University of Cincinnati

Date: 6/5/2013

I, Julie A Miller , hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in Nursing - Doctoral Program.

It is entitled:

Factors Influencing Influenza Vaccination of Children

Student's name: Julie A Miller

This work and its defense approved by:

Committee chair: Gordon Gillespie, Ph.D.

Committee member: Rebecca Lee, Ph.D.

Committee member: Wei Pan, Ph.D.

Committee member: Yin Xu, Ph.D., R.N.

4621

Factors Influencing Influenza Vaccination of Children

A dissertation submitted to the
Graduate School
of the University of Cincinnati
in partial fulfillment of the
requirements of the degree of

Doctor of Philosophy

In the College of Nursing

2013

by

Julie Ann Miller

M.S.N., University of Kentucky, 1997

B.S.N., California State University, Long Beach, 1983

Committee Chair: Gordon Lee Gillespie, PhD, RN, PHCNS-BC, CEN, CPEN, FAEN

Abstract

Background: Influenza is a significant cause of morbidity in both healthy children and children with chronic or serious medical conditions. Although influenza vaccination is recommended for all children over 6 months of age, less than half (49%) are vaccinated against influenza annually, far below the Healthy People 2020 goal of 80%. The purpose of the study was to test a model describing factors influencing parents' likelihood to vaccinate children against influenza. Using the Health Belief Model as the theoretical framework, the model hypothesized the relationships between the main constructs of the Health Belief Model and perceived vaccine risk on likelihood to vaccinate. The construct of perceived vaccine risk was added as a separate construct to address present-day barriers to childhood influenza vaccination.

Methods: A two-phase cross-sectional research design was used. In Phase I, a convenience sample of 100 parents of children aged 2 to 17 years participated. The reliability and validity of the investigator-developed Childhood Influenza Immunization Questionnaire was determined. The instrument is an anonymous 30 item self-report questionnaire designed to measure Health Belief Model constructs within the context of pediatric influenza vaccination. Following content validity and principal component analysis, the instrument was revised. In Phase II, a convenience sample of 200 parents of children aged 5 months to 17 years participated. Data were collected using the revised instrument and psychometrics examined using confirmatory factor analysis. Structural equation modeling analysis was conducted to test the hypothesized model and examine the direct and indirect effects of the Health Belief Model constructs on childhood influenza vaccination.

Findings: Internal consistency of the instrument ranged from .43 to .74. Construct validity was confirmed by confirmatory factory analysis with factor loadings ranging from .39 to

.85. The initial hypothesized structural model did not fit the observed data. The model was then modified following examination of statistical results and theoretical underpinnings. The final model was an acceptable fit to the data (Bollen-Stine $p = .085$; $\chi^2 = 207.44$, $df = 144$, $p < .001$; GFI = .90; CFI = .92; TLI = .90; RMSEA = .047). The likelihood of parents vaccinating children against influenza was directly influenced by perceptions of susceptibility to influenza ($\beta = .38$; $p < .01$) and negative perceptions of vaccine risk ($\beta = -.53$; $p < .001$). Parents' perception of the severity of influenza on likelihood to vaccinate was indirectly influenced by perceived benefits of vaccination and perceptions of vaccine risk. In addition, cues to vaccinate were indirectly influenced by perceptions of system barriers to vaccination and negative perceptions of vaccine risk.

Conclusion: The Childhood Influenza Immunization Questionnaire was an effective instrument to measure parents' perceptions of influenza risk and test the hypothesized model. Parents' perceptions of the risk of influenza vaccination negatively affect childhood influenza vaccination. Strategies for improving vaccination rates should focus on educating parents on vaccine safety and improving knowledge of influenza-related disease in children.

Copyright 2013
By Julie Ann Miller
All rights reserved

Acknowledgements

I would like to acknowledge those that have supported me throughout this four year journey. First, I would like to thank my dissertation committee for their time, guidance, and support. As educators, their commitment to the profession is to be commended. Special thanks to my chair, Dr. Gillespie, who has been with me from the beginning and provided expert guidance on the dissertation process as well as timely, constructive review of the dissertation. Thanks to Dr. Pan, whose statistical knowledge and support was invaluable. And, thanks to Dr. Xu and Dr. Lee whose community health nursing expertise helped to strengthen the study. Special thanks to the Association of Community Health Nursing Educators for providing financial support for this research.

Completing this dissertation would not have been possible without the support, understanding, and encouragement of my family. My husband and children were present throughout the journey and shared in both the successes and struggles. I also extend my sincere love and appreciation to my parents who started me on the path to knowledge.

Again, thank you to everyone who helped me to achieve this goal. I am looking forward to applying the knowledge I have gained through this process in the next “chapter” in my life.

Table of Contents

Chapter I: Introduction:	1
Purpose of the Study	2
Specific Aim and Research Hypotheses	4
Specific Aim	4
Hypothesis 1	4
Hypothesis 2	4
Hypothesis 3	4
Hypothesis 4	4
Hypothesis 5	4
Background	5
Current Research	7
Significance	8
Chapter II: Literature Review	10
Health Belief Model	10
Constructs of the Health Belief Model	12
Health Belief Model Research	13
Health Belief Model and Influenza Vaccination of Children	16
Hypothesized Model	19
Perceived Vaccine Risk	20
Relationship between Perceived Susceptibility and Perceived Severity	25
Relationship between Cues to Action, Perceived Susceptibility, and Perceived Severity	26
Relationship between Perceived Severity and Perceived Vaccine Risk	28
Relationship between Perceived Susceptibility, Perceived Severity, Perceived Benefits, and Perceived System Barriers	28
Variables	30
Likelihood to Vaccinate	30
Perceived Susceptibility	31
Perceived Severity	31
Cues to Action	31
Perceived Benefits	31
Perceived Vaccine Risk	32
Perceived System Barriers	32
Summary	32
Chapter III: Methods	33
Phase I	33
Setting	34
Sample	34
Measures	35
Recruitment	41
Data Collection	42
Data Management	42
Data Analysis	43
Content Validity	43
Construct Validity	43

Reliability.....	44
Phase II.....	45
Setting.....	45
Sample.....	46
Measures.....	46
Recruitment.....	47
Data Collection and Data Management.....	47
Data Analysis.....	47
Measurement Model.....	47
Validity of Structural Model.....	48
Funding.....	49
Human Subjects.....	49
Chapter IV: Results.....	52
Phase I.....	52
Participants.....	52
Data Screening.....	55
Instrument Construct Validity.....	55
Phase II.....	62
Participants.....	62
Measurement Model.....	65
Data Screening.....	66
Results of Measurement Model.....	66
Results of Structural Model.....	72
Hypothesis 1.....	73
Hypothesis 2.....	77
Hypothesis 3.....	77
Hypothesis 4.....	78
Hypothesis 5.....	78
Summary.....	78
Chapter V: Discussion.....	80
Phase I.....	80
Participants.....	80
Instrument.....	81
Phase II.....	82
Participants.....	82
Instrument.....	83
Hypotheses.....	86
Hypothesis 1.....	86
Hypothesis 2.....	87
Hypothesis 3.....	90
Hypothesis 4.....	92
Hypothesis 5.....	92
Implications for Nursing.....	94
Limitations.....	97
Recommendations for Further Research.....	98
Conclusion.....	99

References	100
Appendix A: Copyright Permission John Wiley & Sons, Inc	122
Appendix B: Items on CIIQ and Corresponding Subscale	123
Appendix C: CIIQ.....	125
Appendix D: Allergy Partners Letter of Support.....	128
Appendix E: HBM Scale Items-Chen.....	129
Appendix F: HBM Scale Items-Champion.....	130
Appendix G: Research Information Sheet	132
Appendix H: Content Validity Evaluation.....	134
Appendix I: Content Validity Results.....	137
Appendix J: St. Elizabeth Physicians Letter of Support	139
Appendix K: University of Cincinnati IRB Approval Letter.....	140

List of Tables

Table 1 CIIQ: Revised Items and Original Source	38
Table 2 Phase I: Demographic Characteristics of Participants	54
Table 3 Summary of CIIQ Factor Loadings	56
Table 4 Item Analysis and Internal Consistency of Subscales	58
Table 5 Phase II: Demographic Characteristics of Participants.....	64
Table 6 Fit Indices of Measurement Model	68
Table 7 Item Analysis and Internal Consistency of Subscales	70
Table 8 Summary of Subscale Analysis	72
Table 9 Fit Indices of Structural Model.....	75
Table 10 Hypothesized Model: Correlational Matrix of Latent Constructs	75
Table 11 Final Model: Correlation Matrix of Latent Constructs.....	77

List of Figures

Figure 1 Hypothesized Health Belief Model	4
Figure 2 Relationships between Health Belief Model constructs	11
Figure 3 Hypothesized Health Belief Model	20
Figure 4 Specification of structural model.....	48
Figure 5 Phase I: Participant eligibility chart	52
Figure 6 Phase II: Participant eligibility chart	62
Figure 7 Number and ages of children receiving influenza vaccine last year	65
Figure 8 Final measurement model with standardized estimates and factor loadings.....	69
Figure 9 Specification of structural model.....	73
Figure 10 Hypothesized model with standardized coefficients.....	74
Figure 11 Final structural model with standardized coefficients.....	76

List of Abbreviations

AAP	American Academy of Pediatrics
ACIP	Advisory Committee on Immunization Practice
AGFI	Adjusted Goodness of Fit Index
CDC	Centers for Disease Control and Prevention
CFI	Comparative Fit Index
CIHQ	Childhood Influenza Immunization Questionnaire
FDA	Federal Drug Administration
GFI	Goodness-of-Fit Index
HBM	Health Belief Model
H ₁ N ₁	Pandemic influenza A virus
HRSA	Health Resources and Services Administration
IFI	Incremental Fit Index
IOM	Institute of Medicine
IRB	Institutional Review Board
KMO	Kaiser-Meyer-Olkin Measure of Sampling Adequacy
LAIV	Live attenuated influenza vaccine
MAR	Missing at random
MCAR	Missing completely at random
MNAR	Missing not at random or nonignorable
NFI	Normed Fit Index
PCA	Principal component analysis
RMSEA	Root Mean Square Error of Approximation
RNI	Relative Noncentrality Index
SEM	Structural equation modeling
TIV	Trivalent inactivated influenza vaccine
TLF	Tucker-Lewis Index
USPHS	United States Public Health Service
VFC	Vaccines for Children

CHAPTER I: INTRODUCTION

Influenza is a significant cause of morbidity in both healthy children and children with chronic or serious medical conditions (Izurieta et al., 2000). Depending upon the strain, influenza can also be a significant cause of mortality in children (Bhat et al., 2005; Centers for Disease Control and Prevention [CDC], 2010a). For children less than 5 years of age, the burden of disease is even greater as hospitalizations for influenza-associated complications mirror that of older adults and adults at high risk for influenza-related complications (Thompson et al., 2004). To address this issue, the Advisory Committee on Immunization Practices (ACIP) began recommending annual influenza vaccination for all children 6 months of age and older in 2008 (CDC, 2010c). However, less than half (49%) of children aged 6 months to 17 years are vaccinated against influenza annually (CDC, 2011a), far below the Healthy People 2020 goal of 80% (U. S. Department of Health and Human Services, 2011).

Achieving an 80% influenza vaccination rate among children has the potential to benefit the health of the public. Universal childhood influenza immunization prevents hospitalizations among children (Hassan, Lewis, & Davis, 2009) and also increases herd immunity, thereby reducing influenza incidence in pediatric (Loeb et al., 2010) and adult (Longini et al., 2000) populations. Therefore, an added benefit is a subsequent reduction in influenza-related morbidity and mortality in older adults (Reichert et al., 2001) which is vitally important as complications from influenza in this age group results in more than 200,000 hospitalizations and 32,000 deaths annually (Thompson et al., 2004).

To achieve herd immunity in the pediatric population, the first step is to understand factors influencing parents' likelihood to vaccinate children against influenza. The Health Belief Model (Strecher & Rosenstock, 1997) has served as the theoretical framework in a number of

studies examining influenza vaccination behavior in children (Allison et al., 2010; Chen et al., 2011; Daley et al., 2006; Daley; et al., 2007) and adolescents (Painter et al., 2011). However, in the studies, constructs of the Health Belief Model (HBM) were examined independent of one another preventing a clear understanding of the relationships among the HBM constructs and influenza vaccination. In addition, measuring perceived barriers as a single construct may not adequately address present-day barriers (Chatterjee & O’Keefe, 2010) to childhood influenza vaccination. Therefore, the construct of perceived vaccine risk was examined as a separate construct. An understanding of the relationships among the constructs is important to further the usefulness of the HBM in developing effective interventions to promote influenza vaccination among children.

Purpose of the Study

The purpose of this study was to test a model describing factors influencing parents’ likelihood to vaccinate children against influenza. Developed based on the HBM (Strecher & Rosenstock, 1997), the proposed model hypothesizes the relationships between the main constructs of the HBM (perceived severity, perceived susceptibility, perceived barriers, perceived benefits, cues to action) and perceived vaccine risk on likelihood to vaccinate. As presented in the HBM, individuals are more likely to seek preventive health care if they believe they are susceptible to a condition, believe contracting the condition will cause potentially serious consequences, believe an available intervention would be effective in reducing their susceptibility or severity of the condition, and believe benefits of the health action outweigh anticipated barriers (Strecher & Rosenstock, 1997).

The HBM has utility in understanding factors influencing parents’ likelihood to vaccinate children against influenza. However, since the HBM was originally developed in the 1950s

(Rosenstock, 1974), measuring perceived barriers as a single construct may not adequately address present-day barriers to childhood vaccination. Current barriers to childhood vaccinations are complex and include not only system determinants such as vaccine cost and supply (Fitch & Racine, 2004; Kimmel, Burns, Wolfe, & Zimmerman, 2007), but also parental misperceptions regarding vaccine safety. Although controversies surrounding vaccinations are not new (Kaufman, 1967), concerns over vaccine safety have taken on a renewed vigor in the past 10 years (Chatterjee & O’Keefe, 2010; Kennedy, LaVail, Nowak, Basket, & Landry, 2011). The majority of parents believe childhood vaccinations are important and safe (Bardenheier et al., 2004; Freed, Clark, Butchart, Singer, & Davis, 2010; Keane et al., 2005), but an increasing number of parents are electing to either partially vaccinate or refuse all vaccinations for their children (Dempsey et al., 2011; Robison, Groom, & Young, 2012). Consequently, there has been a resurgence of vaccine preventable diseases in the United States, particularly measles and pertussis (CDC, 2011b). A recent survey assessing parental confidence in vaccines found 77% of parents had concerns about childhood vaccinations (Kennedy et al., 2011). Therefore, as the barriers construct may actually reflect system barriers and perceptions of vaccine risk each was examined as separate constructs in the study. Furthermore, Rosenstock, Strecher, and Becker (1988) postulate the explanatory power and predictive ability of the HBM may be improved by reducing the range of components subsumed within the barriers construct.

The current study consisted of two phases as further refinement of an instrument to measure the constructs in the HBM specific to pediatric influenza vaccination was required. The first phase was to determine the reliability and construct validity of the instrument to measure the constructs. In particular, it was important to determine if the constructs of perceived barriers and perceived vaccine risk should be examined as two separate constructs. Using structural equation

modeling, the second phase tested a hypothesized model of factors influencing parents' likelihood to vaccinate children against influenza (see Figure 1).

Figure 1. Hypothesized Health Belief Model of factors influencing parents' likelihood to vaccinate children against influenza.

Specific Aim and Research Hypotheses

Specific Aim: To test a hypothesized model describing factors influencing parents' likelihood to vaccinate children against influenza.

Hypothesis 1: The overall model fits the data.

Hypothesis 2: Perceived system barriers, perceived vaccine risk, and cues to action will have a direct effect on likelihood to vaccinate.

Hypothesis 3: Perceived benefits will have an indirect effect through perceived barriers on likelihood to vaccinate;

Hypothesis 4: Perceived vaccine risk will have an indirect effect through perceived benefits and perceived barriers on likelihood to vaccinate;

Hypothesis 5: Perceived susceptibility and perceived severity will have an indirect effect through perceived benefits and perceived barriers on the likelihood to vaccinate.

Background

Influenza is the eighth leading cause of death in the United States (Kochanek, Xu, Murphy, Miniño, & Kung, 2011). The annual rate of influenza-related deaths ranges from 1.4 to 16.7 deaths per 100,000 individuals with differences in circulating influenza strains accounting for the variance (CDC, 2010b). Influenza results in a substantial economic burden in lost productivity (Molinari et al., 2007) and is responsible for approximately 200,000 hospitalizations each year (Thompson et al., 2004). Older adults account for the majority of influenza-related morbidity and mortality (CDC, 2010b; Thompson et al., 2004).

Influenza is a highly contagious respiratory illness caused by influenza A and B viruses (Kuiken & Taubenberger, 2008). The viruses most frequently cause epidemics in the winter and affect individuals of all ages (Monto, 2008). Mutations during viral replication cause antigenic change resulting in new strains of the viruses thereby necessitating annual influenza vaccination (Bouvier & Palese, 2008). The impact of a particular strain of influenza in the population is the combination of the antigenic variation of the virus, the level of immunity in the population, and the virulence of the strain (Cox & Subbarao, 1999; Monto & Kioumeh, 1975). Complications of influenza infections include viral pneumonia, bacterial pneumonia, Reye's syndrome, Guillain-Barré syndrome, encephalitis, and myositis (Cox & Subbarao, 1999).

During influenza season, children incur the highest rates of infection (Monto & Kioumeh, 1975) with annual attack rates estimated at 20% to 34% (Neuzil, Hohlbein, & Zhu, 2002; Poehling et al., 2013). Children with chronic medical conditions and healthy children under 2 years of age are the groups most susceptible to serious complications of influenza and most likely to be hospitalized (Izurieta et al., 2000; Lopez-Medina, Ardura, Siegel, Brock, & Sanchez, 2012; Neuzil et al., 2002; Poehling et al., 2013). School-aged children contribute to the

transmission of influenza by serving as the main transmitters of influenza to household members (Monto & Kioumeh, 1975) and individuals at risk for complications (Longini, Koopman, Monto, & Fox, 1982). In addition to hospitalizations, influenza in children results in increased outpatient visits (Neuzil, Mellen, Wright, Mitchell, & Griffin, 2000; Poehling et al., 2006), an increase in antibiotic prescriptions (Neuzil et al., 2000), and significant increases in school absenteeism and parental absenteeism from work (Neuzil et al., 2002).

Annual influenza vaccination of children is an effective method to prevent influenza epidemics among children, adults, and older adults (CDC, 2010c). Currently, the two influenza vaccines licensed for use in children are trivalent inactivated influenza vaccine (TIV) and live, attenuated influenza vaccine (LAIV). The TIV is approved for children 6 months of age and older and is administered by intramuscular injection whereas the LAIV is approved for children 2 years and older and is administered intranasally by sprayer. Unlike TIV, LAIV is contraindicated in children with certain high risk conditions, such as asthma. As LAIV contains live attenuated viruses, side effects such as rhinorrhea, fever, and sore throat may occur. Both vaccines are formulated annually to match projected influenza strains. Research has documented the safety and efficacy of both vaccines for use in children (CDC, 2010c).

Prior to 2002, influenza vaccination was only recommended for children at increased risk for influenza-related complications (CDC, 2002). Recommendations for annual influenza vaccination of children expanded in 2008 to include all children 6 months of age and older (CDC, 2010c). From a public health perspective, annual universal childhood influenza immunization has the potential to benefit society (Poland, Rottinghaus, & Jacobson, 2001). However, current influenza vaccination coverage of children aged 6 months to 17 years is far below the Healthy People 2020 goal of 80% (U. S. Department of Health and Human Services,

2011). During the 2008 to 2009 influenza season, 41% of children aged 6 to 23 months, 32% of children aged 2 to 4 years, and 21% of children aged 5 to 17 years were vaccinated (CDC, 2009a). For the 2010 to 2011 season, national influenza vaccination coverage was 49% for children aged 6 months to 17 years (CDC, 2011a) and for the 2011 to 2012 season 51.5% (CDC, 2012a), an alarming trend suggesting influenza vaccination may have plateaued.

Current Research

In 2002, the ACIP began “encouraging” influenza vaccination of healthy children aged 6 to 23 months (CDC, 2002). Following this new recommendation, several studies were undertaken to assess predictors of influenza vaccination and parental factors influencing vaccination behavior among young children (Chen et al., 2011; Daley et al., 2006; Daley et al., 2007; Humiston, Lerner, Hepworth, Blythe, & Goepp, 2005; Nowalk et al., 2005; Nowalk et al., 2007). The factor consistently associated with positive influenza immunization behavior was physician recommendation to vaccinate. Other factors included reminder letters (Nowalk et al., 2007), belief that getting influenza vaccination for their child “was a smart idea” (Nowalk et al., 2005, p. 212), and perceiving influenza vaccination as a social norm (Daley et al., 2006; Daley et al., 2007).

The HBM (Strecher & Rosenstock, 1997) has served as the theoretical framework in a number of studies examining influenza vaccination behavior in children (Allison et al., 2010; Chen et al., 2011; Daley et al., 2006; Daley et al., 2007) and adolescents (Painter et al., 2011). Parents of young children were more likely to vaccinate their child against influenza if they perceived their child susceptible to influenza, perceived the vaccination as beneficial, and perceived that barriers did not outweigh the benefits (Chen et al., 2011; Daley et al. 2006; Daley et al., 2007). Among parents of school-aged children strong predictors of immunization included

belief in influenza vaccine safety and physician recommendation (Allison et al., 2010). Parents' perception of potential disease severity were less predictive of influenza immunization (Chen et al., 2011) and appears to be reflective of seasonal variation in the virulence of particular influenza strains (Daley et al., 2007; Painter et al., 2011). Parents are less likely to vaccinate their child if they believe the influenza vaccine causes influenza (Daley et al., 2007; Gust, Darling, Kennedy, & Schwartz, 2008; Grant et al., 2003; Nowalk et al., 2005), is not safe for young children (Gust et al., 2008; Daley et al., 2007), causes side-effects worse than influenza, and weakens the immune system (Grant et al., 2003).

The majority of the studies measured parental attitudes to influenza vaccination by using constructs found in the HBM (Chen et al., 2011) or by combining constructs found in the HBM and Theory of Reasoned Action (Allison et al., 2010; Daley et al., 2006; Daley et al., 2007). One consistent predictor of influenza vaccination across studies was provider recommendation which fits the HBM construct of cues to action. Although each of these studies furthers the understanding of childhood influenza vaccination, the relationship among the HBM constructs and influenza vaccination is unclear. In the studies, constructs of the HBM are measured independent of one another. Developers of the model (Strecher & Rosenstock, 1997) as well as Champion and Skinner (2008) argue the HBM should be tested as a model as opposed to equally weighted independent constructs which occur simultaneously. An understanding of the relationships among the constructs is important to further the usefulness of the HBM in developing effective interventions aimed at increasing influenza vaccination of children.

Significance

Influenza-associated illness among children is a major public health concern. Vaccination against influenza is an effective means of preventing the disease, but further

research is needed to understand factors influencing vaccination in children to develop effective interventions aimed at increasing influenza vaccination rates. This study builds on a well-accepted model of health related behavior and also expands upon the model to account for present-day influences on childhood influenza vaccination.

Parental decisions regarding childhood vaccinations are now at the forefront of public health. As parental misperceptions of vaccine risk mount and concerns regarding adverse outcomes continue to increase, the potential public health consequences are of great concern. Therefore, the examination of parental influences related to pediatric influenza vaccination requires incorporation of perceived vaccine risk. The hypothesized HBM for childhood influenza vaccination incorporates present-day views of the health benefits as well as perceived risks of influenza vaccination. The study is further strengthened by testing the hypothesized model using structural equation modeling. The use of structural equation modeling allowed for the examination of the complex interrelationships between constructs of the HBM and perceived vaccine risk on influenza vaccination of children which are important components of analyzing population-focused outcomes. Findings from this study will provide the evidence needed by health care providers and public health officials to develop effective interventions aimed at achieving an 80% influenza vaccination rate in children for not only annual vaccination, but vaccination during pandemics.

CHAPTER II: LITERATURE REVIEW

This literature review is comprised of two sections. In the first section, a review of the historical development of the Health Belief Model (HBM) is presented followed by an examination of related research. In the second section, the proposed model of factors predicting parents' likelihood to vaccinate children against influenza is explicated. To provide support for the proposed model, research on parental vaccination beliefs and influenza vaccination of children are examined.

Health Belief Model

The HBM (Strecher & Rosenstock, 1997) serves as the theoretical framework for the study. Originated in the 1950s, the HBM is one of the most widely used conceptual frameworks to research health related behavior and develop interventions (Champion & Skinner, 2008). The model was developed by Hochbaum, Kegeles, Leventhal, and Rosenstock, social psychologists in the U. S. Public Health Service, in an effort to explain lack of participation in free and low cost preventive health care (Rosenstock, 1974). As presented in the HBM (see Figure 2), individuals are more likely to seek preventive health care if they are motivated and knowledgeable, believe they are vulnerable and the disease is threatening, believe the intervention is effective, and barriers do not outweigh the benefits (Becker et al., 1977). Over the years, the HBM has also been used to explain individual's responses to symptoms and adherence to medical regimens related to acute and chronic illness (Strecher & Rosenstock, 1997).

The foundation of the HBM is rooted in both Stimulus Response Theory and Cognitive Theory. According to Stimulus Response Theory, behavior is determined by its consequences. Conversely, in Cognitive Theory, behavior is a function of an individual's subjective value of an

outcome and the expectation of an action achieving the outcome (Strecher & Rosenstock, 1997). This process, referred to as value expectancy theory, seeks to describe an individual's decision-making within the context of uncertainty (Maiman & Becker, 1974). The HBM incorporates value expectancy concepts into the context of health behavior assuming individuals value avoiding illness and expect a specific health action to prevent illness (Strecher & Rosenstock, 1997).

Figure 2. Relationships among Health Belief Model constructs. Adapted from Health Behavior and Health Education: Theory, Research, and Practice (2nd ed.; p. 48), by K. Glanz, F. M. Lewis, B. K. Rimer (Eds.), 1997, San Francisco, CA: Jossey-Bass Inc. Copyright 1997 by John Wiley & Sons, Inc. Reprinted with permission (see Appendix A).

Constructs of the Health Belief Model

Original constructs of the HBM included perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Rosenstock, 1974). Perceived susceptibility refers to an individual's subjective risk assessment of contracting a health disease or condition. Perceived severity is an individual's feelings of the seriousness of a contracted health condition or the consequences of not seeking treatment for the illness. This includes an evaluation of both the medical and social consequences. Perceived benefits are the individual's perception of the effectiveness of a recommended course of action in diminishing the risk and seriousness of a disease. Benefits may be health- and/or socioeconomic-related. Perceived barriers are the potential negative consequences of a health action that may interfere with an individual's ability to proceed with the health recommendation. Demographic, socioeconomic, and knowledge variables are also hypothesized to indirectly influence health behavior (Strecher & Rosenstock, 1997).

As the HBM evolved, researchers identified additional components necessary to advance the model. Researchers determined a construct to represent triggers to a recommended health action was needed and the construct, cues to action, was added a short time later. The researchers further hypothesized the intensity of the cues was inversely related to the perceived threat of a health condition (Rosenstock, 1974). The variability in what constitutes a cue to action has made the component difficult to measure using surveys, particularly in retrospective studies (Champion & Skinner, 2008; Strecher & Rosenstock, 1997; Zimmerman & Vernberg, 1994).

The component of self-efficacy was later added to the HBM to increase its explanatory power (Strecher & Rosenstock, 1997). Perceived self-efficacy is a core determinant of social cognitive theory and is an individual's ability to "exercise control over one's health habits"

(Bandura, 2004, p. 144). In social cognitive theory, self-efficacy affects health behavior both directly and indirectly by influencing other determining factors (Bandura, 2004). Rosenstock et al. (1988) explain that the concept of self-efficacy was not a component in the original model because the HBM was originally developed to explain one-time preventive action. However, the researchers hypothesize the concept of self-efficacy is necessary to explain and predict health behaviors of individual's with chronic illnesses. Lack of perceived self-efficacy is seen as a perceived barrier in initiating a recommended health action (Strecher & Rosenstock, 1997).

Health Belief Model Research

Since the development of the HBM, numerous studies have been conducted analyzing the utility of the model in understanding health behavior. Janz and Becker (1984) reviewed 46 studies using the HBM as a conceptual framework to provide a comprehensive analysis of the use of the model in explaining health beliefs and behaviors in adults. To elucidate the findings, the authors created a “significance ratio” defined as the number of positive statistically significant findings of a HBM construct divided by the total number of studies reporting significance for the construct. The barrier construct (89%) had the highest predictability for a health behavior followed by susceptibility (81%), benefits (79%), and severity (65%). The construct of severity was even less predictive (50%) in the context of preventive health behavior. Janz and Becker (1984) hypothesized participants may have had difficulty perceiving the severity of a disease if they did not have experience with the disease or did not exhibit symptoms associated with the diseases. Conversely, perceived severity (88%) is a more salient construct in studies examining illness behaviors. Janz and Becker (1984) concluded the reviewed studies provided empirical support for use of the HBM in understanding health care behavior, although acknowledged an important limitation in the analysis was the lack of consistency among the

studies in operationally defining and measuring the constructs.

Recently, Carpenter (2010) conducted a meta-analysis of 18 HBM-related studies to evaluate the accuracy of the variables in predicting behavior. Longitudinal studies measuring HBM variables prior to and after a health-related behavior were included in the analysis. Studies incorporating an intervention between the two time frames were excluded. Similar to the review conducted by Janz and Becker (1984), the analysis found perceived barriers to be the strongest predictor of the outcome behavior ($r = 0.30$) followed by perceived benefits ($r = 0.27$) and perceived severity ($r = 0.15$). Unlike Janz and Becker (1984), Carpenter (2010) found perceived susceptibility to be the weakest predictor in both preventive and treatment outcome behavior ($r = 0.05$). Limitations of the analysis included measurement inconsistencies among the studies and convenience sampling. Due to the low predictive power of perceived severity and perceived susceptibility, Carpenter (2010) hypothesizes the two variables may have more of an indirect effect on behavior and questioned the utility of measuring the direct effects of these variables.

The primary criticism of the HBM is the lack of clarity in defining the relationships between and among the variables and the outcome behavior (Brewer et al., 2007; Carpenter, 2010; Champion & Skinner, 2008; Ronis, 1992; Sutton, 1987). Research aimed at clarifying the relationships has been limited by lack of consistency in defining and measuring the constructs (Cummings, Jette, & Rosenstock, 1978; Janz & Becker, 1984; Champion, 1984), lack of valid and reliable instruments (Carpenter, 2010; Champion & Skinner, 2008), and convenience sampling (Carpenter, 2010). Jette, Cummings, Brock, Phelps, and Naessens (1981) conducted one of the first studies to determine the reliability and validity of the constructs. Items on the questionnaire were analyzed by exploratory factor analysis using loadings of 0.35 or above within factors to group variables. Results indicated the majority of questions traditionally used to

measure HBM constructs do factor on the same underlying construct.

The HBM has been used to examine adult influenza vaccination behavior. Cummings, Jette, Brock, and Haefner (1979) conducted a prospective telephone survey of 286 adults using random digit dialing. Participants were surveyed one week prior to the swine influenza vaccination campaign in 1976 to determine factors influencing vaccination. Following the campaign, participants were randomly divided into two groups. Half were surveyed again immediately following the campaign and the other half two months later to determine if they received the vaccine. In path analysis, perceived susceptibility ($\beta = .24$; $p < .01$), perceived severity ($\beta = .15$; $p < .01$), perceived efficacy of vaccination ($\beta = .31$; $p < .01$), and physician's recommendation ($\beta = .26$; $p < .01$) were strong predictors of intention to vaccinate. Limitations of the study included using only two items to measure predictor variables. Additionally, physician recommendation was measured as a single item and the psychometrics of the instrument were not described.

Although the HBM was developed over 60 years ago, the model continues to be used as a framework in identifying predictors of vaccination. Parental acceptance of human papillomavirus vaccine was assessed by measuring the constructs of perceived benefits, perceived barriers, perceived severity, and perceived susceptibility. Multivariate analysis indicated only perceived barriers (odds ratio [OR] = 0.72, CI: 0.55-0.97) and perceived benefits (OR = 1.24, CI: 1.02-1.52) were significant independent predictors of HPV vaccine acceptability (Marlow, Waller, Evans, & Wardle, 2009). Similarly, independent predictors of parental acceptance of a potential new vaccine against cytomegalovirus were perceived benefits ($\beta = 9.18$, $p < .001$) and perceived barriers ($\beta = -2.55$, $p = .03$; Petty, Callahan, Chen, Edwards, & Dempsey, 2010). The studies support the continued utility of the HBM in assessing vaccination behavior.

HBM and Influenza Vaccination of Children

A number of researchers have used the HBM in an attempt to understand parents' beliefs and attitudes regarding influenza vaccination for children. Daley et al. (2007) surveyed parents of children aged 6 to 23 months to assess knowledge and attitudes of influenza and influenza vaccination of young children. Random sampling was performed to recruit participants from five private pediatric practices with the final sample consisting of 472 parents. The survey comprised 22 items to measure constructs derived from the HBM and Theory of Reasoned Action.

The seven subscales comprising the survey were perceived susceptibility, perceived severity, perceived benefits, risk of vaccination, perceived barriers, social norms, and other factors. The Cronbach alpha for each subscale was not reported, but in another publication was reported as ranging from .46 to .69 (Daley et al., 2006) indicating less than acceptable internal consistency (Nunnally & Bernstein, 1994). A description of how items were developed was not reported nor if content and face validity was performed.

The influenza vaccination rate in children of surveyed parents was 71%. The factor significantly associated with influenza vaccination was the perception that influenza vaccination was the social norm (adjusted odds ratio [AOR], 1.32; 95% confidence interval [CI], 1.03-1.69). Perception of vaccination barriers was negatively associated with immunization (AOR, 0.68; CI, 0.49-0.95). Demographics negatively associated with influenza vaccination were increasing age of the child and having public or no health insurance. Unlike other studies using the HBM, perceived barriers to vaccination and perceived risks of vaccination were measured as individual constructs. Similar to perception of vaccination barriers, perceived risks of vaccination was also negatively associated with vaccination (unadjusted odds ration [UOR], 0.66; CI, 0.52-0.84). Results from the postseason survey indicated physician recommendation for

vaccination was a positive predictor (Daley et al., 2006). Although the use of random sampling increases generalizability of the findings, the low reliability of the survey threatens internal validity.

Chen et al. (2011) conducted a study in Taiwan to examine factors influencing caregivers' decision to vaccinate children against influenza. The researchers used the HBM to develop a questionnaire to measure the constructs of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action. The Cronbach alphas of the subscales ranged from 0.74 to 0.82 demonstrating acceptable to very good internal consistency (Nunnally & Bernstein, 1994). Convenience sampling was used to recruit caregivers of children ages 6 to 36 months participating in a publicly funded influenza vaccination program. The final sample was comprised of 2,778 caregivers. Of those, 1,678 (60.4%) children received influenza vaccination and 1,100 (39.6%) did not. A multiple logistic regression model was constructed and indicated children with a history of hospitalization (AOR, 1.47; CI, 1.20-1.80) and influenza (AOR, 1.80; CI, 1.40-2.32) were significantly more likely to have received the influenza vaccination. The only significant demographic indicative of influenza vaccination was residence in a rural area (AOR 1.47; CI, 1.18-1.82). Constructs of the HBM associated with influenza vaccination included perceived susceptibility (AOR, 1.24; CI, 1.10-1.40), perceived benefits (AOR, 3.10; CI, 2.6-3.63), perceived barriers (AOR, 0.57; CI, 0.48-0.68), and cues to action (AOR, 1.19; CI, 1.03-1.37). The construct of perceived severity was not associated with influenza vaccination (AOR, 0.99; CI, 0.85-1.15). Of the 17 individual items, 11 were associated with vaccination. The most significant items predictive of vaccination included "Influenza vaccines are safe for children" (AOR, 4.12; CI, 2.95-5.92) and "My children get sick more easily than other children do" (AOR, 2.37; CI, 1.53-3.68). The most significant item negatively

predicting vaccination was “I am influenced by negative news about influenza vaccines” (AOR, 0.66; CI, 0.45-0.95). Generalizability of the findings is limited by the use of convenience sampling.

Factors predictive of influenza vaccination in school-aged children are similar to those of young children. Allison et al. (2010) administered an adapted version of the survey developed by Daley et al. (2007) to 259 parents of children in an elementary school to identify parental beliefs and barriers to influenza immunization. Similar to findings reported by Daley et al. (2007), predictors of influenza immunization included belief that immunization is a social norm (AOR, 10.8; CI, 2.8-41.8), belief in benefit of vaccination (AOR, 7.8; CI, 1.8-33.8), and belief in vaccine safety (AOR, 4.0; CI, 1.0-15.8). While 26% of participants indicated that their child had received the influenza vaccine and 24% indicated they intended to have their child immunized, 50% of respondents did not plan on having their child immunized. There was no difference among participants in regards to demographics. Threats to external validity included the use of convenience sampling while the use of an instrument with low reliability threatened internal validity.

Flood et al. (2010) conducted a web-based survey in August 2009 to explore factors influencing parents' decisions of influenza vaccination for children aged 2 to 12 years. A secondary aim of the study was to identify an appropriate theoretical model for describing the relationships among the factors. Participants consisted of 500 parents sampled from a nationwide online panel and stratified based on frequency of child's influenza vaccination (every year, sometimes, never), child's age (2 to 4 years and 5 to 12 years), and parents' frequency of influenza vaccination (every year, sometimes, never). Parents with more than one child were instructed to focus on the one child selected by the age sampling.

The questionnaire was comprised of demographic variables and items to assess perceived threat of influenza, modifying factors, drivers of influenza vaccination, and barriers to influenza vaccination. The major drivers of influenza vaccination among children were prevention of influenza (95%), a doctor's recommendation (89.5%), and desire to reduce influenza symptoms (83.3%). The most common barriers reported were low perceived risk of influenza (46.0%), perception the vaccine caused influenza (44.0%), and concerns regarding side-effects of the vaccine (36.6%). Following data analysis, the researchers identified the HBM as an appropriate framework to describe factors influencing parents' decisions regarding influenza vaccination of children (Flood et al., 2010).

In summary, there is empirical evidence to support the HBM as a framework for understanding factors influencing parents' likelihood to vaccinate children against influenza. However, there were a number of weaknesses in the studies, particularly in regards to the psychometrics of the instruments used to measure the HBM constructs. Construct validity was not reported and the instrument developed by Daley et al. (2007) demonstrated less than acceptable internal consistency. Another weakness was that the HBM constructs were examined independent of one another in terms of their relationships with childhood influenza vaccination thereby preventing a clear understanding of the direct and indirect effects of the constructs on vaccination. Further research is needed to understand the relationships among the constructs in this context.

Hypothesized Model

The hypothesized model is comprised of six constructs intended to describe factors influencing parents' likelihood to vaccinate children against influenza (see Figure 3). The constructs are: (a) perceived severity, (b) perceived susceptibility, (c) perceived system barriers,

(d) perceived benefits, (e) cues to action, and (f) perceived vaccine risk. The concept of perceived self-efficacy is not included in the model. While the previous study by Chen et al. (2011) incorporated items indicating perceived vaccine risk into the barriers component, Rosenstock et al. (1988) advocate reducing the range of dimensions in the barriers concept. The constructs will be examined to determine the direct and indirect effects on likelihood to vaccinate.

Figure 3. Hypothesized Health Belief Model of factors influencing parents' likelihood to vaccinate children against influenza.

Perceived Vaccine Risk

Vaccination is considered one of the top ten greatest public health achievements of the 20th (CDC, 1999a) and 21st centuries (CDC, 2011d) and is the major contributor to the dramatic decline in morbidity and mortality due to infectious diseases (CDC, 1999b). In the United States, vaccination with the current immunization schedule prevents approximately 42,000 deaths and 20 million cases of disease. Economically, this amounts to savings of \$14 billion in direct health care costs and \$69 billion in indirect costs due to permanent disability and work loss (CDC,

2011d). Currently, in the United States there are 17 vaccines recommended for use in children (CDC, 2011c) and vaccination coverage for state mandated vaccines for preschool and school-aged children averages at or above 90% (CDC, 2011c; CDC, 2011e).

Although all vaccines carry a risk of adverse reactions, the vast majority are minor and associated with local reactions at the injection site. Less common reactions include fever, headache, and arthralgia (Maldonado, 2002). Despite data establishing the benefit and safety of vaccines (Offit, Davis, & Gust, 2008), there has been an increase in media reports of unsubstantiated vaccine adverse events over the past few decades (Freed, Katz, & Clark, 1996; Offit, 2007; Offit, 2008) with a subsequent rise in the number of parents refusing recommended vaccines (Smith, Ellenberg, Bell, & Rubin, 2008; Omer et al., 2006). In response to increasing public concerns over vaccine safety, the Health Resources and Services Administration (HRSA) commissioned the Institute of Medicine (IOM) of the National Academy of Sciences to evaluate the scientific evidence of reported vaccine-related adverse events. After an extensive review, the IOM concluded there was insufficient evidence to support or reject causal relationships between the majority of reported adverse events and vaccines (IOM, 2011).

Parents' perception of vaccine risk is variable and ranges along the continuum of minimal to serious concerns regarding vaccine safety. Using content analysis methodology, Mills, Jadad, Ross, and Wilson (2005) conducted a systematic review of 15 qualitative studies on parental attitudes and beliefs of vaccination of children. The major themes identified as barriers to vaccination included issues of harm, issues of mistrust, and access issues.

Gust et al. (2005) analyzed surveys completed by 697 parents of children 6 years of age and younger to determine the range of parental vaccination behavior. The data were extracted from two consumer mail surveys conducted in 2002 assessing consumer behavior, including

beliefs in immunization and vaccine safety. The 44 survey questions were collapsed into 10 constructs using factor analysis, and K-means cluster technique was used to identify groups of parents based upon survey responses. Regarding childhood immunization, five groups emerged: (a) Immunization Advocate ($n = 193$; 33%), (b) Go Along to Get Along ($n = 154$; 26.4%), (c) Health Advocate ($n = 145$; 24.8%), (d) Fence-sitter ($n = 77$; 13.2%), and (e) Worried ($n = 15$; 2.6%). The most frequent vaccine concerns reported were the number of vaccines given at a visit and issues surrounding vaccine safety. The Immunization Advocate cluster had the highest proportion of college graduates and the Worried cluster had the highest percentage of parents aged 40 or over. There was no difference in income or race. The small number of respondents in the Worried group was a limitation of the study.

In a similar study, Keane et al. (2005) analyzed health items from a mail survey conducted in 2001. The sample comprised 2,018 parents of children 15 years of age and younger. Using cluster analysis, 90% ($n = 1820$) of parents were classified into four groups: (a) Vaccine Believer ($n = 599$; 33%), (b) Relaxed ($n = 626$; 34%), (c) Cautious ($n = 416$; 23%), and (d) Unconvinced ($n = 179$; 10%). Parents of higher socioeconomic status and more educated comprised a larger portion of the Vaccine Believer and Relaxed groups than the other two groups. Unlike the study by Gust et al. (2005), there was no significant difference among groups in regards to age.

More recently, Freed et al. (2010) conducted an online survey in 2009 to assess parental opinions on vaccine safety and vaccine refusal. Potential participants were drawn from a national online panel of parents of children aged 17 years and younger with the final sample comprised of 1,552 participants (62% response rate). Survey statements were measured by a dichotomous variable indicating agreement or lack of agreement with the item. Findings

indicated that although 90% of parents agreed vaccines were beneficial, more than half (54%) were concerned about serious adverse effects of vaccines. Additionally, 11.5% of parents had at least once refused a recommended vaccine for their child. However, this percentage may be misleading. The human papillomavirus vaccine accounted for greater than half of the refusals (56.4%), but during the time of the study only recommended for females aged 11 to 19 years (CDC, 2009b) representing a subset of participants' children. Other vaccines reportedly refused were varicella (32.3%), meningococcal conjugate (31.8%), and measles-mumps-rubella (17.7%). Parents were not queried about influenza vaccination.

In addition to general perceptions of vaccine risk, there are also a number of parental misperceptions specific to the influenza vaccine. The most common misunderstanding is the belief the influenza vaccine will cause influenza (Daley et al., 2007; Flood et al., 2010; Gnanasekaran et al., 2006). The inactivated influenza vaccine is not infectious and takes approximately two weeks to confer immunity (CDC, 2010c). Therefore, it is possible a child may be exposed to influenza a short time prior to receiving the vaccine and contract the disease. Also, influenza vaccination tends to occur during the height of respiratory illness season and children may be exposed to other illnesses following vaccination that parents may interpret as symptoms of influenza. Lastly, the efficacy of the influenza vaccine is a persistent concern (Daley, et al., 2006; Daley et al., 2007; Flood et al., 2010) and is due, in part, to the inherent nature of the annual development of the vaccine and variability in effectiveness among different age groups (CDC, 2013b).

Another parental concern is the possibility of influenza vaccination causing serious side effects. During the 1976 to 1977 influenza season, an unexplained increased risk of

Guillain-Barré syndrome was reported in individuals receiving a vaccine against A/New Jersey influenza (swine flu) virus. The rate of Guillain-Barré syndrome in vaccine recipients was significant at 13.3 per 100,000 as compared to 2.6 per 100,000 in unvaccinated individuals ($p < .05$; Marks & Halpin, 1980). Following this incident, a national Guillain-Barré syndrome surveillance system was established and the risk for Guillain-Barré syndrome in subsequent influenza vaccines was determined to be insignificant (Kaplan, Katona, Hurwitz, & Schonberger, 1982). Additionally, reports of Guillain-Barré syndrome to the Vaccine Adverse Events Reporting System from 1990 to 2003 decreased (Haber et al., 2004). A recent meta-analysis examining the association between Guillain-Barré syndrome and the 2009 influenza A (H1N1) vaccine found a small increased risk (2.35, 95% CI 1.42-4.01, $p = .0003$) of Guillain-Barré syndrome following vaccination (Salmon et al., 2013). This fear may influence parental decisions of vaccination.

Parents have also expressed concern regarding the safety of ingredients in the influenza vaccine, specifically thimerosal (Flood et al., 2010). This ingredient, which contains mercury, is used as a preservative in certain vaccines (including influenza) to prevent bacterial contamination. In 1997, the Federal Drug Administration (FDA) conducted a review of the use of thimerosal in childhood vaccines as part of the FDA Modernization Act. Although the FDA determined thimerosal was not harmful, medical experts were concerned over the potential cumulative level of mercury exposure in children less than 6 months of age due to their weight (U.S. FDA, 2012). This prompted the American Academy of Pediatrics (AAP) and United States Public Health Service (USPHS) to release a statement asking vaccine manufacturers to reduce or eliminate thimerosal from vaccines as a precaution (AAP & USPHS, 1999). Although subsequent studies did not find evidence to support the claim, the publicity surrounding the issue

generated new fears about vaccine safety (Epstein, 2005; Offit, 2007). Thimerosal-free preparations of influenza vaccine are available (CDC, 2010c), but the U.S. Code of Federal Regulations require multi-dose vials to contain thimerosal to prevent bacterial growth (U.S. FDA, 2012).

Relationship between Perceived Susceptibility and Perceived Severity

In the HBM, the combination of perceived susceptibility and perceived seriousness is termed perceived threat. According to Strecher and Rosenstock (1997), an increased state of perceived severity is necessary prior to perceived susceptibility becoming an effective predictor, especially in intention to engage in a health behavior rather than actual engagement. However, the relationship between perceived susceptibility and perceived seriousness is not clear. A study using the HBM to examine participation in a genetic screening program indicated perceived severity performed independent of perceived susceptibility and appeared to have an “additive” effect (Becker, Kaback, Rosenstock, & Ruth, 1975, p. 9). Conversely, Champion and Skinner (2008) argue a “multiplicative variable” (p.61) should be generated for the two constructs to measure perceived threat as opposed to measuring them individually. However, Ronis (1992) did not find evidence to support this hypothesis. Studies examining influenza vaccination in children measured perceived susceptibility and perceived susceptibility independent of one another (Allison et al., 2010; Chen et al., 2011; Daley et al., 2006; Daley et al., 2007; Painter et al., 2011). Therefore, the relationship between perceived susceptibility and perceived severity and how the constructs combine to determine perceived threat remains unclear.

The applicability of perceived severity in predicting influenza vaccination is difficult to assess as the severity of influenza varies from season to season and is dependent upon the virulence and communicability of the particular strain. In April 2009, pandemic influenza A

(H1N1) virus was reported in the United States (CDC, 2009c). Ultimately, the virus affected a disproportionate number of children accounting for approximately 1,270 pediatric deaths and approximately 86,000 hospitalizations (CDC, 2010a). Following the outbreak of H1N1 influenza and prior to the administration of the H1N1 vaccine, Painter et al. (2011) surveyed a convenience sample of parents of adolescents ($n = 102$) to examine acceptance of the H1N1 influenza vaccine for their children. Results of the survey indicated 75% of parents would vaccinate their child against H1N1. Significant predictors of vaccination were acceptance of H1N1 vaccination for themselves (AOR, 3.49; CI, 1.87-6.50) and motivated by the H1N1 influenza pandemic to get a seasonal influenza vaccination for their child (AOR, 2.28; CI, 1.14-4.53). Perceived severity, indicated by one item, was not significant (AOR, 1.96; CI, 0.84-4.60).

Relationship between Cues to Action, Perceived Susceptibility, and Perceived Severity

Strecher and Rosenstock (1997) hypothesize the impact of cues to action on behavior is increased when perceived threat is heightened. During influenza pandemics, increased media attention on influenza-associated morbidity and mortality in children may increase influenza vaccination. During the 2003 to 2004 influenza season 153 children died from influenza-related complications (Bhat et al., 2005). At this time, Gnanasekaran et al. (2006) interviewed parents of children aged 5 to 18 years with asthma regarding their beliefs about influenza vaccination. Conducted in the winter of 2003, participants ($n = 295$) were randomly selected from a large, multispecialty group in Massachusetts. Interview questions were developed using the HBM as a guide. While the study was in progress, there was increased media coverage of influenza due to the increase in illness severity and serious complications among children. Following the influenza season, a subsample of parents ($n = 40$) were interviewed about the media attention on

serious influenza-complications in children. Parents interviewed after the media coverage were more likely to be worried about influenza illness than those interviewed prior (22% versus 9%; $p < .001$). The influenza vaccination rate of 43% in 2003 to 2004 was considerably higher than the rate of 27% in 2002 to 2003 with a noticeable increase in vaccinations in December 2003 following the media coverage. The vaccination rate for children of parents participating in the study was 56% compared to 28% for children whose parents did not participate.

During the same influenza season, Daley et al. (2006) conducted a survey based on the HBM to determine how parental knowledge and attitudes regarding influenza immunization in healthy children changed prior to influenza season and after. Using random sampling, participants were selected from five private pediatric practices in Colorado. Of the 472 parents of children aged 6 to 21 months completing a preseason survey, 67% ($n = 316$) completed the postseason survey. Similar to findings reported by Gnanasekaran et al. (2006), media coverage of the severity of influenza-complications was associated with a significant increase in perceived severity of influenza (26% to 58%; $p = .01$; Daley et al., 2006). Although perceived susceptibility to influenza and perceived benefits increased from preseason to postseason, the results were not significant (35% to 48% and 40 to 48% respectively).

One of the issues in determining the relationship between cues to action and perceived threat is the difficulty in operationalizing cues to action. Although physician or health provider recommendation is commonly used in surveys to indicate cues to action (Chen et al., 2011; Daley et al., 2006; Daley et al., 2007), other more subtle cues such as a sneeze or an ill family member may also serve as a cue to action (Strecher & Rosenstock, 1997). Additionally, an individuals' perception of what comprises a health care provider or family recommendation is unclear. In regards to influenza vaccination behavior, does the recommendation consist of a

discussion of the health benefits and risks of vaccination or simply a reference to the current CDC recommendation? Although not clearly elucidated in the studies, health provider recommendation of influenza vaccination in children was a consistent factor associated with positive influenza behavior (Chen et al., 2011; Daley et al., 2006; Daley et al., 2007; Flood et al., 2010; Humiston et al., 2005; Nowalk et al., 2005; Nowalk et al., 2007).

Relationship between Perceived Severity and Perceived Vaccine Risk

The proposed model tests the hypothesis that parents indicating higher perceived severity of influenza will have lower perceived risk of influenza vaccination and increased perception of benefits of vaccination. Daley et al. (2006) also examined parental perception of vaccine risk and found perceived vaccine risk diminished from preseason to postseason (66% to 19%). Media reports of influenza-related child deaths and recommendations to vaccinate young children against influenza were associated with a decrease in perceived risks of vaccination ($p = .01$ and $p = <.01$ respectively). Daley et al. (2006) proposed that an increased perceived threat of influenza was associated with a decrease in perceived vaccine risk. This aligns with the hypothesis put forth by Strecher and Rosenstock (1997).

Relationship between Perceived Susceptibility, Perceived Severity, Perceived Benefits, and Perceived Systems Barriers

Strecher and Rosenstock (1997) hypothesize the predictive ability of perceived benefits and barriers are increased when perceived threat is high, rather than low. Further, the level of perceived threat prompts an individual to pursue a course of action and the most desirable course is a result of perceived benefits outweighing perceived barriers. Strecher and Rosenstock (1997) refer to this as “nonconscious cost-benefit analysis” (p. 46). Additionally, social norms and pressures influence an individual’s perception of available options (Rosenstock, 1974).

This is consistent with studies examining factors influencing influenza vaccination prior to and following a severe influenza season (Daley et al., 2006; Gnanasekaran et al., 2006).

System barriers to childhood vaccination directly impact childhood influenza vaccination rates. The narrow timing of vaccination, the need for annual vaccination, and universal influenza vaccination for children creates logistical issues for health care providers and barriers for parents. In community pediatric practices, influenza vaccination of children occurs most frequently during scheduled ill and preventive health visits in late summer and autumn. Children without scheduled appointments during these months, rely upon the availability of “flu clinic” appointments to receive influenza vaccination. Availability of influenza vaccination is influenced by vaccine availability, costs of the vaccine and administration, and unpredictability of consumer demand for the vaccine (Penfold et al., 2011).

One of the more formidable systems barriers faced by health care providers to providing influenza vaccination is cost. Similar to other childhood vaccinations, influenza vaccines are ordered up front from vaccine manufacturers and payment collected after administration. Providers in small practices do not benefit from discounted pricing available to organizations ordering in large quantities (Penfold et al., 2011). The Vaccines for Children (VFC) program is a federally funded program that provides vaccines to children at no cost because of inability to pay (CDC, 2011f). Although participating providers receive influenza vaccine free of charge, the program does not reimburse providers for vaccine administration (Kimmel et al., 2007). Additionally, the implementation of “flu clinics” requires additional staffing.

The availability of the influenza vaccine is another system barrier. For health care providers, scheduling appointments for influenza vaccination is difficult to anticipate because vaccine availability is unpredictable (Penfold et al., 2011). Providers enrolled in the VFC

program must order VFC vaccines separate from the practice supply and may not receive influenza vaccines at the same time. Practices must then make a decision whether to wait until both private and VFC vaccines are available before starting influenza vaccination or to initiate vaccination of one group over the other. Difficulties in vaccine production may also delay vaccine distribution (CDC, 2004). Vaccine distribution does not occur simultaneously and some providers may have to turn patients away because they do not have the vaccine, but then have a surplus because the child received the vaccine at another facility (Penfold et al., 2011). Resultantly, parents may encounter system barriers in obtaining influenza vaccination for their children.

Variables

The following are the conceptual and operational definitions of constructs used in the study. The outcome variable is likelihood to vaccinate and predictor variables are perceived susceptibility, perceived severity, cues to action, perceived benefits, perceived vaccine risk, and perceived system barriers (see Appendix B).

Likelihood to Vaccinate

The outcome variable, likelihood to vaccinate, is conceptually defined as the likelihood of a parent to vaccinate their child against influenza. The concept is operationally defined as the parent's level of agreement with the statement, "My child will get the flu vaccine this flu season." The subscale is comprised of one item.

Perceived Susceptibility

Perceived susceptibility is conceptually defined as the parent's subjective perception of his or her child's risk of contracting influenza (Strecher & Rosenstock, 1997). Strecher and Rosenstock (1997) recommend the addition of a behavioral anchor when measuring perceived

susceptibility to improve measurement of the construct. The concept is operationally defined as the parent's level of agreement with statements such as, "It is extremely likely that my child will catch the flu if he/she does not get the flu vaccine." The subscale is comprised of four items.

Perceived Severity

Perceived severity is conceptually defined as a parents' perception of how serious influenza and influenza-related complications can be to their child (Strecher & Rosenstock, 1997). The concept is operationally defined as the parents' level of agreement with statements such as: "Flu is a serious illness in children." The subscale is comprised of four items.

Cues to Action

Cues to action is conceptually defined as events or strategies that prompt a parent to obtain an influenza vaccination for their child (Strecher & Rosenstock, 1997). The concept is operationally defined as the parent's level of agreement with statements such as: "My child's health provider's recommendation that my child get the flu vaccine affects my decision whether to vaccinate my child against the flu." The subscale is comprised of four items.

Perceived Benefits

Perceived benefits is conceptually defined as a parents' perception of the efficacy of influenza immunization to reduce the risk or seriousness of their child acquiring influenza (Strecher & Rosenstock, 1997). The concept is operationally defined as the parent's level of agreement with statements such as: "The flu vaccine prevents my child from catching the flu." The subscale is comprised of five items.

Perceived Vaccine Risk

Perceived vaccine risk is conceptually defined as a parent's subjective perception of the risks associated with the influenza vaccine. The concept is operationally defined as the parent's

level of agreement with statements such as: “The flu vaccine is not safe to give to children.” The subscale is comprised of nine items.

Perceived System Barriers

For the purposes of this study, perceived system barriers is conceptually defined as the negative systems and provider barriers involved in influenza vaccination that may impede the ability of the parent to obtain an influenza vaccination for their child (Strecher & Rosenstock, 1997). The concept is operationally defined as the parent’s agreement with statements such as: “It is difficult to get an appointment for a flu vaccine for my child.” The subscale is comprised of four items.

Summary

Vaccinating children against influenza is an effective means of preventing the disease in children and adults thereby protecting the health of the public. To develop effective interventions aimed at improving influenza vaccination, an understanding of factors influencing childhood influenza vaccination is imperative. Although the reviewed studies examined childhood influenza vaccination using the HBM, the use of multiple regression to examine the constructs within the model does not allow for the interpretation of indirect effects. In this study, the examination of the direct and indirect relationships of the HBM constructs on childhood influenza vaccination allowed for a deeper understanding of the issue. Also, the addition of the construct perceived vaccine risk furthered the understanding of the relationship between influenza vaccination of children and perceived risks of influenza vaccination. Lastly, this study addressed the need for a valid and reliable instrument to assess factors influencing childhood influenza vaccination. In the majority of the reviewed studies, instrument reliability was less than acceptable and construct validity was not determined in any of the studies.

CHAPTER III: METHODS

The overall aim of this study is to determine factors associated with parents' likelihood to vaccinate children against influenza and the relationships between those factors. To accomplish this, the study was conducted in two phases. In Phase I, the instrument to measure the constructs in the proposed model was piloted to determine reliability and construct validity. In Phase II, the proposed model was tested using structural equation modeling (SEM). This chapter describes the design of the study, selection of participants, description of the instrument, study procedures, data analysis, and process for human subjects protections for both phases of the study.

Phase I

In Phase I, a cross-sectional design was used to pilot the investigator-developed Childhood Influenza Immunization Questionnaire (CIIQ; see Appendix C). The purpose was to determine the reliability and construct validity of the CIIQ and assess the feasibility of the study protocol. Since items on the CIIQ were adapted and modified from previous studies using instruments to measure HBM constructs (Champion, 1984; Champion, 1995; Chen et al., 2011; Daley et al., 2007; Nexoe, Kragstrup, & Sogaard, 1999), reliability and validity testing was required prior to use in Phase II of the study. Parameters followed in assessing reliability and construct validity of the CIIQ included: (a) a coefficient alpha of greater than .70 on subscales and (b) items on each subscale will have a factor loading of .50 or greater on one dimension using principal component analysis (PCA; Hair, Black, Babin, & Anderson, 2010). Following analysis, items for inclusion were reconfirmed using the theoretical framework of the HBM (Strecher & Rosenstock, 1997).

Setting

Allergy Partners of Greater Cincinnati and Northern Kentucky, an allergy practice located in Northern Kentucky, was the setting for Phase I (see Appendix D for a letter of support). The practice has over 1,750 pediatric patient visits a year and averages 250 pediatric visits a week for immunotherapy. Approximately 90% of the pediatric patients have private insurance and the remaining 10% covered by Medicaid. The office offers influenza vaccination at immunotherapy visits for pediatric patients covered by private insurance, but is unable to provide vaccination to those on Medicaid as the practice does not participate in the Vaccines for Children program. Pediatric patients with Medicaid coverage are encouraged to receive the influenza vaccination through their primary care provider. This setting was selected because the ages of the children receiving immunotherapy are similar to those selected for Phase II.

Sample

Convenience sampling was used to recruit participants. Adults registering a child for immunotherapy during the study period of May 8, 2012 to May 31, 2012 were invited to participate. Inclusion criteria were: (a) parent or legal guardian of a child ages 2 months to 17 years, (b) 18 years of age or older, and (c) able to read and write English. Adults of children for whom the influenza vaccine is contraindicated (such as previous severe allergic reaction to influenza vaccine) were excluded.

Sample size determination in exploratory factor analysis is influenced by level of communalities, number of factors, and number of indicators per factor. A sample size of 100 is often adequate when communalities are high and factors have large loadings (Loehlin, 2004). Because the instrument was developed based upon previous research demonstrating an underlying factor structure (Champion, 1984), a sample size of 100 participants was chosen.

Measures

The CIIQ is an investigator-developed self-administered, two-part anonymous questionnaire designed to measure factors associated with parents' likelihood to vaccinate children against influenza. Constructs of the HBM (Strecher & Rosenstock, 1997) formed the foundation for the development of the CIIQ. Items to measure the constructs were developed after extensive review of studies assessing parental attitudes regarding influenza vaccination and vaccination of children (Allison et al., 2010; Chen et al., 2011; Daley et al., 2006; Daley et al., 2007; Fitch & Racine, 2004; Flood et al., 2010; Grant et al., 2003; Gust et al., 2008; Humiston et al., 2005; Nowalk et al., 2005; Nowalk et al., 2007; Painter et al., 2011; Poehling et al., 2010; Uwemedimo, Findley, Andres, Irigoyen, & Stockwell, 2012) and parental vaccine safety concerns (Bardenheier et al., 2004; Freed et al., 2010; Gust et al., 2008; Mirza et al., 2008). Permission was granted to modify and adapt items to measure the predictor variables from the questionnaire developed by Chen et al. (2011; L. J. Lin, personal communication, August 3, 2011) and Champion (1999; V. Champion, personal communication, September 1, 2011).

Champion (1984) refined measurement of HBM constructs to test the HBM in the context of breast self-examination using exploratory factor analysis. Following assessment of content validity, convenience sampling was used to select 301 women to complete a mail survey or interview. The subscales of perceived susceptibility ($\alpha = .78$), perceived seriousness ($\alpha = .78$), and perceived barriers ($\alpha = .76$) demonstrated adequate reliability (Nunnally & Bernstein, 1994). Perceived benefits ($\alpha = .61$) and perceived motivation ($\alpha = .62$) subscales had less than desirable internal consistency (Nunnally & Bernstein, 1994). Each of the five subscales had greater than six items. All items loaded at .36 or greater and the subscales were found to be mutually exclusive. Findings affirm the reliability and construct validity of the HBM subscales.

A Chinese version of the questionnaire developed by Chen et al. (2011) was administered to caregivers of children aged 6 to 36 months in Taiwan and consisted of 19 items to measure five subscales. Following review for content validity, reliability of the questionnaire was assessed and the subscales of perceived susceptibility ($\alpha = .82$), perceived severity ($\alpha = .81$), perceived barriers ($\alpha = .82$), and cues to action ($\alpha = .82$) demonstrated very good reliability. The subscale of perceived benefits was adequate ($\alpha = .74$). All subscales had three or more items except for perceived susceptibility which had two items. Items were measured using a five-point scale to indicate disagreement to agreement. For the analysis, the scale was collapsed into a dichotomous outcome of either agreement (five-point items between 3 to 5) or disagreement (items between 1 to 2).

The CIIQ is comprised of six subscales representing the predictor variables of perceived susceptibility (four items), perceived severity (four items), cues to action (four items), perceived benefits (five items), perceived vaccine risk (nine items), and perceived system barriers (four items) and consists of 30 items. Items in each of the subscales are assessed using a five-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5). Subscale scores were compiled with higher scores indicating an increased perception of the particular construct. Although a small portion of the items were redundant, this is desirable in initial scale development to increase reliability (DeVellis, 2003). The outcome variable was likelihood to vaccinate and assessed using a five-point scale ranging from very unlikely (1) to very likely (5). A detailed definition of each construct is included in chapter 2.

Operational definitions of the constructs comprising the CIIQ were consistent with those proposed by Chen et al. (2011) and Champion (1984). However, not all items on Champion's questionnaire developed for breast self-examination (1984) or mammography (1999) were able

to be adapted for influenza vaccination of children. Therefore, for the subscale of perceived susceptibility, items developed by Champion (1984) for breast self-examination, Nexoe et al. (1999) for elderly influenza vaccination, and Daley et al. (2006) were modified for the CIIQ. As recommended by Strecher and Rosenstock (1997), a behavioral anchor was added to improve measurement of perceived susceptibility. Items to indicate the constructs of perceived severity, perceived benefits, cues to action, perceived system barriers, and perceived vaccine risk were adapted and modified from questionnaires developed by Chen et al. (2011), Nexoe et al. (1999), Flood et al., (2010), Daley et al., (2006), and Grant et al. (2003; see Table 1).

Table 1

CHIQ: Revised Items and Original Source

Revised Item	Original Item
Perceived Susceptibility	
I worry my child will catch the flu if he/she does not get the flu vaccine.	I am very worried about catching the flu. ^a
It is likely my child will catch the flu if he/she does not get the flu vaccine.	It is extremely likely I will get breast cancer in the future. ^b
My child is more likely to catch the flu than other children if he/she does not get the flu vaccine.	I am more likely than the average woman to get breast cancer. ^b
My child's age makes it likely he/she will catch the flu if he/she does not get the flu vaccine.	Compared with other children your child's age, your child is more likely to get the flu. ^c
Perceived Severity	
Flu is a serious illness in children.	Influenza with complications is dangerous. ^d
Infection with the flu may cause serious problems in children.	Influenza infection may cause serious health problems. ^d
I am afraid the flu will make my child very sick.	I am afraid the flu will make me very sick. ^a
If my child gets the flu, the illness could spread to other family members.	If any of my children contracted influenza, the disease could spread to other family members. ^d
Perceived Benefits	
The flu vaccine prevents my child from getting the flu.	Influenza vaccinations effectively protect against the flu. ^d
Getting the flu vaccine for my child will keep me from missing work to take care of my child with the flu.	To avoid missing work. ^e

Other children will be protected against the flu if my child gets the flu vaccine.

To avoid spreading the seasonal flu to others.^e

Getting the flu vaccine for my child will keep him/her from missing school or daycare due to being sick with the flu.

To avoid my child missing school.^e

If my child got the flu vaccine and still catches the flu, he/she would not be as sick.

Influenza vaccinations can relieve influenza symptoms and complications.^d

Flu vaccine lessens the symptoms of the flu.^e

Cues to Action

My child's healthcare provider telling me my child should get the flu vaccine affects my decision to vaccinate my child against the flu.

My doctor(s) recommendation affects my decision whether to vaccinate my children for influenza.^d

My nurse(s) recommendation affects my decision whether to vaccinate my children for influenza.^d

News or internet sites stressing the importance of the flu vaccine for children affects my decision to vaccinate my child against the flu.

The recommendation in the mass media affects my decision whether to vaccinate my children for influenza.^d

The Internet/media recommended it.^e

My child's school or daycare telling me my child should get the flu vaccine affects my decision to vaccinate my child against the flu.

My child's school recommended it.^e

Family members wanting my child to get the flu vaccine affects my decision to vaccinate my child against the flu.

A family member/friend recommended it.^e

Perceived System Barriers

It is hard to get an appointment for the flu vaccine for my child.

It is easy to get an appointment for a flu shot for your child.^c

It is difficult to find the time to bring my child to the healthcare provider's office to

Vaccinations are inconvenient.^d

get the flu vaccine

Having a mammogram or x-ray of the breast would take too much time.^b

Transportation problems make it hard to bring my child to the healthcare provider's office to get the flu vaccine.

Flu vaccine was not convenient.^e

I cannot afford the flu vaccine for my child.

Influenza vaccinations are expensive.^d

Having a mammogram or x-ray of the breast would cost too much money.^b

Perceived Vaccine Risk

The flu vaccine weakens the immune system.

Influenza vaccinations weaken the natural immune system.^d

The flu vaccine does not work very well.

Flu shot does not work.^f

Side-effects from the flu vaccine are worse than the flu itself.

Influenza vaccinations have unpleasant side effects.^d

The flu vaccine can cause the flu in some children.

The flu vaccine can cause the flu.^e

Hearing a famous celebrity say the flu vaccine may harm children affects my decision to vaccinate my child against the flu.

I am influenced by negative news about influenza vaccines.^d

I heard a TV/movie personality suggest not getting the flu vaccine.^e

The flu vaccine is not safe to give to children.

The seasonal flu vaccine is not safe.^e

My child is likely to get very sick from the flu vaccine.

The seasonal flu vaccine causes side effects.^e

The flu vaccine contains ingredients that are not safe.

The seasonal flu vaccine contains thimerosal.^e

I or someone I know had a bad reaction to the flu vaccine.

I had a bad past experience with the seasonal flu vaccine.^e

Note. ^aNexoe et al. (1999), ^bChampion (1999), ^cDaley et al. (2006), ^dChen et al. (2011), ^eFlood et al. (2010), ^fGrant et al. (2003).

The first part of the questionnaire is comprised of items to elicit factors influencing parents' likelihood to vaccinate children against influenza. Parents were instructed to complete the questionnaire for the child having the immunotherapy appointment. If the parent was accompanying more than one child, the parent was instructed to fill out the questionnaire as it pertained to the older child up to 17 years of age.

In the demographic section of the questionnaire, participants were asked to provide information related to age, gender, race, education level, and child's health insurance type. Demographic data requested included age of participant in years, age of child in years or age in months for children under two years of age, participants' relationship to the child, participants' education, child's health insurance type, and participant's ethnicity/race. Categories for participant's relationship to the child were mother, father, or legal guardian. To assess level of education, participants were requested to state how many years of formal schooling starting with first grade as year one. Child's type of health insurance was assessed by three categories: private, Medicaid, and no insurance. Participants' race/ethnicity was assessed with categories used by the U.S. Census Bureau (2011): American Indian or Alaska Native, Asian, Black or African American, Hispanic or Latino, Native Hawaiian or other Pacific Islander, and White.

Recruitment

Following immunotherapy, office policy required children to be observed in the allergy office waiting area for 20 minutes. The researcher approached adults of children awaiting discharge and informed them of the study. Adults meeting inclusion criteria were invited to participate and those agreeing to participate were handed a study packet. The study packet was comprised of the CIIQ and information sheet describing inclusion and exclusion criteria, the purpose of the study, a description of the study including time requirement, and risks and

benefits of participating (see Appendix G).

Data Collection

Participants completed the pencil-paper survey while in the waiting area, placed the questionnaire in the provided envelope, sealed the envelope, and handed the envelope to the investigator. Study participation lasted approximately 15 minutes or less. After handing the envelope to the investigator, participants received a \$10 Kroger gift card as compensation for their time.

Data Management

Questionnaires were numerically coded for inputting data and determination of response rate. Data tracked during the study period included: (a) number of children receiving immunotherapy, (b) number of adults eligible to participate, (c) percentage of eligible adults agreeing to participate, and (d) reasons for refusing to participate in the study. Data were entered into an electronic file using PASW Statistics version 17.0 (SPSS, Inc., Chicago, IL). Prior to conducting analysis, data were cleaned and variables examined for missing values and outliers (Tabachnick & Fidell, 2007). Missing data were examined for MCAR (missing completely at random), MAR (missing at random), and MNAR (missing not at random or nonignorable). Listwise deletion was performed if less than 5% of the overall data was missing (Tabachnick & Fidell, 2007). If greater than 5% of the overall data was missing at random and determined to be MCAR, missing values were imputed using a regression approach. If the data were not determined to be MCAR, data analysis was conducted with and without imputing missing data and results compared (Tabachnick & Fidell, 2007). Descriptive statistics were generated for demographic characteristics of the participants and analyzed using frequencies and distributions (PASW Statistics, version 17.0, SPSS, Inc., Chicago, IL).

Data Analysis

The purpose of Phase I was to determine the reliability and construct validity of the CIIQ. The instrument was then incorporated into Phase II.

Content validity. Three pediatricians, two PhD credentialed nurses with expertise in community health and knowledge of the HBM, a PhD credentialed pediatric nurse practitioner, and a family nurse practitioner with a master's degree in community health nursing evaluated each item on the CIIQ for clarity and appropriateness of the items to influenza immunization of children (see Appendix H). Content experts were asked to rate each item by relevance (1-not relevant, 2-item needs some revision, 3-relevant but needs minor revision, 4-very relevant), clarity (1-not clear, 2-item needs some revision, 3-clear but needs minor revision, 4-very clear), simplicity (1-not simple, 2-item needs some revision, 3-simple but needs minor revision, 4-very simple), and ambiguity (1-doubtful, 2-item needs some revision, 3-no doubt but needs minor revision, 4-meaning is clear; Yaghmale, 2003). The item content validity index (I-CVI; Polit & Beck, 2006) was 1.0 for relevance, .95 for clarity, .96 for simplicity, and .99 for ambiguity (see Appendix I). Readability statistic of the questionnaire determined by obtaining the Flesch-Kincaid Grade Level score using Microsoft Word was 6.5. Ten volunteers from the pediatric practice staff meeting inclusion and exclusion criteria for the study reviewed the CIIQ for face validity, readability, and clarity of questions and instructions.

Construct validity. Principal component analysis (PCA) was performed to determine reliability and construct validity of the CIIQ. The purpose of PCA is to describe the underlying components among variables in an analysis (Tabachnick & Fidell, 2007). Although the CIIQ was developed using the HBM as a framework, an exploratory rather than confirmatory analysis was warranted due to the addition of a new construct (perceived vaccine risk) and lack of previous

evaluation. Prior to extraction of factors, the correlation matrix was examined to ensure correlation coefficients were greater than .30 (Tabachnick & Fidell, 2007). Next, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, recommended when cases to variable ratio is less than 1 to 5, and Bartlett's test of sphericity were used to ensure correlations were sufficient to factor analyze (Tabachnick & Fidell, 2007). A KMO value of greater than or equal to .6 and significant ($p < .05$) as well as Bartlett's test of sphericity were the criteria set to continue with factor analysis (Tabachnick & Fidell, 2007). PCA using Varimax rotation was performed. Criteria for factor extraction included examination of scree plot and eigenvalues greater than 1. Factor loadings on individual items were generated and items corresponding to more than one factor or with standardized loading estimates less than .50 re-evaluated for possible elimination using the theoretical framework (Hair et al., 2010).

Reliability. A Cronbach alpha was calculated to determine the internal consistency of each subscale in terms of perceived susceptibility, perceived seriousness, perceived benefits, perceived barriers, perceived vaccine risk, and likelihood to vaccinate. In determining research scale reliability, DeVellis (2003) proposes scales with a Cronbach alpha below .60 are unacceptable, between .60 and .65 undesirable, between .65 and .70 minimally acceptable, between .70 and .80 respectable, and between .80 and .90 very good. Nunnally and Bernstein (1994) consider a coefficient alpha of .70 or greater as acceptable. Therefore, a Cronbach alpha of .70 was used to determine acceptance of the subscales in the CIIQ.

Following data analysis, reliability and validity of the CIIQ were determined and revisions made as indicated based on the results. The instrument was then incorporated into Phase II.

Phase II

Using a cross-sectional design, the overall aim of the study was to determine factors predictive of parents' likelihood to vaccinate children against influenza and the relationships between those factors. In Phase II, the hypothesized model was tested using structural equation modeling. The model hypothesizes the direct and indirect effects of the main constructs of the HBM and perception of vaccine risk on likelihood to vaccinate.

Aim: To test a hypothesized model describing factors that may predict parents' likelihood of vaccinating children against influenza.

Hypothesis 1: The overall model fits the data.

Hypothesis 2: Perceived system barriers, perceived vaccine risk, and cues to action will have a direct effect on likelihood to vaccinate.

Hypothesis 3: Perceived benefits will have an indirect effect through perceived barriers on likelihood to vaccinate.

Hypothesis 4: Perceived vaccine risk will have an indirect effect through perceived benefits and perceived barriers on likelihood to vaccinate.

Hypothesis 5: Perceived susceptibility and perceived severity will have an indirect effect through perceived benefits and perceived barriers on the likelihood to vaccinate.

Setting

St. Elizabeth Physicians Pediatrics (see Appendix J for a letter of support), a pediatric primary care practice located in Northern Kentucky, served as the setting for Phase II. The practice averages 100 patient visits per day and has over 27,000 patient visits per year.

Approximately 60% of the patients have health insurance coverage through Medicaid, 35% have

private insurance, and 5% are uninsured. The practice participates in the Vaccines for Children program.

Sample

Convenience sampling was used to recruit participants. Adults registering a child or children for a healthcare provider visit at the pediatric office during the study period from June 18, 2012 to August 15, 2012 were invited to participate. Inclusion and exclusion criteria were the same as detailed for Phase I.

Sample size determination in structural equation modeling may be based on the ratio of participants to the number of model parameters requiring statistical estimates. Although the optimal minimum ratio of participants to parameters is 20:1, a ratio of 10:1 is acceptable (Kline, 2011). The hypothesized model consists of 3 covariates, 8 coefficients, and 7 variables for a total of 18 parameters. Thus, a sample size of 180 is required. To compensate for potential missing data, 200 participants were recruited.

Measures

Participants were asked to complete an anonymous two-part pencil and paper survey which included parent/legal guardian demographics and the CIIQ questionnaire. A description of the questionnaire is described in Phase I. Participants completed the survey in the office waiting area or examination room.

Recruitment

The investigator approached adults in the waiting area who had registered a child for a provider visit and informed them of the study. Adults meeting inclusion criteria were invited to participate and those agreeing to participate were handed a study packet. The study packet was the same as outlined for Phase I.

Data Collection and Data Management

Participants completed the pencil-paper survey in the waiting area or examination room, placed their completed questionnaire in the provided envelope, sealed the envelope, and returned it directly to the investigator. Because the office has a different exit for discharge, participants who completed the survey in the examination room were instructed to return to the waiting area to hand the envelope to the investigator. Participants received a \$10 Kroger gift card as compensation for their time after handing the envelope to the investigator. Procedures for data management were the same as outlined for Phase I.

Data Analysis

Structural equation modeling was used to test the hypothesized model (see Figure 4). This statistical method allows causal relationships between independent and dependent variables to be determined (Dilalla, 2000). The two-step SEM process detailed by Hair et al. (2010) was used to test the model. The process includes tests of the measurement model and structural model in determining fit and validity. It is important the measurement demonstrate psychometrically sound properties prior to proceeding with theory testing using SEM (Byrne, 2010). Therefore, a measurement model and structural model were tested in this phase of the study.

Measurement model. The measurement model was tested by confirmatory factor analysis (CFA). Referred to as the measurement model of structural equation modeling (SEM), CFA allows for the testing of a hypothesized model to explain how measured variables (items) represent a construct (factor) in a theoretical model (Hair et al., 2010). This approach is appropriate when the latent variable structure is known (Byrne, 2010). Unlike EFA, factors in CFA are derived from theory rather than statistical results. In CFA, the number of factors and variables loading on those factors are determined *a priori* using measurement theory (Hair et al.,

2010). Confirmatory factor analysis provides an additional dimension in determining the construct validity of a measurement tool (Garver & Mentzer, 1999).

The measurement model consists of seven latent constructs and 27 indicators to measure the constructs. Four indicators were assessed respectively to measure perceived severity, perceived susceptibility, and cues to action, three indicators to measure perceived benefits, four indicators to measure perceived systems barriers, and seven indicators assessed to measure perceived vaccine risk. One indicator was used to measure the outcome variable, likelihood to vaccinate.

Figure 4. Specification of the structural model.

Validity of the Structural Model

Loading estimates were examined to ensure consistency with the measurement model. A covariance matrix was generated for each parameter estimation performed using maximum likelihood method. To determine how well the model fit the data, goodness-of-fit indices were evaluated. The model's chi-square was used to evaluate the absolute fit between the model and the data and to test that the model was consistent with the covariance data. The chi-square should not be statistically significant ($p > .05$; Kline, 2011). Goodness-of-fit Index (GFI) was used to

measure the relative amount of variance and covariance accounted for in the model (Byrne, 2010). The value of GFI ranges from 0 to 1.0 with 1.0 indicating the best fit (Kline, 2011). The minimum acceptable value is .90 (Hair et al., 2010). Incremental fit indices were used to test the adequacy of the model compared with a null model of uncorrelated variables (Kline, 2011):

(a) comparative fit index (CFI), (b) incremental fit index (IFI), (c) normed fit index (NFI), (d) Tucker-Lewis index (TLI), and (e) relative noncentrality index (RNI). The values incremental fit indices range from 0 to 1.0 with .95 or greater representing an acceptable fit (Hu & Bentler, 1999). The root mean square error of approximation (RMSEA) index was used to estimate the lack of fit in the model compared to a perfect (saturated) model (Tabachnick & Fidell, 2007). This index better approximates a population and is not affected by sample size. The value of RMSEA ranges from 0 to 1.0 with values less than .06 acceptable (Hu & Bentler, 1999). The adjusted goodness of fit index (AGFI) was also evaluated. Estimation and modification of the corresponding statistical model was based on the resulting fit statistics and modification indices. Once the model displayed an acceptable fit to the data, the hypotheses were tested by examining the significance of the corresponding path coefficients.

Funding

Phase II of the study was funded through a research grant provided by the Association of Community Health Nursing Educators.

Human Subjects

Institutional Review Board (IRB) approval from the University of Cincinnati was obtained prior to starting the study (see Appendix K). Participation was purely voluntary and clearly stated as such in the information sheet which was the first page of the study packet. The information sheet also informed potential participants participation in the study would not

influence their child's health care visit. The information sheet outlined the purpose, risks, benefits, choices, and legal rights of the participants. Contact information for investigator and the IRB was included on the sheet. To protect participant anonymity, a waiver of the written consent procedure was approved. Participants indicated their willingness to take part in the research by submitting their completed questionnaire. It was stated in the information sheet that completion of the questionnaire indicated consent for use of their information in the study.

The paper questionnaires are maintained in a locked filing cabinet in the investigator's office. The primary investigator is the only individual with access to the documents. The data were input into an SPSS data file stored on the University of Cincinnati's College of Nursing secure research server protected by a firewall. The server used for research data is one machine with a fault-tolerant RAID 5 hard drive array. Data are backed up nightly to a different backup server, and archived in an encrypted tape that is taken off-site every week. Both the research data and backup server are located in a controlled access area that has full environmental controls, water alarms, and fire-suppression systems. After a period of five years, all paper documents will be destroyed by a bonded documentation destruction company. After a period of five years, electronic data files will be electronically deleted from the research server. Dissemination of the findings will be in aggregate form only.

In addition to training related to data collection, all persons involved in the study received the following training: human subjects training as mandated by the University of Cincinnati IRB, subject inclusion and exclusion criteria, protection of data during the data collection process, and maintenance of subject confidentiality. The conduct of this research study was deemed no more than minimal level of risk to the participants by the IRB. There was no cost to the participant and there were no direct benefits for participating in the study. It is planned that findings of this study

will be used to develop interventions aimed at improving influenza vaccination among children, thereby protecting the health of the public.

CHAPTER IV: RESULTS

The purpose of the study was to test a model based on the HBM describing factors influencing parents' likelihood to vaccinate children against influenza and consisted of two phases. In Phase I, reliability and construct validity of the CHIQ was assessed. In Phase II, a hypothesized model to predict the likelihood to vaccinate against influenza using SEM was tested. Examined constructs included perceived severity, perceived susceptibility, perceived benefits, perceived system barriers, cues to action, and perceived vaccine risk. This chapter presents the results of the study organized into two sections: (a) Phase I results of psychometric properties of the CHIQ and (b) Phase II key findings.

Phase I

Participants

During the recruitment period, 142 children received immunotherapy and 118 adults were invited to participate. Of those, 15 adults were ineligible because they were not the child's legal guardian. Three others declined stating they were not interested in participating (97% response rate). A total of 100 individuals participated (see Figure 5).

Figure 5. Phase I: Participant eligibility chart.

The mean age of participants was 40.9 years (range 26-61; $SD = 6.5$) and of participants' children 10.5 years (range 3-17; $SD = 3.2$). The majority of the children received the influenza vaccine the prior year ($n = 72$; 74%) and were also likely to vaccinate their child against influenza the upcoming influenza season ($n = 72$; 72%). Demographic characteristics of the participants are summarized in Table 2.

Table 2

Phase I: Demographic Characteristics of Participants (n = 100)^a

Variable	Frequency	Percent
Relationship to child		
Mother	75	75
Father	19	19
Guardian	6	6
Age		
18-29 years	2	2
30-39 years	37	37
40-49 years	50	50
50-59 years	10	10
60 years and over	1	1
Education (n = 88)		
Less than 12 years	0	0
12 years	22	25
13-15 years	20	23
16 years	25	28
17-22 years	21	24
Ethnicity		
Asian	5	5
Black or African American	3	3
Hispanic or Latino	1	1
White	89	89
Other	2	2
Child's Age		
Under 2 years	0	0
2-4 years	1	1
5-12 years	74	74
13-17 years	25	25
Health Care Insurance		
Private	83	83
Medicaid	17	17
None	0	0
Received Influenza Vaccine Last Year (n = 97)		
Yes	72	74
No	25	26

^aNot all variables add to 100 due to missing data.

Data Screening

Data were screened for missing data, outliers, and normality. Non-substantive responses (neither agree or disagree) were included in the analysis and treated as a middle position (de Vaus, 2002). There was no missing data among the 30 indicator variables. The data were not normally distributed and all 30 indicator variables were significantly univariately skewed ($p < .001$). As the assumption of normality may be violated when the purpose of PCA is descriptive (Tabachnick & Fidell, 2007), transformation of the variables was not pursued. Using Mahalanobis distance with $p < .001$, only one case was identified as a multivariate outlier (66.38) and retained.

Instrument Construct Validity

Construct validity of the 30 item CIIQ was evaluated using PCA. Prior to performing PCA, the data were assessed to determine factorability by examining the correlation matrix and computing the measure of sampling adequacy. The KMO measure of sampling adequacy was 0.73, Bartlett's test of sphericity was significant ($\chi^2 = 1127.20$, $df = 435$, $p = <.001$), and the majority of correlation coefficients were greater than 0.30 indicating suitability of the data for factor analysis. A PCA with an orthogonal rotation (Varimax) was computed to determine the underlying component structure of the CIIQ (Table 3). The PCA extracted eight components with eigenvalues greater than 1, explaining 22.56%, 11.14%, 6.35%, 5.48%, 5.11%, 4.51%, 3.89%, and 3.41% of the variance respectively. The total variance explained was 62.45%.

Table 3

CHQ: Summary of Item Factor Loadings^a

Item	Factors							
	1	2	3	4	5	6	7	8
The flu vaccine contains ingredients that are not safe.	.78							
The flu vaccine weakens the immune system.	.69							
The flu vaccine is not safe to give to children	.68							
Side-effects from the flu vaccine are worse than the flu itself.	.56			-.34				
I or someone I know had a bad reaction to the flu vaccine.	.53	-.31						
Hearing a famous celebrity say the flu vaccine may harm children affects my decision to vaccinate my child against the flu.	.51				.30			
The flu vaccine can cause the flu in some children.	.46					-.66		
Infection with the flu may cause serious problems in children.		.83						
Flu is a serious illness in children.		.73						
If my child gets the flu, the illness could spread to other family members.		.62		.32				
I am afraid the flu will make my child very sick.							.80	
If my child got the flu vaccine and still catches the flu, he/she would not be as sick.			.65					
Getting the flu vaccine for my child will keep him/her from missing school or daycare due to being sick with the flu.	-.31		.62					
The flu vaccine prevents my child from getting the flu.	-.50		.54					
My child is more likely to catch the flu than other children if he/she does not get the flu vaccine.				.52				
It is likely my child will catch the flu if he/she does not get the flu vaccine.			.38	.50				-.37
My child's age makes it likely that he/she will catch the flu if he/she does not get the flu vaccine.			.67					
I worry my child will catch the flu if he/she does not get the flu vaccine.			.36	.37		.52		
It is difficult to find the time to bring my child to the healthcare provider's office to get the flu vaccine.					.84			
It is hard to get an appointment for the flu vaccine for my child.					.76			

I cannot afford the flu vaccine for my child.	-.54	.40	.33
Transportation problems make it hard to bring my child to the healthcare provider's office to get the flu vaccine.	-.57	.39	
My child's school or daycare telling me my child should get the flu vaccine affects my decision to vaccinate my child against the flu.	.31		.76
Family members wanting my child to get the flu vaccine affects my decision to vaccinate my child against the flu.		.38	.54
News or internet sites stressing the importance of the flu vaccine for children affects my decision to vaccinate my child against the flu.		.78	
My child's healthcare provider telling me my child should get the flu vaccine affects my decision to vaccinate my child against the flu.			.68

^aNote: Extraction performed using Principal Component Analysis with Varimax rotation. Loadings <.30 are not included.

The rotated component matrix of the PCA was examined and items loading on multiple factors and with factor loadings less than .50 were reviewed. The three items loading on more than one factor and subsequently eliminated were: “My child is likely to get very sick from the flu vaccine” (.45, .33, .46), “The flu vaccine does not work very well” (.45, -.38, -.36), and “Other children will be protected against the flu if my child gets the flu vaccine” (.40, .35). The one item with a factor loading of less than .50 on one dimension, “Getting the flu vaccine for my child will keep me from missing work to care for my child with the flu” (.47), was also eliminated. The analysis demonstrated the majority of items loaded on the intended theoretical constructs (Table 4). Additionally, perceived vaccine risk and perceived system barriers loaded as two separate constructs.

Table 4

Item Analysis and Internal Consistency of Subscales

Item	Mean (SD)	Item-Total Correlation	α if Item Deleted
Perceived Severity $\alpha = .72$			
Flu is a serious illness in children.	3.84 (0.85)	.61	.55
Infection with the flu may cause serious problems in children.	3.79 (0.88)	.65	.49
If my child gets the flu, the illness could spread to other family members.	4.15 (0.59)	.42	.77
Perceived Benefits $\alpha = .68$			
The flu vaccine prevents my child from getting the flu.	3.18 (1.00)	.55	.51
Getting the flu vaccine for my child will keep him/her from missing school or daycare due to being sick with the flu.	3.27 (1.03)	.52	.55
If my child got the flu vaccine and still catches the flu, he/she would not be as sick.	3.13 (1.04)	.41	.68
Perceived Vaccine Risk $\alpha = .77$			
The flu vaccine weakens the immune system.	2.43 (0.82)	.60	.76
Side-effects from the flu vaccine are worse than the flu itself.	2.43 (1.04)	.49	.77
The flu vaccine can cause the flu in some children.	3.03 (0.93)	.38	.79
Hearing a famous celebrity say the flu vaccine may harm children affects my decision to vaccinate my child against the flu.	1.65 (0.67)	.33	.79
The flu vaccine is not safe to give to children.	1.78 (0.71)	.60	.76
The flu vaccine contains ingredients that are not safe.	2.42 (0.86)	.71	.74
I or someone I know had a bad reaction to the flu vaccine.	2.21 (1.03)	.46	.78

The first factor retained seven items measuring the construct of perceived vaccine risk. The factor had an eigenvalue of 6.8 and total item variance explained by the factor of 22.56%. Factor loadings ranged from .46 to .78. The item means ranged from 1.65 to 3.03 ($SD = 0.69-1.04$). The internal consistency of the subscale was .77 and interitem correlations ranged from .33 to .71. The item, “The flu vaccine can cause the flu in some children” loaded positively on factor 1 (.46) and negatively on factor 6 (-.66). As only three items loaded on factor 6 and the underlying construct was not clear, the item was retained to measure perceived vaccine risk after reviewing the conceptual definition of the construct and previous studies indicating this was a concern of parents.

The second factor aligned with three items measuring the construct of perceived severity. The factor had an eigenvalue of 3.3 and total item variance explained by the factor of 11.14%. Factor loadings ranged from .62 to .83. The item means ranged from 3.79 to 4.15 ($SD = 0.59-0.88$). The internal consistency of the subscale was .72 and interitem correlations ranged from .42 to .65. One item intended to measure the construct of perceived severity, “I am afraid the flu will make my child very sick” loaded on factor seven with a factor loading of .80. The only other item loading on factor seven (.46) was, “My child is likely to get very sick from the flu vaccine”, an item intended to measure perceived vaccine risk. Since this latter item was eliminated, the former item was retained as the similarity of the two items may have been confusing to participants.

Four items loaded on the third factor with 3 of 4 being items to measure the construct of perceived benefits. Factor loadings for those items ranged from .54 to .65. One item, “The flu vaccine prevents my child from getting the flu”, also loaded negatively (-.50) on factor one (perceived vaccine risk). This item was retained because the reverse item, “The flu vaccine does

not work very well” was eliminated. The factor had an eigenvalue of 1.90 and total item variance explained by the factor of 6.35%. Factor loadings ranged from 0.54 to 0.65. The item means ranged from 3.13 to 3.27 ($SD = 1.00 - 1.04$) and interitem correlations ranged from .41 to .55. The internal consistency of the subscale was .68.

The fourth factor included three items with two of the items measuring perceived susceptibility. The other item, “News or internet sites stressing the importance of the flu vaccine for children affects my decision to vaccinate my child against the flu” had a loading factor of 0.78 but was intended to measure cues to action. Of the remaining two items intending to measure perceived susceptibility, one loaded on the benefits subscale and the other on an undefined factor. Overall, the items intending to measure the construct of perceived susceptibility did not perform very well. Although Strecher and Rosenstock (1994) recommend adding a behavioral anchor to items measuring perceived susceptibility, doing so in this study resulted in items loading on different factors. The instrument developed by Champion (1995) did not include behavioral anchors to measure the construct of perceived susceptibility and all intended items loaded on the same factor. Therefore, for Phase II, the behavioral anchor was removed for items intending to measure perceived susceptibility.

Items loading on the fifth factor included items measuring the construct of perceived system barriers. Two of the items, “I cannot afford the flu vaccine for my child” and “Transportation problems make it hard to bring my child to the healthcare provider’s office to get the flu vaccine” also negatively loaded on the factor indicating perceived severity. Following review of the conceptual definitions of perceived system barriers and perceived severity, it was determined the items most closely aligned with the construct of perceived system barrier. The items were retained as results may differ when the CIIQ is administered in a primary care setting

and to parents' of children on public insurance. In addition, the item "I cannot afford the flu vaccine for my child" was revised to "The flu vaccine is expensive" after reviewing research in which similar wording was used and the item loaded unidimensionally on the barriers construct (Champion, 1999).

Items intending to measure cues to action had strong loadings but loaded on three separate factors. Two items measuring cues to action loaded on factor eight. The remaining two items loaded on the same factors as items intended to measure perceived susceptibility. Because all of the items measuring perceived susceptibility were going to be revised, items intending to measure cues to action were retained.

Based upon the results of Phase I data, the CIIQ was revised. The revisions included: (a) deletion of two items to measure perceived benefits and two items to measure perceived vaccine risk, (b) removal of behavioral anchor on items measuring perceived susceptibility, and (c) rewording of the item, "I cannot afford the flu vaccine for my child" to "The flu vaccine is expensive." The revised version of the CIIQ used in Phase II comprised 26 items with seven items measuring the construct of perceived vaccine risk, four items measuring the construct of perceived severity, three items measuring perceived benefits, four items measuring perceived susceptibility, four items measuring perceived barriers, and four items measuring cues to action. The subscales of perceived severity ($\alpha = .72$) and perceived vaccine risk ($\alpha = .77$) demonstrated respectable reliability and perceived benefits ($\alpha = .68$) was minimally acceptable (DeVellis, 2003). As the subscales of perceived susceptibility, perceived barriers, and cues to action did not demonstrate an adequate factor structure, reliability testing was unable to be conducted.

Phase II

The revised CIIQ was used to collect data in Phase II and the hypothesized model was tested using structural equation modeling. The model hypothesized the direct and indirect effects of the main constructs of the HBM and perception of vaccine risk on likelihood to vaccinate.

Participants

During the recruitment period, 265 adults registered their child for a healthcare provider visit. At the office manager's request, adults were approached after completing necessary registration paperwork and still in the waiting area. As a result, 22 adults were not invited to participate. Of the 243 invited to participate, 33 were ineligible to participate because (a) the child was not between the ages of 2 months to 17 years ($n = 20$), (b) the adult was not able to read and write English ($n = 12$), and (c) the adult was not the child's legal guardian ($n = 1$). Six adults declined because they were not interested in participating and four declined because they were busy caring for their children (95% response rate).

Figure 6. Phase II: Participant eligibility chart.

Two hundred adults participated with the majority ($n = 162$; 81%) being the mother of the child. The mean age of participants was 32.5 years (range 18-65; $SD = 8.6$) and most ($n = 159$; 79.5%) had at least 12 years of education. The average age of participants' children was 6.6 years (range 6 months to 17 years; $SD = 4.7$) and the majority ($n = 141$; 70.5%) was enrolled in Medicaid. Demographic characteristics of the participants are summarized in Table 5. Of children eligible to receive the influenza vaccine, slightly more than half ($n=117$; 60.3%) received the influenza vaccine the prior year and the majority ($n = 124$; 62%) were likely to receive the vaccine the upcoming influenza season (see Figure 7).

Table 5

Phase II: Demographic Characteristics of Participants (n = 200)^a

Variables	Frequency	Percent
Relationship to child		
Mother	162	81
Father	17	8.5
Guardian	21	10.5
Age		
18-29 years	77	17.6
30-39 years	82	41.6
40-49 years	29	14.7
50-59 years	8	4.1
60 years and over	1	0.5
Education		
Less than 12 years	34	17.6
12 years	61	31.6
13-15 years	73	37.8
16 years	16	8.3
17-22 years	9	4.7
Child's Ethnicity		
Asian	2	1.0
Black or African American	20	10.0
Hispanic or Latino	15	7.5
White	158	79.0
Other	4	2.0
Child's Age		
Under 2 years	39	19.5
2-4 years	45	22.5
5-12 years	86	43
13-17 years	30	15
Health Care Insurance		
Private	55	27.5
Medicaid	141	70.5
None	4	2.0
Received Influenza Vaccine Last Year		
Yes	117	58.5
No	81	40.5

^aNot all variables add to 200 due to missing data

Figure 7. Number and ages of children receiving influenza vaccine last year.^{ab}

^a Not all variables add to 200 due to missing data. ^b Children under 1 year of age were not included ($n = 5$; 2.5%) in total since the group was less than 6 months in age during the vaccination period and therefore not eligible for influenza vaccination.

Measurement Model

Confirmatory factor analysis was performed using Amos 17.0 (SPSS, Inc., Chicago, IL). The measurement model consisted of seven latent constructs and 27 indicators to measure the constructs. A six factor model of perceived susceptibility, perceived severity, perceived benefits, perceived system barriers, cues to action, and perceived vaccine risk was hypothesized. Four indicators were assessed to measure perceived severity, perceived susceptibility, and cues to action; three indicators to measure perceived benefits; four indicators to measure perceived systems barriers; and seven indicators assessed to measure perceived vaccine risk.

Data Screening

Data were screened for missing data, outliers, and normality. Similar to Phase I, non-substantive responses (neither agree or disagree) were included in the analysis and treated as a middle position (de Vaus, 2002). Of the 16 indicator variables with missing data, none exceeded 2.5% and were estimated with the mean replacement. Using Mahalanobis Distance ($p = 0.001$), three cases were identified as multivariate outliers and deleted yielding a sample size of 197 participants. The analysis was rerun following deletion of the three outliers. The data were not normally distributed and all 26 indicator variables were significantly univariately skewed ($p < .001$). Mardia's coefficient of multivariate kurtosis was 68.820 (critical ratio = 12.657) indicating a violation of multivariate normality. Therefore, maximum likelihood estimation using Bollen-Stine bootstrapping procedure (Bollen & Stine, 1992) and 2,000 bootstrap samples (Efron & Tibshirani, 1998) were performed to estimate the model to obtain more valid estimates of the standard errors.

Results of the Measurement Model

Fit indices for the initial measurement model did not indicate a good fit of the data to the model. The Bollen-Stine p value for the model was statistically significant ($p = .001$) suggesting a poor model fit (see Table 6). Additional indices demonstrated less than an acceptable fit ($\chi^2 = 496.463$, $df = 284$, $p < .001$; GFI = .84; CFI = .78; IFI = .79; NFI = .62; TLI = .75; RFI = .56; RMSEA = .06; AGFI = .81). To improve the fit of the model, post hoc model modifications were performed.

Standardized residual covariances were examined with a cutpoint value of 2.58 (Byrne, 2010). The indicator VR2 (Hearing a famous celebrity say the flu vaccine may harm my child affects my decision to vaccinate my child against the flu) had large residual values on CTA4

(3.447 [Family members wanting my child to get the flu vaccine affects my decision to vaccinate my child against the flu]), CTA3 (3.734 [My child's school or daycare telling me my child should get the flu vaccine affects my decision to vaccinate my child against the flu]), CTA2 (4.910 [News or internet sites stressing the importance of the flu vaccine for children affects my decision to vaccinate my child against the flu]), and SEV4 (-3.058 [If my child gets the flu, the illness could spread to other family members]). Next, modification indices were inspected and the parameter representing a covariance between e21 and Cues to Action exhibited a large modification index of 23.228 with a minimal expected parameter change (EPC) of .180. As only 2% of the sample agreed with this statement, the risk of social desirability in responding to the item is high, and the factor loading was .39, the indicator was deleted and the model re-specified.

Although suggesting an improvement in fit to the data, the next model continued to demonstrate less than acceptable fit to the data (Bollen-Stine $p = .010$; $\chi^2 = 417.055$, $df = 260$, $p < .001$; GFI = .86; CFI = .82; IFI = .83; NFI = .65; TLI = .80; RFI = .60; RMSEA = .056; AGFI = .82). Standardized residual covariates greater than 2.58 were (a) a residual of -2.846 for VR5 (The flu vaccine is not safe to give to children) and SEV4 (If my child gets the flu, the illness could spread to other family members), (b) a residual of -2.756 for VR5 and SUS1 (I worry my child will catch the flu), and (c) a residual of 2.619 for VR4 (The flu vaccine can cause the flu in some children) and SEV2 (I am afraid the flu will make my child very sick). Following a review of respective modification indices and EPC values, free parameters were not added because EPC values were not substantial and additional parameters did not make theoretical sense.

Factor loadings were then examined and indicators with loadings of less than .50 were examined for possible deletion. Indicators subsequently deleted included SUS1 (.32), SUS2

(.34), SEV4 (.37), BAR1 (.22), BAR2 (.18), BEN3 (.37), and VR4 (.36). Although having marginal factor loads, indicators SUS3 (.41), SEV2 (.46), and VR7 (.41) were retained following a review of the item to the theoretical construct. The model was re-specified (see Figure 8) and the results indicated an acceptable fit of the data to the model (Bollen-Stine $p = .045$; $\chi^2 = 181.397$, $df = 120$, $p < .001$; GFI = .91; CFI = .91; IFI = .92; NFI = .79; TLI = .89; RFI = .73; RMSEA = .051; AGFI = .87; see Table 6).

Table 6

Fit Indices of Measurement Model

Fit Indices	Acceptable	Hypothesized Model	Final Model
<i>Absolute Fit Indices</i>			
Chi-square	$p > .05$	$p < .001$	$p < .001$
Bollen-Stine	$p > .05$	$p = .001$	$p = .045$
RMSEA	.07	.06	.051
GFI	.95	.84	.90
AGFI	.95	.81	.87
<i>Incremental Fit Indices</i>			
NFI	.95	.62	.79
TLI	.95	.75	.89
CFI	.95	.78	.91
IFI	.95	.79	.92
RFI	.95	.56	.73

Figure 8. Final measurement model with standardized estimates and factor loadings.

Note. * $p < .05$; ** $p < .01$

The Cronbach alpha was calculated for all subscales. See Table 7 for an analysis of each item and subscale. The subscales of perceived barriers ($\alpha = .72$), cues to action ($\alpha = .72$), and perceived vaccine risk ($\alpha = .74$) demonstrated respectable internal consistency. The perceived severity subscale internal consistency was undesirable ($\alpha = .62$) and the subscales of perceived susceptibility and perceived benefits were unacceptable ($\alpha = .49$ and $.43$ respectfully). Findings indicated subscales with the total mean scores near the midpoint position (3-neither agree or disagree) had the poorest internal consistency (see Table 8).

Table 7

Item Analysis and Internal Consistency of Subscales

Item	Mean (SD)	Item-Total Correlation	α if Item Deleted
Perceived Susceptibility $\alpha = .49$			
SUS3 My child is more likely to catch the flu than other children.	2.43 (1.06)	.33	^a
SUS4 My child's age makes it likely that he/she will catch the flu.	2.97 (0.96)	.33	^a
Perceived Severity $\alpha = .62$			
SEV1 Flu is a serious illness in children.	4.04 (0.90)	.43	.53
SEV2 Infection with the flu may cause serious problems in children.	3.70 (0.92)	.51	.42
SEV3 I am afraid the flu will make my child very sick.	3.39 (1.15)	.38	.63
Perceived Benefits $\alpha = .43$			
BEN1 The flu vaccine prevents my child from getting the flu.	3.22 (1.03)	.55	.51
BEN2 Getting the flu vaccine for my child will keep him/her from missing school or daycare due to being sick with the flu.	3.25 (1.15)	.52	.55

Perceived System Barriers $\alpha = .72$		3.70 (1.61)		
BAR3	It is difficult to find the time to bring my child to the healthcare provider's office to get the flu vaccine.	1.95 (0.96)	.57	^a
BAR4	Transportation problems make it hard to bring my child to the healthcare provider's office to get the flu vaccine.	1.74 (0.86)	.57	^a
Cues to Action $\alpha = .72$		10.61 (3.22)		
CTA1	My child's healthcare provider telling me my child should get the flu vaccine affects my decision to vaccinate my child against the flu.	3.16 (1.17)	.46	.68
CTA2	News or internet sites stressing the importance of the flu vaccine for children affects my decision to vaccinate my child against the flu.	2.57 (1.07)	.47	.67
CTA3	My child's school or daycare telling me my child should get the flu vaccine affects my decision to vaccinate my child against the flu.	2.64 (1.10)	.59	.60
CTA4	Family members wanting my child to get the flu vaccine affects my decision to vaccinate my child against the flu.	2.24 (1.05)	.50	.66
Perceived Vaccine Risk $\alpha = .74$		12.16 (3.52)		
VR1	The flu vaccine weakens the immune system.	2.76 (1.073)	.47	.71
VR3	Side-effects from the flu vaccine are worse than the flu itself.	2.42 (0.95)	.60	.66
VR5	The flu vaccine is not safe to give to children.	2.02 (0.83)	.61	.67
VR6	The flu vaccine contains ingredients that are not safe.	2.56 (0.88)	.58	.67
VR7	I or someone I know had a bad reaction to the flu vaccine.	2.40 (1.24)	.36	.77
Likelihood to Vaccinate		3.8 (1.17)		
OC	My child will get the flu vaccine this flu season.			

^a Not computed.

Table 8

Summary of Subscale Analysis

Scale	Number of Items	Mean	Neutral Score	SD	Cronbach Alpha	Factor Loadings
Susceptibility	2	5.41	6	1.65	.49	.39-.85
Severity	3	11.13	9	2.26	.62	.45-.79
Benefits	2	6.47	6	1.74	.43	.52-.53
System Barriers	2	3.70	6	1.61	.72	.68-.84
Cues to Action	4	10.61	12	3.22	.72	.53-.76
Vaccine Risk	5	12.16	15	3.52	.74	.39-.80

Results of the Structural Model

The structural model (see Figure 9) consists of four endogenous (dependent) variables (benefits, vaccine risk, system barriers, and likelihood to vaccinate) and three exogenous (independent) variables (severity, susceptibility, and cues to action). The exogenous factors are hypothesized to influence the endogenous factors. Total scores of variables were used in the structural model. Because the data were not normally distributed, maximum likelihood estimation using Bollen-Stine bootstrapping procedure (Bollen & Stine, 1992) and 200 bootstrap samples (Efron & Tibshirani, 1998) were performed to test the model.

Figure 9. Specification of the structural model.

Hypothesis 1: The overall model fits the data. Following the analysis, results indicated that the hypothesized model was not a good fit to the data (Bollen-Stine $p = .015$; $\chi^2 = 232.657$, $df = 142$, $p < .001$; GFI = .89; CFI = .88; IFI = .89; NFI = .75; TLI = .86; RFI = .70; RMSEA = .057; AGFI = .86; see Table 9). See Figure 10 for a diagram of the hypothesized model with standardized coefficients. The correlation matrix of latent constructs is detailed in Table 10. Therefore, post hoc analysis was undertaken to improve model fit. Modification indices were reviewed and the path from cues to action to likelihood to vaccinate was deleted and a path was added from cues to action to system barriers (MI 8.186, par change .346). Adding the path made theoretical sense as a parent may be cued as to the importance of influenza vaccination for their child but a barrier such as transportation difficulties may impact their ability to get their child vaccinated.

Table 9

Fit Indices of Structural Model

Fit Indices	Acceptable	Hypothesized Model	Final Model
<i>Absolute Fit Indices</i>			
Chi-square	$p > .05$	$p < .001$	$p < .001$
Bollen-Stine	$p > .05$	$p = .015$	$p = .085$
RMSEA	.07	.057	.047
GFI	.95	.89	.90
AGFI	.95	.86	.87
<i>Incremental Fit Indices</i>			
NFI	.95	.75	.78
TLI	.95	.86	.90
CFI	.95	.88	.92
IFI	.95	.89	.92
RFI	.95	.70	.74

Figure 10. Hypothesized model with standardized coefficients. $*p < .05$; $**p < .01$; $***p < .001$

Table 10

Hypothesized Model: Correlation Matrix of Latent Constructs

	CTA	SUS	SEV	BAR	BEN	VR	OC
Cues to Action (CTA)							
Susceptibility (SUS)	.365*						
Severity (SEV)	.187	.500*					
Barriers (BAR)	-.011	-.029	-.039				
Benefits (BEN)	.104	.280	.381	-.103			
Vaccine Risk (VR)	-.005	-.013	-.027	.065	-.637***		
Likelihood to Vaccinate (OC)	.183*	.072	.046	-.011	.342	-.510***	

* $p < .05$; ** $p < .01$; *** $p < .001$

Following the deletion of the path from cues to action to likelihood to vaccinate and the addition of the path from cues to action to system barriers, the analysis was rerun. Results indicated a slight improvement in fit but still not a good fit to the data (Bollen-Stine $p = .025$; $\chi^2 = 227.236$, $df = 142$, $p < .001$; GFI = .90; CFI = .89; IFI = .89; NFI = .76; TLI = .87; RFI = .71; RMSEA = .055; AGFI = .86). Next, the standardized residuals covariance matrix was examined. None of the residuals were found to be greater than 2.58 indicating the addition of a path correlating residuals was not indicated. Following examination of the modification indices, a path from perceived susceptibility to likelihood to vaccinate was added (MI 15.882; par .822). This resulted in an improved fit of the data to the model (Bollen-Stine $p = .070$; $\chi^2 = 209.270$, $df = 142$, $p < .001$; GFI = .90; CFI = .91; IFI = .92; NFI = .78; TLI = .90; RFI = .73; RMSEA = .049; AGFI = .87). Non-significant paths were then removed: severity to vaccine risk ($\beta = .01$, $p = .96$), system barriers to likelihood to vaccinate ($\beta = .05$; $p = .71$), and benefits to system barriers ($\beta = -.21$; $p = .24$).

The model was re-examined. Although the path from vaccine risk to benefits was significant, this did not make theoretical sense after deleting the paths from benefits to system barriers and system barriers to likelihood to vaccinate. Therefore, paths were added from benefits to vaccine risk and system barriers to vaccine risk. This resulted in an improved fit of the data to the model (Bollen-Stine $p = .085$; $\chi^2 = 207.44$, $df = 144$, $p < .001$; GFI = .90; CFI = .92; IFI = .92; NFI = .78; TLI = .90; RFI = .74; RMSEA = .047; AGFI = .87; see Table 10). See Figure 11 for the final model with standardized coefficients. The correlation matrix of latent constructs is detailed in Table 11.

Figure 11. Final model with standardized coefficients. * $p < .05$; ** $p < .01$; *** $p < .001$

Table 11
Final Model: Correlation Matrix of Latent Constructs

	CTA	SUS	SEV	BAR	BEN	VR	OC
Cues to Action (CTA)							
Susceptibility (SUS)	.393**						
Severity (SEV)	.167	.579***					
Barriers (BAR)	.286*	.112	.048				
Benefits (BEN)	.046	.161	.277*	.013			
Vaccine Risk (VR)	.047	-.058	-.138	.246**	-.536**		
Likelihood to Vaccinate (OC)	.112	.375***	.269	.326	.326	-.525***	

* $p < .05$; ** $p < .01$; *** $p < .001$

Hypothesis 2: Perceived system barriers, perceived vaccine risk, and cues to action will have a direct effect on likelihood to vaccinate. Testing of the hypothesized model indicated the path from system barriers to likelihood to vaccinate was not statistically significant and therefore not effecting vaccination ($\beta = .01$; $p = .34$). In addition, the direct path from cues to action to likelihood to vaccinate was deleted following examination of modification indices. Subsequently, for the final model, these paths were not included. In the final model (see Figure 11), the path leading from perceived vaccine risk to likelihood to vaccinate was significant and demonstrated a large effect (Cohen, 1988) indicating that perceived vaccine risks had an inverse direct effect on vaccination ($\beta = -.53$; $p < .001$). Therefore, parents' perception of system barriers and recommendations to vaccinate children against influenza did not affect likelihood of vaccination. Conversely, parents' perception of the risks of influenza vaccination to children negatively affected likelihood to vaccinate.

Hypothesis 3: Perceived benefits will have an indirect effect through perceived barriers on likelihood to vaccinate. In the hypothesized model, the path from perceived benefits to perceived barriers was not significant ($\beta = -.05$; $p = .21$) and subsequently not

included in post hoc analysis testing of the model. Therefore, parents' perceived benefits of vaccinating children against influenza did not have an indirect effect on likelihood to vaccinate through perception of barriers to vaccination.

Hypothesis 4: Perceived vaccine risk will have an indirect effect through perceived benefits and perceived barriers on likelihood to vaccinate. The best fit of the data to the model (see Figure 11) indicated perceived vaccine risk had a significantly large direct inverse effect on likelihood to vaccinate ($\beta = -.53; p < .001$). Additionally, perceived benefits had a significant medium (Cohen, 1988) indirect inverse effect on likelihood to vaccinate through perceived vaccine risk ($\beta = -.54; p < .01$) and perceived barriers had a significant small effect on vaccination through perceived vaccine risk ($\beta = .25; p < .01$). The results indicate that parents' perception of the benefits and barriers of influenza vaccination of children on likelihood of vaccination was indirectly negatively affected by perceptions of vaccine risk.

Hypothesis 5: Perceived susceptibility and perceived severity will have an indirect effect through perceived benefits and perceived barriers on the likelihood to vaccinate. In the final model, perceived susceptibility had a significant medium direct effect on vaccination ($\beta = .38; p < .01$). Perceived severity had a significant small indirect effect on vaccination ($\beta = .28; p < .05$) through benefits and vaccine risk (see Figure 11). Therefore, parents' perception of a child's susceptibility to contracting influenza directly affects likelihood of vaccination. However, parents' perception of the severity of influenza on vaccination is indirectly affected by benefits of vaccination and perceptions of vaccine risk.

Summary

In Phase I, the construct validity and reliability of the CIIQ was examined using PCA. Initial results indicated an eight factor structure with the majority of items loading on the

intended theoretical construct. As hypothesized, the constructs of perceived vaccine risk and perceived system barriers were two separate constructs. Based upon the analysis, necessary revisions were made to the CIIQ including the rewording of two items and the deletion of four items.

In Phase II, the hypothesized model was tested using SEM. The initial hypothesized model did not fit the data. Following post hoc analyses, the final model did fit the data and indicated the likelihood of parents vaccinating children against influenza is directly influenced by perceptions of susceptibility to influenza and negative perceptions of the risk of vaccination. Parents' perception of the severity of influenza and likelihood to vaccinate was indirectly influenced by perceived benefits of vaccination and perceptions of vaccine risk. In addition, cues to vaccinate on likelihood to vaccinate were indirectly influenced by perceptions of system barriers to vaccination and negative perceptions of vaccine risk.

CHAPTER V: DISCUSSION

Vaccinating children against influenza is an effective measure to prevent influenza-related illness among children. As only approximately 50% of children are vaccinated against influenza each year (CDC, 2012a), improving the vaccination rate is an important step in improving the health of children. The purpose of the study was to test a model describing factors influencing parents' likelihood to vaccinate children against influenza. Developed based on the HBM (Strecher & Rosenstock, 1997), the proposed model hypothesizes the indirect, direct, and total effects between the main constructs (perceived severity, perceived susceptibility, perceived benefits, perceived system barriers, cues to action) and perceived vaccine risk on likelihood to vaccinate using SEM. This chapter discusses the study results in regards to published research and literature. Sections on implications to nursing practice, limitations of the study, and recommendations for further research conclude the chapter.

Phase I

The purpose of Phase I was to assess the reliability and construct validity of the investigator developed Childhood Influenza Immunization Questionnaire. One hundred adults recruited from an allergy practice in Kenton County, Northern Kentucky participated.

Participants

Substantial differences in educational level and influenza vaccination of children were found between participants and the population. Participants had higher educational levels and were more likely to vaccinate their children against influenza than the population of Kentucky (U.S. Census Bureau, 2013). The majority of children (74%) received the influenza vaccine for the 2011 to 2012 season, higher than the state (48.9%) and nation (51.5%; CDC, 2012a). A large proportion ($n = 72$; 72%) of parents were likely/very likely to vaccinate their child the upcoming

influenza season and 13% were unsure. As parental education level does not appear to influence childhood influenza vaccination (Chen et al., 2011; Grant et al., 2003; Soyer et al., 2011), there are other possible explanations for the overall high vaccination rate including study location and convenience of immunization. The study was conducted at an allergy practice and therefore likely a large proportion of children receiving immunotherapy had asthma. Children with asthma are at high-risk for influenza-related complications and influenza vaccination has been a priority for this group even prior to the expanded guidelines (American Academy of Pediatrics, 2011). A study examining influenza vaccination in children with asthma found a similarly increased vaccination rate of 69.5% (Soyer et al., 2011). Also, the allergy practice makes influenza vaccination convenient to parents by offering the vaccine at the same time as immunotherapy and allowing walk-in appointments. As many children receive immunotherapy at weekly to monthly intervals, there are ample opportunities for vaccination during the influenza season. Although the practice does not offer the influenza vaccine to children enrolled in Medicaid, the vast majority (93%; $n = 14$) received the vaccine the prior year.

Instrument

This was the first study to conduct both reliability and validity testing of an instrument designed to assess factors influencing influenza vaccination of children. Items developed for the instrument were based upon previous research on childhood influenza vaccination and the HBM. Principal components analysis was performed to determine the factor structure of the 30 item CIIQ. Eight components were extracted and the majority of items loaded on the intended HBM construct with factor loadings of retained items ranging from .39 to .84.

Phase II

In Phase II, a hypothesized model describing factors influencing parents' likelihood to vaccinate children against influenza was tested using SEM. Participants were recruited from a large community pediatric practice in Boone County, Northern Kentucky.

Participants

As compared to participants in Phase I, participants in Phase II were less educated and the majority of children had public insurance. Although the number of children on Medicaid is higher than the county, (Foundation for a Healthy Kentucky, 2008), it approximates the insurance distribution of the practice

Of the participants, 60.3% ($n = 117$) of eligible children received the influenza vaccine the previous influenza season which is higher than both Kentucky (48.9%) and the U.S. (51.5%; CDC, 2012a). For the upcoming influenza season, 12.5% ($n = 25$) of parents were very unlikely/unlikely to vaccinate, 25.1% ($n=50$) were unsure, and 62.3% ($n = 125$) were likely/very likely to vaccinate. As the pediatric practice makes a concerted effort to make influenza vaccination as accessible as possible, the increased vaccination rate of the practice as compared to the state and nation is not surprising. Strategies employed by the practice include: ordering influenza vaccine early, including thimerosal free and intranasal doses, to ensure adequate supply and early season delivery; offering express vaccination services, including same-day appointments, vaccination clinics, and after-hours appointments; offering vaccination at both well and episodic visits; notifying parents of high-risk children of vaccine availability; and charging a nominal co-pay for children with private insurance. There is no cost to children enrolled in Medicaid, because the practice participates in the Vaccines for Children program. In addition, the practice does not accept children whose parents oppose vaccination or request

alternative vaccination schedules and influenza vaccination rates may be lower in practices that do. In terms of insurance status, both 60% of those with private insurance and 60% of those on Medicaid received the vaccine the previous season. Influenza vaccine is not required for school entry. As the vaccination rate in Boone County for state-mandated vaccines, such as diphtheria, tetanus, and polio, is 87% (Foundation for a Healthy Kentucky, 2008), a discrepancy could exist between the perceived benefits of the influenza vaccine and other childhood vaccines.

Results from this study align with previous research finding childhood vaccination acceptance is not dichotomous, but rather along a continuum (Benin, Wisler-Scher, Colson, Shapiro, & Holmboe, 2005; Gust et al., 2005; Keane et al., 2005). Benin et al. (2005) use the terms “vaccine-hesitant parents” and “late vaccinators” to refer to those in the middle of the continuum. Vaccine-hesitant parents are identified as being amenable to vaccination but have significant concerns whereas late vaccinators may delay vaccinating or choose an alternative vaccination schedule. In studies examining required childhood vaccinations, these two groups represent the majority of parents (Benin et al., 2005; Gust et al., 2005; Keane et al., 2005). Findings were similar in this study in which 59% ($n = 118$) of parents were in the middle of the continuum, with those very unlikely ($n = 10$; 5%) and very likely ($n = 72$; 36%) to vaccinate representing the minority.

Instrument

As the intent of the CIIQ was to measure parental attitudes regarding influenza vaccination, a middle response option of “neither agree or disagree” was offered. Although including a neutral response decreases non-response (Guy & Norvell, 1977), it presents difficulty when interpreting the meaning of the response. Neutral responses may indicate ambivalent or non-attitudes, social desirability effect (de Vaus, 2002), undecided, and “don’t know”

(Raaijmakers et al., 2000). Options for handling neutral responses during data analysis include treating as a middle position or treating as missing data (de Vaus, 2002). As approximately 30% to 50% of neutral responses reflect an ambivalent attitude (de Vaus, 2002), neutral responses were included in the analysis and treated as a middle position. However, it is possible the middle position indicated a knowledge deficit on some items. For instance, the statements “The flu vaccine contains ingredients that are not safe” and “My child’s age makes it likely that he/she will catch the flu” had the largest percent of middle responses (42.5% and 38.5% respectively). This may reflect a lack of knowledge regarding ingredients in the vaccine and the transmission of influenza among children rather than an ambivalent attitude. Further studies in which a separate response category of “don’t know” is included in addition to a midpoint may help to provide further clarity.

The reliability of an instrument is influenced by a number of factors including test length, distribution of test scores, and total test variance. Factors increasing scale reliability include an increased number of items and higher total scale variance (Nunnally & Bernstein, 1994). Consistent with instrument development theory (Nunnally & Bernstein, 1994), internal consistency of the CIIQ was higher in subscales with more than two items and greater variance in scores among the items. Consequently, the subscales with unacceptable internal consistency, perceived susceptibility and perceived benefits, only had two items and lesser item score variance. One of the difficulties in developing valid items for the subscale of perceived susceptibility was the narrow breadth of the construct. Initial items for the subscale of perceived susceptibility were adapted from a reliable scale ($\alpha = .93$) developed by Champion (1999) and included items such as “It is extremely likely I will get breast cancer in the future,” “I feel I will get breast cancer in the future,” “There is a good possibility I will get breast cancer in the

next 10 years,” and “My chances of getting breast cancer are great.” Interestingly, participants evaluating the CIIQ for face validity questioned the number of similar items within the CIIQ and felt the items were redundant. Although item redundancy tends to increase the reliability of a scale, validity is compromised (Kline, 2000). In an effort to maintain a balance between scale reliability and validity, redundant items were eliminated and additional items developed.

In regards to the subscale of perceived benefits, it is possible the two retained items may be measuring different aspects of the same construct resulting in a lower Cronbach alpha. The item, “Getting the flu vaccine for my child will keep him/her from missing school or daycare due to being sick with the flu”, may be indicating one aspect of the construct of perceived benefits whereas “The flu vaccine prevents my child from getting sick” another. In addition, the inclusion of both “school or daycare” within the same item may have been confusing to parents and contributed to measurement error. Finally, the item may not have been applicable to all parents as a child may not be attending school or daycare and the only response available was “neither agree or disagree” when, in this case, the item was not applicable.

As the internal consistency of the subscales of perceived susceptibility ($\alpha = .49$) and perceived benefits ($\alpha = .43$) remains unacceptable, further refinement of the instrument focusing on the development of additional items to indicate the constructs of perceived susceptibility and perceived benefits, is warranted. In addition, the removal of the behavioral anchor from items measuring perceived susceptibility may have been premature as only two of the four items demonstrated adequate factor loadings.

Overall, The CIIQ demonstrated adequate validity but suboptimal internal consistency on the subscales of perceived susceptibility, perceived benefits, and perceived severity. One approach to increasing internal consistency is to increase the number of items on the CIIQ,

specifically in subscales with less than three indicator items. As initial items were adapted from quantitative studies, the use of qualitative methods to further explore the HBM constructs within the context of childhood influenza vaccination is needed to develop additional items. Therefore, additional study of the CIIQ including modifications and re-evaluation is indicated.

Hypotheses

Hypothesis 1: The Overall Data Fits the Model

Findings from the study did not support the hypothesis as the overall data did not fit the model. As this is the first study to examine factors influencing childhood influenza vaccination using SEM, there are a number of explanations as to why the hypothesized model was not a good fit to the data. First, the hypothesized model was developed following extensive review of the theoretical underpinnings of the HBM and existing literature in which relationships between constructs were measured independently of one another. Second, although the instruments used in the studies had established reliability, construct validity had not been evaluated. Third, in previous studies items measuring perceived vaccine risk were included in the barriers construct (Allison et al., 2010; Chen et al., 2011; Daley et al., 2006; Daley et al., 2007). Following modifications, the data were an acceptable fit to the final model thereby validating the usefulness of the HBM in influenza vaccination of children. However, potential confounding demographic variables such as age of child, race and ethnicity, and socioeconomic status were not included in the model. Additional studies with a more diverse sample and incorporation of demographic variables would be helpful to further refine the model.

One significant path was the large correlation between perceived susceptibility and perceived severity. According to the HBM, perceived seriousness and perceived susceptibility combine to form perceived threat (Stretcher & Rosenstock, 1997). One of the difficulties in

operationalizing perceived threat is the lack of clarity on how the constructs are combined (Armitage & Conner, 2000) and whether perceived threat is an additive (Becker et al., 1975) or multiplicative (Champion & Skinner, 2008) variable. In studies examining perceived susceptibility and perceived severity independently in relation to childhood influenza vaccination (Allison et al., 2010; Chen et al., 2011; Daley et al., 2006; Daley et al., 2007) neither construct was associated with vaccination. In this study, findings suggest a large correlation between perceived susceptibility and perceived severity. This is supported by the theory as an increased state of perceived severity is necessary prior to perceived susceptibility becoming an effective predictor indicating a correlation between the constructs. One of the difficulties in evaluating this relationship in regards to influenza vaccination is the variability of illness severity from season to season. However, influenza vaccination of children appears to increase following media reports of pediatric deaths due to influenza-related illness (Daley et al., 2006; Ma et al., 2006) suggesting an increase in perceived severity and perceived susceptibility of the disease positively affecting vaccination. For this study, data were collected following a particularly mild influenza season (2011-2012) in which there were 34 pediatric deaths (CDC, 2012b). Consequently, there were very few media reports of pediatric deaths and hospitalizations.

Hypothesis 2: Perceived System Barriers, Perceived Vaccine risk, and Cues to Action will have a Direct Effect on Likelihood to Vaccinate

Perceived system barriers did not have a direct effect on likelihood to vaccinate. This result was in contrast to previous studies in which perceptions to barriers was the strongest predictor of preventive outcome behavior (Carpenter, 2010; Janz & Becker, 1984). However, unlike previous studies, a construct was added to assess attitudes regarding vaccination. In this study, barriers concerning time (“It is difficult to find the time to bring my child to the healthcare

provider's office to get the flu vaccine" [$M = 1.95$; $SD = 0.96$]) and transportation ("Transportation problems make it hard to bring my child to the healthcare provider's office to get the flu vaccine" [$M = 1.74$; $SD = 0.86$]) were retained in the final measurement model and appear to represent personal logistical barriers as opposed to system barriers. Although a previous qualitative study indicated parents' were reluctant to bring children to the healthcare provider's office just for influenza vaccination (Bhat-Schelbert et al., 2012), this finding was not supported in the study. Surprisingly, the issue of access specific to influenza vaccination appointment availability was also not a factor in this study which is also contrary to previous studies (Allison et al., 2010; Bhat-Schelbert et al., 2012). One explanation may be that, unlike previous seasons, appointments at the practice were not in short supply as there was not a vaccine shortage and options for vaccination were expanded by way of flu clinics, expanded hours, vaccination during both well and episodic visits, and same-day vaccination appointments.

Cues to action also did not have a direct effect on likelihood to vaccinate; rather the construct had indirect effect on vaccination through perceived susceptibility, perceived system barriers, and perceived vaccine risk. However, as cues to action was examined solely on individual (healthcare provider) or group (school, media, family) recommendations the ability to evaluate the full scope of the construct was not possible. Consistent with other studies (Bhat-Schelbert et al., 2012; Chen et al., 2011; Flood et al., 2010; Humiston et al., 2005; Nowalk et al., 2005; Nowalk et al., 2007), parents were most influenced to vaccinate based upon recommendations from healthcare providers ($M = 3.16$; $SD = 1.17$) and less influenced by recommendations from the child's school ($M = 2.64$; $SD = 1.10$), media ($M = 2.57$; $SD = 1.07$), and family members ($M = 2.24$; $SD = 1.05$). Although physician recommendation has been shown to be a consistent factor associated with influenza vaccination of children, the content and

influence of the recommendation remains unclear. It is likely illness severity and susceptibility are embedded within the cues to action as studies have found increased vaccination during times of heightened media reports of influenza-related complications (Daley et al., 2006; Gnanasekaran et al., 2006; Ma et al., 2006). Therefore, studies suggest the cues to action construct is much more complex, particularly when applied to influenza vaccination, as “triggers” of vaccination may be as subtle as hearing a child cough to media reports of pediatric deaths from influenza. As cues to action appear to be an important influence on vaccination, further research exploring the content and messaging of the construct is needed to further clarify the influence of cues to action on vaccination.

Among the constructs examined, perceived vaccine risk had the greatest direct effect on parents’ likelihood to vaccinate. The results indicated parents with increased perception of risks associated with influenza vaccination were less likely to vaccinate. This finding is consistent with other studies indicating parents of children not immunized against influenza had concerns about vaccine safety (Allison et al., 2010; Chen et al., 2011; Grant et al., 2003; Humiston et al., 2005). Results from the study suggest parents continue to have a number of misunderstandings about the safety of the influenza vaccine including side effects, ingredients, and effect on the immune system. Approximately 12% of parents believed side effects of vaccination were worse than influenza illness and one third indicated a neutral response ($M = 2.42$; $SD = 0.95$). While research is needed to further explore specific side effects parents are alluding to, this finding suggests parents are unaware of the potential severity of influenza illness. In regards to immunity, 25% of parents believed the influenza vaccine weakens the immune system and approximately 33% were neutral ($M = 2.76$; $SD = 1.07$). This is similar to a national survey in which 25% of parents believed that vaccination could weaken the immune system (Gellin,

Maibach, & Marcuse, 2000). Another concern is the safety of the ingredients in the vaccine. Approximately 13% of parents believed ingredients in the vaccine were not safe and another 43% were neutral ($M = 2.56$; $SD = 0.88$). Lastly, although the majority of parents believed influenza vaccination is safe for children, approximately 20% were neutral and 5% believed the vaccine was not safe for children ($M = 2.02$; $SD = 0.83$). Findings from the study provide evidence to support perceived vaccine risk as a significant predictor of childhood vaccination. As parental concerns regarding the risks associated with childhood vaccination continue to increase, the inclusion of perceived vaccine risk as a separate construct when applying the HBM to the vaccination of children may be warranted.

Hypothesis 3: Perceived Benefits will have an Indirect Effect through Perceived System Barriers on Likelihood to Vaccinate

According to the HBM, “perceived benefits minus perceived barriers” (Strecher & Rosenstock, 1997, p. 48) directly affect the likelihood of the preventive behavior. Historically, the construct of perceived barriers was intended to encompass all potential negative aspects of a health action including barriers to access and negative attitudes towards the health action (Champion & Skinner, 2008). In the model, both perceived system barriers and perceived vaccine risk were hypothesized to have a direct effect on likelihood to vaccinate indicating both constructs were barriers to vaccination. However, in the final model, the path from perceived benefits to perceived system barriers was not significant. Therefore, parents’ perceived benefits of vaccinating children against influenza did not have an indirect effect on likelihood to vaccinate through perception of system barriers to vaccination. One explanation for this result is parents in the study reported few system barriers to vaccination. As system barriers to vaccination have been identified, committed practices have developed interventions such as

vaccine reminders and flu clinics to make vaccination more accessible. Findings suggest the vast majority of parents did not find getting an appointment difficult nor did personal barriers such as transportation issues and time constraints pose a barrier to vaccination. As children in the study had an established healthcare provider, perceived system barriers may become more of an important factor among parents of children without a medical home and healthcare insurance.

In the final model, perceived benefits had an inverse indirect effect on likelihood to vaccinate through perceived vaccine risk. Therefore, parents not perceiving influenza vaccination as beneficial were less likely to vaccinate. Although 47% of parents surveyed believed influenza vaccination effective in preventing influenza in children, 31% did not believe the vaccine was effective and 21.5% were neutral ($M = 3.22$; $SD = 1.03$). This is a common misperception among parents, particularly those unlikely to vaccinate (Flood et al., 2010). Although the influenza vaccine is not as effective as other vaccines (CDC, 2006), mid-season assessment of the overall effectiveness of the 2012 to 2013 influenza vaccine was 56% (95% CI; 47 – 63%) and 64% (95% CI; 51-73%) in children ages 6 months to 17 years (CDC, 2013b). The fact that vaccine effectiveness is variable among age groups, particularly in the elderly, may also create a source of confusion among parents.

In children, optimal effectiveness of the vaccine may be decreased because many children who should receive two doses of influenza vaccine either fail to do so or receive the second vaccination beyond the recommended time interval (Hofstetter et al., 2013; Poehling et al., 2013). The ACIP recommends children less than 9 years of age receive two doses of influenza vaccine their first influenza season as vaccine effectiveness is much lower in children receiving one dose. For optimal effectiveness, the doses should be separated by one month and vaccination complete by early winter. Additionally, children receiving just one dose the prior

season should receive two doses the following season (CDC, 2010c). During the 2009 to 2010 season, only 29% of children requiring two doses were fully vaccinated and the average interval between doses was 64 days (Hofstetter et al., 2013). Interventions to increase full vaccination of eligible children include: (a) appointment reminders (Gaglani, Riggs, Kamenicky, & Glezen, 2001), (b) text-message reminders (Stockwell et al., 2012), (c) electronic medical record vaccine alerts (Fiks et al., 2007), and (d) vaccinating at both well and episodic visits (Daley et al., 2005).

Hypothesis 4: Perceived Vaccine Risk will have an Indirect Effect through Perceived Benefits and Perceived System Barriers on Likelihood to Vaccinate.

The hypothesized indirect paths between perceived vaccine risk and both perceived system barriers and perceived benefits were not significant. As described previously, perceived vaccine risk had a significantly large direct inverse effect on likelihood to vaccinate. Accordingly, parents are more likely to vaccinate if the benefits of vaccination outweigh the risks. Ultimately, both perceived benefits and perceived barriers had an indirect effect on likelihood to vaccinate through perceived vaccine risk underscoring the importance of including perceived vaccine risk as a separate construct. Results may have differed if items measuring perceived vaccine risk had been embedded in the construct of perceived barriers.

Hypothesis 5: Perceived Susceptibility and Perceived Severity will have an Indirect Effect through Perceived Benefits and Perceived Barriers on Likelihood to Vaccinate

In the final model, perceived susceptibility had a significant medium direct effect on vaccination. Previous studies analyzing the HBM in relationship to preventive health behavior had mixed results on the relationship between perceived susceptibility and a health behavior. Carpenter (2010) found perceived susceptibility to be the weakest predictor whereas Janz and Becker (1984) found perceived susceptibility to be a fairly strong predictor. Similarly, in relation

to influenza vaccination and children, Chen et al. (2011) found perceived susceptibility to be a significant predictor of vaccination whereas Daley et al. (2007) did not find the relationship significant. The results indicate parents' perception of a child's susceptibility to influenza positively affects the likelihood to vaccinate and is not mediated by perceptions of system barriers and benefits of vaccination. Findings suggest a heightened awareness among parents that children are at particularly high risk for contracting influenza. This may be a reflection of the increased media attention on children and influenza-related illness, particularly during the 2009 H1N1 influenza pandemic (SteelFisher, Blendon, Bekheit, & Lubell, 2010). The expansion of the influenza guidelines in 2008 to include all children over 6 months of age (CDC, 2010c) including ongoing recommendations from healthcare providers to vaccinate has also likely broadened parental understanding regarding the transmission of influenza and influenza's impact on children.

Perceived severity did not perform as expected. In the hypothesized model, perceived severity was correlated with cues to action and perceived susceptibility and had an indirect effect through both perceived vaccine risk and perceived benefits. In the final model, significant paths included a large correlation with perceived susceptibility and an indirect path to perceived vaccine risk with a small effect size. In previous studies, influenza vaccination appears to increase during seasons in which influenza was particularly severe (Daley et al, 2006; Ma et al., 2006). For this study, data were collected from May to July 2012, coinciding with the completion of influenza vaccination and prior to the initiation of vaccination for the upcoming influenza season. During the previous vaccination year (2011-2012), the influenza season was particularly mild (CDC, 2012b) and the vaccination rate was steady without any significant increases (CDC, 2012a). This is consistent with findings from Janz and Becker (1984) in which perceived severity

is less predictive in the context of preventive health behavior. As previous studies have suggested media coverage of influenza-related illness increased influenza vaccination of children (Daley et al., 2006; Ma et al., 2006), it is likely that the model, particularly the construct of perceived severity, may perform differently in times of moderate to severe illness and pandemics.

Implications for Nursing

During the 2012 to 2013 influenza season, 110 children died from influenza-related illness and 90% were not vaccinated (CDC, 2013a). As influenza vaccination rates of children appear to have plateaued at approximately 50% (CDC2011a; CDC, 2012a), parents may not fully comprehend the importance of vaccination in preventing influenza. Nurses can play a vital role in increasing influenza vaccination of children by first understanding factors influencing vaccination. Results from this study suggest the HBM, particularly with the inclusion of the construct of perceived vaccine risk, can be useful in guiding the development of effective nursing interventions aimed at improving childhood influenza vaccination rates. When planning influenza vaccination programs, the CIIQ could be useful in developing and evaluating interventions. For instance, the tool could be used as a pre- and post-measure to assess parental beliefs about vaccination following an educational program. This may provide valuable information when developing annual influenza vaccination campaigns and campaigns during pandemics.

As school-aged children are the main transmitters of influenza within households (Monto & Kioumeh, 1975) and communities (Longini et al., 1982), school nurses play an important role in promoting influenza awareness and vaccination of children. School-based influenza vaccination is effective in decreasing influenza-related illness in households (King et al., 2006)

and decreasing student absenteeism (Davis, King, Moag, Cummings, & Magder, 2008). In addition, the majority of physicians (McCormick et al., 2012) and parents (Allison et al., 2010; Bhat-Schelbert, 2012) support influenza vaccination at school. However, as many school-based programs receive financial and personnel assistance through the public health system, recent federal budget cuts (Association of State and Territorial Health Officials, 2013) place current and future vaccination programs in jeopardy. One solution is for public health departments and school districts to partner with academic nursing programs for assistance in program planning, implementation, and evaluation.

Another potential strategy for improving influenza vaccination rates of children is providing education on influenza and influenza vaccine safety. Findings from the study suggest parents continue to hold misperceptions about influenza-related illness in children and vaccine safety. Influenza vaccination of children may be increased by providing education on the potential severity of influenza-related illness among children and emphasizing the importance of vaccination. Based on this study, specific interventions targeting vaccine safety are likely to provide the greatest benefit in improving vaccination rates. One of the most common misperceptions regarding the influenza vaccine and consequently negatively affecting vaccination is the belief that the vaccine can cause influenza. In this study, 60% of parents believed this to be true. This is similar to findings by Daley et al. (2007) in which 70% of parents thought the influenza vaccine caused infection. Similarly, Flood et al. (2010) found 50% of parents not intending to vaccinate their child against influenza believed the influenza vaccine can cause influenza (Flood et al., 2010). Media reports (Russell, 2012; Stobbe, 2013) and public service announcements (U.S. Department of Health and Human Services, 2013) often focus on influenza severity in the reporting of child deaths and hospitalizations from influenza. Rare is

there media coverage on the safety of the influenza vaccine. Parents need to be educated regarding the overall safety of the vaccine particularly that the inactivated vaccine and LAIV do not cause influenza infection (CDC, 2010c) nor place their child at risk for Guillain-Barré syndrome (Salmon et al., 2013). In a qualitative study, Bhat-Schelbert et al. (2012) found parents wanted consistent and accurate information on both influenza-related illness and vaccine safety. Methods to communicate this information to parents include public safety announcements, billboards, and placing posters in the office. However, as vaccine attitudes and factors influencing vaccination differ among parents, education should be tailored to meet the needs of different types of parents (Keane et al., 2005). In addition, while studies have focused on the positive influence of the healthcare provider on influenza vaccination, the influence nurses' have on vaccination is unclear. Nurses' influence on vaccination is becoming increasingly relevant as influenza vaccination moves beyond the office setting and into the hospital inpatient setting.

Approximately 30% of surveyed parents were either unsure or unlikely to vaccinate their child against influenza. As studies have demonstrated the two groups most amenable to change (Gust et al., 2005; Keane et al., 2005), healthcare providers can help promote vaccination by engaging in on-going and open communication with parents hesitant to vaccinate (Leask et al., 2012). The vast majority of parents who change their mind about delaying or refusing a vaccine for their child do so after being given information and assurances from their healthcare provider (Gust et al., 2005), thereby further validating the importance of provider recommendation.

To improve vaccine-messaging, consideration of the parents' cognitive decision-making style as opposed to the provider's style, including the use of motivational interviewing, has also been advocated (Poland & Poland, 2011). Motivational interviewing is a collaborative communication technique focused on behavior change by eliciting and exploring the person's

own argument for change and has shown to be effective in managing addictive behaviors such as alcohol and substance abuse (Miller & Rose, 2010). The technique is complex and requires specific training (Miller & Rose, 2010). The required training and time needed to conduct the technique limit the feasibility within the context of influenza vaccination. However, principles of motivational interviewing, such as expressing empathy and supporting self-efficacy may be useful in starting the dialogue with vaccine-hesitant parents. For example, asking open-ended questions about the parents' concerns and reflecting on their answers is more likely to promote vaccination than to simply tell parents their children should get vaccinated. While motivational interviewing holds promise, research on the messaging and feasibility of delivery in a busy pediatric practice setting is needed.

Limitations

There were a number of limitations in the study. Convenience sampling was used to recruit participants from one pediatric office prior to the start of a single influenza season thereby limiting generalizability of the findings. Participant access was also a limitation as registration paperwork had to be completed prior to being invited to participate. In addition, the causality of associations cannot be inferred as cross-sectional data were used. As childhood vaccination, particularly influenza vaccination can be an emotionally charged issue, the possibility of social desirability effect exists. The potential for selection bias exists as parents may have chosen not to participate because of their unwillingness to vaccinate their child against influenza. Although parental reporting of influenza vaccination has been demonstrated to be fairly reliable (Brown et al., 2011; Shinnal, Plosa, & Poehling, 2007), the use of self-report data did not allow for verification of past and upcoming influenza vaccination. Future studies to determine intended and actual influenza vaccination are warranted to further the usefulness of the CIIQ in predicting

vaccination. In addition, the vast majority of participants identified their children as White so findings may not be generalizable to parents of children of other races or ethnicity.

Sample size was another possible limitation. Structural equation modeling requires large samples and the sample size for the study was determined based on the recommended minimum of 10 cases to one parameter ratio. Ideally, a sample size of 20 cases per parameter ratio is recommended to improve the statistical accuracy of the results (Kline, 2011). Lastly, changing the direction of the path between vaccine risk and benefits indicates a weakness of the theoretical model and limits the statistical accuracy of the results.

Recommendations for Further Research

Additional refinement of the CIIQ is needed to further the usefulness of the instrument within the context of childhood influenza vaccination. As evidenced in the study, the transferability of valid and reliable HBM scales from one health behavior to another is limited and highlights the difficulty in operationalizing constructs of the HBM. Additional research using qualitative methods would be beneficial in the development and refinement of additional items for each of the subscales, particularly the system barriers construct, as item relevance may differ among different socioeconomic, racial, and ethnic groups (Champion & Scott, 1997). Recommendations for future studies to improve instrument generalizability include a heterogeneous sample and subject-to-item ratio of 10 to 1 (DeVellis, 2003).

To improve the usefulness of the model in developing interventions, future studies with larger and heterogeneous samples are needed. The larger sample would allow for a closer examination of the indirect and direct effects of factors influencing vaccination among parents who are hesitant and less likely to vaccinate. In addition, variables such as ethnicity, race, and socioeconomic status should be incorporated into the model. Most importantly, experimental

studies to evaluate the effectiveness of interventions aimed at changing parental perceptions of illness risk and vaccine safety are needed. As provider recommendation has shown to positively affect influenza vaccination, structural model comparisons to test the effect of cues to action as a moderating variable between perceived vaccine risk and likelihood to vaccinate may help to further explore the influence of cues to action on vaccination.

Conclusion

Although influenza vaccination is recommended for all children aged 6 months and older, only approximately 50% of children are vaccinated yearly. Findings from this study demonstrate that parents continue to have misperceptions about influenza disease and the importance of influenza vaccination of children. The newly developed CIIQ may be useful in assessing factors influencing vaccination. The most important factor influencing vaccination in this study was perceived vaccine risk. Strategies to improve vaccination rates should focus on education regarding vaccine safety and on improving the knowledge about influenza disease.

References

- Allison, M. A., Reyes, M., Young, P., Calame, L., Sheng, X., Weng, H. C., & Byington, C. L. (2010). Parental attitudes about influenza immunization and school-based immunization for school-aged children. *Pediatric Infectious Disease Journal*, 29(8), 751-755. doi: 10.1097/INF.0b013e3181d8562c
- American Academy of Pediatrics. (2011). Policy statement: Recommendations for prevention and control of influenza, 2011-2012. *Pediatrics*, 128(4), 813-825. doi: 10.1542/peds.2011-2295
- American Academy of Pediatrics & U.S. Public Health Service. (1999). Joint statement of the American Academy of Pediatrics and U.S. Public Health Service. *Pediatrics*, 104(3), 568-569. Retrieved from <http://pediatrics.aappublications.org/>
- Armitage, C. J., & Conner, M. (2000). Social cognition models and health behavior: A structured review. *Psychology & Health*, 15, 173-189. Retrieved from <http://www.tandfonline.com/loi/gpsh20>
- Association of State and Territorial Health Officials. (2013). *Potential impact of sequestration on public health*. Retrieved from <http://www.astho.org/Advocacy/ASTHO-Report-on-Sequestration>
- Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, 31(2), 143-164. doi: 10.1177/1090198104263660
- Bardenheier, B., Yusuf, H., Schwartz, B., Gust, D., Barker, L., & Rodewald, L. (2004). Are parental safety concerns associated with receipt of measles-mumps-rubella, diphtheria and tetanus toxoids with acellular pertussis, or hepatitis B vaccines by children? *Archives of Pediatrics and Adolescent Medicine*, 158, 569-575. Retrieved from <http://www.archpediatrics.com>

- Becker, M. H., Haefner, D. P., Kasl, S. V., Kirscht, J. P., Maiman, L. A., & Rosenstock, I. M. (1977). Selected psychosocial models and correlates of individual health-related behaviors. *Medical Care*, 15(5S), 27-46. Retrieved from <http://journals.lww.com/lww-medicalcare/pages/default.aspx>
- Becker, M. H., Kaback, M. M., Rosenstock, I. M., & Ruth, M. (1975). Some influences on public participation in a genetic screening program. *Journal of Community Health*, 1(1), 3-14. Retrieved from <http://www.springer.com/public+health/journal/10900>
- Benin, A. L., Wisler-Scher, D. J., Colson, E., Shapiro, E. D., & Holmboe, E. S. (2005). Qualitative analysis of mothers' decision-making about vaccines for infants: The importance of trust. *Pediatrics*, 117(5), 1532-1541. doi: 10.1542/peds.2005-1728
- Bhat, N., Wright, J. G., Broder, K. R., Murray, E. L., Greenberg, M. E., Glover, M. J., ... Uyeki, T. (2005). Influenza-associated deaths among children in the United States 2003-2004. *New England Journal of Medicine*, 353, 2559-2567. Retrieved from <http://www.nejm.org/doi/full/10.1056/NEJMoa051721#t=articleTop>
- Bhat-Schelbert, K., Lin, C. J., Matambanadzo, A., Hannibal, K., Nowalk, M. P., & Zimmerman, R. K. (2012). Barriers to and facilitators of child influenza vaccine-Perspective from parents, teens, marketing and healthcare professionals. *Vaccine*, 30, 2448-2452. doi: 10.1016/j.vaccine.2012.01.049
- Bollen, K. A., & Stine, R. A. (1992). Bootstrapping goodness-of-fit measures in structural equation models. *Sociological Methods & Research*, 21(2), 205-229. Retrieved from <http://smr.sagepub.com/>
- Bouvier, N. M., & Palese, P. (2008). The biology of influenza viruses. *Vaccine*, 26S, D49-D53. doi: 10.1016/j.vaccine.2008.07.039

- Brewer, N. T., Chapman, G. B., Gibbons, F. X., Gerrard, M., McCaul, K. D., & Weinstein, N. D. (2007). Meta-analysis of the relationship between risk perception and health behavior: The example of vaccination. *Health Psychology, 26*(2), 136-145. doi: 10.1037/0278-6133.26.2.136
- Brown, C., Clayton-Boswell, H., Chaves, S. S., Prill, M. M., Iwane, M. K., Szilagyi, P. G.,...Bridges, C. B. (2011). Validity of parental report of influenza vaccination in young children seeking medical care. *Vaccine, 29*(51), 9488-9492. doi: 10.1016/j.vaccine.2011.10.023
- Byrne, B. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2nd ed.). New York, NY: Taylor and Francis Group, LLC.
- Carpenter, C. J. (2010). A meta-analysis of the effectiveness of Health Belief Model variables in predicting behavior. *Health Communication, 25*, 661-669. doi: 10.1080/10410236.2010.521906
- Centers for Disease Control and Prevention. (1999a). Achievements in public health, 1900-1999 impact of vaccines universally recommended for children-United States, 1900-1998. *Morbidity and Mortality Weekly Report, 48*(12), 243-248. Retrieved from <http://www.cdc.gov/MMWR/preview/MMWRhtml/00056803.htm>
- Centers for Disease Control and Prevention. (1999b). Ten great public health achievements – United States, 1900-1999. *Morbidity and Mortality Weekly Report, 48*(12), 241-243. Retrieved from <http://www.cdc.gov.mmwr/preview/mmwrhtml/00056796.htm>
- Centers for Disease Control and Prevention. (2002). Prevention and control of influenza:

- Recommendations of the Advisory Committee on Immunization Practices. *Morbidity and Mortality Weekly Report*, 51(RR03), 1-31. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5103a1.htm>
- Centers for Disease Control and Prevention. (2004). Interim influenza vaccination recommendations: 2004-05 influenza season. *Morbidity and Mortality Weekly Report*, 53(50), 1183-1184. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5339a6.htm>
- Centers for Disease Control and Prevention. (2006). *Epidemiology and prevention of vaccine-preventable diseases* (9th ed.). Washington, DC: Public Health Foundation.
- Centers for Disease Control and Prevention. (2009a). Influenza vaccination coverage among children and adults-United States, 2008-2009 influenza season. *MMWR*, 58(390), 1091-1095. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5839a1.htm>
- Centers for Disease Control and Prevention. (2009b). Recommended adult immunization schedule-United States, 2009. *Morbidity and Mortality Weekly Report*, 57(53), Q1-Q4. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5753a6.htm>
- Centers for Disease Control and Prevention. (2009c). Update: Novel influenza A (H1N1) Virus Infections---Worldwide, May 6, 2009. *Morbidity and Mortality Weekly Report*, 58(17), 453-458. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5817a1.htm>
- Centers for Disease Control and Prevention. (2010a). CDC estimates of 2009 H1N1 influenza cases, hospitalizations and deaths in the United States, April 2009-March 13, 2010. Retrieved from http://www.cdc.gov/h1n1flu/estimates/April_March_13.htm
- Centers for Disease Control and Prevention. (2010b). Estimates of deaths associated with

seasonal influenza---United States 1976-2007. *Morbidity and Mortality Weekly Report*, 59(33), 1057-1062. Retrieved from

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5933a1.htm>

Centers for Disease Control and Prevention. (2010c). Prevention and control of influenza with vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP), 2010. *Morbidity and Mortality Weekly Report*, 59, 1-62. Retrieved from

<http://www.cdc.gov/mmwr/pdf/rr/rr59e0729.pdf>

Centers for Disease Control and Prevention. (2011a). Interim results: State-specific influenza vaccination coverage---United States, August 2010---February 2011. *Morbidity and Mortality Weekly Report*, 60(22), 737-743. Retrieved from

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6022a3.htm>

Centers for Disease Control and Prevention. (2011b). Measles---United States---January-May 20, 2011. *Morbidity and Mortality Weekly Report*, 60(20), 666-668. Retrieved from

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm60a7.htm?s_cid=mm6020a7_w

Centers for Disease Control and Prevention. (2011c). National and state vaccination coverage among children aged 19 – 35 months – United States, 2010. *Morbidity and Mortality Weekly Report*, 60(34), 1157-1163. Retrieved from

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6034a2.htm>

Centers for Disease Control and Prevention. (2011d). Ten great public health achievements – United States, 2001-2010. *Morbidity and Mortality Weekly Report*, 60(19), 619-623.

Retrieved from

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6019a5.htm>

Centers for Disease Control and Prevention. (2011e). Vaccination coverage among children in

kindergarten – United States, 2009-2010. *Morbidity and Mortality Weekly Report*, 60(21), 700-704. Retrieved from
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6021a4.htm?s_cid=mm6021a4_w

Centers for Disease Control and Prevention. (2011f). *Vaccines and immunizations: Vaccines for Children Program (VFC)*. Retrieved from
<http://www.cdc.gov/vaccines/programs/vfc/default.htm>

Centers for Disease Control and Prevention. (2012a). *Flu vaccination coverage, United States, 2011-2012 influenza season*. Retrieved from
http://www.cdc.gov/flu/preofessionals/vacciantion/coverage_1112estimates.htm

Centers for Disease Control and Prevention. (2012b). Update: Influenza activity – United States, 2011-2012 season and composition of the 2012-13 influenza vaccine. *Morbidity and Mortality Weekly Report*, 61(22), 414-420. Retrieved from
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6122a4.htm?s_cid=mm6122a4_w

Centers for Disease Control and Prevention. (2013a). *CDC reports about 90% of children who died from flu this season not vaccinated*. Retrieved from
<http://www.cdc.gov/flu/spotlights/children-flu-deaths.htm>

Centers for Disease Control and Prevention. (2013b). Interim adjusted estimates of seasonal influenza vaccine effectiveness – United States, February 2013. *Morbidity and Mortality Weekly Report*, 62(7), 119-123. Retrieved from
http://www.cdc.gov.mmwr/preview/mmwrhtml/mm6207a2.htm?s_cid=mm6207a2_w#tab2

Champion, V. (1995). Development of a benefits and barriers scale for mammography utilization. *Cancer Nursing*, 18(1), 53-59. Retrieved from

- <http://journals.lww.com/cancernursingonline/pages/default.aspx>
- Champion, V. (1999). Revised susceptibility, benefits, and barriers scale for mammography screening. *Research in Nursing and Health*, 22, 341-348. Retrieved from <http://onlinelibrary.wiley.com/doi/10.1002/nur.v35.4/issuetoc>
- Champion, V. L. (1984). Instrument development for health belief model constructs. *Advances in Nursing Science*, 6(3), 73-85. Retrieved from <http://journals.lww.com/advacesinnursingscience/pages/default.aspx>
- Champion, V. L., & Scott, C. R. (1997). Reliability and validity of breast cancer screening belief scales in African American women. *Nursing Research*, 46(6), 331-337. Retrieved from <http://journals.lww.com/nursingresearchonline/pages/default.aspx>
- Champion, V. L., & Skinner, C. S. (2008). The Health Belief Model. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health behavior and health education: Theory, research, and practice* (pp. 45-65). San Francisco, CA: John Wiley & Sons, Inc.
- Chatterjee, A. & O'Keefe, C. (2010). Current controversies in the USA regarding vaccine safety. *Expert Review of Vaccines*, 9(5), 497-502. Retrieved from <http://www.expert-reviews.com/loi/erv>
- Chen, M. F., Wang, R. H., Schneider, J. K., Tsai, C. T., Jiang, D. D. S., Hung, M. N., & Lin, L. J. (2011). Using the Health Belief Model to understand caregiver factors influencing childhood influenza vaccination. *Journal of Community Health Nursing*, 28, 29-40. doi: 10.1080/07370016.2011.539087
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. New York, NY: Lawrence Erlbaum.
- Cox, N. J., & Subbarao, K. (1999). Influenza. *Lancet*, 354, 1277-1282. Retrieved from

<http://www.thelancet.com/>

- Cummings, K. M., Jette, A. M., Brock, B. M., & Haefner, D. P. (1979). Psychosocial determinants of immunization behavior in a swine flu campaign. *Medical Care*, *XVII*(6), 639-649. Retrieved from <http://journals.lww.com/lww-medicalcare/pages/default.aspx>
- Cummings, K. M., Jette, A. M., & Rosenstock, I. M. (1978). Construct validation of the Health Belief Model. *Health Education Monographs*, *6*(4), 394-405. Retrieved from <http://heb.sagepub.com/>
- Daley, M. F., Beaty, B. L., Barrow, J., Pearson, K., Crane, L., Berman, S., & Kempe, A. (2005). Missed opportunities for influenza vaccination in children with chronic medical conditions. *Archives of Pediatrics and Adolescent Medicine*, *159*(10), 986-991. Retrieved from <http://archpedi.jamanetwork.com/journal.aspx>
- Daley, M. F., Crane, L. A., Chandramoulim V., Beaty, B. L., Barrow, J., Allred, N., ... Kempe, A. (2006). Influenza among healthy young children: Changes in parental attitudes and predictors of immunization during the 2003 to 2004 influenza season. *Pediatrics*, *117*(2), e268-e277. doi: 10.1542/peds.2005-1752.
- Daley, M. F., Crane, L. A., Chandramoulim V., Beaty, B. L., Barrow, J., Allred, N., ... Kempe, A. (2007). Misperceptions about influenza vaccination among parents of healthy young children. *Clinical Pediatrics*, *46*(5), 408-417. doi: 10.1177/0009922806298647
- Davis, M. M., King, J. C., Moag, L., Cummings, G., & Magder, L. S. (2008). Countywide school-based influenza immunization: Direct and indirect impact on student absenteeism. *Pediatrics*, *122*, e260-e265. doi:10.1542/peds.2007-2963
- Dempsey, A., Schaffer, S., Singer, D., Butchart, A., Davis, M., & Freed, G. L. (2011).

- Alternative vaccine schedule preferences among parents of young children. *Pediatrics*, 128(50), 848-856. doi: 10.1542/peds.2011-0400
- deVaus, D. (2007). *Analyzing social science data*. Los Angeles, CA: Sage Publications, Inc.
- DeVellis, R. F. (2003). *Scale development: Theory and applications* (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.
- Dilalla, L. F. (2000). Structural equation modeling: Uses and issues. In H. E. Tinsley & S. D. Brown (Eds.), *Handbook of applied multivariate statistics and mathematical modeling* (pp. 439-464). San Diego, CA: Academic Press.
- Efron, B., & Tibshirani, R. J. (1998). *An introduction to the bootstrap*. New York: Chapman and Hall.
- Epstein, R. A. (2005). It did happen here: Fear and loathing on the vaccine trail. *Health Affairs*, 24(3), 740-743. doi: 10.1377/hlthaff.24.3.740.
- Fiks, A. C., Grundmeier, R. W., Biggs, L. M., Localio, A. R., & Allessandrini, E. A. (2007). Impact of clinical alerts within and electronic health record on routine childhood immunization in an urban pediatric population. *Pediatrics*, 120(4), 707-717. doi:10.1542/peds.2007-0257
- Fitch, P., & Racine, A. (2004). Parental beliefs about vaccination among an ethnically diverse inner-city population. *Journal of the National Medical Association*, 96(8), 1047-1050. Retrieved from http://nmanet.org/index.php?option=com_content&view=article&id=234&Itemid=363
- Foundation for a Healthy Kentucky. (2008). *Kentuckyhealthfacts.org Location: Kenton County*.

Retrieved from

http://www.kentuckyhealthfacts.org/data/location/show.aspx?cat=1%2C2%2C3%2C5%2C8%2C11&loc=59#src_21

- Flood, E. M., Rousculp, M. D., Ryan, K. J., Beusterien, K. M., Divino, V. M., Toback, S. L., ...Mahadevia, P. J. (2010). Parents' decision-making regarding vaccinating their children against influenza: A web-based survey. *Clinical Therapeutics*, 32(8), 1448-1467. Doi: 10.1016/j.clinthera.2010.06.202
- Freed, G. L., Clark, S. J., Butchart, A. T., Singer, D. C., & Davis, M. M. (2010). Parental vaccine safety concerns in 2009. *Pediatrics*, 125, 654-659. doi: 10.1542/peds.2009-1962
- Freed, G. L., Katz, S. L., & Clark, S. J. (1996). Safety of vaccinations: Miss America, the media, and public health. *JAMA*, 276(23), 1869-1872. Retrieved from <http://jama.ama-assn.org/>
- Gaglani, M., Riggs, M., Kamenicky, C., & Glezen, W. P. (2001). A computerized reminder strategy is effective for annual influenza immunization of children with asthma or reactive airway disease. *Pediatric Infectious Disease Journal*, 20, 1155-1160. Retrieved from <http://journals.lww.com/pidj/pages/default.aspx>
- Garver, M. S., & Mentzer, J. T. (1999). Logistics research methods: Employing structural equation modeling to test for construct validity. *Journal of Business Logistics*, 20(1), 33-57. Retrieved from <http://cscmp.org/memberonly/jbl.asp>
- Gellin, B. G., Maibach, E. W., & Marcuse, E. K. (2000). Do parents understand immunizations? A national telephone survey. *Pediatrics*, 105(5), 1097-1102. Retrieved from <http://pediatrics.aappublications.org/>
- Glanz, K., Lewis, F. M., & Rimer, B. K. (1997). *Health behavior and health education: Theory, research, and practice* (2nd ed.). San Francisco, CA: Jossey-Bass Inc.

- Gnanasekaran, S. K., Finkelstein, J. A., Hohman, K., O'Brien, M., Kruskal, B., & Liu, T. (2006). Parental perspectives on influenza vaccination among children with asthma. *Public Health Reports, 121*, 181-121. Retrieved from <http://www.publichealthreports.org/>
- Grant, V. J., Saux, N. L., Plint, A. C., Correll, R., Gaboury, I., Ellis, E., & Tam, T. (2003). Factors influencing childhood influenza immunization. *Canadian Medical Association Journal, 168*(1), 39-41. Retrieved from <http://www.cmaj.ca/>
- Gust, D., Brown, C., Sheedy, K., Hibbs, B., Weaver, D., & Nowalk, G. (2005). Immunization attitudes and beliefs among parents: Beyond a dichotomous perspective. *American Journal of Health Behavior, 29*(1), 81-92. Retrieved from <http://www.ajhb.org/>
- Gust, D. A., Darling, N., Kennedy, A., & Schwartz, B. (2008). Parents with doubts about vaccines: Which vaccines and why. *Pediatrics, 122*(4), 718-725. doi:10.1542/peds.2007-0538
- Guy, R. F., & Norvell, M. (1977). The neutral point on a Likert scale. *The Journal of Psychology, 95*, 199-204. Retrieved from <http://www.press.uillinois.edu/journals/ajp.html>
- Haber, P., DeStefano, F., Angulo, F. J., Iskander, J., Shadomy, S. V., Weintraub, E., & Chen, R. T. (2004). Guillain-Barré syndrome following influenza vaccination. *JAMA, 292*(20), 2478-2481. Retrieved from <http://jama.ama-assn.org/>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Hassan, F., Lewis, T. C., & Davis, M. M. (2009). Hospital utilization and costs among children with influenza, 2003. *American Journal of Preventive Medicine, 36*(4), 292-296. doi: 10.1016/j.amepre.2008.11.016
- Hofstetter, A. M., Natarajan, K., Martinez, R. A., Rabinowitz, D., Vawdrev, D. K. & Stockwell,

- M. (2013). Influenza vaccination coverage and timeliness among children requiring two doses. 2004-2009. *Preventive Medicine*, 56, 165-170. doi:10.1016/j.ypmed.2012.11.018
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), 1-55. Retrieved from <http://www.tandf.co.uk/journals/titles/10705511.asp>
- Humiston, S. G., Lerner, B., Hepworth, E., Blythe, T., & Goepp, J. G. (2005). Parent opinions about universal influenza vaccination for infants and toddlers. *Archives of Pediatrics and Adolescent Medicine*, 159, 108-112. Retrieved from www.archpediatrics.com
- Institute of Medicine. (2011). *Adverse effects of vaccines: Incidence and causality*. Retrieved from <http://www.iom.edu/Reports/2011/Adverse-Effects-of-Vaccines-Evidence-and-Causality.aspx>
- Izurieta, H. S., Thompson, W. W., Kramarz, P., Shay, D. K., Davis, R. L., DeStefano, F., ... Fukuda, K. (2000). Influenza and the rates of hospitalizations for respiratory disease among infants and young children. *New England Journal of Medicine*, 342(4), 232-239. Retrieved from <http://www.nejm.org/>
- Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A decade later. *Health Education Quarterly*, 11(1), 1-47. Retrieved from <http://www.uk.sagepub.com/journals/Journal200851>
- Jette, A. M., Cummings, K. M., Brock, B. M., Phelps, M. C., & Naessens, J. (1981). The structure and reliability of Health Belief indices. *Health Services Research*, 16(1), 81-98. Retrieved from <http://www.hsr.org/>
- Kaplan, J. E., Katona, P., Hurwitz, E. S., & Schonberger, L. B. (1982). Guillain-Barré syndrome

- in the United States, 1979-1980: Lack of an association with influenza vaccination. *JAMA*, 248(6), 698-700. Retrieved from <http://jama.ama-assn.org/>
- Kaufman, M. (1967). The American anti-vaccinationists and their arguments. *Bulletin of the History of Medicine*, 41(5), 463-478. Retrieved from http://muse.jhu.edu/journals/bulletin_of_the_history_of_medicine/
- Keane, M. T., Walter, M. V., Patel, B. I., Moorthy, S., Stevens, R. B., Bradley, K. M... Vernon, T. M. (2005). Confidence in vaccination: A parent model. *Vaccine*, 23, 2486-2493. doi: 10.1016/j.vaccine.2004.10.026
- Kennedy, A., LaVail, K., Nowak, G., Basket, M., & Landry, S. (2011). Confidence about vaccines in the United States: Understanding parents' perceptions. *Health Affairs*, 30(6), 1151-1159. doi: 10.1277/hlthaff.2011.0396
- Kimmel, S. R., Burns, I. T., Wolfe, R. M., & Zimmerman, R. T. (2007). Addressing immunization barriers, benefits, and risks. *Journal of Family Practice*, 56(2), S61-S69. Retrieved from www.jfponline.com
- King, J. C., Stoddard, J. J., Gaglania, M. J., Moore, K. A., Magder, L., McClure, E.,...Neuzil, K. (2006). Effectiveness of school-based influenza vaccination. *New England Journal of Medicine*, 355(24), 2523-2352. Retrieved from www.nejm.org
- Kline, P. (2000). *Handbook of psychological testing* (2nd ed.). New York, NY: Routledge.
- Kline, R. B. (2011). *Principles and practice of structural equation modeling*. New York, NY: The Guilford Press.
- Kochanek, K. D., Xu, J. Q., Murphy, S. L., Miniño, A. M., & Kung, H. C. (2011) Deaths: Preliminary data for 2009. *National Vital Statistics Reports*, 59(4). Hyattsville, MD: National Center for Health Statistics.

- Kuiken, T., & Taubenberger, J. K. (2008). Pathology of human influenza revisited. *Vaccine*, 26S, D59-D66. doi: 10.1016/j.vaccine.2008.07.025
- Leask, J., Kinnersley, P., Jackson, C., Cheater, F., Bedford, H., & Rowles, G. (2012). Communicating with parents about vaccination: A framework for health professionals. *BMC Pediatrics*, 12(154), 1-11. Retrieved from <http://www.biomedcentral.com/147-2431/12/154>
- Loeb, M., Russell, M. L., Moss, I., Fonseca, K., Fox, J., Earn, D. J. D., Walter, S. D. (2010). Effect of influenza vaccination of children on infection rates in Hutterite communities. *JAMA*, 303(10), 943-950. Retrieved from <http://jama.ama-assn.org/>
- Loehlin, J. C. (2004). *Latent variable models* (4th ed.). Mahwah, NJ: Lawrence Erlbaum Associates.
- Longini, I. M., Halloran, M. E., Nizam, A., Wolff, M., Mendelman, P. M., Fast, P. E., & Belshe, R. B. (2000). Estimation of the efficacy of live, attenuated influenza vaccine from a two-year, multi-center vaccine trial: Implications for influenza epidemic control. *Vaccine*, 18, 1902-1909. Retrieved from http://www.elsevier.com/wps/find/journaldescription.cws_home/30521/description
- Longini, I. M., Koopman, J. S., Monto, A. S., & Fox, J. P. (1982). Estimating household and community transmission parameters for influenza. *American Journal of Epidemiology*, 115, 736-751. Retrieved from <http://aje.oxfordjournals.org/>
- Lopez-Medina, E., Ardura, M., Siegel, J. D., Brock, E., & Sanchez, P. J. (2012). 2009 Influenza A in infants hospitalized at younger than 6 months. *Journal of Pediatrics*, 160(4), 626-631. doi: 10.1016/j.peds.2011.09.060
- Ma, K. K., Schaffner, W., Colmenares, C., Howser, J., Jones, J., & Poehling, K. A. (2006).

- Influenza vaccinations of young children increased with media coverage. *Pediatrics*, 117(2), e157-e163. doi: 10.1542/peds.2005-1079.
- Maiman, L. A., & Becker, M. H. (1974). The Health Belief Model: Origins and correlates in psychological theory. In M. H. Becker (Ed.), *The Health Belief Model and personal health behavior* (pp. 9-26). Thorofare, NJ: Charles B. Slack, Inc.
- Maldonado, Y. A. (2002). Current controversies in vaccination: Vaccine safety. *JAMA*, 288(24), 3155-3158. Retrieved from <http://jama.ama-assn.org/>
- Marks, J. S., & Halpin, T. J. (1980). Guillain-Barré syndrome in recipients of A/New Jersey influenza vaccine. *JAMA*, 243(24), 2490-2492. Retrieved from <http://jama-assn.org/>
- Marlow, L., Waller, J., Evans, R., & Wardle, J. (2009). Predictors of interest in HPV vaccination: A study of British adolescents. *Vaccine*, 27, 2483-2488. doi: 10.1016/j.vaccine.2009.02.057
- McCormik, E. V., Durfee, J., Vogt, T. M., Daley, M. F., Hambidge, S. J., & Shlay, J. (2012). Physician attitudes regarding school-located vaccinations. *Pediatrics*, 130(5), 887-896. doi:10.1542/peds.2011-2962
- Miller, W. R., & Rose, G. S. (2010). Toward a theory of motivational interviewing. *American Psychological Association*, 64(6), 527-537. doi: 10.1037/a0016830
- Mills, E., Jadad, A. R., Ross, C., & Wilson, K. (2005). Systematic review of qualitative studies exploring parental beliefs and attitudes toward childhood vaccination identifies common barriers to vaccination. *Journal of Clinical Epidemiology*, 58, 1081-1088. doi: 10.1016/j.clinepi.2005.09.002
- Mirza, A., Subedar, A., Fowler, S. L. Murray, D. L., Arnold, S., Tristram, D., ...Rathore, M. H.

- (2008). Influenza vaccine: Awareness and barriers to immunization in families of children with chronic medical conditions other than asthma. *Southern Medical Journal*, 101(11), 1101-1105. Retrieved from <http://journals.lww.com/smajournalonline/pages/default.aspx>
- Molinari, N. M., Ortega-Sanchez, I. R., Messonnier, M. L., Thompson, W. W., Wortley, P. M., Weintraub, E., & Bridges, C. B. (2007). The annual impact of seasonal influenza in the US: Measuring disease burden and cost. *Vaccine*, 25, 5086-5096. doi: 10.1016/j.vaccine.2007.03.046
- Monto, A. S. (2008). Epidemiology of influenza. *Vaccine*, 26S, D45-D48. doi: 10.1016/j.vaccine.2008.07.066
- Monto, A. S., & Kioumeh, F. (1975). The Tecumseh study of respiratory illness: Occurrence of influenza in the community, 1966-1971. *American Journal of Epidemiology*, 102(6), 553-563. Retrieved from <http://aje.oxfordjournals.org/>
- Neuzil, K., Hohlbein, C., & Zhu, Y. (2002). Illness among schoolchildren during influenza season. *Archives of Pediatrics and Adolescent Medicine*, 156, 986-991. Retrieved from www.archpediatrics.com
- Neuzil, K. M., Mellen, B. G., Wright, P. F., Mitchel, E. F., & Griffin, M. R. (2000). The effect of influenza on hospitalizations, outpatient visits, and course of antibiotics in children. *New England Journal of Medicine*, 342(4), 225-231. Retrieved from <http://www.nejm.org/>
- Nexoe, J., Kragstrup, J., & Sogaard, J. (1999). Decision on influenza vaccination among the elderly: A questionnaire study based on the Health Belief Model and Multidimensional Locus of Control Theory. *Scandinavian Journal of Primary Health Care*, 17, 105-110. Retrieved from www.sjphc.org/www

- Nowalk, M. P., Lin, C. J., Zimmerman, R. K., Ko, F. S., Hoberman, A., Zoffel, L., & Kearney, D. H. (2007). Changes in parents' perceptions of infant influenza vaccination over two years. *Journal of the National Medical Association*, 99(6), 636-641. Retrieved from http://www.nmanet.org/index.php/publications_sub/jnma
- Nowalk, M. P., Zimmerman, R. K., Lin, C. J., Ko, F. S., Raymund, M., Hoberman, A...Greenberg, D. P. (2005). Parental perspectives on influenza immunization of children aged 6 to 23 months. *American Journal of Preventive Medicine*, 29(3), 210-214. doi: 10.1016/j.amepre.2005.05.101
- Nunnally, J. C., & Bernstein, J. C. (1994). *Psychometric theory* (3rd ed.). New York, NY: McGraw-Hill, Inc.
- Offit, P. (2007). Thimerosal and vaccines-A cautionary tale. *New England Journal of Medicine*, 357(13), 1278-1279. Retrieved from <http://www.nejm.org/>
- Offit, P. (2008). Vaccines and autism revisited-the Hannah Poling case. *New England Journal of Medicine*, 358(20), 2089-2091. Retrieved from <http://www.nejm.org/>
- Offit, P., Davis, R. L., & Gust, D. (2008). Vaccine safety. In S. A. Plotkin, W. A. Orenstein, & P. A. Offit (Eds.), *Vaccines* (5th ed.; pp. 1629-1650). Philadelphia, PA; Saunders Elsevier.
- Omer, S. B., Pan, W. K., Halsey, N. A., Stokley, S., Moulton, L. H., Navar, A. M.,... Salmon, D. A. (2006). Nonmedical exemptions to school immunization requirements: Secular trends and association of state policies with pertussis incidence. *JAMA*, 296(14), 1757-1963. Retrieved from <http://jama.ama-assn.org/>
- Painter, J. E., Gargano, L. M., Sales, J. M., Morfaw, C., Jones, L. M., Murray, D.,...

- Hughes, J. M. (2011). Correlates of 2009 H1N1 influenza vaccine acceptability among parents and their adolescent children. *Health Education Research*, 26(5), 751-760. doi: 10.1093/her/cyr025
- Penfold, R. B., Rusinak, D., Lieu, T. A., Shefer, A., Messonnier, M., & Lee, G. M. (2011). Financing and systems barriers to influenza vaccine delivery in community settings. *Vaccine*, 29, 9632-9639. doi: 10.16/j.vaccine.2011.10.041
- Petty, T. J., Callahan, S. T., Chen, Q., Edwards, K. M., & Dempsey, A. F. (2010). Assessment of parental acceptance of a potential cytomegalovirus vaccine for adolescent females. *Vaccine*, 28, 5686-5690. doi: 10.1016/j.vaccine.2010.06.051
- Poehling, K. A., Edwards, K. M., Griffin, M. R., Szilagyi, P. G., Staat, M. A., Iwane, M. K.,...Bridges, C. B. (2013). The burden of influenza in young children, 2004-2009. *Pediatrics*, 131(2), 207-216. doi:10.1542/peds.2012-1255
- Poehling, K. A., Edwards, K. M., Weinberg, G. A., Szilagyi, P.G., Staat, M. A., Iwane, M. K.,...Griffin, M. R. (2006). The underrecognized burden of influenza in young children. *New England Journal of Medicine*, 355(1), 31-40. Retrieved from <http://www.nejm.org/>
- Poehling, K. A., Fairbrother, G., Zhu, Y., Donauer, S., Ambrose, S., Edwards, K. M., ...Szilagyi, P. G. (2010). Practice and child characteristics associated with influenza vaccine update in young children. *Pediatrics*, 126(4), 665-673. doi: 10.1542/peds.2009-2620
- Poland, G. A., Rottinghaus, S. T., & Jacobson, R. M. (2001). Influenza vaccines: A review and rationale for use in developed and underdeveloped countries. *Vaccine*, 19, 2216-2220. Retrieved from http://www.elsevier.com/wps/find/journaldescription.cws_home/30521/description
- Poland, C. M., & Poland, G. A. (2011). Vaccine education spectrum disorder: The importance of

- incorporating psychological and cognitive models into vaccine education. *Vaccine*, 29, 6145-6148. doi: 10.1016/j.vaccine.2011.07.131
- Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Research in Nursing & Health*, 29, 489-497. doi: 10.1002/nur.20147
- Raaijmakers, Q. A., van Hoof, A., Hart, H., Verbogt, T. F., & Vollebergh, A. (2000). Adolescents' midpoint responses on Likert-type scale items: Neutral or missing values? *International Journal of Public Opinion Research*, 12(2), 207-215. Retrieved from <http://ijpor.oxfordjournals.org/>
- Reichert, T. A., Sugaya, N., Fedson, D. S., Glezen, P., Simonsen, L., & Tashiro, M. (2001). The Japanese experience with vaccinating schoolchildren against influenza. *New England Journal of Medicine*, 344(12), 889-896. Retrieved from www.nejm.org
- Robinson, S. G., Groom, H., & Young, C. (2012). Frequency of alternative immunization schedule use in metropolitan area. *Pediatrics*, 130(1), 32-38. doi: 10.1542/peds.2011-3154
- Ronis, D. (1992). Conditional health threats: Health beliefs, decisions, and behaviors among adults. *Health Psychology*, 11(2), 127-134. Retrieved from <http://www.apa.org/pubs/journals/hea/index.aspx>
- Rosenstock, I. M. (1974). Historical origins of the Health Belief Model. *Health Education Monographs*, 2(4), 328-335. Retrieved from <http://heb.sagepub.com/>
- Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the Health Belief Model. *Health Education Quarterly*, 15(2), 175-183. Retrieved from <http://www.uk.sagepub.com/journals/Journal200851>

- Russell, E. (2012, December 19). 6-year-old's flu death prompts alert in Maine. *Portland Press Herald*. Retrieved from <http://www.pressherald.com/news/Maine-CDC-reports-first-flu-death-this-season.html?pagenum=full>
- Salmon, D. A., Proschan, M., Forshee, R., Gargiullo, P., Blese, W., Burwen, D.,...Lurie, N. (2013). Association between Guillain-Barre syndrome and influenza A(H1N1) 2009 monovalent inactivated vaccines in the USA: A meta-analysis. *Lancet*, March 13 (online) 1-8. doi: 10.1016/S1040-6736(12)62189-8.
- Shinnal, M. C., Plosa, E. J., & Poehling, K. A. (2007). Validity of parental report of influenza vaccination in children 6 to 59 months of age. *Pediatrics*, 120(4), e783-7. doi: 10.1542/peds.2007-0052
- Smith, M. J., Ellenberg, S. S., Bell, L. M., & Rubin, D. M. (2008). Media coverage of the measles-mumps-rubella vaccine and autism controversy and its relationship to MMR immunization rates in the United States. *Pediatrics*, 121(4), e836-e843. doi: 10.1542/peds.2007-1760
- Soyer, O. U., Hudaverdiyev, S., Civelek, E., Isik, E., Karabulut, E., Kocabas, C., & Sekerel, B. E. (2011). Parental perspectives on influenza vaccination in children with asthma. *Pediatric Pulmonology*, 46, 139-144. doi: 10.1002/ppul.21332
- SteelFisher, G. K., Blendon, R. J., Bekheit, M.M., & Lubell, K. (2010). The public's response to the 2009 H1N1 influenza pandemic. *New England Journal of Medicine*, 362(22), e65(1)-e65(6). doi: 10.1056/NEJMP1005102
- Stobbe, M. (2013, March 22). Flu death toll: 105 U.S. kids have died this season. *Huffington Post*. Retrieved from http://www.huffingtonpost.com/2013/03/25/flu-death-toll_n_2949153.html

- Stockwell, M. S., Kharbanda, E. O., Martinez, R. A., Vargas, C.Y., Vawdrey, D. K., & Camargo, S. (2012). Effect of text messaging intervention on influenza vaccination in an urban, low-income pediatric and adolescent population: A randomized controlled trial. *JAMA*, 307(16), 1702-1708. doi: 10.1001/jama.2012.502
- Strecher, V. J., & Rosenstock, I. M. (1997). The health belief model. In K. Glanz, F.M. Lewis, & K. Rimer (Eds.), *Health behavior and health education* (2nd ed., pp. 41-59). San Francisco, CA: Jossey-Bass Publishers Inc.
- Sutton, S. (1987). Social psychological approaches to understanding addictive behaviors: Attitude-behavior and decision-making models. *British Journal of Addiction*, 82, 355-370. Retrieved from [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1360-0443a/issues?activeYear=1991](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1360-0443a/issues?activeYear=1991)
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*. Boston, MA: Pearson Education, Inc.
- Thompson, W. W., Shay, D. K., Weintraub, E., Brammer, L., Bridges, C. B., Cox, N. J., & Fukuda, K. (2004). Influenza-associated hospitalizations in the United States. *JAMA*, 292(11), 1333-1340. Retrieved from <http://jama.ama-assn.org/>
- U.S Census Bureau. (2013). *State and county QuickFacts: Kenton County, KY*. Retrieved from <http://quickfacts.census.gov/qfd/states/21/21117.html>
- U. S. Census Bureau. (2011). *Overview of race and Hispanic origin: 2010* (C2010BR-02). Retrieved from <http://www.census.gov/prod/cen2010/briefs/c2010br-02.pdf>
- U. S. Department of Health and Human Services. (2011). Immunizations and infectious diseases. *Healthy People 2020*. Retrieved from <http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=23>

U.S. Department of Health and Human Services. (2013). Public service announcements (PSAs):

Seasonal flu. *Flu.gov*. Retrieved from <http://www.flu.gov/resources/psa/#>

U. S. Food and Drug Administration. (2012, June 20). Vaccines, blood and biologics:

Thimerosal in vaccines. Retrieved from

<http://www.fda.gov/BiologicsBloodVaccines/SafetyAvailability/VaccineSafety/UCM096>

228

Uwemedimo, O. T., Findley, S. E., Andres, R., Irigoyen, M., & Stockwell, M. S. (2012).

Determinants of influenza vaccination among young children in an inner-city community.

Journal of Community Health, 37(3), 663-672. doi: 10.1007/s10900-011-9497-9

Yaghmale, F. (2003). Content validity and its estimation. *Journal of Medical Education*, 3(1),

25-27. Retrieved from <http://www.jmededu.com/>

Zimmerman, R. S., & Vernberg, D. (1994). Models of preventative health behavior: Comparison,

critique, and meta-analysis. *Advances in Medical Sociology*, 4, 45-67. Retrieved from

<http://www.emeralinsight.com/products/books/series.htm?id=1057-6290>

Appendix A

Copyright Permission from John Wiley & Sons, Inc.

Campbell, Brenton - Hoboken

From: Goldweber, Paulette - Hoboken on behalf of Permissions - US
Sent: Wednesday, September 14, 2011 9:36 AM
To: Campbell, Brenton - Hoboken
Subject: FW: Republication/Electronic Request Form

Categories: Permissions

Thesis.

Paulette Goldweber
Associate Manager, Permissions
Global Rights
John Wiley & Sons, Inc.
ph: 201-748-8765
f: 201-748-6008
pgoldweb@wiley.com

PERMISSION GRANTED

BY: Brenton D. Campbell
Global Rights Dept., John Wiley & Sons, Inc.

NOTE: No rights are granted to use content that appears in the work with credit to another source

-----Original Message-----

From: PermissionsUS@wiley.com on www.wiley.com [<mailto:webmaster@wiley.com>]
Sent: Tuesday, September 13, 2011 2:56 PM
To: Permissions - US
Subject: Republication/Electronic Request Form

A01_First_Name: Julie
A02_Last_Name: Miller
A03_Company_Name: University of Cincinnati
A04_Address: 788 Foresthill Dr
A05_City: Crescent Springs
A06_State: KY
A07_Zip: 41017
A08_Country:
A09_Contact_Phone_Number: 859-380-4133
A10_Fax:
A11_Emails: millja@mail.uc.edu
A12_Reference:
A13_Book_Title: Health Behavior and Health Education: Theory, Research, and Practice (2nd edition)
A40_Book_or_Journal: Book
A14_Book_Author: Karen Glanz
A15_Book_ISBN: 0-7879-0310-8
A16_Journal_Month:
A17_Journal_Year:
A18_Journal_Volume:
A19_Journal_Issue_Number:
A20_Copy_Pages: p. 48 Figure 3.1
A21_Maximum_Copies: unknown
A22_Your_Publisher: Proquest-Doctoral dissertation
A23_Your_Title: Predictors of Influenza Vaccination among Children
A24_Publication_Date: June, 2012
A25_Format: Other
A41_Ebook_Reader_Type:
A26_If_WWW_URL:
A27_If_WWW_From_Adopted_Book:

Appendix B

Items on CIIQ and Corresponding Subscale

Perceived Susceptibility (4 items)

- I worry my child catching the flu if he/she does not get the flu vaccine.
- It is likely my child will catch the flu if he/she does not get the flu vaccine.
- My child is more likely to catch the flu than other children if he/she does not get the flu vaccine.
- My child's age makes it likely he/she will catch the flu if he/she does not get the flu vaccine.

Perceived Severity (4 items)

- Flu is a serious illness in children.
- Infection with the flu may cause serious complications in children.
- I am afraid the flu will make my child very sick.
- If my child gets the flu, the illness could spread to other family members.

Perceived Vaccine Risk (9 items)

- The flu vaccine weakens the immune system.
- The flu vaccine does not work very well.
- Side-effects from the flu vaccine are worse than the flu itself.
- The flu vaccine can cause the flu in some children.
- Hearing a famous celebrity suggest the flu shot may harm my child affects my decision to vaccinate my child against the flu.
- The flu vaccine is not safe for children.
- My child is likely to have a serious reaction to the flu vaccine.
- The flu vaccine contains ingredients that are not safe.
- I or someone I know had a bad experience with the flu vaccine.

Perceived System Barriers (4 items)

- It is difficult to get an appointment for the flu vaccine for my child.
- I do not have the time to bring my child to the health provider's office to get the flu vaccine.
- Transportation difficulties make it hard to get to the health provider's office to get the flu vaccine for my child.
- I cannot afford the flu vaccine for my child.

Perceived Benefits (5 items)

- The flu vaccine prevents my child from getting the flu.
- Getting the flu vaccine for my child will keep me from missing work to take care of my child with the flu.
- Other children will be protected against the flu if my child gets the flu vaccine.
- Getting the flu vaccine for my child will keep him/her from missing school or daycare due to being sick with the flu.

- If my child got the flu vaccine and still caught the flu, he/she would not be as sick.

Cues to Action (4 items)

- My child's health provider's recommendation that my child get the flu vaccine affects my decision whether to vaccinate my child against the flu.
- News or internet sites stressing the importance of the flu vaccine for children affects my decision whether to vaccinate my child against the flu.
- My child's school or daycare recommendation that my child get the flu vaccine affects my decision whether to vaccinate my child against the flu.
- Family members wanting my child to get the flu vaccine affects my decision whether to vaccinate my child against the flu.

Likelihood to Vaccinate (1 item)

- My child will get the flu vaccine this flu season.

Appendix C

Childhood Influenza Immunization Questionnaire (CIIQ)

Phase I

Directions: The following items are intended to assess what factors affect your decision to have your child (the child here for an appointment) get the flu vaccine. Circle the number to indicate whether you strongly disagree (1), disagree (2), neither agree or disagree (3), agree (4), or strongly agree (5).

If you are here with more than one child for an appointment, complete the questionnaire for the older child.

	1 Strongly Disagree	2 Disagree	3 Neither Agree or Disagree	4 Agree	5 Strongly Agree
I worry a lot about my child catching the flu if he/she does not get the flu vaccine.	1	2	3	4	5
The flu vaccine weakens the immune system.	1	2	3	4	5
My child's health provider's recommendation that my child get the flu vaccine affects my decision whether to vaccinate my child against the flu.	1	2	3	4	5
It is difficult to get an appointment for the flu vaccine for my child.	1	2	3	4	5
The flu vaccine does <u>not</u> work very well.	1	2	3	4	5
It is extremely likely my child will catch the flu if he/she does <u>not</u> get the flu vaccine.	1	2	3	4	5
Flu is a serious illness in children.	1	2	3	4	5
Infection with the flu may cause serious complications in children.	1	2	3	4	5
Side-effects from the flu vaccine are worse than the flu.	1	2	3	4	5
The flu vaccine prevents my child from getting the flu.	1	2	3	4	5
News or internet sites stressing the importance of the flu vaccine for children affects my decision whether to vaccinate my child against the flu.	1	2	3	4	5
Getting the flu vaccine for my child will keep me from missing work to take of my child with the flu.	1	2	3	4	5
The flu vaccine can cause the flu in some children.	1	2	3	4	5
I cannot afford the flu vaccine for my child.	1	2	3	4	5
Compared to other children, my child is more likely to catch the flu if he/she does not get the flu vaccine.	1	2	3	4	5
I am afraid the flu will make my child very sick.	1	2	3	4	5

	1 Strongly Disagree	2 Disagree	3 Neither Agree or Disagree	4 Agree	5 Strongly Agree
Hearing a famous celebrity suggest the flu shot may harm my child affects my decision whether to vaccinate my child against the flu.	1	2	3	4	5
The flu vaccine is <u>not</u> safe for children.	1	2	3	4	5
My child's age makes it likely that he/she will catch the flu if he/she does <u>not</u> get the flu vaccine.	1	2	3	4	5
My child is likely to have a serious reaction to the flu vaccine.	1	2	3	4	5
My child's school or daycare recommendation that my child get the flu vaccine affects my decision whether to vaccinate my child against the flu.	1	2	3	4	5
The flu vaccine contains ingredients that are not safe.	1	2	3	4	5
If my child gets the flu, the illness could spread to other family members.	1	2	3	4	5
I do not have the time to bring my child to the health provider's office to get the flu vaccine.	1	2	3	4	5
Other children will be protected against the flu if my child gets the flu vaccine.	1	2	3	4	5
Family members wanting my child to get the flu vaccine affects my decision whether to vaccinate my child against the flu.	1	2	3	4	5
I or someone I know had a bad experience with the flu vaccine.	1	2	3	4	5
Getting the flu vaccine for my child will keep him/her from missing school or daycare due to being sick with the flu.	1	2	3	4	5
Transportation difficulties make it hard to get to the health provider's office to get the flu vaccine for my child.	1	2	3	4	5
If my child got the flu vaccine and still caught the flu, he/she would <u>not</u> be as sick.	1	2	3	4	5
My child will get the flu vaccine this upcoming flu season.	Very Unlikely	Unlikely	Unsure	Likely	Very Likely

- How old are you? _____ years old
- How old is the child you are filling out the survey for? _____ years old (for children under 2 years of age, put age in months)
- Did your child receive a flu vaccine last flu season? Yes No
- How many years have you attended school beginning with first grade? _____ number of years

5. What is your relationship to the child? Mother Father Guardian
6. What type of insurance does the child have? Private (for example Aetna, Humana, Cigna) Medicaid No insurance
7. Please circle your ethnicity/race.

American Indian or Alaska Native	Asian	Black or African American	Hispanic or Latino
Native Hawaiian or other Pacific Islander	White	Other	

Thank you for participating in the study. Please put your questionnaire in the provided envelope and place it in box in the waiting area labeled “Questionnaires.”

Appendix D

Letter of Support: Allergy Partners of Greater Cincinnati and Northern Kentucky

ALLERGY PARTNERS of Greater Cincinnati and Northern Kentucky

November 18, 2011

Duane L. Keitel, MD, FAAAAI

Theresa A. Furnish, APRN, FNP

517 Centre View Blvd.
Crestview Hills, KY 41017
Phone: 859.341.5030
Fax: 859-578-7551

Turfway Medical Center
7370 Turfway Road Ste 290
Florence, KY 41042
Phone: 859-341-5030
Fax: 859-578-7551

Allergy Partners of Greater Cincinnati and Northern Kentucky has agreed to be a survey site for the study "Predictors of Influenza Immunization among Children."

Thank You,

Duane Keitel, MD FAAAAI

Board Certified In Allergy and Immunology • Specializing In Adult and Pediatric Allergy and Asthma
Medical Services Provided by Allergy Partners, P.A.

Appendix E

Scale Items from Health Belief Model Questionnaire (Chen et al., 2011).

Items were answered on a 5 point Lickert scale: Strongly disagree, disagree, neither agree or disagree, agree, strongly agree.

Perceived Susceptibility

My children have a high risk of influenza.

My children get sick more easily than other children do.

Perceived Severity

Influenza infection may cause serious health problems.

Influenza with complications is dangerous.

If any of my children contracted influenza, the disease could spread to other family members.

Perceived Benefits

Influenza vaccination can relieve influenza symptoms and complications.

Influenza vaccinations effectively protect against the flu.

Influenza vaccines are safe for children.

Perceived Barriers

I am generally opposed to vaccinations

Influenza vaccinations have unpleasant side effects.

Influenza vaccinations weaken the natural immune system.

Vaccinations are inconvenient.

Influenza vaccinations are expensive.

I am influenced by negative news about influenza vaccines.

Cues to Action

The recommendation in the mass media affects my decision whether to vaccinate my children for influenza.

My doctor(s) recommendation affects my decision whether to vaccinate my children for influenza.

My nurse(s) recommendation affects my decision whether to vaccinate my children for influenza.

Appendix F

Scale Items from Health Belief Model Scales for Measuring Beliefs Related to Breast Cancer (Champion, 1999)

Items were answered on a 5 point Lickert scale: Strongly disagree, disagree, neither agree or disagree, agree, strongly agree.

SUSCEPTIBILITY

1. It is extremely likely I will get breast cancer in the future.
2. I feel I will get breast cancer in the future.
3. There is a good possibility I will get breast cancer in the next 10 years.
4. My chances of getting breast cancer are great.
5. I am more likely than the average women to get breast cancer.

SERIOUSNESS

1. The thought of breast cancer scares me.
2. When I think about breast cancer, my heart beats faster.
3. I am afraid to think about breast cancer.
4. Problems I would experience with breast cancer would last a long time.
5. Breast cancer would threaten a relationship with my boyfriend, husband, or partner.
6. If I had breast cancer my whole life would change.
7. If I developed breast cancer, I would not live longer than 5 years.

BENEFITS (Breast-Self Examination)

1. When I do breast self-examination I feel good about myself.
2. When I complete monthly breast self-examination I don't worry as much about breast cancer.
3. Completing breast self-examination each month will allow me to find lumps early.
4. If I complete breast self-examination monthly during the next year I will decrease my chance of dying from breast cancer.
5. If I complete breast self-examination monthly I will decrease my chances of requiring radical or disfiguring surgery if breast cancer occurs.
6. If I complete monthly breast self-examination it will help me to find a lump which might be cancer before it is detected by a doctor or nurse.

BARRIERS (Breast-Self Examination)

1. I feel funny doing breast self-examination.
2. Doing breast self-examination during the next year will make me worry about breast cancer.
3. Breast self-examination will be embarrassing to me.
4. Doing breast self-examination will take too much time.
5. Doing breast self-examination will be unpleasant.
6. I don't have enough privacy to do breast self-examination.

CONFIDENCE

1. I know how to perform breast self-examination.
2. I am confident I can perform breast self-examination correctly.
3. If I were to develop breast cancer I would be able to find a lump by performing breast self-examination.
4. I am able to find a breast lump if I practice breast self-examination alone.
5. I am able to find a breast lump which is the size of a quarter.
6. I am able to find a breast lump which is the size of a dime.
7. I am able to find a breast lump which is the size of a pea.
8. I am sure of the steps to follow for doing breast self-examination.
9. I am able to identify normal and abnormal breast tissue when I do breast self-examination.
10. When looking in the mirror, I can recognize abnormal changes in my breast.
11. I can use the correct part of my fingers when I examine my breasts.

HEALTH MOTIVATION

1. I want to discover health problems early.
2. Maintaining good health is extremely important to me.
3. I search for new information to improve my health.
4. I feel it is important to carry out activities which will improve my health.
5. I eat well balanced meals.
6. I exercise at least 3 times a week.
7. I have regular health check-ups even when I am not sick.

BENEFITS-MAMMOGRAM

1. When I get a recommended mammogram, I feel good about myself.
2. When I get a mammogram, I don't worry as much about breast cancer.
3. Having a mammogram or x-ray of the breast will help me find lumps early.
4. Having a mammogram or x-ray of the breast will decrease my chances of dying from breast cancer.
5. Having a mammogram or x-ray of the breast will decrease my chances of requiring radical or disfiguring surgery if breast cancer occurs.
6. Having a mammogram will help me find a lump before it can be felt by myself or a health professional.

BARRIERS-MAMMOGRAM

1. Having a routine mammogram or x-ray of the breast would make me worry about breast cancer.
2. Having a mammogram or x-ray of the breast would be embarrassing.
3. Having a mammogram or x-ray of the breast would take too much time.
4. Having a mammogram or x-ray of the breast would be painful.
5. Having a mammogram or x-ray of the breast would cost too much money.

Appendix G

**Information Sheet for Research
University of Cincinnati
Department: College of Nursing
Principal Investigator: Julie Miller, MSN, APRN
Faculty Advisor: Yin Xu, PhD, RN**

Title of Study: Predictors of Influenza Immunization among Children (Phase I)

Introduction:

You are being asked to take part in a research study. Please read this paper carefully and ask questions about anything that you do not understand.

Who is doing this research study?

The person in charge of this research study is Julie Miller, MSN, APRN a PhD student of the University of Cincinnati (UC) College of Nursing. She is being guided in this research by Yin Xu, PhD, RN.

What is the purpose of this research study?

The purpose of this research study is to determine factors associated with parents' decision to vaccinate children against influenza and the relationships between those factors.

Who will be in this research study?

About 45-100 people will take part in this study. Parents coming to the office while the study is being conducted will be invited to participate. You may be in this study if:

- You are 18 years of age or older
- You are able to read and write English
- You are the parent or legal guardian of one or more children ages 2 months to 17 years

You may not participate if:

- You have been told by your child's healthcare provider that your child cannot get the flu vaccine.

What will you be asked to do in this research study, and how long will it take?

You will be asked to complete a questionnaire. It will take about 15 minutes. You will complete the questionnaire in the waiting room or exam room and place the completed questionnaire in the provided envelope, seal the envelope, and hand it to the investigator.

Are there any risks to being in this research study?

The risk is not expected to be more than you would have in daily life. The results of your questionnaire will be kept private and not shown to your healthcare provider.

Are there any benefits from being in this research study?

You will probably not get any benefit from taking part in this study. But, being in this study may help researchers have an improved understanding of factors associated with parents' decision to vaccinate children against influenza and the relationships between those factors.

What will you get because of being in this research study?

You will be given a \$10 Kroger gift certificate for you time when you hand in the packet.

Do you have choices about taking part in this research study?

If you do not want to take part in this research study you may turn in a blank questionnaire.

How will your research information be kept confidential?

Information about you will be kept private. No information will be collected in the questionnaire that will allow you to be identified. Your information will be kept in an electronic file on the secure research drive at the University of Cincinnati for five years. After that it will be electronically deleted from the research drive. Agents of the University of Cincinnati may inspect study records for audit or quality assurance purposes.

What are your legal rights in this research study?

Nothing in this consent form waives any legal rights you may have. This consent form also does not release the investigator, the institution, or its agents from liability for negligence.

What if you have questions about this research study?

If you have any questions or concerns about this research study, you should contact Julie Miller at milljul@mail.uc.edu. Or you may contact Yin Xu at xyi@ucmail.uc.edu.

The UC Institutional Review Board reviews all research projects that involve human participants to be sure the rights and welfare of participants are protected.

If you have questions about your rights as a participant or complaints about the study, you may contact the UC IRB at (513) 558-5259. Or, you may call the UC Research Compliance Hotline at (800) 889-1547, or write to the IRB, 300 University Hall, ML 0567, 51 Goodman Drive, Cincinnati, OH 45221-0567, or email the IRB office at irb@ucmail.uc.edu.

Do you HAVE to take part in this research study?

No one has to be in this research study. Refusing to take part will NOT cause any penalty or loss of benefits that you would otherwise have. You may start and then change your mind and stop at any time.

Your finished questionnaire should be put in the envelope and handed to the researcher. If you do not want to be in the study you may either turn in your blank or unfinished questionnaire, or not turn it in at all.

BY TURNING IN YOUR COMPLETED QUESTIONNAIRE YOU INDICATE YOUR
CONSENT FOR YOUR ANSWERS TO BE USED IN THIS RESEARCH STUDY.
PLEASE KEEP THIS INFORMATION SHEET FOR YOUR REFERENCE.

Appendix H

Content Validity Evaluation

Childhood Influenza Immunization Questionnaire

Reviewer: I would appreciate your expertise in evaluating the content of a questionnaire designed to measure factors associated with parents' likelihood to vaccinate children against influenza. The questionnaire is comprised of 30 items and items are assessed using a five-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5). Please rate each item as follows:

Relevance

1 = not relevant
2 = item needs some revision
3 = relevant but needs minor revision
4 = very relevant

Simplicity

1 = not simple
2 = item needs some revision
3 = simple but needs minor revision
4 = very simple

Clarity

1 = not clear
2 = item needs some revision
3 = clear but needs minor revision
4 = very clear

Ambiguity

1 = doubtful
2 = item needs some revision
3 = no doubt but needs minor revision
4 = meaning is clear

Item	Relevance 1 = not relevant 4 = very relevant	Simplicity 1 = not simple 4 = very simple	Clarity 1 = not clear 4 = very clear	Ambiguity 1 = doubtful 4 = meaning is clear	Comments
I worry a lot about my child catching the flu if he/she does not get the flu vaccine.					
The flu vaccine weakens the immune system.					
My child's health provider's recommendation that my child get the flu vaccine affects my decision whether to vaccinate my child against the flu.					
It is difficult to get an appointment for the flu vaccine for my child.					
The flu vaccine does not work very well.					
It is extremely likely my child will catch the flu if he/she does not get the flu vaccine.					
Flu is a serious illness in children.					
Infection with the flu may cause serious complications in children.					

Side-effects from the flu vaccine are worse than the flu.					
The flu vaccine prevents my child from getting the flu.					
News or internet sites stressing the importance of the flu vaccine for children affects my decision whether to vaccinate my child against the flu.					
Getting the flu vaccine for my child will keep me from missing work to take of my child with the flu.					
The flu vaccine can cause the flu in some children.					
I cannot afford the flu vaccine for my child.					
Compared to other children, my child is more likely to catch the flu if he/she does not get the flu vaccine.					
I am afraid the flu will make my child very sick.					
Hearing a famous celebrity suggest the flu shot may harm my child affects my decision whether to vaccinate my child against the flu.					
The flu vaccine is not safe for children.					
My child's age makes it likely that he/she will catch the flu if he/she does not get the flu vaccine.					
My child is likely to have a serious reaction to the flu vaccine.					
My child's school or daycare recommendation that my child get the flu vaccine affects my decision whether to vaccinate my child against the flu.					
The flu vaccine contains ingredients that are not safe.					
If my child gets the flu, the illness could spread to other family members.					
I do not have the time to bring my child to the health provider's office to get the flu vaccine.					

Other children will be protected against the flu if my child gets the flu vaccine.					
Family members wanting my child to get the flu vaccine affects my decision whether to vaccinate my child against the flu.					
I or someone I know had a bad experience with the flu vaccine.					
Getting the flu vaccine for my child will keep him/her from missing school or daycare due to being sick with the flu.					
Transportation difficulties make it hard to get to the health provider's office to get the flu vaccine for my child.					
If my child got the flu vaccine and still caught the flu, he/she would <u>not</u> be as sick.					
My child will get the flu vaccine this upcoming flu season.					

Thank you for your time.

Julie Miller

Appendix I

Content Validity Index of Items

Item	Relevance	Simplicity	Clarity	Ambiguity	Item CVI
I worry a lot about my child catching the flu if he/she does not get the flu vaccine.	1	.86	.86	1	Relevance - 1 Overall - .93
The flu vaccine weakens the immune system.	1	.86	1	1	Relevance - 1 Overall - .97
My child's health provider's recommendation that my child get the flu vaccine affects my decision whether to vaccinate my child against the flu.	1	1	.86	1	Relevance - 1 Overall .97
It is difficult to get an appointment for the flu vaccine for my child.	1	1	1	1	Relevance - 1 Overall - 1
The flu vaccine does not work very well.	1	1	1	1	Relevance - 1 Overall -1
It is extremely likely my child will catch the flu if he/she does <u>not</u> get the flu vaccine.	1	1	1	1	Relevance - 1 Overall -1
Flu is a serious illness in children.	1	1	1	1	Relevance - 1 Overall -1
Infection with the flu may cause serious complications in children.	1	.86	1	.86	Relevance - 1 Overall - .93
Side-effects from the flu vaccine are worse than the flu.	1	1	.86	1	Relevance - 1 Overall - .97
The flu vaccine prevents my child from getting the flu.	1	1	1	1	Relevance - 1 Overall - 1
News or internet sites stressing the importance of the flu vaccine for children affects my decision whether to vaccinate my child against the flu.	1	.86	1	1	Relevance - 1 Overall - .97
Getting the flu vaccine for my child will keep me from missing work to take of my child with the flu.	1	1	.86	1	Relevance - 1 Overall - .97
The flu vaccine can cause the flu in some children.	1	1	1	1	Relevance - 1 Overall - 1
I cannot afford the flu vaccine for my child.	1	1	1	1	Relevance - 1 Overall - 1
Compared to other children, my child is more likely to catch the flu if he/she does not get the flu vaccine.	1	.86	.86	.86	Relevance - 1 Overall - .90
I am afraid the flu will make my child very sick.	1	1	1	1	Relevance - 1

					Overall - 1
Hearing a famous celebrity suggest the flu shot may harm my child affects my decision whether to vaccinate my child against the flu.	1	.86	1	1	Relevance - 1 Overall - .97
The flu vaccine is not safe for children.	1	1	1	1	Relevance - 1 Overall - 1
My child's age makes it likely that he/she will catch the flu if he/she does not get the flu vaccine.	1	1	.86	1	Relevance - 1 Overall - .97
My child is likely to have a serious reaction to the flu vaccine.	1	.86	1	1	Relevance - 1 Overall - .97
My child's school or daycare recommendation that my child get the flu vaccine affects my decision whether to vaccinate my child against the flu.	1	.86	1	1	Relevance - 1 Overall - .97
The flu vaccine contains ingredients that are not safe.	1	1	1	1	Relevance - 1 Overall - 1
If my child gets the flu, the illness could spread to other family members.	1	1	1	1	Relevance - 1 Overall - 1
I do not have the time to bring my child to the health provider's office to get the flu vaccine.	1	1	.86	.86	Relevance - 1 Overall - .93
Other children will be protected against the flu if my child gets the flu vaccine.	1	1	1	1	Relevance - 1 Overall - 1
Family members wanting my child to get the flu vaccine affects my decision whether to vaccinate my child against the flu.	1	1	1	1	Relevance - 1 Overall - 1
I or someone I know had a bad experience with the flu vaccine.	1	1	1	1	Relevance - 1 Overall - 1
Getting the flu vaccine for my child will keep him/her from missing school or daycare due to being sick with the flu.	1	.86	.86	1	Relevance - 1 Overall - .93
Transportation difficulties make it hard to get to the health provider's office to get the flu vaccine for my child.	1	.86	.86	1	Relevance - 1 Overall - .93
If my child got the flu vaccine and still caught the flu, he/she would not be as sick.	1	1	1	1	Relevance - 1 Overall - 1
My child will get the flu vaccine this upcoming flu season.	1	1	1	1	Relevance - 1 Overall - 1
CVI	1	.95	.96	.99	.98

Appendix J

Letter of Support: St. Elizabeth Physicians Pediatrics

Pamela E. Zipperer-Davis,
FACHE, FACMPE
Chief Operations Officer

August 31, 2011

Julie Miller, ARNP, MSN
College of Nursing
University of Cincinnati Academic Health Center
3110 Vine St
PO Box 210038
Cincinnati OH 45221-0038

Dear Mrs. Miller,

It is with much enthusiasm that I write this letter to support your research proposal titled "Predicators of Influenza Immunization Among Children." Previous research has shown that many children do not receive annual influenza immunization necessary for protection against seasonal influenza. Your proposal directly addresses the need to evaluate factors influencing parents' decision to vaccinate children against influenza. This is an important first step in developing effective interventions aimed at improving influenza vaccination of children. The pediatric office understands that you will serve as the primary investigator in the project. The practice will collaborate by allowing recruitment of participants. I look forward to the opportunity to assist you in this proposal in any way I can.

Sincerely,

Pamela E. Zipperer-Davis, MHA, FACHE, FACMPE
Chief Operating Officer
St. Elizabeth Physicians

Appendix K

University of Cincinnati IRB Approval Letter

Institutional Review Board
Medical Center
University of Cincinnati

University Hall – Suite 300
51 Goodman Drive
Cincinnati, OH 45221
Phone (513) 558-5259
Fax (513) 558-4111

TO: Julie Miller, MSN
Department of Nursing
ML 0038

FROM: Michael Linke, PhD, Chair *Michael Linke /en*
University of Cincinnati
Institutional Review Board #1 and #2

DATE: September 21, 2011

RE: IRB # 11-08-31-05 — Predictors of Influenza Immunization Among Children

Please be advised that I have reviewed the study referenced above as outlined in your IRB submission, and have determined this activity to be exempt from IRB review and surveillance according to the definition of a human subject outlined at 45 CFR 46.101(b)4. The full Board will be notified of the exempt status of your study at its next convened meeting.

You must report to the IRB any changes affecting the exempt status of this study. No changes may be made without prior approval by the Board except those necessary to eliminate immediate hazards.

Thank you for your continued compliance with the Board's requirements with regard to your research activities.

Please note: This approval is through the U.C. IRB only. You may be responsible for reporting to other regulatory officials (e.g., VA Research and Development Office, UC Health- University Hospital). Please check with your Institution and Department to ensure you have met all reporting requirements.