Enhancing Our Understanding of Human Poverty: An Examination of the Relationship
Between Income Poverty and Material Hardship

DISSERTATION

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By
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Abstract

The purpose of this study was to investigate the Official Poverty Measure’s (OPM) classifications and predictions of ten material hardships: unmet essential need, rent or mortgage nonpayment, eviction, skip or cut meal, a day without food, utility nonpayment or disconnection, phone disconnection, unmet medical need, and unmet dental need. The basis for the OPM was developed in 1965, and it has been used by the United States’ federal government to estimate the prevalence of poverty since 1969. Many criticized the OPM for its single price index, its definition of income and family, and its lack of geographic variation in prices. These limitations were expected to affect the OPM’s accuracy to identify and predict hardship. Respectively, classification and predictive probabilities are statistical metrics of a binary test’s efficacy to indicate the presence or absence of a condition (e.g., material hardship) and the trustability of that indication.

The OPM’s correct positive classifications (i.e., sensitivity) exceeded the evaluative guideline for interpretation, nevertheless, they were low. The probabilities of true-positive results (i.e., OPM and hardship positive) were lower than those for false-negatives (i.e., OPM negative but hardship positive). It was more likely the OPM would
erroneously classify families as nonpoor. The correct negative classifications (i.e., specificity) for all but one hardship indicator failed the evaluative criterion and were uninterpretable. The probabilities of false-positive results (i.e., OPM poor but without hardship) were too near the probabilities of OPM positives. The OPM’s capability to predict a true-positive or true-negative was also low or uninterpretable. Therefore, a positive or negative OPM prediction had little association with the presence or absence of hardship.

The OPM’s sensitivity to material hardship (i.e., the odds of a true-positive result) varied across the sociodemographic and labor-power variables associated with poverty. Families with an unemployed primary person had statistically significantly greater odds of an OPM true-positive result for all ten hardship indicators. The presence of two, three, or four children in a family was statistically significantly associated with greater sensitivity across all hardship indicators, except three children and an adult without food for a day. Families with a lone-parent or without a high school diploma were not statistically significantly associated with greater odds of a true-positive result for eviction, a day without food for a lone man or a primary person with no high school diploma, or utility disconnection and phone disconnection for family heads with no high school diploma.

African American racial identification had no statistically significant association with OPM sensitivity. Asian identification was associated with greater odds of a true-positive for unmet essential need and eviction but lower odds of a true-positive for skip or cut meal. Indigenous or Native Persons identification was associated with lower odds
of a true-positive for a day without food. Hispanic or Latino(a) families had greater odds of a true-positive for five of the hardships.

Families with a physical or mental disability had statistically significantly lower odds of a true-positive for skip or cut meals. Veteran status was not associated with any of the ten hardships.
This work is dedicated to my mother, Christy, my brothers, Kasey and Nickolas, my grandparents, JoAnn and Rodney, and my red, Kevin.
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Fields of Study

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Chapter 1: Introduction and Background

Poverty statistics are important social indicators, significant to a holistic view of society (Innes De Neufville, 1975). Social indicators are, “…statistics, statistical series, and all other forms of evidence—that enable us to assess where we stand and are going with respect to our values and goals, and to evaluate specific programs and determine their impact” (Bauer, 1966, as cited in Land & Michalos, 2017, 1.1 section, para. 4). Because these indicators serve as evaluative measures, their informational quality is critical, especially when an indicator is institutionalized. Institutionalization of a social indicator is, “The setting up of procedures and practices which ensure the continuing existence of an indicator and which legitimize and formalize its methods and concepts” (Innes De Neufville, 1975, p. 180). The US Census poverty measure is one such institutionalized social indicator, like unemployment or mortality, and its accuracy is central to assessments of societal justice (Rawls, 1958) and morality (Gregor, 1996), to eligibility for public assistance programs (“Annual Update of the HHS Poverty Guidelines; Notice,” 2016), and to political decisions about how to fund programs (Innes De Neufville, 1975).
Study Purpose

The first purpose of this study was to investigate how well the United States Census Bureau’s Official Poverty Measure (OPM) classified and predicted material hardship. Test classification probabilities and test predictive values are quantifications of “how well” a given test performs. Test classification probabilities are metrics of accuracy. Sensitivity is the measure of a test’s capacity to correctly classify persons as “positive” when they are positive for a condition (Pepe, 2003). It is also referred to as the true-positive fraction (TPF). Specificity, on the other hand, is a quantification of a test’s capacity to correctly classify persons as “negative” when they are condition negative (Pepe, 2003). Specificity is an inverse of the false-positive fraction (FPF). Test predictive probabilities are gauges of test trustability. The positive predictive value (PPV) and negative predictive value (NPV) are, respectively, the probability that a “positive” test result is truly condition positive and the probability that a “negative” test result is truly condition negative.

The second purpose of this study was to identify sociodemographic and labor-power variables associated with OPM classifications of families condition positive (i.e., with material hardship) and to quantify that association. The goal was to examine for whom the OPM works best when material hardship is present. Race and ethnicity, family configuration, physical or mental disability, and military veteran status were the sociodemographic variables included in this research (Bauman, 2002; Brucker, Mitra, Chaitoo, & Mauro, 2015; Haveman, Blank, Moffitt, Smeeding, & Wallace, 2014; Heflin, Wilmoth, & London; Schiller, 2008). Labor-power is one’s capability to and capacity for
work (Marx, 1867), and it was operationalized through education and current employment (Williams, 2011).

**Background of the Problem**

President Johnson was ambitious in his 1964 State of the Union Address. He called for the expansion of civil rights and elimination of apartheid-conditions in the United States, the slowing of nuclear material and weapons stockpiles, and the implementation of hospital insurance for elders. The speech is possibly most remembered for Johnson’s declaration of “unconditional war on poverty” in America (Trattner, 1999, p. 322).

Johnson’s war cry prompted the President’s Council of Economic Advisors (CEA) to investigate “…the enemy [poverty] and to outline the main features of a strategy of attack” (Johnson, 1964, p. 55). The CEA defined poverty as, “…the inability to satisfy minimum needs” (Johnson, 1964, p. 62, emphasis added). The CEA definition of minimum needs included food, shelter, “…clothing, transportation, school supplies and books, home furnishings and supplies, medical care, personal care, recreation, insurance, and everything else” (Johnson, 1964, p. 58). The poor, then, were “…those whose basic needs exceed their means to satisfy them [i.e., “current income from whatever source”]” (Johnson, 1964, p. 57, emphasis added).

The CEA argued, “An attempt to quantify the problem [poverty] must begin with some concept of average need for an average or representative family” (Johnson, 1964, p. 57). One reasonable expectation, then, would be to quantify the average prices for minimum needs (i.e., food, shelter, clothing, etc.) for an average family. Instead, the
CEA referred to a Social Security Administration (SSA) study by Mollie Orshansky wherein she calculated a single need (i.e., food) and scaled it to characteristics of family composition (Fisher, 1992). Nevertheless, the CEA recommended a “crude and approximate measure” (Orshansky, 1965a, p. 3) of poverty—$3,000 for families and half as much for single adults—and counted 33-35 million US citizens as poor in 1962 (Johnson, 1964). It is difficult to question the earnestness of the CEA with their strong peppering of commentary, like, “Poverty is no purely private or local concern. It is a social and national problem” (Johnson, 1964, p. 55).

One catalyst for government attention to poverty in the 1960s was publication of Michael Harrington’s *The Other America* in 1962. Trattner (1999) described Harrington’s work as, “a classic,” wherein Harrington, “…demonstrated that the poor, black and white alike, were subjected to a chronic suppression of their living standards, something that escaped most citizens” (pp. 316-317). Harrington (1981) sought “…to tell every well-fed and optimistic American that it is intolerable that so many millions should be maimed in body and in spirit when it is not necessary that they should be” (p. 19). Harrington (1981) empathized with people in poverty and challenged generally held expectations about, for example, technology: “They [the other Americans] might say: Progress is misery” (p. 13). He observed how machine automation “…condemned to the economic underworld—to low-paying service industries, to backward factories, to sweeping and janitorial duties—[anyone without a high school education]” (p. 13).

Harrington (1981), throughout his book, but especially in discussion of ethnic and racial minority groups, put words to the social roots of poverty: “There would still be a vast,
silent, and automatic system directed against men and women of color [even after repeal of all discriminatory laws]” (p. 75). Harrington (1981) prescribed:

So the Seventies need planned, long-range social investments to provide a decent home for every citizen and to guarantee either a living income or a good job for all. But as the decade begins, the nation, including its Chief Executive, believes in myths which keep us from even defining the problem as it is. They think we tried too much when actually we did so little. (p. xxviii)

**The Orshansky index.** Mollie Orshansky’s role in US poverty measurement was accidental. As a research analyst at SSA, she was asked in 1960 to prepare an official estimate of the costs for a retired couple to live (Fisher, 2008). Orshansky was directed in 1963 to determine the effects of poverty on children, and for this project, she designed a poverty measure similar to the one she employed for elders (Fisher, 2008). Orshansky’s immediate supervisor at SSA, Ida Merriam, saw the potential of Mollie’s research once President Johnson declared his War on Poverty (Fisher, 2008). Orshansky was tasked to extend her poverty measure to all families in the United States (Fisher, 2008).

Orshansky (1969) was skeptical of the CEA poverty measure—$3,000 for families and $1,500 for singles—because, “This original standard led to the odd result that an elderly couple with $2,900 income for the year would be considered poor, but a family with a husband, wife, and four little children with $3,100 income would not be” (p. 37). She attempted to avoid arbitrary determinations of poverty in several ways. First, her poverty index (or measure) was based on food prices and consumption data from the US Department of Agriculture (USDA) (Orshansky, 1965). The USDA had constructed food plans since the 1930s (Fisher, 1992), and Orshansky (1965) used food
prices from the low-cost and economy plans to determine the minimum a family had to spend to feed itself. She then utilized the most recent (i.e., 1955) USDA consumption data to determine the proportion of families’ budgets spent on food, and that proportion was about one-third (Orshansky, 1965). The normative assumption of Orshansky’s poverty index was that families spent a third of their income on food, and therefore, a multiplier of 3.0 applied to their food need would yield a minimum necessary income (Fisher, 1992). Orshansky (1969) scaled her poverty measure (124 thresholds in all) by family size, family composition, and residence (i.e., farm/nonfarm), and this produced vastly different necessary annual incomes from the CEA measure: $1,855 for the elderly couple and $4,135 for the family of six.

The Orshansky poverty index was institutionalized as the official US social indicator of poverty in 1969, but not without bureaucratic tussling and disagreement (Fisher, 1992). The CEA and Office of Economic Opportunity (OEO) disagreed with the SSA approach to calculate and maintain Orshansky’s matrix. The SSA recommended the use of consumption data from 1965 instead of 1955 (resulting in a multiplier larger than 3.0), the use of 1965 USDA food plan prices instead of 1963 (an eight percent increase in thresholds), and the use of food plan price changes instead of the CPI for annual adjustments (Fisher, 1992). The SSA proposal would have “…resulted in poverty thresholds that were 25-30 percent higher than the existing thresholds” (Fisher, 1992, p. 7). Fisher (1992) details how “…several agencies, notably the OEO and [CEA], repudiated the [SSA] position…” (p. 7). The Bureau of the Budget (BoB), now the Office of Management and Budget (OMB), established an interagency Poverty Level
Review Committee that chose a lower basis for the calculation of poverty thresholds (i.e., the 1955 budgetary data, the economy food plan, the 1963 food plan prices, and the CPI annual adjustment) (Fisher, 1992). The first official statistic on US poverty was 24 million, or 12.2 percent, in 1969 (US Census, 1970).

Figure 1 is a chart of poverty statistics from 1969 to 2016. The fewest number of people counted poor was in 1973 (22.973 million), which was also the year with the lowest poverty rate (11.1 percent). The most number of people counted poor was in 2014 with over 46 and a half million. Over 11 and a half million more people would need to be subsisting in 2014 for that year’s poverty rate to be equivalent to 1973. The poverty rate for 2014 would be 7.2 percent if the prevalence of poverty was unchanged since 1973 (i.e., 22.973 million).

The OPM has undergone only two revisions since its institutionalization in 1969. In 1980, the US Census chose the Consumer Price Index for All Urban Consumers (CPI-U) as the annual inflation metric over the Consumer Price Index for Urban Earners and Clerical Workers (CPI-W) (Fisher, 1992). In 1981, the Interagency Committee on Income and Wealth Distribution Statistics recommended (a) the elimination of distinctions between families headed by lone men or lone women, (b) the elimination of distinctions between farm and nonfarm families, and (c) an increase in detailed income amounts from seven to nine family members (Fisher, 1992).
Orshansky never intended her poverty index to serve as the official measure of poverty (Fisher, 1992); that notwithstanding, the administrative function of the OPM—as a social indicator and a derivative for public assistance eligibility—makes it the target of public, political, and scientific criticism. The major criticisms of the OPM include the exclusive reliance on food prices, even with the multiplier to incorporate other necessities; too low a multiplier; the exclusion of in-kind benefits and personal assets (e.g., savings) from determinations of income; the method to apply it year-to-year; and inattention to “life’s nonmonetary satisfactions” (Blank, 2008; Orshansky, 1969, p. 39;
US Census, 1982). Orshansky (1969) firmly but humbly responded to critiques of her poverty matrix: she acknowledged the need to incorporate shelter prices but cautioned against the inclusion of any held assets or valuation of in-kind public assistance programs (e.g., food stamps, housing assistance, or public health insurance). She warned that valuation of in-kind benefits is a Pandora’s box, since the nonpoor also receive public and private benefits, “including health insurance benefits, expense accounts, vacations, free tuition, and commodity discounts. Nonmoney income, like income tax benefits, would go mainly to the nonpoor” (p. 39).

**The Supplemental Poverty Measure.** The publication of Technical Paper 50 in 1982 documented attempts to expand the definition of income to include public assistance benefits. The US Census (1982) presented three methods to value public assistance benefits: (a) market value, (b) recipient or cash equivalent value, and (c) poverty budget share. The cash equivalent value method was deemed most realistic (US Census, 1982). The Census (1982) recommended three income calculation methods: “food and housing alone; food, housing, and medical care excluding institutional care benefits; and food, housing, and medical care including institutional care” (p. vi). The market value approach and broadest definition of income resulted in a 42 percent reduction in the poverty rate (from 11.1 percent to 6.4 percent) (US Census, 1982). The last report of these alternative poverty measures, before their replacement by the measure described next, resulted in an 18 percent reduction to the poverty rate in 2005 (from 12.6 percent to 10.3 percent) (US Census, 2007).
The Supplemental Poverty Measure (SPM) is the intellectual successor of the experimental poverty measures sparked by Technical Paper 50. The basis for the SPM was developed across two years by the National Academy of Sciences (NAS) Panel on Poverty and Family Assistance, with funding from the Administration for Children and Families and the Bureau of Labor Statistics (Citro & Michael, 1995). The NAS designed “…a type of relative measure…” calibrated to about 60 percent of median consumption in food, shelter, clothes, and utilities (Citro & Michael, 1995, p. 42). The final SPM was calibrated through interagency collaboration (Interagency Technical Working Group [ITWG] on Developing a Supplemental Poverty Measure, 2010) after the Obama administration allocated funds for its development, “…in order to improve an important measure of poverty” (OMB, 2011, p. 52).

The ITWG (2010) calibrations of the SPM followed recommendations from the NAS. For example, the NAS proposed that necessary incomes should result from consumption costs between the 30th-36th percentile (Citro & Michael, 1995), and the ITWG (2010) selected the 33rd because it was “…at the center of this range…” (p. 4). The ITWG (2010) chose to update the thresholds with a five-year average “…to reduce the risk that they might change significantly from year-to-year” (p. 8). The ITWG (2010) accepted the NAS definition of income, renamed “resources,” because its calculation includes adjustments for taxes, child support, medical-out-of-pocket (MOOP) expenses, and noncash public assistance benefits. The US Census (2011, 2012, 2013, 2014, 2015, 2016a) has yet to find a significant difference between SPM and OPM rates of poverty at traditional levels of significance ($p < 0.05$). Figure 2 is a display of the total US
population and the numbers of US citizens identified as poor by the OPM and SPM for 2010 through 2015. The restricted time window (five years) is due to the recency of the SPM.

**Figure 2.** The five-year prevalence (2010-2015) of poverty in the United States as measured by the Official Poverty Measure (OPM) and Supplemental Poverty Measure (SPM), numbers in the millions. Adapted from US Census (2011, 2012, 2013, 2014, 2015, 2016a).
Problem Statement

The OPM is fundamentally unchanged since 1969, and therefore, remains subject to relevant criticisms. The potential problem is it misclassifies families as nonpoor when material hardship is present (i.e., false-negative result) or as poor when material hardship is absent (i.e., false-positive result), not to mention the other potential problems of an inaccurate national poverty rate and a misunderstanding of the consumption limitations implied by the OPM. (The erroneous estimates of poverty and consumption limitations may be particularly stinging for people in areas with above average costs of living, as the OPM is geographically invariant [Citro & Michael, 1995]). The accuracy of the OPM could theoretically improve from inclusion of shelter prices (Orshansky, 1969), a mechanism to vary prices by geography (Citro & Michael, 1995), and/or a multiplier set to contemporary consumption patterns (Fendler & Orshansky, 1979). In 1982, the multiplier was too low by a third (Ward, 1985). The lack of these improvements undermines the validity claim that the OPM’s minimum necessary incomes represent an amount sufficient for “subsistence” (Fisher, 1992, p.13, footnote 13).

The SPM was designed to improve upon the OPM, but it has limitations that could negatively affect its classifications and predictions. One advancement was the inclusion of a mechanism to account for geographic variations in shelter payments by occupancy status (i.e., renter, owner with a mortgage, and owner without a mortgage) (US Census, 2015). That notwithstanding, the design of the SPM also brought with it the valuation of noncash public assistance benefits as cash income (US Census, 2015). Orshansky (1969) cautioned, “The full effect of incorporating these benefits into the
income distribution, if we were honest, might be to skew it even more than now” (p. 39).

Further, the inclusion of assets, like savings and credit, might similarly skew the income distribution and demand the conceptual question, is a person/family poor if he/she/they must reduce or deplete saved assets to subsist.

John Cogan, the only dissenting member of the NAS panel, warned that use of the SPM “…would fundamentally change the concept of poverty from an absolute standard to a relative standard” (Citro & Michael, 1995, p. 387). An absolute poverty measure is assumed to produce minimum incomes beneath which subsistence is unachievable, whereas a relative poverty measure is dependent on the overall distribution of necessary commodities (e.g., money or basic needs) and is analogous to inequality (Blackburn, 1990). Cogan expressed disappointment in the NAS panel recommendations, since he saw them as “…not based on scientific evidence alone, that they also involve the value judgements of panel members” (Citro & Michael, 1995, p. 388). Cogan believed:

…the report’s recommendations—to choose three particular commodities upon which to base the calculation of poverty and to exclude other commodities; to establish a normative range of values within which the poverty line should fall; to increase the poverty line over time to account for perceived improvements in the standard of living; and to exclude medical expenses from family resources—are the outcome of highly subjective judgements. (Citro & Michael, 1995, p. 390)

Cogan was also critical of the panel’s use of a decade’s old, unevaluated paper to justify its exclusion of public medical insurance (i.e., Medicaid and Medicare) and valuation of in-kind public assistance benefits (Citro & Michael, 1995).

One commentator described institutionalization of the OPM as, “an abortive effort,” and hoped open revisions would increase consensus among bureaucrats, academics, and the public (Innes De Neufville, 1975, p. 188). As discussed above, the
OPM is nearly identical to Orshansky’s (1965) original matrix, and the SPM was designed by a closed group of scientists, which produced an incomparable relative poverty measure. The institutionalization of a poverty measure need not “institutionalize poverty” (Innes De Neufville, 1975, p. 188), as some fear; it can instead, “…indicate a relationship between a and b, and that relationship is of interest to decision-makers” (Carly, 1981, p. 109, emphasis in original).

Uncertainty remains about the exact definition of and appropriate measure for poverty:

The conceptual obstacles to poverty measurement are also unresolved: Efforts have gone on for at least 75 [now at least 117] years to define and measure poverty. The real obstacle is clearly the conceptual one rather than the technical one. The very basic decision has not been made whether poverty is a level of material well-being, a relative condition, or a state of mind. (Innes De Neufville, 1975, p.121)

Townsend (1993) sought to overcome the conceptual pitfalls of poverty research with a unidimensional conception of poverty he viewed as a “…more comprehensive and rigorous social formulation of the meaning of poverty—that of relative deprivation” (p. 33, emphasis in original). However, complex concepts, like poverty, are more often multidimensional, and “Dimensions represent the different ways that phenomena can vary” (Perron & Gillespie, 2016, p. 15). Arbitrary distillation of concepts into a single dimension can lead to inadequate measurement and significant information loss (Perron & Gillespie, 2016).

The conceptualizations of poverty widely vary. Subsistence poverty is a lack of specific physical necessities (e.g., food, water, shelter), basic needs poverty is a low quality and/or insufficient quantity of both physical necessities and social infrastructure,
and social exclusion (poverty) is the type, quality, and extent of structural and experiential discrimination and oppression (Townsend, 1993). Therefore, it is crucial to specify which conceptual dimension(s) of poverty undergirds its measure. The subsistence poverty conceptualization undergirds both the OPM and the material hardship measure for this research, but the operationalization of poverty is distinct to each tool.

The OPM uses the income method to measure poverty, and therefore, it is a measure of potential for poverty, or alternatively, the ability to avoid the lack of physical necessities (Sen, 1976). The expectation, under the OPM, is that the probability of subsistence poverty is certain when a family’s income is beneath the poverty line (Orshansky, 1965).

The material hardship measure, on the other hand, uses the direct method of poverty measurement and consists of indicators for each physical necessity category—shelter, food, utilities, telephone, and medical and dental care (Health and Human Services [HHS], 2004). Both measures fail to assess for the quality of physical necessities or the presence of social exclusion.

**Study Significance**

This study was an important extension of prior investigations into the OPM’s effectiveness as a poverty measure. Previous researchers used ‘sensitivity’ in reference to experimental modifications of OPM components, like its multiplier or definition of income (e.g., Blackburn, 1998; Fendler & Orshansky, 1979; DeFina & Thanawala, 2001; US Census, 1982); however, these examinations lacked any attempt to relate changes to consumption. The method for this study was an exploratory application of statistics common in biomedical research, classification probabilities and predictive values, used to
quantify test efficacy and evaluate a test’s predictions. Results from the tests provided evidence of, not only, how well the OPM identifies and predicts hardship, but also, its effectiveness for high-risk demographic groups and degrees of labor-power.

This study was also significant due to the central role of the OPM in social assessments, social research, and social work practice. First, the dichotomous classifications of the OPM—poor or nonpoor—are important to investigate because they are a crucial economic social indicator in the aggregate. Second, researchers use the OPM poverty lines, or their percentage multiple (e.g., 150 percent), to investigate the association between poverty and myriad socially relevant outcomes. Third, social workers and others use the OPM poverty rate to support their arguments for fairness and advocacy for social resources. Inadequacies of the OPM threaten the integrity of our understanding about the prevalence of poverty, the consequences of poverty, and the need for interventions.

The OPM is also integral to the determination of income thresholds for public assistance eligibility (i.e., the means-test). These maximum incomes to qualify for assistance, referred to as the poverty guidelines, “…are a simplified version of the poverty thresholds that the Census Bureau uses to prepare its estimates of the number of individuals and families in poverty” (“Annual Update of the HHS Poverty Guidelines; Notice,” 2016, p. 3593, emphasis in original). The poverty guidelines are weighted averages of OPM minimum incomes within each set of family compositions and sizes. Therefore, the results of this research are generalizable to the HHS poverty guidelines.
and implicate the degree of error, either false-positives or false-negatives, in their classifications of families as in need of public assistance.

Research Questions

The two research questions for this study were complementary to its purposes. The first purpose of this study was to investigate the OPM’s classifications and predictions of material hardship. The research question to achieve this purpose was, *How well does the Official Poverty Measure classify and predict material hardship?* The classification and predictive probability statistics are common to investigations of diagnostic medical test accuracy and trustability, respectively (Pepe, 2003). Cross-classification and predictive values are comparable across measures (Pepe, 2003).

The second study purpose was to examine the association between sociodemographic group membership and measures of labor-power with OPM sensitivity to material hardship. The research question aligned to the second purpose was, *What is the association between sociodemographic and labor-power variables and Official Poverty Measure sensitivity to material hardship?* The goal was to quantify the odds a “true-positive” result from the OPM.

Operational Definitions

There were several concepts significant to this research and were understood with these definitions:

- Poverty is, “…the inability to satisfy minimum needs” (CEA, 1964, p. 62).
A direct poverty measure is one that, “…check[s] the set of people whose actual consumption baskets happen to leave some minimum need unsatisfied” (Sen, 1979, p. 290).

An absolute poverty measure, “…defines poverty as the inability of an individual’s [or family’s] income to meet [her, his, or their] subsistence needs…” (Blackburn, 1990, p. 55).

A relative poverty measure, “…defines poverty as a situation in which an individual’s [or family’s] income is low relative to some social standard, such as the average level of income for all individuals [or families]” (Blackburn, 1990, p. 55).

Income poverty thresholds, or frontiers, are the amount of annual income beneath which a person, family, or household is unable to purchase minimum needs and is considered poor (Anderson, 2010; CEA, 1964).

**Study Assumptions**

The assumptions of this research were that human poverty is multiconceptual, multidimensional, and best represented with fuzzy sets. Townsend (1992) delineated three conceptualizations for poverty (described above): subsistence, basic needs, and social. The methods to measure poverty are: (a) income, (b) direct, and (c) social. Each method is individually significant and yields valuable information, but they are interrelated for measurement purposes and in their compounded consequences for individuals, families, groups, and societies.
Multidimensional poverty can be simplified to a classic set with crisp boundaries wherein one is either poor or nonpoor or not subsistent or subsistent; however, such a dichotomy ignores the multiple conceptualizations and manifestations of poverty. The broader fuzzy set approach of Zadeh (1965) maintains the complexity and nuance of multidimensional poverty. Classic sets consist of mutually exclusive and exhaustive categories, like those of dichotomous or Likert-type responses (Zimmerman, 2001). These are a special case of fuzzy sets, with a membership function that is one or zero—within the category or outside it, respectively (Zadeh, 1965). A fuzzy set, on the other hand, is a quantification of vagueness or subjectivity through a membership function between one and zero (Zadeh, 1965; Zimmerman, 2001).

Smithson and Verkuilen (2006) described fuzzy set as “…designed to handle a particular kind of uncertainty—namely degree-vagueness—which results when we have a property that can be possessed by objects to varying degrees” (p. 6). They continued, “Many concepts in the social sciences contain essential vagueness in the sense that while we can define prototypical cases that fit the definition, it is not possible to provide crisp boundaries between sets. Consider poverty…” (p. 6). For example, under the subsistence conceptualization (i.e., poverty as lack of physical necessities) with a fuzzy set approach, the classification of poverty could be qualified by degree of intensity, like ‘low,’ ‘moderate,’ and ‘high.’ Such a fuzzy set is useful with any method of poverty measurement. Consider income, one possible fuzzy set classification for poverty is ‘low’ intensity between 100 and 75 percent of OPM, ‘moderate’ intensity between 74 and 50 percent, and ‘high’ intensity below 49 percent. These categories could be made ‘fuzzier’
with the addition of a membership function that includes non-income variables related to poverty intensity, like disability or education.

The fuzzy set intersection (Zadeh, 1965; Zimmerman, 2001) is inherent to calculations of classification probabilities and predictive values. If the OPM is assumed to be a ‘test’ for poverty and the material hardship measure a ‘true’ indicator of poverty, then a cross-tabulation of the two produces four possible results: poor and not subsistent, or true-positive; poor and subsistent, or false-positive; nonpoor and subsistent, or true-negative; and nonpoor and not subsistent, or false-negative. Poor and nonpoor refer to the result from the OPM, and subsistent and not subsistent refer to the result from the material hardship measure. The fewer people in the false-negative and false-positive groups, the greater the OPM’s sensitivity and specificity, respectively (Pepe, 2003).

**Overview of Chapters**

Chapter 1 is a review of the history of poverty measurement in the United States and central components of this study. Chapter 2 is dedicated to a presentation of Marx’s explanation for poverty, the application of ethical Marxism to the measurement of poverty, and the empirical literature on poverty measurement. Chapter 3 is a presentation of the method and limitations of this research. The results from analyses of sensitivity are detailed in Chapter 4. Chapter 5 is a discussion of implications from this research to social policy, future investigations of poverty measurement, and social work.
Chapter 2: Review of Theory and Literature

The empirical measurement of poverty is a scientific endeavor (Sen, 1979) contextualized by theories of ethics (Asselin & Dauphin, 2001) and explanations for human poverty. The measurement of poverty, like any construct, develops from theoretical explanations (Perron & Gillespie, 2015). This Chapter is devoted to a review of theories for poverty and ethics, particularly Marx’s political economy and ethical Marxism, and the empirical literature pertinent to poverty measurement.

Theories of Human Poverty

Theories of human poverty are myriad and originate from across the academy—anthropology, psychology, economics, political science, and sociology (Vu, 2010). It is possible to thematically organize these numerous theories for poverty. Blank (2003) suggested six such thematic categories: (a) underdeveloped markets, (b) individual constraints on market participation, (c) market dysfunction, (d) social and political oppression and discrimination, (e) individual choice, and (f) institutional antipoverty efforts. Blank (2003) reviewed the idiosyncratic public policy responses to each thematic category, including external capital investment, public insurance programs, strict regulation on capital, individual work requirements, and short-term public assistance.
Disagreement about the causal mechanism(s) of poverty produce fragmentation in societal responses, civil discourse, and academic efforts. A parsimonious explanation for contemporary human poverty could coalesce these divergent, and sometimes oppositional, energies toward consensus on sound empirical measurement and effective public policy interventions.

There are several reasons to prefer Karl Marx’s (1867) political economy as a theoretical context for poverty and its measurement over the alternative explanations. First, Marx (1867) parsimoniously explained the mechanisms of capitalistic production that relegate people into poverty. He offered a unified model of economic and social relations that explain poverty. However, contemporary social scientists explain poverty through reductionist theories that focus on individual components of those economic and social relations (e.g., Blank, 2003). Second, Marx (1867) noted the minimum standard for life in any society, at a specific time in history, is quantifiable—“One article [means of subsistence] must be bought or paid for daily, another weekly, another quarterly, and so on. But in whatever way the sum total of these outlays may be spread over the year, they must be covered by the average income, taking one day with another” (Marx, 1867, p. 121). Marx’s recommendation for poverty measurement would produce a comprehensive measure, described below, that includes prices for all subsistence and necessary commodities adjusted by rate of consumption. Third, Marx’s (1867) contention that subsistence is measureable conforms to the multidimensionality argument of this research: the measurement of human poverty consists of three independent, yet interrelated, dimensions—income, direct, and social. The parallels to these three
dimensions in Marx’s theory are money and prices, commodities, and exploitation (Marx, 1867).

**Marx’s Political Economy**

Marx (1867) undertook a full and thorough description of capitalistic production and how this mode of production dehumanizes and impoverishes persons. Marx (1867) recognized that human beings require certain objects to live and others to thrive. He labeled the former “natural wants” and the latter “necessary wants” (Marx, 1867). Both are historically and culturally situated, however, Marx (1867) proposed natural wants “…such as food, clothing, fuel, and housing, vary according to the climate and other physical conditions of [a] country” (p. 121). Necessary wants are more nebulous:

On the other hand, the number and extent of his so-called necessary wants, as also the modes of satisfying them, are themselves the product of historical development, and depend therefore to a great extent on the degree of civilisation of a country, more particularly on the conditions under which, and consequently on the habits and degree of comfort in which, the class of free labours has been formed. (Marx, 1867, p. 121)

It is crucial for persons to fulfill both types of wants, and they can be alternatively thought of as absolute and relative wants, respectively.

Marx (1867) stipulated the gratification of wants, natural or necessary, is dependent upon the means prescribed by a society. Societies wherein the primary mode of production is capitalistic will have commodities as first-order satisfiers of wants (Marx, 1867). A commodity is “…an object outside us, a thing that by its properties satisfies human wants of some sort or another” (Marx, 1867, p. 27). Commodities are of a dual form. A commodity in-use by its possessor is a means of subsistence (i.e., natural want) or enjoyment (i.e., necessary want); the possessor consumes the commodity’s use-
value (Marx, 1867). On the other hand, a commodity is truly that when it is of no use to its possessor and so is exchangeable; the commodity owner can seek its exchange-value (Marx, 1867). The universal equivalent commodity is money—it is exchangeable for any other commodity (Marx, 1867).

Marx (1867) assumed two circuits predominate the acquisition of money in societies with capitalistic production. The commodity → money → commodity, or C-M-C, circuit is representative of the prototypical laborer, one whose only option is to sell his or her labor-power to acquire money for means of subsistence or enjoyment. Marx (1867) defined labor-power as, “By labour-power or capacity for labour is to be understood the aggregate of those mental and physical capabilities existing in a human being, which he [or she] exercises whenever he [or she] produces a use-value [commodity] of any description” (p. 119). Labor-power is the potential of a person to work. Marx (1867) theorized the price for labor-power, given as wage, is a combination of costs for reproduction (i.e., subsistence) and production (i.e., education and training) of that specific form of labor-power. The money → commodity → money, or M-C-M, circuit is undertaken by the archetypal capitalist (Marx, 1867). The capitalist purchases means of production (e.g., raw materials, machinery, facilities) and contracts with laborers ready to sell (i.e., commodify) their labor-power. The application of labor-power to means of production results in a commodity with use-value that can exchange for money (Marx, 1867).

The M-C-M mode of capitalistic production theoretically operates without creation of poverty. Fairness in exchange (a central tenet of classical political economy)
ensures the money outlaid to produce the commodity equals that from its sale, including labor-power (Marx, 1867). Therefore, any poverty in a society with M-C-M capitalistic production theoretically corresponds to Blanks (2003) thematic categories: (a) underdeveloped markets, (b) individual constraints on market participation, (c) social and political oppression and discrimination, (d) individual choice, and/or (e) institutional antipoverty efforts (notice market dysfunction is absent this list because it is undone by fair exchange). Marx (1867) pointed out the M-C-M form of production offers little or no incentive for the capitalist—an equal quantity of money returns as was invested in production, the capitalist’s effort yields no monetary gain.

Marx (1867) argued, “…it is only in so far as the appropriation of ever more and more wealth in the abstract becomes the sole motive of his [or her] operation, that he [or she] functions as a capitalist…” (p. 107). This accumulation of wealth through capitalistic production is possible with the circuit M-C-M*, or money→commodity→money-prime (Marx, 1867). The change in money, represented by M*, is from realization of surplus-value (Marx, 1867). Surplus-value is the difference between a commodity’s value (its cost to produce) and its social price—the quantity of money-form exchanged for the commodity (Marx, 1867). Mechanisms of surplus-value allow the capitalist to produce commodities at a lower cost but sell them at, or below, their social price. For example, one capitalist enforces a “long” workday (a form of absolute surplus-value), which results in more production at a lower cost per unit because labor is paid a daily amount. The maximum monetization of this absolute surplus-value results from sale of the “cheaper” commodity at its social price (the cost other capitalists
incur to produce the commodity). The minimum monetization of this surplus-value, through sale of the commodity at its cost to produce (i.e., value), and therefore below its social price, intensifies competition among capitalists. The relentless hunt for surplus-value, a lower production cost, generates “coercive competition” between and among capitalists, which further amplifies the drive for surplus-value, and produces denigration for workers and the environment (Marx, 1867).

Surplus-value, like commodities, is of a dual form. The capitalist secures absolute surplus-value from payment of low wages and/or enforcement of long workhours (Marx, 1867). Both these strategies affect the ratio of necessary to surplus labor-time. Necessary labor-time, in this context, is the amount of productive labor-time that replaces the laborer’s wage; surplus labor-time is the contractually obligated time spent in production beyond that necessary to reproduce the laborer’s wage (Marx, 1867). The laborer ostensibly works for free during surplus labor-time. Absolute surplus-value has practical and legal limitations. Practically, the exertion of labor-power depletes a laborer’s physical and mental energies beneath the social average, which diminishes productivity and intensity (Marx, 1867). Legally, regulations on labor-time, labor price, and machinery “…curb the passions of capital for limitless draining of labour-power…” (Marx, 1867, p. 166).

Relative surplus-value, like its absolute counterpart, increases the ratio of surplus to necessary labor-time but through augmentation of the productivity and/or intensity of labor-power (Marx, 1867). Co-operation, division of labor, and machinery affect the productivity and intensity of labor-power to above the social average (Marx, 1867). Co-
operation in labor is, “When numerous labourers work together side by side, whether in one and the same process, or in different but connected processes…” (Marx, 1867, p. 229). Co-operation, as a lone strategy, increases the number of workers and expenditures on wage and reduces surplus-value, unless those wages are excessively low (Marx, 1867). Divisions of labor are purposeful, even empirical, fractures in the production process that simplify tasks (Marx, 1867). Marx (1867) explained:

It is clear that this direct dependence of the operations, and therefore of the labourers, on each other, compels each one of them to spend on his work no more than the necessary time, and thus a continuity, uniformity, regularity, order, and even intensity of labour, of quite a different kind, is begotten than is to be found in an independent handicraft or even in simple co-operation. (p. 241)

Finally, machinery is a potent source of surplus-value (Marx, 1867). Machinery consists of (a) motors to propel movement by some means (e.g., wind, steam, or electricity), (b) transmitting mechanisms to transfer the motor movement, and (c) implement or tool components (e.g., hammer, drill, or screwdriver) (Marx, 1867). The labor-power expended by “engineers” is directed toward exceeding the limit on the number of implement or tool components driven by machinery (Marx, 1867). Co-operation and division of labor among machinery is automation, “As soon as a machine executes, without man’s help, all the movements requisite to elaborate the raw materials, needing only attendance from him, we have an automatic system of machinery, and one that is susceptible of constant improvement in its details” (Marx, 1867, p. 265). The most efficient implementation of automation is the factory (Marx, 1867).

The single-minded chase after surplus-value, particular to capitalistic production, is the cause of poverty (Marx, 1867). First, the simplified tasks resultant from division of
labor (e.g., “carpentry” to simply “nailing”) and machinery (e.g., “assembly” to “machine attendance”) require more easily producible forms of labor-power, which are of lower price (Marx, 1867). A lower price for labor-power means a lower wage, and a lower wage means less money to purchase commodities that meet natural wants, like food and shelter. Further, a lower price for labor-power means the worker must labor longer to achieve the quantity of labor-time necessary to reproduce his or her labor-power (i.e., sustains his or her life). Necessary labor-time is positional: the laborer understands necessary labor-time as the time in production that yields a wage sufficient to purchase wants and the capitalist understands it as the time to reproduce a labor’s wage. Marx (1867) illuminates the conflict between workers’ acquisition of necessary labor-time and capitalists’ demand for surplus-value:

…[The working day] loses all meaning as soon as [it] ceases to contain a definite number of hours. The connection between paid and unpaid labour is destroyed. The capitalist can now wring from the labour a certain quantity of surplus labour without allowing him [or her] the labor-time necessary for his [or her] own subsistence [laborer’s necessary labor-time] (p. 385, emphasis added).

Second, the co-operation and division of labor among machinery, with automation its highest form, supplants human labor-power. Marx (1867) was clear, “As soon as the handling of [a] tool becomes the work of the machine, then, with the use-value, the exchange-value too, of the workman’s labour-power vanishes; the workman [or workwoman] becomes unsaleable, like paper money thrown out of currency by legal enactment” (pp. 288-289). The application of machine automation, as Harrington (1981) observed in the US a hundred years later, yields surplus-value for the capitalist and unemployment, poverty, and misery for the worker:
That portion of the working-class, thus by machinery rendered superfluous, ie, no longer immediately necessary for the self-expansion of capital, either goes to the wall in the unequal contest of the old handicrafts and manufactures with machinery, or else floods all the more easily accessible branches of industry, swamps the labor-market, and sinks the price of labor-power below its value. (Marx, 1867, p. 289)

Third, social prejudice, discrimination, and oppression artificially lower the price of labor-power for the specific groups victim to it. Marx (1867) focused on women and children as examples of this. Women confront the societal prejudice that their wage is secondary to family reproduction, which exacerbates the first reduction in labor-power price through task simplification (Marx, 1867). Youth also encounter this prejudice, plus a further premium on the price of their labor-power due to its simple production (Marx, 1867). The presence of families in the labor-market affects the price for men's labor-power as it, “…spreads the value of the man’s labour-power over [the] whole family. It thus depreciates his labour-power” (Marx, 1867, p. 272). Put another way, the reproduction component of men’s labor-power price proportionately declines as society expects other family members to participate in wage labor. The failure of men to join women in their liberation allows the capitalist to extract greater surplus-value from employment of family-heads than a single member (Marx, 1867).

Marx’s explanation for poverty provides a theoretical foundation for its measurement. Poverty, in a society with capitalistic production, manifests through wages and prices (i.e., income poverty), consumption of commodities (i.e., direct poverty), and social and political prejudice, discrimination, and oppression (i.e., social exclusion). Marx (1867) revealed numerous ethical dilemmas immanent in capitalistic production—the commodification/alienation of persons and their virtues, the simplification of labor-
power, the enforcement of surplus labor-time, the violence of primitive accumulation, and others—but was unable to interrogate those dilemmas within the confines of his political economy. The argument of this study is Marx’s political economy provides a theoretical explanation for poverty, a conceptualization of poverty, and a method to operationalize poverty.

**Ethical Marxism**

The moral framework for poverty measurement is from a combination of ethical theory and Marx’s political economy. “Ethical Marxism” was an attempt by Bill Martin to integrate Kant’s ethical theory and Marx’s political economy. Martin (2008), like Marx (1867), expressed skepticism that consequentialist ethical theories, particularly utilitarianism, were sufficient to resolve the ethical dilemmas of capitalistic production. Consequentialism is a broad term to describe those theories of ethics that establish morality from the consequences of actions (Peterson, 2003). The forms of utilitarianism, that an action is moral when it produces the most utility (good, happiness, etc.) for the most number, were unacceptable to Martin (2008) and Marx (1867) because they are susceptible to prioritization of majority interests.

A more contemporary ethical approach is Rawls’s contractarian theory, which straddles consequentialism and deontology. Rawls (1958) proposed moral institutions were possible if persons agreed to promote fairness and seek equality in role relations. However, Rawls (1958) permitted inequality when it “…will work out for everyone’s advantage…” (p. 165). Thus, his contractarian approach is susceptible to “just” inequalities (Gardner, 1975; Gordon, 1973), which like consequentialism could subjugate
individuals to majority needs. Further, it is possible some persons would be excluded from contract development or revision (Sen, 2009).

Martin (2008) nominated Kantian deontological ethics, the philosophical opposite of consequentialism, to guide ethical Marxism due to its focus on, “…doing what is right out of a regard for the other, for what can be understood as universal, and for the reason that it is right, and not for some other reason” (Martin, 2008, p. 45). Kant rejected moral philosophies based on adherence to God or maximization of happiness (Schneewind, 2002). He viewed utility maximization as a negation of reason, since the pursuit of satisfaction above all else is an instinctual inclination from nature (Kant, 2002). Instead, Kant (2002) proposed an action is moral when it arises from a good will and a maxim (or principle) that is an end in itself.

Kant presented a pure and a practical philosophy of morals. He claimed morals are sensible, intelligible concepts accessible to rational beings, like humans (Kant, 2002). Rational beings are capable of freedom from inclination—passions and natural desires felt as stimuli (Kant, 1996). When inclination fully determines action, Kant (1996) described it as “animal choice” (p. 13). Human (or rational) choice, on the other hand, is only predisposed to inclination instead of fully determined by it (Kant, 1996). “Freedom of choice is this independence from being determined by sensible impulses [inclination]…” (Kant, 1996, p. 13). The freedom from inclination affords rational beings choice in their actions, and the choice to deny immediate or vital inclination extends a rational being’s motives to duty to imperatives, or formulations of objective principles (Kant, 1996).
The rational being, with its freedom of choice, holds a central position in Kant’s metaphysics of morals:

Now I say that the human being, and in general every rational being, exists as end in itself, not merely as means to the discretionary use of this or that will, but in all its actions, those directed toward itself as well as those directed toward other rational beings, it must always at the same time be considered as an end (Kant, 2002, p. 45, emphasis in original).

Human beings, as rational beings, are ends in themselves with “…an absolute worth…only in [them] alone would lie the grounds of a possible categorical imperative, i.e., of a practical law” (Kant, 2002, p. 45). The forms of practical law are categorical imperatives, “…an action as objectively necessary for itself, without any reference to another end” (Kant, 2002, p. 31), and hypothetical imperatives, “…a possible action as a means to attain something which one wills (or which it is possible that one might will)” (Kant, 2002, p. 31). The choice to follow a hypothetical imperative is the expectation or hope it might yield reward or avoid pain. Morality, or ethical action, is the constraint of internal freedom in the service of (or duty to) categorical imperatives—those actions taken from their own necessity.

Kant suggested both pure and practical forms of the categorical imperative. The pure, universal formula of the categorical imperative is: “Act only in accordance with that maxim through which you can at the same time will that it become a universal law” (Kant, 2002, p. 37, emphasis in original). A maxim is an internal rule adopted by a rational being that “…gains moral content through its application from duty instead of inclination” (Kant, 2002, p. 14). The practical imperative to follow from the categorical imperative is: “Act so that you use humanity, as much in your own person as in the
person of every other, always at the same time as end and never merely as means” (Kant, 2002, p. 47, emphasis in original). The final formulation of the categorical imperative is an emphasis on freedom: “…namely the idea of the will of every rational being as a universal legislative will” (Kant, 2002, p. 50, emphasis in original). The irreplaceable presupposition of freedom means a rational being has always the choice to follow any maxim—moral or otherwise. Morality is, then, voluntary, yet the highest virtue of a rational being. The practical moral imperatives of perfection and benevolence are also choices, as are gratitude, sympathy, and respect (Kant, 1996).

An “ethical” Marxist Approach to Poverty Measurement

The application of ethical Marxism to poverty measurement preserves Marx’s theoretical explanation for poverty and satisfies the need for an ethical framework. It is possible to suggest several principles for poverty measurement from Kantian ethics in a Marxist context:

1. “The poor” are persons, rational beings of absolute worth.

   A person’s worth is immanent in his/her/their existence, and natural wants, like food and shelter, are essential to existence. Necessary wants, whatever they might be, are essential to participation in the society in which they develop, and are, therefore, essential to existence. Denial of natural and necessary wants is immoral.

2. An ethical absolute poverty line is a threshold at which persons become unable to free themselves from inclination.

   A person’s worth is independent of his/her/their economic condition, but a person’s economic condition affects his/her/their fulfillment of natural and necessary
wants. A person’s freedom from inclination is dependent on his/her/their satisfaction of natural and necessary wants. The inducement of inclination by economic insufficiency for natural and necessary wants limits freedom, is immoral, and is, therefore, the demarcation line for absolute measures of poverty.

3. An ethical relative poverty line is a threshold at which persons become unable to enact perfection and beneficence.

A person free from inclination, with the assurance of natural and necessary wants, will need for that which facilitates his/her/their perfection and benevolence. A person enacts perfection as a struggle toward his/her/their cultivation of reason; memory, imagination, and taste; and physicality (Kant, 1996). A person enacts benevolence with treatment of others’ ends as his/her/their own ends (Kant, 1996). Perfection requires holistic education (as an end in itself), time, attention (intimate and institutional), and nature. Benevolence requires the satisfaction of others’ natural and necessary wants and the needs that facilitate perfection.

The integration of Marx’s political economy with ethical theory satisfies a broad requirement that measures of social science constructs develop from relevant theoretical explanations (Perron & Gillespie, 2015) and a specific recommendation that ethics guide measures of poverty (Asselin & Dauphin, 2001). Marx (1867) suggested measures of poverty include commodities, or those material items, that sate natural wants (i.e., food, shelter, fuel, and clothes) and necessary wants (i.e., those items that facilitate full-participation in society).
The empirical implication of Marx’s theory is a recognition that measures of poverty are an operationalization of a multidimensional construct. The OPM and SIPP Adult Well-Being Module are examples of unidimensional poverty measures that respectively focus on income and prices (i.e., the income method) and possession of specific commodities (i.e., the direct method). The integration of these two measures is a possible, if crude, multidimensional measure of poverty.

The application of ethical theory contextualizes measures of poverty and guides the empirical work. Kantian ethics remind social scientists, politicians, and the public that “the poor” are persons and the poverty they experience limits their freedom of choice, their actualization of self, and their participation in society.

**Review of Human Poverty Measures**

The three methods to measure human poverty are income, direct, and social (Townsend, 1993; Sen, 1979). The determination of poverty through the income method is by comparison of available income to an estimation of the minimal income sufficient for minimum needs (Sen, 1979). The minimal income estimation is the poverty line \( Z \), and any income less than the poverty line \( y_i < Z \) indicates poverty. Aggregate poverty indices are statistical quantifications of all the people found poor. The determination of poverty through the direct method is “…to check the set of people whose actual consumption baskets happen to leave some minimum need unsatisfied” (Sen, 1979, p. 290). A person is poor when his or her consumption is below a benchmark of consumption (Land & Michalos, 2017). Finally, the determination of poverty through the social method is to identify those conditions that limit participation in a society, which
could include low income, inhumane employment, unequal access to institutions, and/or experience of institutional or normative discrimination and oppression (Blank, 2008).

For example, the United Nations (2010) defines social exclusion as, “…the involuntary exclusion of individuals and groups from society’s political, economic and societal processes, which prevents their full participation in the society in which they live” (p. 1).

The focus of this review is the income and direct method, but it is also important to define and outline the social method.

**Income Method**

The income method is “second best;” income is a proxy for actual consumption, and this method often includes normative assumptions about how units of analysis (i.e., individuals, families, or households) distribute or deploy income (Sen, 1979).

Application of the income method to develop a poverty measure (hereafter referred to as an income poverty measure) must include consideration of (a) the definition of income, (b) the determination of a poverty line, (c) the identification of reference-period and unit of analysis (and their effects on income and the poverty line), and (d) the specification of an aggregate poverty index (Blackburn, 1998; Blank, 2008; Corak, 2006). The OPM and SPM are income poverty measures with divergent methods for determination of income, poverty lines, and units of analysis.

**Definition of income.** The conceptualization of income is an identification of available money to purchase minimum needs (Blank, 2008). One possible conceptualization of income is money from employment or public insurance programs, like Social Security (Orshansky, 1965). This is the OPM definition of income (Blank,
2008). This conceptualization of income excludes (a) money from other sources (e.g., capital gains or odd jobs), (b) in-kind or voucher transfers from public assistance programs, and (c) tax liabilities or credits (Citro & Michael, 1995; Couch & Pirog, 2010). Estimates of US income poverty are statistically significantly lower (DeFina & Thanawala, 2001) or variable (Blackburn, 1998) when transfers and taxes are included in the definition of income. The SPM definition of income includes transfers from public assistance programs, tax deductions and credits, work expenses, out-of-pocket medical expenses, and paid child support (US Census, 2016a). However, the US Census (2016a) income poverty estimates from the OPM and SPM are not statistically significantly different at the $p < 0.05$ level.

The redefinition of noncash transfers from public assistance programs to simply cash for the calculation of income is controversial because it negates differences between in-kind or voucher benefits and actual money (Burkhauser, 2008; Orshansky, 1969). Even so, the justification for valuation of these benefits is (a) these benefits augment the income available for other purchases and (b) they represent a substantial portion of federal anti-poverty spending since the 1960s (Haveman, Blank, Moffitt, Smeeding, & Wallace, 2014). The US Census (1982 & 1985) experimented with three valuation methods for food, shelter, and medical benefits. First, the market value (MV) approach equates a benefit to its money value in the private market; for example, the valuation of no cost public housing residence is the equivalent private market rent (US Census, 1982). Second, the recipient value approach is the cash equivalent (RV-CE) for a benefit. For instance, a $100 Supplemental Nutrition Assistance Program (SNAP) voucher is $100 of
income (US Census, 1982). Third, the poverty budget share value (PBS) approach caps a
benefits monetary value at the proportion of the poverty line for that commodity. The
maximum PBS money value of a SNAP voucher is 33 percent of poverty, a voucher less
0.33 percent of poverty is the MV amount (US Census, 1982).

The US Census (2007) issued Technical Papers from 1984 to 2007, parallel to their annual publication on income poverty, with experimental income poverty statistics after valuation of public assistance benefits. The US Senate commissioned these reports to determine “…the effects of in-kind benefits. Without such information, Congress and the Executive Branch cannot be certain that Government transfer programs are properly targeted” (US Census, 1990, p. 137). The reports for years 1979 through 1987 were complementary comparisons between the official income poverty statistics and a set of experimental statistics. The Census implemented the three methods of public assistance valuation—market, recipient, and poverty budget value—for food, housing, and medical assistance. The Census excluded mention, in these Technical Papers, of statistically significant differences between the official statistics and any of the experimental ones. The Census (1990) further expanded the definition of income to include 15 variations, but only in reports for years 1989 to 1994, and in a retrospective report for years 1979 to 1991. The Census (1999) again shifted the experimental reports to pilot implementation of what would become the Supplemental Poverty Measure. The Census consistently referred to these Technical Papers, that cover more than two decades, as experimental and unofficial.
Supporters view the empirical challenges to the valuation of noncash public assistance as surmountable (e.g., Couch & Pirog, 2010), but detractors raise questions of its ethics and outcome (e.g., Orshansky, 1969). For instance, any valuation approach for public insurance programs, like Medicaid, will substantially increase income without a subsequent effect on money available for purchases; consequently, such a valuation would perversely reduce the number of people in poverty while these same people are unable to secure minimum needs (US Census, 1985). Orshansky (1969) pointed out citizens across the income spectrum receive noncash benefits, and “…the full effect of incorporating these benefits into the income distribution, if we were honest, might be to skew it even more than now…” (p. 39). Further, “It should also be remembered that in a money economy, housing, food, and medical care received free are not substitutes for things for which people must have cash” (Orshansky, 1969, p. 39).

**Determination of poverty line.** A poverty line, or threshold or frontier, is the demarcation, set by the “user,” at which an income is insufficient for the purchase of minimum needs (Foster, 1984; Sen, 1979). The exact number of minimum needs and how to estimate them are debates in the literature and lead to the pervasive claim that poverty lines are arbitrary (e.g., Atkinson, 1987; Citro & Michael, 1995; Orshansky, 1969). This disbelief in poverty line specificity justifies nebulous analytical techniques in major US poverty measures. For example, the use of a catch-all (i.e., “everything else”) by the Council of Economic Advisors to explicate minimum needs (Johnson, 1964), or Orshansky’s (1965) claim her measure includes food and “other necessities,” or
the application of a small multiplier by the NAS to account for “other needs” (Citro & Michael, 1995).

Marx (1867) rejected the assumption that minimum needs are unknowable and unquantifiable and that poverty lines are essentially arbitrary, “One article must be bought or paid for daily, another weekly, another quarterly, and so on. But in whatever way the sum total of these outlays may be spread over the year, they must be covered by the average income” (p. 121). Marx (1867) was confident that, “…in a given country, at a given period, the average quantity of the means of subsistence necessary for the labouror is practically known” (p. 121).

Setting aside the definitive identification of minimum needs, there are several poverty line paradigms, including absolute, relative, subjective, and probabilistic. The methods to develop each poverty line are specific to its type, as is its interpretation. An absolute poverty line “…defines poverty as the inability of an individual’s income to meet his [or her] subsistence needs…” (Blackburn, 1990, p. 55). An absolute poverty line, then, is a quantification of minimum needs complementary with income, like price. The portion of the OPM poverty thresholds for food is an estimate from the USDA economy food plan price index. The USDA food plans are an aggregation of food prices for items in the plan, and the economy plan (now the thrifty plan) was meant for “temporary use” (Orshansky, 1965). Marx (1867) recommended a cumulative absolute poverty line:

If the total of the commodities [natural and necessary wants] required daily for the production [subsistence] of labour-power = A, and those required weekly = B, and those required quarterly = C, and so on, the daily average of these commodities = (365A + 52B + 4C +&c) / 365. (p. 121)
The interpretation of an absolute poverty line is that incomes beneath the line are quantitatively insufficient to purchase minimum needs.

A relative poverty line “…defines poverty as a situation in which an individual’s income is low relative to some social standard, such as the average level of income for all individuals” (Blackburn, 1990, p. 55). Relative poverty lines depend on the overall distribution, and the poverty line is set to a proportion of the distribution (Anderson, 2010). For example, in the European Union (EU), persons in families with incomes less than 60 percent of a country’s median income are at-risk for poverty (Couch & Pirog, 2010), and the SPM poverty line is household spending on food, clothes, shelter, and utilities at the 33rd percentile (ITWG, 2010). It is important to note relative poverty lines mirror changes in the distribution; a relative poverty line for an income distribution with a $50,000 median is higher than that for a distribution with a $45,000 median.

A subjective poverty line is set to citizens’ qualitative assessment of the income sufficient to purchase minimum needs (Zheng, 2001). For example, Gallop polls in the United States asked respondents the amount of income sufficient to meet needs in their community; results from their subjective poverty line are nearly identical to 50 percent of mean income from 1957 to 1993 (Blank, 2008).

A probabilistic poverty line is a statistical derivation through application of theoretical distributions (Anderson, Pittau, & Zelli, 2014). For example, Chattopadhyay and Mallick (2007) suggested application of the Pareto distribution, a measure of inequality in the same class as Lorenz (used to calculate the GINI coefficient), to determine the poverty line. They proposed the inflection point (or dip) of the Pareto
distribution relative to income variance in the sample is a poverty line. Chattopadhyay and Mallick (2007) recommended the Pareto distribution over the lognormal distribution of income, a popular strategy in studies of income and regression analyses with income (Bresson, 2009; Gujarati, 2011).

**Identification of reference-period and unit.** The reference-period and unit of analysis for an income poverty measure are the spans across which income and minimum needs are spread. The reference-period for many income poverty measures is annual, however, it is possible to atomize it to month, week, or day. Debel and Vandecasteele (2008) recognized any measurement reference-period implies a time lag, since collection of data on income is retrospective. Their “change-adjusted income method” adjusts a unit’s income estimate for changes in membership over time (Debel & Vandecasteele, 2008). For example, the estimate of income for a unit with two persons, one a member for 12 months and one a member for six, would include all the income of the first and only a portion of income from the second.

The unit of analysis for income poverty measures is the configuration of persons that share income and minimum needs. Families or households are the “natural units” for income poverty measures (Sen, 1979). The unit of analysis for the OPM and SPM is families and households, respectively (Orshansky, 1965; Citro & Michael, 1995). Unit of analysis affects income poverty thresholds through equivalence scales—a technique to quantify economies of scale. Economy of scale is the normative assumption that families or households with more members purchase bulk items (Citro & Michael, 1995). Equivalence scales are mathematical functions that estimate relative consumption within
and across units (Atkinson, 1992). For example, the SPM equivalence scale for adults is 1.0 and for children is 0.8 or 0.5 dependent on household configuration; these scales are exponential at either 0.5 or 0.7, again dependent on household configuration (US Census, 2016a). On the other hand, the OPM equivalence scale is a combination of the USDA food plan scale and a 3.0 multiplier (Blank, 2008). The result of equivalence scale misspecification is underestimation of unit economy of scale and overestimation of poverty thresholds or overestimation of unit economy of scale and underestimation of poverty thresholds (Atkinson, 1992). That is, an inaccurate equivalence scale would assume too much or too little relative consumption within and across units and cause poverty thresholds to be too low or too high, respectively.

**Specification of aggregate index.** Aggregate statistical indices are quantifications of data after application of an income poverty line. Their results answer important questions, like what proportion of a population is poor, how poor are they, and how unequal is their poverty? The headcount ratio \( H \) is a simple index of total poor over total population (Sen, 1976). The headcount ratio is the single official statistic from both the OPM and SPM. The aggregate poverty gap \( I \) is the sum of every unit’s income-poverty deficit, or the amount of income that would put the unit at the poverty line (Orshansky, 1969); the average poverty gap is the sum of every unit’s income-poverty deficit over the total number of units in poverty (Sen, 1976). The headcount ratio is a measure of poverty prevalence, and the aggregate poverty gap is a measure of poverty intensity (Sen, 1976). The \( H \) and \( I \) aggregate indices are, therefore, appropriate
to respectively answer questions about the number of units in poverty (i.e., prevalence) and the depth of that poverty (i.e., intensity).

Sen (1976) fundamentally altered statistical indices of income poverty with his recommendation they quantify: Incidence, Intensity, and Inequality. The headcount ratio and poverty gap are quantification of poverty incidence and intensity, respectively, but neither produce the information of the other or information about inequality. Atkinson (1987) viewed Sen’s recommendation as pertinent to studies of inequality not poverty, but nevertheless, researchers continue to propose statistical axioms and indices that improve the information about poverty. Sen (1976) proposed a poverty index should increase if a person in poverty loses income (the monotonicity axiom) or if a person in poverty transfers income to someone richer (the transfer axiom). Sen’s (1976) ordinal index is a weighted aggregate poverty gap that fulfills the monotonicity and transfer axioms.

Kakwani (1980) proposed sensitive monotonicity and transfer axioms to increase the sensitivity of poverty indices to changes at low ranks in the distribution. These axioms require an index increase when a person low in the income distribution loses or transfers income. Foster, Greer, and Thorbecke (1984) extended the axioms of Sen (1979) and Kakwani (1980) to include decomposability, or the requirement that a poverty index estimate aggregate and subgroup poverty statistics. Their $P_a$ poverty index meets the prior five axioms (plus a focus axiom); yields $H, I,$ and $I^2$; and is robust to normal data contamination (Bresson, 2009; Cowell & Victoria-Feser, 1996; Foster, Greer, & Thorbecke, 1984).
The information from the Sen, Kakwani, and Foster-Greer-Thorbecke poverty indices augments that from $H$ and $I$, with important consequences for evaluations of social policy and social morality. Atkinson (1987) suggested the sophistication of these poverty indices results in four approaches toward poverty: (a) only inequality matters, (b) poverty elimination is primary for effective liberty and inequality is secondary for fairness, (c) only poverty matters, and (d) the poverty gap matters and then unequal distribution. Alternatively, Bourguignon and Fields (1997) expected application of $P_a$ would allow policy-makers to focus anti-poverty programs on the poorest-poor (p-type), richest-poor (r-type), or all poor (mixed-type).

**Direct Method**

The direct method is “superior” to the income method in the identification of persons with insufficient consumption of minimum needs (Sen, 1979). Income poverty measures assess one dimension of a person’s ability to satisfy minimum needs, while the direct method measures actual consumption (Sen, 1979). Direct poverty measures share limitations of income measures, including debate over minimum needs, consideration of personal preference, and proper aggregation of indicators (Beverly, 2001). There are examples in the literature of innovative responses to these limitations. Saunders & Naidoo (2009) asked respondents to specify which minimum needs are essential to subjectively determine minimum needs. Also, they test the subjective determination and prevalence of minimum needs to suggest an aggregation method for indicators (Saunders & Naidoo, 2009). Hick (2014) included an item response to assess if lack of consumption was a personal preference or was enforced from without (e.g.,
unaffordability). Finally, Babones, Moussa, and Suter (2016) tested the application of the Poisson statistical distribution—the distribution for count variables—to set direct poverty thresholds.

The variable of interest for direct poverty measures in the United States is material hardship—the inadequate consumption of specific minimum needs. Mayer and Jencks (1988) were the first to survey a US sample about material hardship. They identified minimum needs as those commodities for which there exists a public assistance program (Mayer & Jencks, 1988). Mayer and Jencks (1988) assumed the presence of such programs was a proxy for social agreement on a set of minimum needs. Their subsequent direct poverty indicators were food unaffordability, shelter nonpayment, utilities disconnection, and medical and dental care need (Mayer & Jencks, 1988). The survey instrument Mayer and Jencks (1988) created is the basis for other similar measures. For example, the Women’s Employment Study in Michigan included those indicators from Mayer and Jencks (1988), plus inadequate winter clothes (Heflin, 2006), and the Fragile Families and Child Wellbeing Study also included indicators from Mayer and Jencks.

There is no annual, nationally representative survey of material hardship in the United States (Beverly, 2001). However, the US Census collects material hardship data through its Survey of Income and Program Participation (SIPP). The SIPP is nationally representative sample of noninstitutionalized US citizens and military veterans in private residences. The SIPP Adult Well-Being Topical Module includes the Basic Needs & Food Insecurity measure of material hardship, and its indicators include unmet essential
need, shelter nonpayment and eviction, food insufficiency and hunger, utility
nonpayment and disconnection, telephone disconnection, and medical and dental care
need (US Department of Health and Human Services [HHS], 2004). The psychometrics
of this module are uncertain (HHS, 2004); that notwithstanding, researchers report
significant associations between material hardship and income and employment, family
configuration, and health insurance (Baker & Mutchler, 2010; Bauman, 2002; Beverly,
2001b; Heflin, 2014; Lovell & Oh, 2005)

Townsend’s (1993) relative deprivation is an alternative to the material hardship
concept for direct poverty measures. His formal conceptual definition is:

People are relatively deprived if they cannot obtain, at all or sufficiently, the
conditions of life, that is, the diets, amenities, standards and services, which allow
them to play the roles, participate in the relationships and follow the customs
which are expected of them by virtue of their memberships of society.
(Townsend, 1993, p. 37)

Townsend’s relative deprivation measure consists of nine dichotomous items: an annual
holiday, replacement furniture, home insurance, home décor, ability to host guests, new
clothes, inclusion of meats in meals, all-weather shoes, and heat for shelter (Hick, 2014).
Townsend (1993) progressed the direct measurement of poverty through recognition of
the social dimension but explicitly intends his measure be unidimensional.

Social Method

The social method of poverty measurement (or social exclusion) is a focus on
exclusionary societal institutions and norms. Social exclusion is the systematic or
normative denial of participation in a society’s civil, political, cultural, and/or economic
activities (Chakravarty & D’Ambrosio, 2006; Devicienti & Poggi, 2011). Social
exclusion is a multidimensional concept, and operationalizations of it should include comprehensive (i.e., process) and culmination (i.e., \textit{prima facie}) outcomes (Sen, 2009). The application of multiple indicators to social exclusion measurement varies from aggregation of population-level data on income poverty, material deprivation, employment, and education (Giambona & Vassallo, 2014) to summation of direct method indicators of basic needs fulfillment, quality of life, shelter adequacy, social relationships, health, and environment (Devicienti & Poggi, 2011). Unfortunately, neither of those social exclusion operationalizations include indicators of comprehensive outcomes, like intensity of discriminatory experiences or presence of discriminatory laws, rules, or practices.

**Unidimensional Versus Multidimensional Poverty Measurement**

The unidimensional measurement of human poverty involves numerous choices. The first choice is method. Unidimensional poverty measures are income, direct, or social. The income method choices are (a) definition of income, (b) determination of poverty line, (c) identification of reference-period and unit of analysis, and (d) application of aggregate index. The OPM income poverty measure components are: (a) income from employment or public insurance, (b) a poverty line of 3.0 times a minimum diet, (c) annual reference-period and family unit of analysis, and (d) the headcount ratio aggregate index (Orshansky, 1965). The direct method choices are of minimum needs, reference-period and unit of analysis, and indicator aggregation. The Basic Needs & Food insecurity measure on the SIPP Adult Well-Being topical module includes ten minimum needs indicators, across the calendar year (except food insecurity indicators).
for households, with no guidance on aggregation (HHS, 2004). Choices for the social method, like the direct, are of those indicators that represent exclusion from a society’s civil, political, cultural, and/or economic activities; the reference-period and unit; and indicator aggregation.

The multidimensional measurement of poverty, for instance, a simultaneous application of income, direct, and social methods, is a comprehensive alternative to unidimensional poverty measures. Unidimensional poverty measures underestimate the concomitant consequence of human poverty. For example, an income poverty measure alone is unable to identify persons with “subsistence” incomes who nonetheless experience material deprivation and/or exclusion from their society. Income poverty measures are crucial to gauge a person’s ability to sate minimum needs or to describe a society’s distributional fairness (i.e., degree of inequality), but the inattention to informational limitations of single measures misguides conclusions about social relations and interventions (Blank, 2008).

The next Chapter is a description of the method for this study. It includes presentation of the sampling procedure; data collection; the study instrumentation, with report of significant empirical findings from previous studies; and the analysis plan.
Chapter 3: Study Method

The goal for this Chapter is to present the method of this study. The measures under investigation in this research are unidimensional, either income or direct; however, their joint application in this research is an example of how they might operate as a multidimensional poverty measure. A multidimensional poverty measure is one that includes multiple methods to measure human poverty (e.g., Hick, 2014; Sen, 1979; Zheng, 1997).

Method

This study was a secondary analysis of income and material hardship data collected between January and June 2010 for the 2008 panel of the SIPP. The SIPP is a nationally representative, longitudinal panel survey of households in the United States (US Census, n. d.).

The purpose of this study was to investigate the sensitivity of the Official Poverty Measure to material hardship. Material hardship, or direct poverty, was conceptualized as the “true” poverty status and the OPM as a “test” for poverty (see Sen, 1979). Sensitivity and specificity (i.e., classification probabilities) and predictive values, positive and negative, are statistical evaluations of binary tests (Pepe, 2003). It is possible to
extend the evaluative information from classification probabilities through regression analysis. Multivariable regression analysis, with logit link function, estimates the association between relevant predictor variables and test sensitivity (Pepe, 2003). The relevant variables in this research are those sociodemographic and labor-power variables associated with increased risk for income poverty.

What follows is a description of the method used to address the two study purposes. The two research questions for this study are:

1. How well does the Official Poverty Measure classify and predict material hardship?

2. What is the association between sociodemographic and labor-power variables and Official Poverty Measure sensitivity to material hardship?

The assumption of these research questions was that the OPM is a “test” for poverty and material hardship measures (i.e., direct method measures) are “true” determinations of poverty (Sen, 1979). The intersection of these sets allows for calculation of classification probabilities (sensitivity and specificity) and predictive values to address research question one. Figure 3 is an example intersection, or cross-tabulation, of “test” and “true” indicators and the possible results.
The purpose of research question two was to investigate the poverty risk variables associated with the OPM sensitivity to material hardship. The “poverty risk variables” (described below) are sociodemographic and labor-power variables associated with OPM income poverty. The operationalization of labor-power in educational achievement and employment status is consistent with Marx’s (1867) description in Capital. Williams (2011) described education as, “…evidence of an enhancement of [students’] labor power when they eventually come to sell their labor on the market to a future producer” (p. 286). Schatzkin (1978) extended labor-power beyond education and skills to include health. A logistic regression of poverty risk variables on OPM sensitivity is one method to respond to research question two (Pepe, 2003).

**Study Sample**

The sample for this study was “lone families” with at least one adult head. The US Census (2014) defines a family as two or more persons related by birth, marriage, or adoption who live together, and lone families consist of single or married adults, with or
without children, who are the sole occupants of their households. The sample restriction
to families that live alone in their household was necessary to reconcile the different units
of analysis for the OPM (i.e., family) and the Basic Needs & Food Insecurity measure
(i.e., household) (HHS, 2004; US Census, 2016b). The demographic characteristics of
the families included in this study are in the next Chapter. What follows is a description
of the SIPP sampling procedure and the process of data preparation for this study, along
with description of study measures, variables, and the statistical analyses.

The US Census sample selection procedure for the SIPP is complex and
oversamples from persons with low incomes (US Census, n. d.). Step one is the
identification of primary sample units (PSU). Step two is selection of residential
addresses within the PSUs. A PSU is a single county, independent city, or a collection of
adjacent counties (US Census, n. d.). Residential address units within PSUs are from five
mutually-exclusive sample frames: unit, area, group quarters, housing unit coverage, a
coverage improvement frame, and new-construction (US Census, n. d.). The unit frame
is a list of residential addresses with 96 percent or greater complete information; the area
frame is the inverse, with four percent or more addresses incomplete; the group quarters
frame is boarding houses, hotel rooms, and institutions (US Census, n. d.). The largest
proportion of the SIPP sample is from the unit, area, and group quarters frames (nearly 90
percent), with small proportions from the improvement and new-construction frames (US
Census, n. d.). The PSUs are collapsed into 114 variance strata for variance estimation.

Sample attrition. The SIPP sample simultaneously grows and shrinks from
wave-to-wave because of its panel design. The sample grows when a member of an

53
interview eligible household leaves to form a new household with new members (i.e., spouse, child, and/or blood relative). On the other hand, the sample shrinks when (a) the interviewer is unable to contact the household after repeated visits, (b) all household members are away from home for the full interview period, (c) household members decline further participation, (d) the interviewer is unable to reach the household due to impassable conditions, or (e) the household experiences serious illness or death. These are Type A household nonresponse; whereas, Type D household nonresponse occurs when household members move to an unknown or uninterviewable address. The Census addresses household nonresponse through sample weights that replicate the characteristics of the original sample. The sample loss for wave six was 33.3 percent, even with a four percent growth in the sample (US Census, 2016c).

Data Collection

The SIPP is a longitudinal panel survey. Each panel is a new sample of persons (US Census, n. d.). These persons are followed for the duration of the study. For example, the 2008 panel started in September 2008 and ended December 2012. US Census representatives use computer assisted interviewing (CAI) to conduct telephone interviews every four months. Each interview is a wave and consists of a core and topical questionnaire. The reference-period for the core questionnaire is the previous four months, and respondents provide data for each month of the reference-period. The reference-period for the topical questionnaires depends on its content. The 2008 panel includes 13 waves. Data for this study are from wave six when participants respond to the Basic Needs & Food Insecurity measure.
**Data imputation.** The US Census (n. d.) implements hot deck imputation to manage item nonresponse. Hot deck imputation is a method common to survey research that preserves statistical estimates (Myers, 2011). The hot deck procedure matches respondents on variables thought to cause an item nonresponse and copies the complete item response to replace the nonresponse (Brick & Kalton, 1996). The SIPP hot deck imputation process is the same for items on topical modules as it is for items on the core questionnaire (US Census, n. d.). For current wave imputation, the deck variables are sex, race, age, marital status, disability status, and presence of own children (US Census, n. d.) The amount of data imputation done by the US Census for the variables in this research is less than ten percent.

**Study Measures**

The two measures for this study are the OPM and the Basic Needs & Food Insecurity measures. The OPM is the US Census statistical poverty measure developed in 1965 by Mollie Orshansky, described previously in Chapter 1. The Basic Needs & Food Insecurity measure is a component of the SIPP Adult Well-Being topical module. The US Census developed this measure to examine material hardship.

**Official Poverty Measure.** The OPM is the official income poverty measure of the United States (US Census, 2016b). It was developed in 1965 and was institutionalized in 1969, and the US Census Bureau is responsible for annual estimations of the United States’ official poverty statistics (Fisher, 1992). The definition of income for the OPM is cash receipts from employment and/or public insurance programs, like Social Security (Orshansky, 1965). The OPM poverty thresholds are absolute, and an
income beneath the threshold is insufficient to purchase food and other necessities (Orshansky, 1965). The OPM poverty thresholds are an index of food price from the USDA economy food plan multiplied by 3.0 to account for other necessities (Orshansky, 1969). The OPM reference-period is annual and the unit of analysis is families (Orshansky, 1965). A family is persons related by blood or legal process (e.g., marriage).

The US Census only reports the headcount ratio aggregate statistical index.

**Poverty risk variables.** Some groups in the US experience OPM income poverty in consistently higher proportions than the general population. The proportion of children and adolescents in poverty is consistently high (e.g., Corak, 2006). For example, in the reference-period for this study (i.e., 2010), 21.5 percent of persons under 18 years old, in families, were poor, compared to 13.2 percent of all families (US Census, 2011). Persons of “minority” racial and ethnic groups experience income poverty in different, but high, proportions (e.g., Haveman et al., 2014). The proportion of families in poverty that identify as Black was 26 percent and that identify as Hispanic was 25.6 percent for 2010 (US Census, 2011). These families respectively constituted about 12.5 and 17.5 percent of families in the United States for 2010 (US Census, 2011).

Additionally, lone-parent families are at greater risk of income poverty (e.g., Bauman, 2002) and experience poverty in larger proportions than two-parent families. The proportion of lone-woman headed families in poverty was 31.6 percent, and among lone-man headed families, it was 15.8 percent in 2010 (US Census, 2011). Family size positively correlates with OPM income poverty status (e.g., Schiller, 2008). Persons with less than a high school education or who are unemployed experience income poverty in
larger than average proportions (e.g., Blackburn, 1998; Schiller, 2008). Finally, persons with a disability or veteran status experience higher than average proportions of poverty (e.g., Brucker, Mitra, Chaitoo, & Mauro, 2015; Heflin, Wilmoth, & London, 2012).

These patterns remain observable in the most current data from the US Census. Nearly one-in-five (19.2 percent) persons under 18 years old, in families, was income poor in 2015 (US Census, 2016b). The proportion of families in poverty that identify as Black was 22.2 percent and that identify as Hispanic was 20.4 percent (US Census, 2015). Finally, there was nearly twice the proportion of lone-woman headed families in poverty (28.2 percent) as lone-man headed families (14.9 percent) in 2015 (US Census, 2016b).

**Basic Needs & Food Insecurity measure.** The Basic Needs & Food Insecurity measure is one instrument from the SIPP Adult Well-Being topical module (HHS, 2004). The SIPP Interagency Working Group developed the foundation for the module, and the Census finalized it (HHS, 2004). The instrument includes ten measures of material hardship: unmet essential need, rent/mortgage nonpayment, eviction, utility (gas/oil/electric) nonpayment, utility disconnection, telephone disconnection, medical/hospital unmet need, dental unmet need, food insecurity, and food insecurity with hunger (HHS, 2004). Table 1 lists items from the Basic Needs & Food Insecurity measure. The reference-period for most items is the previous 12 months; however, the reference-period for items about food consumption is the previous four months (HHS, 2004).
<table>
<thead>
<tr>
<th>Material hardship indicator</th>
<th>Question text</th>
<th>Question attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rent/mortgage nonpayment</td>
<td>Was there any time in the past 12 months when (you/your household) did not pay the full amount of the rent or mortgage?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
<tr>
<td>Eviction</td>
<td>Was there any time in the past 12 months when … were evicted from your home or apartment for not paying the rent or mortgage?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
<tr>
<td>Utility nonpayment</td>
<td>How about not paying the full amount of the gas, oil, or electricity bills? Was there a time in the past 12 months when that happened to …?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
<tr>
<td>Utility disconnection</td>
<td>In the past 12 months did the gas or electric company turn off service, or the oil company not deliver oil?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
<tr>
<td>Telephone disconnection</td>
<td>How about the telephone company disconnecting service because payments were not made? Was there a time in the past 12 months when that happened to …?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
<tr>
<td>Medical or hospital unmet need</td>
<td>In the past 12 months was there a time (you/anyone in your household) needed to see a doctor or go to the hospital but did not go?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
<tr>
<td>Dental unmet need</td>
<td>In the past 12 months was there a time (you/anyone in your household) needed to see a dentist did not go?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
<tr>
<td>Sufficient food</td>
<td>Getting enough food can also be a problem for some people. Which of these statements best describes the food eaten in your household in the last four months:</td>
<td>1. Enough of the kinds of food we want</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Enough but not always the kinds of food we want to eat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Sometimes not enough to eat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Often not enough to eat</td>
</tr>
<tr>
<td>Food and money exhausted</td>
<td>“The food that (I/we) bought just didn’t last and (I/we) didn’t have money to get more.” Was that often, sometimes, or never true for … in the last four months?</td>
<td>1. Often true</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Sometimes true</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Never true</td>
</tr>
<tr>
<td>No balance in meals</td>
<td>“(I/We) couldn’t afford to eat balanced meals.” Was that often, sometimes, or never true for … in the last four months?</td>
<td>1. Often true</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Sometimes true</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Never true</td>
</tr>
<tr>
<td>Insufficient food for children</td>
<td>“(My child was/Our child was/The children were) not eating enough because (I/we) couldn’t afford enough food.” Was that often, sometimes or never true for … in the last four months?</td>
<td>1. Often true</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Sometimes true</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Never true</td>
</tr>
<tr>
<td>Adult cut or skip meals</td>
<td>In the past four months did you or the other adults in the household ever cut the size of your meals or skip meals because there wasn’t enough money for food?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
<tr>
<td>Adult ate less</td>
<td>In the past four months did you or the other adults in the household ever eat less than you felt you should because there wasn’t enough money to buy food?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
<tr>
<td>Adult full day without food</td>
<td>In the past four months did you or the other adults in the household ever not eat for a whole day because there wasn’t enough money for food?</td>
<td>1. Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No</td>
</tr>
</tbody>
</table>
Data Preparation

File linkage. The SIPP public-use files are available for download from the US Census website (http://www.census.gov). Data files for the core and topical questionnaires are separate, and the Census recommends use of variables common to each to match participant core and topical responses. The core and topical questionnaires for wave six were combined with the sample unit identifier (variable: SSUID).

The core file contains data from each respondent for each month (352,469 logical records), and the topical file contains data from each respondent for a single month (US Census, 2008). The data for this study were from the month of the topical questionnaire interview. The other three months of the core questionnaire reference period were superfluous. The “split into files” tool in SPSS was used to create a separate dataset limited to the 88,164 logical records from the merged core/topical file. A new dichotomous variable that indicated the presence or absence of material hardship data was created to split the merged core/topical file.

The complex sample and oversample of persons with low incomes require identification of strata and appropriate statistical weight (US Census, 2008). The sample is stratified by state, and each respondent is assigned the appropriate Federal Information Processing Standard (FIPS) state code (variable: TFIPSST) (US Census, n. d.). The US Census (n. d.) recommends use of sample weights (variable: WFFINWGT) to account for the oversample of person with low incomes and sample loss. The complex sample tool of the Statistical Package for the Social Sciences (SPSS) statistical software was utilized to produce sample estimates and run statistical models.
**Case selection.** A case selection filter code was written to restrict the sample to lone families. Respondents receive a person number (variable: EPPNUM), and the family receives the person number of the primary reference person (variable: EFREFPER). When these variables are set equal, the primary reference person for each family is active. Each family receives a type code (variable: EFTYPE), and each household receives a count of families and pseudo families (variable: RHNF) and a count of related subfamilies within the household (variable: RHNF). The subsequent filter code is EFTYPE set equal to one (“primary family”), RHNF set equal to one, and RHNSF set equal to zero. This filter selects data from primary families with zero related subfamilies in the home.

**Study variables.** The “test variables” for the first research question—*How well does the Official Poverty Measure classify and predict material hardship?*—were OPM poverty status and material hardship indicators from the SIPP Basic Needs & Food Insecurity measure. The assumption that OPM poverty status represents a “test” of poverty and material hardship indicators represent a family’s “true” poverty status followed Sen’s (1979) description of income and direct methods for poverty measurement.

The predictor variables for the second research question—*What is the association between sociodemographic and labor-power variables and Official Poverty Measure sensitivity to material hardship?*—were those sociodemographic and labor-power variables predictive of OPM poverty status (i.e., poverty risk variables). These variables were described above as coming from empirical research on the OPM and included race...
and ethnicity, lone parenthood, number of own children in family, less than high school education, unemployment, physical or mental disability, and veteran status.

The outcome variable for the second research question was a family’s classification outcome, specifically true-positive or false-negative. A true-positive occurs when the “test” indicator (i.e., OPM poverty status) and “true” poverty indicator (i.e., material hardship) are both positive, and a false-negative occurs when the “test” indicator is negative but the “true” indicator is positive (Pepe, 2003).

**Test and regressor variables.** Data for test and regressor variables were from the SIPP 2008 panel at wave six. The material hardship and OPM poverty status were necessary to answer research question one. The income poverty risk variables were essential for research question two. Variable measurement level and US Census label follow description of each variable in parentheses.

**Material hardship.** The ten material hardship variables were from the Basic Needs & Food Insecurity measure of the SIPP Adult Well-Being topical module. Eight of the material hardship variables were nominal with a yes/no dichotomous response option, but four food consumption items were ordinal with response options to indicate intensity. The material hardship variables are sequential in the instrument but are not rank ordered: unmet essential need (nominal variable: EABMEET), rent/mortgage nonpayment (nominal variable: EABRENT), eviction (nominal variable: EABEVCT), utility nonpayment (nominal variable: EABGAS), utility disconnection (nominal variable: EABCUT), telephone disconnection (nominal variable: EABPHON), medical or hospital need unmet (nominal variable: EABDOCT), dental need unmet (nominal
variable: EABDENT), sufficiency of food (ordinal variable: EAFOOD1), food and money exhausted (ordinal variable: EAFLAST), no balance in meals (ordinal variable: EAFBALN), insufficient food for children (ordinal variable: EAFCHLD), adult cut or skip meals (nominal variable: EAFSKIP), adult ate less (nominal variable: EAFLESS), and adult full day without food (nominal variable: EAFDAY).

*Official Poverty Measure poverty status.* Instructions for determination of OPM income poverty status are presented in the SIPP user manual (see US Census, n. d.). Code for the new OPM poverty status variable must interact the variables “reaggregated total family earned income for this month” (ratio variable: TFEARN) and “poverty thresholds for this family in this month” (nominal variable: RFPOV). The Census (n. d.) topcodes and aggregates income data for anonymity. Monthly incomes above $12,500 were coded at that amount, unless the income was highly variable across months (US Census, n. d.). The truncation of incomes at the high end of the distribution was irrelevant to application of the OPM. The family income variable was continuous, and the family poverty threshold was discontinuous. The new variable (code: TFEARN ≤ RFPOV) was nominal, family-level OPM poverty status.

*Poverty risk variables.* The empirically-determined poverty risk variables were available in the SIPP core questionnaire. Respondents chose among White, Black, Asian, and Residual for racial and ethnic identity (nominal variable: ERACE) in the SIPP. The identities that constitute Residual race and ethnicity were Indigenous Persons, Hawaiian Native, and Pacific Islander. Hispanic and Latino(a) racial/ethnic identity was a separate, dichotomous question (nominal variable: EORIGIN). The options for kind of family
were female headed, male headed, or headed by husband/wife (nominal variable: EFKIND). Number of children in the family was a count of own children, 18 years old or younger, in the family (ratio variable: RFOKL18). A respondent’s education was his or her highest grade or degree (ordinal variable: EEDUCATE). Employment status (ordinal variable: RMESR) was specific to the reference month. A respondent self-reported disability status (nominal variable: EDISABL) and veteran status (nominal variable: EAFEVER).

**Outcome variable.** The outcome, or regressand, variable for research question two was a family’s true-positive or false-negative poverty status. A true-positive poverty status occurred when a family was OPM “positive” for poverty and positive for material hardship. A false-negative poverty status occurred when a family was OPM “negative” for poverty but positive for material hardship.

*True positive/false negative poverty status.* There were four possible status outcomes: true-positive, false-negative, true-negative, and false-positive (Pepe, 2003). The former two were of interest for this study because the consequences of incorrect negative classifications are more severe than incorrect positives. A false-negative classification might prevent a family with material hardship from receiving public assistance. Computation of new variables for each material hardship indicator facilitated differentiation among possible status outcomes. If the two attributes (i.e., no/yes) of the hardship variables were set to 0 and 2 and the two attributes (i.e., subsistent/poor) of the OPM poverty status variable were set to 0 and 1, then addition of the two variables yielded distinct values for the four groups (i.e., true-negative = 0 + 0 = 0, false-negative =
2 + 0 = 2, false-positive = 0 + 1 = 1, and true-positive = 2 + 1 = 3). The true-positive and false-negative statuses were the outcome of interest for research question two.

**Statistical Analysis Plan**

The appropriate statistical analysis for research question one was cross-classification tables. Classification probabilities are informational statistics for evaluation of binary tests (Pepe, 2003). The possible link functions to model the true-positive fraction (TPF) for research question two are log, logistic, and probit (Pepe, 2003). The logistic model was used for this research because results from logit and probit link functions are comparable (Gujarati, 2011) and because the link is often used in social science research and econometrics to quantify and test the relationship between explanatory and outcome variables (Scott & Wild, 1989). Further, the log link function may produce fitted probabilities that exceed 1.0.

**Classification probabilities.** The OPM poverty measure and SIPP material hardship indicators produce dichotomous outcomes (e.g., poor or subsistent) like binary medical tests. It is, therefore, possible to consider these measures as binary tests for poverty. A binary test is one that produces a positive or negative indication of a condition (e.g., cardiovascular disease or depression). The “true” test, binary or otherwise, is one that consistently produces an accurate positive or negative result for a condition (Parikh, Mathai, Parkh, Sekhar, & Thomas, 2008). Statistical comparison of a test to its true counterpart provides information about the efficacy of the test to indicate the presence or absence of a condition (Pepe, 2003).
One statistical comparison of a binary test and a true indicator is a cross-classification table. Shown in Figure 3, a cross-classification table is a cross tabulation of the results from a test and its true counterpart. There are four possible outcomes from this comparison: true-negative (upper-left cell), false-negative (upper-right), true-positive (lower-right cell), and false-positive (lower-left cell). A true-negative or true-positive occurs when the test and true indicator return the same result. On the other hand, a false-negative or false-positive occurs when the test and true indicator return contradictory results. The consistency of a test and its true standard (i.e., large proportions of true-positives and true-negatives) is evidence the test effectively indicates the condition (Pepe, 2003).

Classification probabilities are statistical quantifications of a test’s efficacy, or consistency with its true standard, and are referred to as a test’s sensitivity and specificity (Pepe, 2003). Test sensitivity to a condition is its propensity to correctly classify persons as positive for a condition; whereas, test specificity is its correct classification of persons as negative (Parikh et al., 2008; Pepe, 2003). The true-positive fraction value (TPF = [proportion persons positive] / [proportion persons with condition]) is a determination of test sensitivity, and the false-positive fraction value (FPF = [proportion persons with positive test but negative true standard] / [proportion persons without condition]) is a determination of test specificity (Pepe, 2003). Both TPF and FPF range from 0.0 to 1.0, however, a useful test is one with a TPF value close to 1.0 and a FPF value close to 0.0 (Pepe, 2003). A test is useless if either TPF or FPF equal the proportion of persons classified positive by the test, the tau value (Pepe, 2003).
Estimation of the OPM poverty measure sensitivity and specificity to direct poverty required calculation of separate sets of classification probabilities for each material hardship indicator. The relationship between or among SIPP indicators of material hardship is unknown, and there is no guidance to produce a cumulative hardship score (HHS, 2004). Importantly, the classification probabilities are comparable across material hardship indicators (Pepe, 2003).

**Predictive probabilities.** Another useful set of statistics for the evaluation of test efficacy is positive and negative predictive values. The predictive values are the probabilities a positive or negative test result corresponds to a true-positive or true-negative for the condition, respectively (Pepe, 2003). Positive and negative predictive values range from 0.0 to 1.0, and values close to 1.0 indicate the degree to which a test correctly predicts true-positives and true-negatives (Parikh et al., 2008). A positive predictive value (PPV) equal to the condition prevalence or a negative predictive value (NPV) equal to one minus the condition prevalence indicates a test is useless (Pepe, 2003).

**Logistic regression.** Multivariable regression is a technique to extend the evaluation of test sensitivity from research question one (Pepe, 2003). Multivariable linear regression quantifies the effect of multiple regressors, or predictor variables, on a single regressand, or outcome variable (Gujarati, 2011). The notation of a multivariable linear regression is:

\[ Y_i = B_1 + B_2 X_{2i} + B_3 X_{3i} + u_i \]
where $Y_i$ is the regressand (outcome variable); $B_1$ is the intercept; $B_2$ and $B_3$ are slope coefficients; $X_2$ and $X_3$ are regressors (predictor variables); and $u_i$ is a stochastic (random) error term (Gujarati, 2011). The purpose of multivariable linear regression is to examine the average behavior of $Y$ in response to changes in $X$ (Gujarati, 2011). The regression coefficients ($B$) are a quantification of the effect at each value of $X$, independent of other $X$ values, on the mean of $Y$ (Gujarati, 2011).

The generalized linear model (GLM) above is appropriate for ratio- and interval-level variables, however, GLMs are inappropriate for nominal-level variables, like the dichotomous outcome from binary tests (Gujarati, 2011). Instead, the logistic or probit models are viable alternatives to GLMs of nominal-level regressands (Gujarati, 2011). The logistic and probit models differ from GLMs in important ways. First, the regressand and regressors follow the link function of choice, logit or probit. For example, the logit link function is:

$$Z_i = \ln\left(\frac{P_i}{1 - P_i}\right)$$

where $Z_i$ is the new outcome variable, $\ln$ is the natural log, $P_i$ is the probability for the outcome, and $(P_i/(1 - P_i))$ is the odds ratio in favor of the outcome. $Z_i$ represents the natural log of the odds ratio in favor of the regressand outcome (e.g., a true-positive result). Second, the estimation strategy for logistic models is maximum likelihood (ML); whereas, it is ordinary least squares (OLS) for GLMs. The ML estimation procedure maximizes the probability that estimates for unknown coefficients ($B$) match observations of $Y$ from the sample (Gujarati, 2011). The primary difference between logistic and
probit models is that the stochastic error term follows a logistic distribution or a normal distribution, respectively (Gujarati, 2011).

The regressand of the logistic regression models for this research were respondents’ true-positive or false-negative result for each material hardship indicator, and the regressors were the empirically-based poverty risk variables:

\[ Z_i = B_1 + B_2(ERACE)_{2i} + B_3(ERIGIN)_{3i} + B_4(EFKIND)_{4i} + B_5(EOFKLTLT18)_{5i} + B_6(EEDUCATE)_{6i} + B_7(RMESR)_{7i} + B_8(EDISABL)_{8i} + B_9(EFAEVER)_{9i} \]

Separate logistic regression models were fit for each SIPP material hardship indicator. The coefficient estimates and fit statistics are comparable across models.

**Regression model diagnostics.** Several assumptions underlie generalized linear models with cross-sectional data, and violation of these assumptions compromise model outputs. The first assumption is regressors are independent of other regressors—they share no linear relationship (Gujarati, 2011). Violation of the first assumption is collinearity, or multicollinearity if more than two regressors share a relationship. The calculation of partial correlation coefficients of regressors is a strategy to detect collinearity (Gujarati, 2011). Partial correlation coefficients hold other regressor variables constant while estimating the correlation between regressors. High partial correlations coefficients suggest collinearity (Gujarati, 2011). The second assumption is linearity of regressors in the logit function (Hosmer, Lemeshow, & Sturdivant, 2013). A logistic regressor at the interval or ratio level is not necessarily linear in the logit. Design variables, also referred to as dummy variables, are linear when applied to nominal variables and can approximate linearity when applied to variables at other levels of
measurement. The third assumption is correct model specification. Errors of model specification are numerous but avoidable with attention to detail. The assumption to test is that the logistic model for this research was correctly specified: (a) the model included all relevant variables, (b) the model excluded extraneous variables, (c) a logistic model was the correct functional form, and (d) the US Census data collection procedures resulted in minimum measurement error.

$R^2$ is the conventional goodness of fit statistic for generalized linear models and is the ratio of explained sum of squares to total sum of squares (Gujarati, 2011). The $R^2$ value is interpreted as the proportion of variance in the outcome variable explained by a model. However, $R^2$ is inappropriate for logistic models. Instead, the pseudo $R^2$ and count $R^2$ are acceptable for logistic models, with similar interpretation (Gujarati, 2011). The count $R^2$ is the number of correct predictions over the total number of observations (Gujarati, 2011).

Nagelkerke (1991) generalized the $R^2$ for application with logistic regressions and retained the interpretation. Goodness of fit statistics are secondary in the logistic regression context, the direction of coefficient signs and the statistical significance of respective $t$ values are primary (Gujarati, 2011; Hosmer et al., 2013). The $F$ test, which indicates at least one coefficient of a GLM is statistically significant, is likewise inappropriate in the logistic context (Gujarati, 2011).

Limitations

Research with social indicators carries with it measurement and sampling limitations and errors. Social indicators are data intensive, and therefore, resource
intensive concepts. Systematic measurement errors are doubly expensive, and random
errors must be few and distributed at random to avoid systemic interference (Fowler &
Conzenza, 2009). The income poverty conceptualization and operationalization of this
research relied on determinations of need(s) and adequate questions of income and family
composition from secondary data sources. These data formed the matrix from which
family were classified as poor or subsistent.

The generalizability of this study was constrained by measurement choices of the
US Census. First, study results were generalizable only to lone families. The focus on
these families was a compromise to create equivalence between the different units of
analysis for the OPM and Basic Needs & Food Insecurity measure. Lone adults and co-
resident families also experience poverty and hardship, but the constraints imposed by
measurement prevent discussion of OPM efficacy for these groups. Second, the cultural
heterogeneity of this sample was limited by the SIPP’s few racial and ethnic categories.
For example, the Indigenous Persons racial category includes persons from the many
Native American or Native Alaskan groups.

The study results were limited by the different reference-periods of the OPM and
Basic Needs & Food Insecurity measure. The OPM reference-period was current month,
and the Basic Needs & Food Insecurity measure reference-period was the prior year. The
mismatch of reference-period means a family could be poor under the OPM but report no
hardship for the previous year—such a response pattern would affect specificity and
negative predictive values because these families received false-positive results. On the
other hand, a family might be nonpoor under the OPM but report hardship for the
previous year—this response pattern would affect sensitivity and positive predictive values because these families received false-negative results. That notwithstanding, families that received OPM true-negative and true-positive results, respectively, were OPM “negative” that month and experienced no material hardship last year or were OPM “positive” that month and experienced hardship last year.
Chapter 4: Results

The goal for this Chapter is to describe the sample characteristics and results from statistical analyses. Recall that the sample for this study was respondents to the US Census 2008 Survey of Income and Program Participation (SIPP) panel who live in a “lone family.” Results from cross-classification tables of OPM poverty status and material hardship indicators (i.e., direct poverty) addressed research question one, *How well does the Official Poverty Measure classify and predict material hardship?* Results from logistic regressions of sociodemographic and labor-power variables on false-negative and true-positive results (one set of classifications from research question one) were used to address research question two, *What is the association between sociodemographic and labor-power variables and Official Poverty Measure sensitivity to material hardship?*

**Sample Characteristics**

The complex sample design and sample weights of the SIPP mean sample estimates were for the whole population of the United States (US Census, n.d.). Therefore, the sample for this study was a population estimate of all “lone families” in the US with an adult head of the family (N = 186.6 million). The adult age sample
restriction was to avoid inclusion of adolescent heads of families, which reduced the possible full sample by less than 0.00 percent. Table 2 is a presentation of sample characteristic estimates, including sex, age, race and ethnicity, education, family kind, poverty status, employment, disability, and veteran status.

The sample for this study was majority female, 52.8 percent 95% CI [51.6, 54.1]. The 2008 panel of the SIPP included no questions on gender identity or sexual orientation. The sample ranged in age from 18 to 86, with a mean age of 47.53 [47.11, 47.95]. The SIPP racial identification options for respondents were only Black, Asian, Indigenous, and White. The estimates produced here were similar to those from the Census (2011) for 2010: 70.9 percent for White, 11.4 percent for Hispanic, 12.5 for Black, and 3.8 percent for Asian. Please refer to Table 2 for sample characteristics.

Most families in this sample conformed to the married man-woman family configuration, 80.7 percent 95% CI [79.6, 81.7]. A modest proportion of families were headed by a lone woman, 15.3 percent [14.4, 16.3], with a smaller number headed by a lone man, 4.0 percent [3.7, 4.3]. The US Census (2011) estimated for 2010 that nearly 75 percent of families were married man-woman families, with 18.5 percent headed by a lone woman and 6.5 percent headed by a lone man. It is possible the difference between SIPP and Census estimates for family configuration is due to the sample restriction to “lone families.” Lone-parent families were slightly underrepresented in the sample for this research, which could affect their variability and the generalizability of results. As data were collected prior to the legalization of same-sex marriage, the sample of married families included only opposite-sex couples. Nearly ten percent of the sample reported a
physical or mental disability that limits ability to work. More than ten percent of the sample disclosed an active duty military experience.

Table 2

Sample Characteristics of Lone Families with Adult Heads in the United States (N = 186,639,228*)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>% Estimate [95% CI]</th>
<th>Characteristic</th>
<th>% Estimate [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female</td>
<td>&lt; High school</td>
<td>9.4 [7.9, 11.3]</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>High school</td>
<td>22.0</td>
</tr>
<tr>
<td>Age</td>
<td>18-24</td>
<td>Some college</td>
<td>13.7</td>
</tr>
<tr>
<td></td>
<td>25-30</td>
<td>Vocational</td>
<td>12.1</td>
</tr>
<tr>
<td></td>
<td>31-36</td>
<td>Associate’s</td>
<td>9.7</td>
</tr>
<tr>
<td></td>
<td>37-42</td>
<td>Bachelor’s</td>
<td>20.9</td>
</tr>
<tr>
<td></td>
<td>43-48</td>
<td>Master’s</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>49-54</td>
<td>Professional</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>55-60</td>
<td>Doctorate</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>61-65</td>
<td>Family Kind</td>
<td>15.3</td>
</tr>
<tr>
<td></td>
<td>66+</td>
<td>Lone woman</td>
<td>15.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lone man</td>
<td>4.0</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>Black/African</td>
<td>Married (man-woman)</td>
<td>80.7</td>
</tr>
<tr>
<td></td>
<td>American</td>
<td>[8.9, 13.2]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td>Employed</td>
<td>67.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[2.2, 6.1]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hispanic/Latino(a)</td>
<td>Underemployed</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[8.6, 20.1]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indigenous Persons/</td>
<td>Unemployed</td>
<td>31.4</td>
</tr>
<tr>
<td></td>
<td>Hawaiian Native/</td>
<td>[1.9, 3.0]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pacific Islander</td>
<td>White</td>
<td>69.8 [63.0, 75.8]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disability</td>
<td>9.6 [8.8, 10.6]</td>
</tr>
<tr>
<td></td>
<td>Povery</td>
<td>No disability</td>
<td>81.8 [80.4, 83.1]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[11.7, 13.8]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subsistent</td>
<td>Veteran</td>
<td>11.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[86.2, 88.3]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ever active duty</td>
<td>[10.3, 12.3]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Civilian</td>
<td>88.7 [87.7, 89.7]</td>
</tr>
</tbody>
</table>

*Estimate from the 2008 panel of the US Census Survey of Income and Program Participation.
Employment status was a distillation of eight response categories. Respondents with employment, 67.4 percent 95% CI [66.3, 68.5], had a job all month and (a) worked all weeks of the month or (b) were absent from work at least one week but not due to a layoff. Respondents with underemployment, 1.2 percent [1.1, 1.4], had a job all month but were absent some weeks without pay due to layoff or had a job at least one week, but not all weeks, and either (a) spent no time in layoff or job search or (b) spent time in layoff or job search. Finally, respondents unemployed, 31.4 percent [30.3, 32.5], had no job all month and (a) spent all weeks on layoff or job search, (b) spent at least one week on layoff or job search, or (c) spent no weeks on layoff or job search. The estimate of lone families in poverty was 12.7 percent [11.7, 13.8], slightly less than the official US Census estimate of 13.2 for all families in 2010 (US Census, 2011).

Results from Research Question One

The procedure to investigate the first research question was cross-classification tables. A cross-classification table is a 2x2 matrix of results from two tests for the same condition—a new or alternative test and a trusted test. Without a truly objective test for poverty, the assumption here was indicators of material hardship (i.e., direct poverty indicators) are the trustable tests for poverty and the OPM is the test for poverty under review (see Sen, 1979). The method to aggregate the ten direct poverty indicators from the Basic Needs & Food Insecurity measure is left for future research (HHS, 2004). Therefore, each indicator was treated as a separate test for poverty.

Classification probabilities. The interpretation of sensitivity is the degree to which a test correctly classifies persons with a condition as positive for that condition
On the other hand, specificity is the degree to which a test correctly classifies persons without a condition as negative (Pepe, 2003). Sensitivity and specificity range from 1.0 to 0.0, and a sensitivity or specificity of 1.0 means the test correctly classifies all person as condition positive or negative, respectively. Critically, a test is useless when its sensitivity value or one minus its specificity value equal the sample proportion with a “positive” test result (or tau [τ]). Estimates of OPM sensitivity and specificity to material hardships are presented in Table 3.

The lowest OPM sensitivity value was for dental hardship, .253 95% CI [.230, .278], and the highest was a day without food, .423 [.360, .489]. The OPM test result was “positive” for 25.3 percent of families that were positive for dental hardship, and it was positive for 42.3 percent of families that were positive for an adult without food. Read another way, the OPM classified approximately 75 percent of families as “negative” for poverty when they were positive for dental hardship (as was also the case for medical hardship), and the OPM classified nearly 60 percent of families as “negative” for poverty that were positive for an adult without food for a day.

The low magnitudes of OPM sensitivity indicated larger proportions of families were classified as “negative” for poverty when they were positive for material hardship (i.e., a false-negative result). For example, the OPM classified nearly 70 percent of families as “negative” for poverty when these families were positive for unmet essential need, rent/mortgage nonpayment, skip or cut meal, or utility nonpayment. The lowest proportions of OPM false-negative results were for telephone disconnection, an adult without food for a day, and eviction, but these were still near or above 60 percent.
<table>
<thead>
<tr>
<th>Direct indicator</th>
<th>Sensitivity</th>
<th>95% CI</th>
<th>Specificity</th>
<th>95% CI</th>
<th>τ</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential need</td>
<td>.285</td>
<td>[.263, .309]</td>
<td>.904</td>
<td>[.893, .914]</td>
<td>.127</td>
<td>[.117, .138]</td>
</tr>
<tr>
<td>Rent/mortgage</td>
<td>.315</td>
<td>[.286, .346]</td>
<td>.890†</td>
<td>[.880, .900]</td>
<td>.127</td>
<td>[.117, .138]</td>
</tr>
<tr>
<td>Eviction</td>
<td>.412</td>
<td>[.321, .508]</td>
<td>.690†</td>
<td>[.660, .718]</td>
<td>.315</td>
<td>[.286, .346]</td>
</tr>
<tr>
<td>Skip or cut meal</td>
<td>.329</td>
<td>[.292, .369]</td>
<td>.752†</td>
<td>[.732, .770]</td>
<td>.272</td>
<td>[.254, .290]</td>
</tr>
<tr>
<td>Utility</td>
<td>.310</td>
<td>[.286, .335]</td>
<td>.895†</td>
<td>[.883, .905]</td>
<td>.127</td>
<td>[.117, .138]</td>
</tr>
<tr>
<td>Utility cut</td>
<td>.394</td>
<td>[.316, .478]</td>
<td>.707†</td>
<td>[.679, .734]</td>
<td>.310</td>
<td>[.286, .335]</td>
</tr>
<tr>
<td>Phone cut</td>
<td>.348</td>
<td>[.309, .390]</td>
<td>.881†</td>
<td>[.871, .891]</td>
<td>.127</td>
<td>[.117, .138]</td>
</tr>
<tr>
<td>Medical</td>
<td>.269</td>
<td>[.230, .312]</td>
<td>.884†</td>
<td>[.873, .893]</td>
<td>.127</td>
<td>[.117, .138]</td>
</tr>
<tr>
<td>Dental</td>
<td>.253</td>
<td>[.230, .278]</td>
<td>.885†</td>
<td>[.875, .895]</td>
<td>.127</td>
<td>[.117, .138]</td>
</tr>
</tbody>
</table>

*Note. CI = confidence interval; τ = tau. †estimate includes tau value.*

The evaluative guideline for sensitivity (and specificity) is relative to the proportion of persons who test “positive” with the new or alternative test, referred to as tau. The OPM sensitivity to an adult who skip or cut meal, .329 95% CI [.292, .369], was the closest sensitivity value to its tau (τ), .272 [.254, .290]. The other OPM sensitivity values were larger than their respective tau values. Figure 3 is a plot of OPM sensitivity and tau values. The closest point to the line of equivalence was the OPM sensitivity value for an adult who skip or cut meal and the farthest was telephone disconnection. So, while the OPM incorrect “negative” classifications were large, the correct “positive” classifications of poverty were sufficient to surpass the tau guideline.
The lowest OPM specificity value was for eviction, .690 95% CI [.660, .718], and the highest was unmet essential need, .904 [.893, .914]. Respectively, 69 and 90.4 percent of families that were negative for eviction or unmet essential need test “negative” for poverty with the OPM. Read another way, the OPM classified 31 percent of families that were negative for eviction as “positive” for poverty and nearly ten percent of families that were negative for unmet essential need as “positive” for poverty. That is, these families received a false-positive result for poverty—the OPM classified them as “positive” for poverty, but they were negative for eviction and/or unmet essential need.

The OPM specificity was low for an adult without food for a day, .699 [.665, .711]; utility disconnection, .707 [.679, 734]; and skip or cut meal, .752 [.732, .770]. The OPM
specificity values for telephone disconnection, medical hardship, dental hardship, and rent/mortgage nonpayment were approximately 90 percent.

All the (1.0 minus) estimated OPM specificity values were near their respective tau values, and for all but unmet essential need, the OPM specificity confidence intervals included the respective tau values. Figure 4 is a plot of OPM specificity (minus 1.0) and each tau. The OPM specificity values for telephone disconnection, medical hardship, and dental hardship were different by .012 from their respective tau values and nearest the line of equivalence. The OPM specificity value was different by .017 from the tau value for rent/mortgage nonpayment, by .022 from the tau value for utility nonpayment, and by .031 from the tau value for unmet essential need. The nearness of the OPM specificity values to their respective tau values is an indication the OPM is ineffective for families without material hardship.
Predictive values. Positive and negative predictive values are the likelihood a condition is present with a “positive” test result or absent with a “negative” test result. These values represent the trustability of a test and are useful for condition prevention. The result from a highly predictive test gives confidence a condition will be present or absent. Therefore, it is best to begin treatment after a positive result from a highly predictive test. The predictive probabilities range from 1.0 to 0.0, and values close to 1.0 suggest a test prediction (positive or negative) is highly associated with the condition. The OPM positive and negative predictive values are presented in Table 4. The lowest OPM positive predictive value was for eviction, .064 95% CI [.046, .087], and the highest was for unmet essential need, .368 [.337, 399]. This means a positive OPM result was
associated with a 6.4 percent probability of eviction or a 36.8 percent probability of unmet essential need.

Table 4

Estimates of Official Poverty Measure Predictive Values for Material Hardship Indicators for Lone Families in the United States

<table>
<thead>
<tr>
<th>Direct indicator</th>
<th>PPV</th>
<th>95% CI</th>
<th>NPV</th>
<th>95% CI</th>
<th>( \rho )</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential need</td>
<td>.368</td>
<td>[.337, .399]</td>
<td>.866</td>
<td>[.856, .875]</td>
<td>.164</td>
<td>[.154, .174]</td>
</tr>
<tr>
<td>Rent/ mortgage</td>
<td>.211</td>
<td>[.191, .232]</td>
<td>.933</td>
<td>[.927, .939]</td>
<td>.085</td>
<td>[.078, .092]</td>
</tr>
<tr>
<td>Eviction</td>
<td>.064†</td>
<td>[.046, .087]</td>
<td>.958†</td>
<td>[.945, .968]</td>
<td>.004</td>
<td>[.003, .005]</td>
</tr>
<tr>
<td>Skip or cut meal</td>
<td>.349†</td>
<td>[.312, .389]</td>
<td>.734†</td>
<td>[.702, .764]</td>
<td>.045</td>
<td>[.041, .049]</td>
</tr>
<tr>
<td>Day without food</td>
<td>.214†</td>
<td>[.168, .268]</td>
<td>.862†</td>
<td>[.834, .887]</td>
<td>.012</td>
<td>[.010, .014]</td>
</tr>
<tr>
<td>Utility cut</td>
<td>.215†</td>
<td>[.172, .266]</td>
<td>.851†</td>
<td>[.817, .880]</td>
<td>.018</td>
<td>[.015, .022]</td>
</tr>
<tr>
<td>Phone cut</td>
<td>.103</td>
<td>[.088, .120]</td>
<td>.972†</td>
<td>[.967, .976]</td>
<td>.038</td>
<td>[.032, .044]</td>
</tr>
<tr>
<td>Medical</td>
<td>.152</td>
<td>[.125, .184]</td>
<td>.940†</td>
<td>[.933, .946]</td>
<td>.072</td>
<td>[.064, .081]</td>
</tr>
<tr>
<td>Dental</td>
<td>.177</td>
<td>[.155, .202]</td>
<td>.924</td>
<td>[.913, .933]</td>
<td>.089</td>
<td>[.078, .101]</td>
</tr>
</tbody>
</table>

Note. PPV = positive predictive value; NPV = negative predictive value; CI = confidence interval; \( \rho \) = prevalence. †estimate includes prevalence

The lowest OPM negative predictive value was for skip or cut meal, .734 95% CI [.702, .764], and the highest was for eviction, .958 [.945, .968]. This means a “negative” OPM was associated with a 73.4 percent probability of a negative for skip or cut meal, and a “negative” OPM was associated with a 95.8 percent probability of a negative for eviction. The probability of no eviction, then, was high when a family was negative for OPM poverty. On the other hand, the probability of a false-negative (i.e., OPM “negative” but hardship positive) for skip or cut meal was 26.6 percent and 4.2 percent
for eviction. So, even with a “negative” OPM result, the probability of eviction was 4.2 percent.

Predictive values are dependent on test performance and condition prevalence ($\rho$). The prevalence of material hardships in this sample ranged from .004 95% CI [.003, .005] for eviction to .164 [.154, .174] for unmet essential need. This means the estimate of sample prevalence for eviction was .4 percent and for unmet essential need was 16.4 percent. The effect of low condition prevalence is an artificial suppression of predictive values (Pepe, 2003). Prevalence for eviction, a day without food, utility disconnection, and skip or cut meal were low relative to the full sample (shown in Table 4). Estimates of predictive values for eviction, skip or cut meal, a day without food, and utility disconnection were from the subpopulations at-risk for them. For example, of the families unable to pay their rent or mortgage, the prevalence of eviction was .049 [0.038, 0.062], over ten times greater than the prevalence relative to the full sample. The subpopulation prevalence for a day without food was .162 [0.139, 0.188], for utility disconnection was .169 [0.146, 0.196], and for skip or cut meal was .288 [0.262, 0.317].

The analogous evaluative guideline for predictive values is: (a) positive predictive values equal condition prevalence and (b) negative predictive values equal 1.0 minus condition prevalence (Pepe, 2003). Figure 5 is a plot of OPM positive predictive values and hardship prevalence. None of the OPM positive predictive values equaled condition prevalence, but the confidence intervals of OPM positive predictive values for eviction, skip or cut meal, a day without food, and utility disconnection included their respective subpopulation prevalence values. The low prevalence of these material hardships is a
possible explanation for the inadequate OPM positive predictive values. The low OPM positive predictive values for telephone disconnection, medical hardship, dental hardship, rent or mortgage nonpayment, utility nonpayment, and unmet essential need mean an OPM “positive” result was associated with a low probability of these material hardships.

Figure 6. Cross plot of Official Poverty Measure positive predictive values and material hardship prevalence.

Figure 6 is a plot of OPM negative predictive values and their respective 1.0 minus condition prevalence. The 95 percent confidence intervals of OPM negative predictive values for eviction, skip or cut meal, a day without food, utility disconnection,
telephone disconnection, and medical hardship included their respective 1.0 minus condition prevalence values. These values were uninterpretable. On the other hand, the confidence intervals for unmet essential need, utility nonpayment, dental hardship, and rent and mortgage nonpayment excluded their respective 1.0 minus condition prevalence.

The OPM predicted a negative for unmet essential need with 86.6 percent confidence and 93.3 percent confidence for rent or mortgage nonpayment. However, even with a “negative” OPM, the probability of unmet essential need was 13.4 percent and 6.9 percent for nonpayment of rent or mortgage.

Figure 7. Cross plot of Official Poverty Measure negative predictive values and 1.0 minus material hardship prevalence.
Results from Research Question Two

The OPM sensitivity values were low but larger than the tau evaluative guideline. Regression analysis is one strategy to investigate variables associated with test sensitivity. There are several sociodemographic and labor-power variables theoretically relevant to OPM sensitivity to material hardship, including race and ethnicity, family configuration, number of children, disability and veteran status, educational attainment, and employment. The logistic regression analysis below is an attempt to estimate the association of these variables to OPM sensitivity.

**Logistic regression results.** The logit link function for multivariable regression is appropriate to estimate the association between sociodemographic and labor-power variables and OPM sensitivity to material hardship (Pepe, 2003). The poverty risk variables identified in Chapter 3 served as independent predictors of OPM sensitivity. Results from the ten logistic models are presented in Tables 5 and 6. Regression coefficients are odds ratios, the probability an event will occur divided by the probability an event will not occur (Lamb & Pfeiffer, 2008), but each is the odds relative to another attribute. For example, the odds of an OPM true-positive were statistically significant ($p < 0.001$) and greater than 1.0 for families with an unemployed primary person, relative to families with an employed one, for all hardship indicators. Specifically, the odds of an OPM true-positive for unmet essential need was 5.125 95% CI [2.368, 11.109] times higher for a family with an unemployed head relative to a family with an employed one.

**Race and ethnicity.** The OPM sensitivity to material hardship indicators varied across racial and ethnic identities, with White as reference group. Its sensitivity was not
statistically significantly associated with family identification as Black, relative to White identification (the reference group). The OPM sensitivity was statistically significantly associated with family identification as Asian or Indigenous. The odds of an OPM true-positive result for families that identified as Asian, relative to White, were nearly double for unmet essential need, 1.934 95% CI [1.192, 3.136]; more than five times for eviction, 5.332 [1.211, 23.478]; and approximately half for skip or cut meal, 0.473 [0.225, 0.994]. There were too few families that identified as Asian to estimate their odds of an OPM true-positive for utility disconnection. The odds of an OPM true-positive for families that identified as Indigenous were statistically significantly lower than 1.0 for a day without food, 0.133 [0.036, 0.497], relative to White families. The OPM sensitivity for families that identified as Hispanic or Latino(a) were statistically significant for unmet essential need, 1.633 [1.318, 2.023]; rent/mortgage nonpayment, 1.690 [1.103, 2.588]; utility nonpayment, 1.505 [1.124, 2.015]; medical hardship, 1.847 [1.179, 2.893]; and dental hardship, 1.966 [1.381, 2.797].

**Family configuration.** Family configuration was statistically significantly associated with OPM sensitivity, with the married man-woman family configuration as reference group. The odds of an OPM true-positive for lone-woman families, relative to married couples (the reference group), were statistically significantly higher than 3.0 for medical hardship, 3.553 95% CI [2.616, 4.826]; skip or cut meal, 3.659 [2.533, 5.286]; telephone disconnection, 3.818 [2.591, 5.625]; and utility nonpayment, 3.873 [2.977, 5.038]. The odds were statistically significantly higher than 4.0 for rent/mortgage nonpayment, 4.019 [3.193, 5.058]; dental hardship, 4.083 [2.949, 5.653]; unmet essential
need, 4.328 [3.710, 5.049]; day without food, 4.443 [1.352, 14.603]; and utility disconnection, 4.908 [2.487, 9.683].

The odds of an OPM true-positive were statistically significant for lone-man families, relative to married couples (the reference group). The OPM true-positive odds among lone-man families were more than twice that of the reference group for medical hardship, 2.577 95% CI [1.333, 4.982]; skip or cut meal, 2.673 [1.005, 7.107]; and dental hardship, 2.771 [1.564, 4.912]. The odds were statistically significantly greater than 3.0 for unmet essential need, 3.051 [1.799, 5.174]; utility nonpayment, 3.673 [1.872, 7.206]; and utility nonpayment, 3.873 [2.977, 5.038]. Finally, the odds were statistically significantly larger than 4.0 or 5.0 for telephone disconnection, 4.118 [1.970, 8.607], and utility disconnection, 5.333 [1.807, 15.736].
### Table 5

**Logistic Regression Analysis of Poverty Risk Variables on Official Poverty Measure Sensitivity to Material Hardship Indicators**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Essential need OR</th>
<th>95% CI</th>
<th>Rent/mortgage nonpayment OR</th>
<th>95% CI</th>
<th>Eviction OR</th>
<th>95% CI</th>
<th>Skip or cut meal OR</th>
<th>95% CI</th>
<th>Day without food OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.040***</td>
<td>[0.031, 0.053]</td>
<td>0.062***</td>
<td>[0.040, 0.097]</td>
<td>0.007***</td>
<td>[0.001, 0.102]</td>
<td>0.069***</td>
<td>[0.042, 0.113]</td>
<td>0.067**</td>
<td>[0.020, 0.224]</td>
</tr>
<tr>
<td>Black</td>
<td>1.249 [0.971, 1.608]</td>
<td>1.341 [0.944, 1.905]</td>
<td>0.432 [0.069, 2.726]</td>
<td>1.106 [0.706, 1.733]</td>
<td>0.857 [0.353, 2.082]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>1.934** [1.192, 3.136]</td>
<td>1.634 [0.757, 3.524]</td>
<td>5.332* [1.211, 23.478]</td>
<td>0.473* [0.225, 0.994]</td>
<td>1.052 [0.171, 6.491]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native</td>
<td>1.522 [0.966, 2.399]</td>
<td>1.156 [0.667, 2.003]</td>
<td>0.578 [0.065, 5.094]</td>
<td>0.700 [0.283, 1.731]</td>
<td>0.133** [0.036, 0.497]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic/ Latino(a)</td>
<td>1.633*** [1.318, 2.023]</td>
<td>1.690* [1.103, 2.588]</td>
<td>5.040 [0.855, 29.716]</td>
<td>1.682 [0.928, 3.048]</td>
<td>1.336 [0.464, 3.846]</td>
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<td></td>
</tr>
<tr>
<td>Native</td>
<td>1.616*** [1.258, 2.077]</td>
<td>1.246 [0.868, 1.787]</td>
<td>11.158* [1.387, 89.792]</td>
<td>1.264 [0.700, 2.283]</td>
<td>1.825 [0.739, 4.504]</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Hispanic/ Latino(a)</td>
<td>2.153*** [1.726, 2.685]</td>
<td>2.333*** [1.673, 3.255]</td>
<td>0.349 [0.046, 2.642]</td>
<td>2.205*** [1.468, 3.313]</td>
<td>1.793 [0.824, 3.902]</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Asian</td>
<td>0.845 [0.613, 1.165]</td>
<td>0.829 [0.575, 1.197]</td>
<td>5.042 [0.702, 36.232]</td>
<td>0.638* [0.439, 0.928]</td>
<td>0.455 [0.202, 1.026]</td>
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<td></td>
</tr>
<tr>
<td>Native</td>
<td>0.935 [0.502, 1.742]</td>
<td>0.851 [0.289, 2.508]</td>
<td>0.086 [0.008, 0.969]</td>
<td>1.103 [0.390, 3.122]</td>
<td>2.260 [0.580, 8.803]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic/ Latino(a)</td>
<td>0.328</td>
<td>0.294</td>
<td>0.625</td>
<td>0.294</td>
<td>0.380</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. OR = odds ratio; CI = confidence interval.

*p < .05, *p < .01, ***p < .001.
Number of children. The number of children in a family was statistically significantly associated with OPM sensitivity, with no children as reference group. Families with a single child, relative to families with no children (the reference group), were at statistically significantly higher odds for an OPM true-positive when the hardship was unmet essential need, 1.616 95% CI [1.258, 2.077]; medical hardship, 1.850 [1.154, 2.965]; dental hardship, 1.853 [1.346, 2.550]; and eviction, 11.158 [1.387, 89.792]. The odds of an OPM true-positive when the family consists of two children were statistically significant for rent or mortgage nonpayment, 2.332 [1.661, 3.276]; dental hardship, 2.630 [2.068, 3.344]; skip or cut meal, 2.647 [1.643, 4.263]; medical hardship, 2.790 [1.844, 4.223]; utility nonpayment, 2.805 [2.092, 3.760]; unmet essential need, 2.805 [2.168, 3.629]; day without food, 3.277 [1.531, 7.013]; telephone disconnection, 3.716 [2.264, 6.098]; utility disconnection, 4.163 [1.753, 9.888]; and eviction, 18.934 [3.326, 107.784].
Table 6

Logistic Regression Analysis of Poverty Risk Variables on Official Poverty Measure Sensitivity to Material Hardship Indicators

<table>
<thead>
<tr>
<th>Variable</th>
<th>Utility nonpayment</th>
<th>Utility disconnection</th>
<th>Phone disconnection</th>
<th>Medical need</th>
<th>Dental need</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>95% CI</td>
<td>OR</td>
<td>95% CI</td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td>Constant</td>
<td>0.050*** [0.037, 0.068]</td>
<td>0.039*** [0.013, 0.112]</td>
<td>0.053*** [0.029, 0.097]</td>
<td>0.048*** [0.032, 0.071]</td>
<td>0.042*** [0.032, 0.056]</td>
</tr>
<tr>
<td>Black</td>
<td>1.339 [0.986, 1.818]</td>
<td>1.002 [0.532, 1.890]</td>
<td>0.941 [0.627, 1.410]</td>
<td>1.286 [0.840, 1.969]</td>
<td>1.371 [0.978, 1.921]</td>
</tr>
<tr>
<td>Asian</td>
<td>1.107 [0.362, 3.385]</td>
<td>---</td>
<td>1.951 [0.813, 4.683]</td>
<td>0.976 [0.458, 2.080]</td>
<td>1.781 [1.143, 2.776]</td>
</tr>
<tr>
<td>Native</td>
<td>1.347 [0.810, 2.240]</td>
<td>1.238 [0.333, 4.599]</td>
<td>0.780 [0.354, 1.718]</td>
<td>1.113 [0.565, 2.192]</td>
<td>1.118 [0.597, 2.096]</td>
</tr>
<tr>
<td>Hispanic/Latino(a)</td>
<td>1.505** [1.124, 2.015]</td>
<td>1.401 [0.496, 3.956]</td>
<td>1.057 [0.683, 1.635]</td>
<td>1.847** [1.179, 2.893]</td>
<td>1.966*** [1.381, 2.797]</td>
</tr>
<tr>
<td>Disability</td>
<td>0.605 [0.414, 0.886]</td>
<td>0.462 [0.242, 0.882]</td>
<td>0.746 [0.454, 1.225]</td>
<td>0.781 [0.562, 1.086]</td>
<td>0.896 [0.618, 1.301]</td>
</tr>
<tr>
<td>Veteran</td>
<td>0.939 [0.495, 1.783]</td>
<td>0.530 [0.164, 1.712]</td>
<td>0.697 [0.292, 1.662]</td>
<td>1.341 [0.683, 2.632]</td>
<td>1.368 [0.755, 2.477]</td>
</tr>
</tbody>
</table>

Pseudo-$R^2$ 0.337 0.494 0.345 0.296 0.289

Note. OR = odds ratio; CI = confidence interval.
*p < .05. ** p < .01. ***p < .001.
When a family had three children, the odds of an OPM true-positive were statistically significantly greater than 1.0 for skip or cut meal, 3.480 [1.850, 6.547]; rent or mortgage nonpayment, 3.959 [2.467, 6.353]; utility nonpayment, 3.985 [2.991, 5.310]; unmet essential need, 4.663 [3.564, 6.102]; medical hardship, 4.729 [3.099, 7.218]; dental hardship, 6.130 [4.484, 8.382]; telephone disconnection, 6.757 [3.729, 12.243]; and utility disconnection, 8.955 [2.870, 27.935]. The odds were not significantly different for families with three children for a day without food. The odds of an OPM true-positive were statistically significantly higher than 1.0 when the family had four children for rent or mortgage nonpayment, 3.220 [1.706, 6.074]; skip or cut meal, 3.756 [1.445, 9.763]; a day without food, 4.116 [1.268, 13.364]; utility nonpayment, 4.615 [2.428, 8.769]; unmet essential need, 5.956 [3.632, 9.767]; dental hardship, 6.472 [4.117, 10.172]; telephone disconnection, 6.650 [2.347, 14.763]; medical hardship, 7.408 [3.477, 15.786]; utility disconnection, 12.233 [1.942, 77.070]; and eviction, 49.054 [2.707, 889.018]. Finally, the odds of an OPM true-positive were statistically significantly above 1.0 when the family had five children for medical need, 3.291 [1.149, 9.423]; dental hardship, 3.970 [1.577, 9.993]; rent or mortgage nonpayment, 4.608 [2.007, 10.576]; utility nonpayment, 4.650 [1.786, 12.109]; telephone disconnection, 12.525 [2.347, 66.848]; skip or cut meal, 15.513 [3.454, 69.677]. The odds for families with five or more children were not statistically significantly different for utility disconnection. There were too few of these families to estimate the odds for eviction or a day without food.
**Education and employment.** The sensitivity of OPM to material hardship was statistically significantly associated with less than a high school education and employment. For family heads without a high school diploma, relative to family heads with a high school diploma or other degree (the reference group), the odds were statistically significantly higher than 1.0 for dental hardship, 1.818 95% CI [1.282, 2.577]; utility nonpayment, 2.076 [1.618, 2.664]; medical hardship, 2.127 [1.436, 3.150]; unmet essential need, 2.153 [1.726, 2.685]; skip or cut meal, 2.205 [1.468, 3.313]; and rent or mortgage nonpayment, 2.333 [1.673, 3.255]. There was no statistically significant difference when the family head lacked a high school diploma for eviction, a day without food, utility disconnection, or telephone disconnection. Unemployment of the family head was statistically significantly associated with higher odds of an OPM true-positive, relative to an employed family head (the reference group), for skip or cut meal, 3.968 [2.821, 5.582]; dental hardship, 4.068 [3.248, 5.094]; rent or mortgage nonpayment, 4.179 [3.307, 5.281]; medical hardship, 4.727 [3.408, 6.557]; unmet essential need, 5.125 [4.031, 6.515]; utility nonpayment, 5.878 [4.484, 7.705]; telephone disconnection, 6.243 [3.997, 9.751]; a day without food, 7.174 [2.675, 19.239]; utility disconnection, 11.680 [5.136, 26.560]; and eviction, 45.516 [7.992, 259.228].

**Disability and veteran status.** The OPM sensitivity to material hardship was statistically associated with physical and/or mental disability but not veteran status. The odds of a true-positive OPM when the family head had a disability was statistically significantly lower than 1.0 for skip or cut meal, 0.638 95% CI [0.439, 0.928], relative to family heads without a disability (the reference group). The odds for a military veteran
head of family were not statistically significantly different for any material hardship, relative to civilians (the reference group).

**Logistic model diagnostics.** The reliability and efficiency of logistic regression coefficients is dependent on (a) the absence of (multi)collinearity and errors of model specification and (b) the presence of linearity in predictor variables (Hosmer et al., 2013). Multicollinearity is present when two or more regressors share a linear relationship. The largest partial correlation coefficient is between unemployment and physical and/or mental disability ($r = .338$). Such small partial correlations among predictor variables suggest little contamination by (multi)collinearity (Gujarati, 2011).

The coefficient of determination (or $R^2$) is the amount of variance explained by the model. However, it is inappropriate for the logistic regression context. Nagelkerke (1991) generalized the coefficient of determination for multivariable regression with a logit link function. The model for dental hardship had the lowest coefficient of determination, $R^2 = .289$. Such a quantity means the predictor variables explained 28.9 percent of the variance between a false-negative and true-positive OPM result. The model coefficients of determination for rent/mortgage nonpayment ($R^2 = .294$), skip or cut meal ($R^2 = .294$), and unmet medical need ($R^2 = .296$) were equally low. The coefficients of determination for unmet essential need ($R^2 = .328$), utility nonpayment ($R^2 = .337$), phone disconnection ($R^2 = .345$), and a day without food ($R^2 = .380$) were higher. The model coefficients of determination for utility disconnection ($R^2 = .494$) and eviction ($R^2 = .625$) were highest.
The next Chapter presents interpretations of these results and a discussion of their implications to social policy and social work practice and research.
Chapter 5: Discussion and Implications

Previous researchers have investigated the OPM through alternative definitions of family, higher multipliers, and percentage multiples (Blackburn, 1998; Fendler & Orshansky, 1979; US Census, 1982). The researchers examined how these changes affected the proportions of overall and group poverty but not on the consumption of minimum needs. The current study advanced research on the OPM, and other binary poverty measures, through comparison of its poverty classifications to experience of material hardship. The purpose of this Chapter is to discuss results from this research and their implications for public policy, future research, and social work practice and education. Review of results, and their interpretation, will address each research question in turn.

Discussion of Research Question One

The first research question for this study was, *How well does the Official Poverty Measure classify and predict material hardship?* The conceptual assumption for this research question was that the OPM represents a test for poverty and material hardship indicators from the Basic Needs & Food Insecurity measure were “true” signifiers of poverty (see Sen, 1979). The comparison of results from these measures was an
opportunity to evaluate the OPM. Large proportions of true-positive and true-negative results, respectively sensitivity and specificity, mean a test correctly classifies persons as “positive” or “negative.” In this context, the OPM correctly classified a family as poor when they experienced hardship and subsistent when no hardship was present. False-positives and false–negatives are errors of classification. A false-positive means that the family’s income was insufficient, nevertheless, they experienced no hardship. On the other hand, the false-negative result occurred when a family’s income was sufficient, however, they experienced a hardship. Predictive probabilities are a metric of trust in a test. A high positive probability means that the material hardship was likely when the family was “positive” under the OPM, and a high negative predictive value means the hardship was unlikely when the OPM was “negative.” Discussion of results from cross-classification tables of OPM and material hardship indicators follows.

**Classification probabilities.** The OPM classifications of families that were positive for material hardship (i.e., test sensitivity) surpassed the tau evaluative guideline from Chapter 4 and are interpretable. On the other hand, the OPM classifications of families negative for material hardship (i.e., test specificity) failed the tau guideline, except for unmet essential need, and are uninterpretable. Simply, the OPM true-positive results were useful, but its true-negative results were useless (excluding unmet essential need). The highest OPM sensitivity values were for eviction and an adult without food for a day. That notwithstanding, it misclassified (i.e., false-negative result) approximately 60 percent of families as nonpoor when they experienced either eviction or an adult without food for a day. The OPM assumed these families had sufficient income
to purchase all minimum needs, but they experienced the severe hardships of eviction or lack of food. These families were counted subsistent when they experienced a condition of poverty.

The OPM classified more families as falsely negative for poverty than it classified as correctly positive. Specifically, the proportion of false-negative results was greater than 70 percent for dental hardship, medical hardship, and unmet essential need. The income of these families was assumed sufficient to meet all minimum needs, when instead, their income was insufficient to cover their dental, medical, and essential needs. This is evidence the OPM underestimates poverty.

The OPM correctly classified 90.4 percent of families as “negative” when they were negative for unmet essential need (i.e., test specificity). Its proportion of false-positives was under ten percent. The other OPM specificity values are uninterpretable, the confidence intervals for each included the estimate of test “positive” families (what is referred to as tau). This means that, based on this study, the OPM classifications of families negative for hardship are useless (Pepe, 2003).

**Predictive probabilities.** The OPM positive predictive values (PPV) for eviction, skip or cut meal, an adult without food for a day, and utility disconnection failed the prevalence evaluative guideline and are uninterpretable. One explanation for the failure of these PPVs is the low prevalence of their respective hardships (Pepe, 2003). The highest PPV (for unmet essential need) was less than 40 percent. That is, an OPM “positive” result was associated with a near 40 percent probability of unmet essential need. The other PPVs were lower, even as low as ten percent, which means an OPM
“positive” result was more associated with no material hardship. These low predictive values made it difficult to assume a hardship would occur when a family was “positive” under the OPM. Presumably, families strategized to avoid hardship even when their incomes were insufficient.

Fewer OPM NPVs were above the evaluative criteria—unmet essential need, utility nonpayment, dental hardship, and rent or mortgage nonpayment. The lowest NPV was for unmet essential need (.866), with the others just over 90 percent. The likelihood of an unmet essential need when the family was “negative” under the OPM was more than ten percent, and approximately ten percent for the other hardship indicators. A family “negative” for poverty under the OPM had a ten percent probability of these hardships. The acceptability of a ten percent likelihood of hardship with an OPM “negative” result is subjective.

**Discussion of Research Question Two**

The second research question was, *What is the association between sociodemographic and labor-power variables and OPM sensitivity to material hardship?*

The purpose of this question was to estimate the association between personal and family variables and OPM performance for families that report material hardship. Question two was an extension of question one, and specifically, the goal was to estimate the odds of a true-positive result relative to a false-negative result when a family head endorses theoretically and/or empirically relevant racial or ethnic identity, family configuration, number of children, educational attainment, employment, disability, or veteran status.
Simply put, the purpose of research question two was to investigate for whom the OPM works best.

**Families with children or unemployment.** Two or more children in a family was statistically significantly associated with higher odds of an OPM true-positive result for eight of the ten material hardship indicators, and unemployment was a statistically significant predictor of an OPM true-positive result across all ten hardship indicators. The strong association between unemployment and OPM true-positive results was expected given the well-established link between low income and hardship (Beverly, 2001a; Iceland & Bauman, 2007; Lovell & Oh, 2008; Mayer & Jencks, 1988). The OPM performed better for these families, with few exceptions. However, the exceptions were possibly the result of low sample size instead of inadequate test performance (Hosmer et al., 2013). The odds were particularly high for severe hardships, including eviction and telephone or utility disconnection. This means that when these families were “positive” under the OPM the odds were high they would have experienced a severe hardship. This may owe to Orshansky’s (1965) use of family size to scale the poverty line.

**Family configuration and education.** Lone parenthood was statistically associated with higher odds of all material hardships, except eviction for lone-women and an adult without food for a day for lone-men. The odds of an OPM true-positive for lone-parents were at a minimum double and at most five times those of families headed by a married couple. Therefore, the odds of an OPM false-negative result (a classification error) were low when the family is headed by a lone-parent. Less than a high school education was statistically associated with higher odds of an OPM true-positive for six of
the ten material hardship indicators. Nevertheless, these families’ odds were approximately double those of families with a high school education and beyond for dental hardship, utility nonpayment, medical hardship, unmet essential need, skip or cut meal, and rent or mortgage nonpayment. Results for the lone-women family configuration were consistent with previous research that found these families experience higher incidence of material hardship across longer durations (Heflin, 2006; Nepomnyaschy & Garfinkel, 2011).

**Race and ethnicity.** Racial and ethnic identity was statistically associated with the odds of an OPM true-positive result for specific groups and hardships. Black racial identity was not statistically significantly associated with OPM true-positive results. Their odds were not statistically different from those of families that identified as White. The odds of an OPM true-positive for Asian families, relative to White families, were double for unmet essential need and more than quintuple for eviction. However, the odds of a true-positive for skip or cut meal were lower for Asian families. These families were at higher odds for a false-negative result. So, even with an OPM “negative” classification, they were unable to afford the number or size of meals for their families.

The odds of an OPM true-positive were lower for Indigenous families, relative to White families, when the hardship was an adult without food for a day. They were OPM “negative” but still unable to afford meals of adequate number and/or size. Hispanic or Latino(a) families, relative to White families, were at higher odds of an OPM true-positive result for more hardship than the other groups. The odds for utility nonpayment, unmet essential need, rent or mortgage nonpayment, and medical hardship were greater
than 1.5 and nearly double for dental hardship. This means the odds were high a Hispanic or Latino(a) family would have experienced material hardship when OPM “positive.” The higher odds of a true-positive result for Hispanic or Latino(a) families conformed with prior research that found higher co-occurrence of poverty and material hardship among Hispanic baby boomers, with citizenship status a possible moderator (Gassoumis, Wilber, Baker, & Torres-Gil, 2010).

**Disability and veteran status.** Veteran status had no statistically significant association with OPM true-positive odds. Their odds were no different from civilians. Nevertheless, the incidence of material hardship among veterans is higher than for the general population (Hefflin et al., 2012). Physical or mental disability was statistically significantly associated with lower odds of an OPM true-positive for skip or cut meals. The odds were higher these families must skip meals and/or cut their size when “negative” under the OPM. The absence of statistical significance for any other material hardship indicator was a surprise given the higher incidence and risk of hardship among persons with disabilities (Brucker et al., 2015; Schmidt & Danzinger, 2012; She & Livermore, 2007).

**Implications**

The OPM is the singular measure of poverty for the United States. It is a significant social indicator of civilian capability to fulfill minimum needs. Further, the OPM is the basis for income eligibility criteria used by many public assistance programs (“Annual Update of the HHS Poverty Guidelines; Notice,” 2016). Criticisms of its face validity are old and new, and social decision makers have taken few actions to address
them. The goal of this research was to empirically investigate the substance of these criticism and offer evidence of OPM suitability as a poverty measure.

**Public policy implications.** The President of the United States alone holds the authority to revise the process and structure of the OPM (Blank, 2008). Calls to include additional price indices (e.g., shelter, fuel, or clothes) or endow an impartial agency, like the Census Bureau, with discretion over the OPM are stalled by immediate political consequences. Blank (2008) noted an increase in poverty due to more accurate measurement is a political risk. First, the opposition party could choose to use an increase in poverty prevalence for political attacks against the party in the White House. Second, an increase in poverty prevalence would challenge mainstream US political rhetoric that poverty is a relatively rare, individual circumstance. The potential for both self-inflicted political vulnerability and loss of coercive rhetorical devices are a potent combination that stops US Presidents from remedial actions to improve the OPM.

The conclusion from this research is that the OPM fails to classify large proportions of families as poor when they experienced material hardship and fails to surpass evaluative criteria among families without hardship and is useless for these families (Pepe, 2003). The OPM sensitivity to material hardship was low across all indicators. Instead, the measure produced larger proportions of false-negative results, families classified as nonpoor when they reported a hardship. These misclassifications were most egregious for dental hardship (i.e., 75 percent), but the failure was nearly equivalent for unmet essential need, 71.5 percent, and medical hardship, 73.1 percent. The failure to account for the price of medical and dental care, or health insurance, in the
OPM poverty lines is a likely explanation for the high proportions of false-negative results for these hardships. These families’ incomes were greater than their respective poverty lines but were insufficient to address health hardships.

It is possible the recommendations of Fendler and Orshansky (1979) and others to include shelter prices and/or geographically vary commodity prices could reduce the proportion of false-negative results. The logic of this hypothesis is that such changes would increase the poverty line for areas with higher commodity prices, and thereby, classify more families as poor when they experience material hardship. Further, the inclusion of geographic variation in prices might simultaneously improve OPM specificity (i.e., lower proportions of false-positive results), as it would reduce the poverty line for areas with lower commodity prices.

The large proportions of false-negative results are evidence the OPM is an inadequate basis for means tests on public assistance benefits. Families with material hardships are ineligible for these benefits if their incomes exceed the respective Poverty Guideline (i.e., weighted average of OPM poverty lines) for their family. It is possible such an inexact tool results in more false-negative results. The application of percentage multiples for some programs, like Medicaid, could offset false-negative results; however, the proportion of false-positives might increase because these families might avoid material hardship but their income will remain at or below the poverty line. The provision of minimum needs is too important a task to leave to random chance or inexact methods.
The use of the OPM as a derivative for public assistance program eligibility is irresponsible, given its classification performance, and furthers capitalistic exploitation. A moral minimum price for labor-power in an economy with capitalistic production is one that, when realized as wage, facilitates freedom. That notwithstanding, a politically defensible minimum price for labor-power needs only be above the poverty line (when earned as wage). A lone-parent with one child must price his or her labor-power at $7.85 and engage in 2,080 hours of labor time to earn a wage equal to the 2015 OPM poverty line. The quantity of labor time increases to 2,254 hours at the federal minimum price for labor-power ($7.25), which is the state minimum price in Idaho, Indiana, Iowa, Kansas, Kentucky, North Carolina, North Dakota, Oklahoma, Pennsylvania, Texas, Utah, Virginia, and Wisconsin. The amount of labor time for a poverty line wage increases with the number of persons in a family unable to work. For example, at the federal minimum price for labor-power, a lone-parent with two children must secure 2,634 hours of labor time to earn a poverty line wage. The division of labor time into necessary and surplus means an increase in labor time would multiplicatively increase surplus labor time and the degree of exploitation for extraction of surplus value (Marx, 1867).

It is possible to extend the critique that use of the OPM is irresponsible and exploitative to claim it is also oppressive. The Poverty Guidelines inherit, and likely exacerbate, the inadequacies of the OPM. So, while the Guidelines are a neutral test for program eligibility, its application could further disadvantage persons through denial of public assistance. The results from this study are evidence of possible institutional
oppression of Asian, Indigenous, or disabled families (these families had lower odds of a true-positive result relative to respective reference groups).

The goal of a social indicator, like the OPM, is to measure societal progress or well-being (Land & Michalos, 2017). However, the OPM is widely criticized as inadequate and results from this study were supportive of those criticisms. One strategy to correct this dereliction is to implement a national, annual survey of multidimensional poverty (Beverly, 2001b). Such a measure would align with the goals of either the US Census’s Annual Social and Economic Supplement or SIPP and would provide greater information on consumption, previously unavailable information on social exclusion, and the data to assess the accuracy of OPM classifications (as was done in this research). The accuracy of the OPM is critical beyond its application as a social indicator because it is also the basis for public assistance means-tests. The simplistic calculation of the Poverty Guidelines from the OPM thresholds at best retains and at worst exacerbates the classification errors observed in this study. So, families that experience material hardship might be deemed ineligible for public assistance due to a classification error.

**Future research implications.** The conclusion of this study is a start for additional investigations. Each is presented as a research question.

Do changes to the OPM improve its classification and predictive probabilities? The hypothesis is that inclusion of additional commodity price indices or geographic variability to the OPM could increase the correct classification of families as “positive” or “negative” when condition positive or negative. However, inclusion of additional indices without attention to the variation in price, especially for shelter, could perversely
reduce OPM specificity (i.e., larger proportions of false-positive results). Therefore, it is important to consider how a change will affect both sensitivity and specificity. It is possible to statistically compare the results from alternative tests for the same condition (Pepe, 2003).

If the OPM is judged as beyond repair, then the question becomes, what should replace the Official Poverty Measure? Marx (1867) recommended a comprehensive poverty measure with food, shelter, fuel, and clothes prices aggregated to annual consumption. The SPM includes these commodities; however, it is a relative measure of income spent (Citro & Michael, 1995; ITWG, 2010) and violates recommendations to avoid valuation of public assistance benefits (Orshansky, 1969; Fendler & Orshansky, 1979). If the goal is to develop a comprehensive poverty measure conceptually akin to the OPM (i.e., an absolute measure), then it should consist of price indices for each minimum need commodity. The inclusion of a geographic differential to account for variation in commodity prices across space would address longstanding criticisms of the OPM (e.g., Fendler & Orshansky, 1979; US Census, 1985; Citro & Michael, 1995). Finally, use of the Foster-Greer-Thorbecke (FGT) decomposable aggregate index would allow calculation of the headcount ratio (or poverty rate), income poverty gap, and a severity sensitive income poverty gap. Social decision makers and the public can contextualize changes in the headcount ratio with the information about poverty severity and the effect on specific groups, like the poorest.

What is the effect of public assistance receipt on OPM classifications and predictions? If the goal of public assistance is to alleviate material hardships, and it
achieves that end, then the OPM will classify these families as false-positive for poverty. That is, the OPM will classify the family as “positive,” but the public assistance provision will make the family condition negative. (The inattention to public assistance receipt is one explanation for the low or uninterpretable specificity values from this study.) One option for future research is to assign families as hardship positive when they report public assistance receipt and no hardship. For example, a family negative for utility nonpayment that receives assistance from the Home Energy Assistance Program (HEAP) would be changed to positive. The assumption is without such assistance the family’s income would be too low to afford utility payment. Importantly, the experimental alteration of hardship incidence from negative to positive for public assistance beneficiaries could artificial inflate the OPM sensitivity values, if it correctly classifies these families as “positive.”

What is the effect of alternative material hardship measures on OPM classifications and predictions? Two components of the Basic Needs & Food Insecurity measure might confound investigations of OPM sensitivity and specificity. First, its time-period is the previous calendar year. That is, it is possible that a family that tested as “positive” under the OPM did not experience material hardship in the previous year or vice versa. Contemporaneous measurement of income and hardship is one strategy to resolve this limitation. Second, developers of the Basic Need & Food Insecurity measure left determination of its psychometric properties to future research (HHS, 2004). The available psychometric research into the measure is restricted to latent group analysis (Rose, Parish, & Yoo, 2009) and provided no determination as to whether the measure is
a scale or index or how to aggregate its multiple indicators. Further, the Basic Need & Food Insecurity measure lacks significant material hardship indicators, including transportation, access to water, clothes, and mental health. One route for future research is to develop a cumulative measure of material hardship, that includes natural and necessary wants, and investigate its psychometric properties.

The last recommendation for future research is, what is the effect of alternative aggregate indices on OPM classification and predictions? The headcount ratio used in the OPM is criticized for its insensitivity to severity and transfers (Sen, 1979); however, its outcome metric is dichotomous—poor or subsistent (Fisher, 1992). Another aggregate index, like the Foster-Greer-Thorbecke index (Foster et al., 1984), would incorporate and quantify poverty severity but be inappropriate for strict binary comparisons. Investigations along this line must confront the aforementioned challenges and ones specific to evaluations of categorical tests.

The future research investigations recommended here that rely on SIPP data will be greatly limited by revisions to the Adult Well-Being module. The US Census reduced its hardship indicators to rent or mortgage nonpayment and utility nonpayment (M. Marlay, personal communication, January 20, 2016). This will be an incredible loss of information about material conditions in the US and of potential investigations into OPM classifications and predictions. Further, the 45th Presidential administration is lax about its commitment to fund the Census, which is constitutionally responsible for the decennial census. This lack of commitment could also negatively affect SIPP data, as the interviewers follow respondents for years with multiple instances of data collection per
year. While the Census adjusts for SIPP sample loss through weights, the loss of respondents reduces sample variability because these sample members could represent small groups in the total population, hold particular characteristics, or experience certain circumstances. It is crucial, then, for the Census to implement strategies that increase respondent retention and data provision. These efforts will improve the accuracy of parameter estimates from the SIPP and confidence in those estimates, as well as in their use in statistical tests.

Social work implications. Social work professionals will be bound by the limitations of the OPM and Poverty Guidelines for the foreseeable future. These inadequacies will hamper efforts by social workers to address material needs through public assistance programs. Even so, the results from this research are useful to inform social work practice and education.

Social work practice. Social workers who wish to predict and prevent material hardships will find the OPM is an insufficiently trustworthy tool to achieve that goal. Its positive predictive values (PPV) for severe hardships (i.e., eviction, skip or cut meals, a day without food, and utility disconnection) are useless, and its PPVs for other hardships are less than 40 percent. A social worker, and his or her client, has little certainty a hardship will occur with an OPM positive result. Likewise, the OPM negative predictive values (NPV) are useless for eviction, skip or cut meals, day without food, utility disconnection, phone disconnection, and medical hardship. The social worker and client cannot expect the lack of these hardships with an OPM negative result. That is, even with a negative OPM result, it is not possible to predict the absence of these hardships.
Of the interpretable NPVs, the probability of material hardship is still approximately ten percent. A client negative for poverty under the OPM has a ten percent probability for unmet essential need, rent or mortgage nonpayment, utility nonpayment, or dental hardship.

While the overall predictive values are of little help, social workers can expect an OPM true-positive result when their client has certain characteristics. Families positive for poverty under the OPM have higher odds of a true-positive result when they have more children, a lone head, unemployment, or less than a high school education. Social workers should anticipate material hardship when these families are positive for poverty under the OPM. Importantly, families that identify as Asian, Indigenous, or have a disabled head could experience food hardship due to cost regardless of their OPM status. Social workers must devote particular attention to these families’ food needs; unfortunately, if the OPM classifies these families as nonpoor, then they will likely be ineligible for the Supplemental Nutrition Assistance Program. The exclusion of these families from federal public assistance restricts their formal options for hardship alleviation to state, local, or charity services. Such a patchwork of local and voluntary services is less efficient, effective, and reliable.

Radical social work, or structural critical social work or emancipatory practice, is the integration of Marx’s political economy into social work education, research, and practice (Fook, 2003). The history (and present) of radical practice is fraught with repression (and worse) by other social work professionals and US officials (Reisch & Andrews, 2001). Social work colleagues dismiss radical practitioners with innuendo and

Contemporary radical social work in the US tends to accept and promote liberal or social democratic perspectives and solutions instead of a truly radical lens (Wagner, 2009). Take, for example, demands for full employment. The anticipated benefits from full employment (that is, an unemployment rate below four percent) sound venerable: increased work hours, higher wages, and greater labor unionization (Tomczak & Rofuth, 2015). However, through a radical lens, such benefits wither. First, more time and energy spent in labor, under capitalistic production, is expected to produce greater alienation and less time and energy for personal development. Second, there appears to be little association between rate of employment or labor productive and wage growth over the last three decades (Mishel, Gould, & Bivens, 2015). Third, it is a strange prediction that labor unions would thrive under a full employment policy when some of their major benefits (i.e., protection from unemployment and higher wages) would naturally arise from such a policy. One radical solution for unemployment and poverty is a network of social policies with a universal basic income (UBI) at its core. The provision of an adequate UBI would support individual freedom to pursue personal development, empower workers to negotiate labor-power price and conditions of the working day, and soothe financial pains of unpaid care-work to children, elders, and other family members (Harrington, 1973; Theobald, 1966; Wade, 1967; Wax, 2009).

Marx’s political economy is a unified theoretical framework for (radical) social work professionals to understand and redress poverty in the United States. Social
workers in the US already employ a macro-theory, von Bertalanffy’s (1968) systems theory, and the benefits of systems theory are its description of system components and states, like inputs and homeostasis; its applicability to individuals, groups, institutions, and societies; and its attention to nested systems, what social workers refer to as the person-in-environment perspective. Nonetheless, systems theory is not explanatory, is susceptible to arguments for the status quo, and is most useful for liberal (versus radical) reform (Longres, 1986). Marx’s political economy is a necessary complement to social workers’ application of systems theory for interventions on poverty. Marx’s discussion of alienation, the objectification of self and others in capitalistic production, is a potential core for emancipatory social work practice (Ferguson & Lavalette, 2004). Clients and social workers experience alienation in their interactions—clients a sense of powerlessness in service utilization and social workers a sense of lost control in service allocation—and this commonality is an opportunity to join, cooperate, and challenge the dominate system (Ferguson & Lavalette, 2004).

The American Academy of Social Work and Social Welfare (AASWSW) launched its 12 Grand Challenges for Social Work (GCSW) at the 2016 annual conference of the Society for Social Work and Research (SSWR) (Wilson, 2016). The results from this research are relevant to the GCSW: reduce extreme economic inequality. This GCSW is a liberal (versus radical) objective from its use of “reduce” instead of eliminate, remove, or outlaw. That notwithstanding, Lein, Romich, and Sherraden (2016) recommended reversal of extreme inequality through mechanisms reminiscent of Marx, including minimum wage (that is, minimum labor-power price) increases; humanization
of work hours; expansion of Earned Income Tax Credit, childcare support, and public-sector employment; improvements to unemployment insurance; and unionization. They also suggested higher taxes on wealth and investment. Their strategies retain capitalistic production as the primary form of production in the United States and attempt to protect workers from its detrimental consequences. It is critical to acknowledge these recommendations would affect extraction of surplus-value and accumulation. Therefore, it is reasonable to anticipate strong resistance from capitalists.

**Poverty-aware social work education.** The results from this study integrate well into the poverty-aware social work education framework. The goals of a poverty-aware social work curriculum are that social work students learn to, first, “…oppose the existence of poverty and inequality in their work with and on behalf of people living in poverty…” and, second, “…provide ‘good enough’ services to people in poverty based on the understanding of the centrality of poverty in people’s lives and of the ways in which poverty, and its intersection with gender, age, disability, ethnicity and race, affects diverse situations of distress that may have behavioral or emotional expressions” (Krumer-Nevo, Monnickendam, & Weiss-Gal, 2009, p. 229).

Social work educators can assist students to achieve poverty-aware practice goals as social work professionals through Kolb’s (1984) experiential learning theory and recommendations from Krumer-Nevo and colleagues (2009). Kolb (1984) described the process of education from an experiential perspective. Learners internalize concepts through the cycle of (1) concrete experience, (2) reflective observation, (3) abstract conceptualization, and (4) active experimentation (Kolb, 1984). These stages are present
in poverty-aware education. Social work students undertake concrete experiences in poverty simulations; local, state, and federal policy analysis; and poverty intervention in field placement (Krumer-Nevo et al., 2009). After each concrete experience, students engage in critical reflection on the experience and how their personal and cultural values influenced it and their beliefs about poverty (Krumer-Nevo et al., 2009). Educators expose students to theories of poverty, empowerment, and community to develop abstract conceptualizations for social work practice (Krumer-Nevo et al., 2009). Finally, classroom and field placement educators support and facilitate ethical active experimentation by students as they internalize theory and attempt interventions. Saar-Heiman, Lavie-Ajayi, and Krumer-Nevo (2017) found Israeli clients experienced an increase in feelings of visibility, an active partnership to fight poverty, a close relationship that challenged hierarchy, and a responsiveness to material and emotional needs.

Poverty-aware social work educators can use the results from this study to support students’ concrete experiences and abstract conceptualizations. Students must learn to assess for material hardship and anticipate a higher chance of hardship among lone-parent families, families with two or more children, families with an unemployed head, and families without a high school diploma. Students can anticipate greater chances of hardship among Hispanic or Latino(a) families, Asian families, and Indigenous families. Students must not assume the absence of hardship for Asian or Indigenous families or families with disabilities when their incomes are above the poverty line. The odds of an
OPM true-positive result were low for these families, and there is a chance these families will experience food hardship when their income is greater than the poverty line.

Students could use the eight nonfood items of the Basic Needs & Food Insecurity measure at intake, first contact, or assessment to determine the material needs of a client. These questions are not exhaustive, they fail to include significant minimum needs, like transportation and mental health. Nevertheless, the short items are a possible tool to “break the ice” and initiate dialogue on the difficult topic of unmet needs. The USDA food insecurity scale is a complete food hardship measure and consists of ten items for adults and 18 items for families with children (USDA, 2016). It is crucial students know of the federal, state, and local programs and resources and how to refer clients who are positive for hardship.

Poverty-aware social work educators can also use results from this study to present empirical arguments for revision of the OPM. One goal of social work education is to prepare students for advocacy and macro-level intervention. Social work students can incorporate the evidence from this study as they advocate for accurate social indicators. The poverty rate is an oft cited statistic to justify claims of societal fairness and need. Social work students should understand the limitations of the OPM and how these affect the means test. It is also important for students to be familiar with recommendations for how to improve the OPM, including additional price indices and geographic variation (Fendler & Orshansky, 1979). Advocacy to improve the OPM is one strategy for future social work professionals to pursue justice.
References


