenarios)

Now that you have used the willingness to pay method to rate three choices in healthcare, we would like you to rate the method by responding to the following questions:

How do you rate the willingness to pay method in terms of:

<table>
<thead>
<tr>
<th>Difficulty of making decisions</th>
<th>All decisions</th>
<th>Most decisions</th>
<th>Indifferent</th>
<th>Most decisions</th>
<th>All decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>easy</td>
<td>easy</td>
<td>Indifferent</td>
<td>difficult</td>
<td>difficult</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clarity of text</th>
<th>Very Clear</th>
<th>Somewhat Clear</th>
<th>Indifferent</th>
<th>Somewhat Unclear</th>
<th>Very Unclear</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Reasonableness for decision making</th>
<th>Very Reasonable</th>
<th>Somewhat Reasonable</th>
<th>Indifferent</th>
<th>Somewhat Unreasonable</th>
<th>Very Unreasonable</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Comfort for use in decision making</th>
<th>Very Comfortable</th>
<th>Somewhat Comfortable</th>
<th>Indifferent</th>
<th>Somewhat Uncomfortable</th>
<th>Very Uncomfortable</th>
</tr>
</thead>
</table>

Any Comments?

---

---
Now that you have used the willingness to pay method, chance board (computer slides) and thermometer (blue felt board) to rate choices in healthcare, we would like you to compare the different methods.

For example, suppose you were asked which of the three methods willingness to pay (W), chance board (C), and thermometer (T) required the most technology to perform. If you believe that T and W are of equal rating with C requiring a higher level of technology you may respond the following way.

<table>
<thead>
<tr>
<th>Most</th>
<th>Least</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology use:</td>
<td>T, W</td>
</tr>
</tbody>
</table>

Using the following abbreviations willingness to pay (W), chance board (C), and thermometer (T) in your comparisons please compare the three methods for the following four questions.

<table>
<thead>
<tr>
<th>All decisions</th>
<th>Most decisions</th>
<th>Most decisions</th>
<th>All decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty of making decisions</td>
<td>easy</td>
<td>easy</td>
<td>indifferent</td>
</tr>
<tr>
<td>clarity of text</td>
<td>Very Clear</td>
<td>Somewhat Clear</td>
<td>indifferent</td>
</tr>
<tr>
<td>Reasonableness for decision making</td>
<td>Very Reasonable</td>
<td>Somewhat Reasonable</td>
<td>indifferent</td>
</tr>
<tr>
<td>Comfort for use in decision making</td>
<td>Very Comfortable</td>
<td>Somewhat Comfortable</td>
<td>indifferent</td>
</tr>
</tbody>
</table>
### F VALIDATION OF SCENARIOS

**[RESPONDENT COMPLETED]**

How would you rate each of these health components for the following health states?

<table>
<thead>
<tr>
<th>Poor</th>
<th>Average</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perfect Health</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Emotional</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td><strong>Your Health</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Emotional</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td><strong>Cure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Emotional</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td><strong>Treatment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Emotional</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td><strong>Recurrence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Emotional</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
</tbody>
</table>
That completes all the questions for the interview. Thank you for giving us your time and help. We appreciate your assistance very much.

<table>
<thead>
<tr>
<th>Time ended:</th>
<th>_____</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of interview:</td>
<td>_____ minutes</td>
</tr>
</tbody>
</table>

Status of Interview

- Completed [ ]
- Subject ineligible [ ]
- Broken off [ ]
- Refused [ ]

If ineligible, broken off or refused, why?

_________________________
In your judgment how well did the respondent understand what she was asked to do in the WTP questions?

<table>
<thead>
<tr>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Understood completely</td>
<td>Understood a great deal</td>
<td>Understood somewhat</td>
<td>Understood a little</td>
<td>Did not understand very much</td>
<td>Did not understand at all</td>
<td>Other (SPECIFY):</td>
</tr>
</tbody>
</table>

Which of the following descriptions best describe the degree of effort the respondent made to arrive at a value for the WTP scenarios?

<table>
<thead>
<tr>
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<th>1</th>
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<th>7</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Gave the questions prolonged consideration in an effort to arrive at the best possible value</td>
<td>Gave the questions careful consideration, but the effort was not prolonged</td>
<td>Gave the questions some consideration</td>
<td>Gave the questions very little consideration</td>
<td>Other (SPECIFY):</td>
<td>378</td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


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