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Socioeconomic Factors Affecting Infant Sleep-Related Deaths

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2012

Abstract

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Dissertation Submitted in Partial Fulfillment

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Public Health

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Abstract

Racial disparity is present in deaths attributed to sudden infant death syndrome (SIDS) and unintentional suffocation. The Back to Sleep Campaign that began in 1994 caused an overall decrease in SIDS rates, but the racial disparity has continued to increase. Researchers have analyzed and described various socio-demographic characteristics of SIDS and infant deaths by unintentional suffocation in urban areas yet have not simultaneously controlled for multiple risk factors that may contribute to racial disparity such as race, poverty, maternal education, and number of children born to each mother (parity). The purpose of this study was to determine if there is a relationship between poverty, race, maternal education, parity, and infant sleep-related deaths in the African American population in an urban setting. This quantitative case-control study used secondary data collected from birth certificates and matched birth/death certificates by a Midwestern state health department between 2005 and 2009. The health belief model was used as a conceptual framework. To answer the research questions that asked if there was a relationship between infant sleep-related deaths (dependent variable) and race, poverty, maternal education, and parity (independent variables), chi-square analysis and logistic regression analysis were performed. These analyses suggested that race and poverty have significant relationships with infant sleep-related deaths. The analyses did not suggest a relationship between maternal education or parity and sleep related infant deaths. The social significance of these findings may be that the results could be useful for population-specific modifications of prevention messages that will reduce infant sleep-related deaths.

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Chapter 1: Introduction to the Study

Background of Study

For many years, there has been racial disparity in deaths attributed to sudden infant death syndrome (SIDS), unintentional suffocation, and infant deaths of undetermined causes (Hackett, 2006). The Back to Sleep Campaign that began in 1994 caused a decrease in SIDS rates overall, yet the racial disparity has continued to increase (Pressley, Barlow, Kendig, & Paneth-Pollak, 2007). Behavioral factors associated with this increase are prone sleep positioning, unsafe sleep surfaces, and bed sharing in African American populations. In addition to these unsafe sleep practices, socioeconomic factors such as race, poverty, maternal education, and parity may compound disparity (Hackett, 2006). I will present and in-depth review of several studies that analyze socioeconomic factors in Chapter 2.

African Americans have 1.9 times the SIDS mortality rate of Caucasians (CDC, 2012). Unger et al. (2003) conducted a retrospective population-based study in St. Louis in which the researchers determined that SIDS rates in African American infants were higher than in Caucasian infants (2.08 vs 0.65 per 1000 live births). In 2006, 2007, and 2008, unsafe sleep practices led to the deaths of 8, 14 and 19 African American infants respectively in St. Louis as reported by Graham, Chief Medical Examiner for St. Louis (Graham, 2008). Bed sharing deaths among African American infants were nearly twice that of among Caucasian infants [67.1% vs. 35.1% of deaths] (Unger et al., 2003). African American infant deaths on nonstandard sleep surfaces were also nearly twice as common as similar Caucasian infant deaths [79.0% vs. 46.0%] (Unger et al., 2003). Though Unger et al. (2003) researched infants' sleep environments and sleep surfaces, they did not study the contribution of modifiable race-specific risk factors and their role in infant safe sleep practices in the African American population in St. Louis.

In this retrospective population-based study, I conducted a review of matched birth and death certificates of infant deaths occurring between 2005 and 2009. I matched death certificates and birth certificates to gather socioeconomic information about each mother. I analyzed socioeconomic data derived from the death certificates and then compared them to data derived from the birth certificates of infants who lived for more than one year.

Problem Statement

Though researchers have analyzed and described various sociodemographic characteristics of SIDS and unintentional suffocation deaths in St. Louis, they have not simultaneously controlled for multiple risk factors that may contribute to racial disparity such as race, poverty, maternal education, and number of children birthed by the mother (parity). Nationally, the leading cause of death in the postneonatal period is sleep related and occurs more than twice as often among African American infants as Caucasian infants (Pressley et al., 2007). Researchers have not determined whether identifying modifiable risk factors would decrease racial disparity related to infant deaths, nor whether risk factors commonly found in poor populations have contributed to differences in programmatic results. People with a clear understanding of factors such as race, maternal level of education, parity, and maternal level of poverty can enhance existing educational programs such as the Back to Sleep Campaign by making modifications to address the African American population.

Purpose of the Study

The purpose of this study was to determine if there is a relationship between poverty, race, maternal education, parity, and infant sleep-related deaths in the African American population in St. Louis, MO. Contributing factors to infant unsafe sleep practices often include mistrust of health care providers, neighborhood residential segregation, and lack of access to

quality health care (LaVeist, 2000). To decrease African American/ Caucasian disparities in deaths due to SIDS and unintentional suffocation, there has to be an understanding of these contributing factors (Byrd, Katcher, Peppard, Durkin, & Remmington, 2007). Understanding combinations of factors that may be predictive of unsafe sleep practices may provide public health practitioners with important guidance for developing educational materials and programs to assist African American mothers in adhering to safe sleep guidelines illustrated in the Back to Sleep Campaign.

Nature of the Study

To date, there is no evidence of whether variables such as poverty, race, education level of the mother, and parity are related to infant sleep-related deaths. These variables may provide information that aids in the reduction of racial disparity in SIDS and sudden unexplained infant death (SUID). For this research I analyzed socioeconomic data of mothers of infants who had sleep-related deaths, then compared those findings with data of the general population of infants who did not die in their first year of life. The intent of this research was not to determine the degree of risk associated with the variables but rather to evaluate their contributory roles in SIDS and sleep-related deaths.

In this study I used a quantitative case-control design that examined secondary data collected by the Missouri Department of Health and Senior Services from 2005 through 2009. I matched infant death certificates with corresponding birth records to collect maternal demographic data. I also collected maternal data from birth certificates of infants who lived more than one year. I analyzed data from the years 2005 through 2009 for matched infant birth and death record. Additionally, I analyzed birth records of infants who survived beyond one year of age. I obtained data from the Missouri Department of Health and Senior Services

(DHSS), and obtained permission for use of the data by using the DHSS Internal Review Board process. The data of interest for this research included maternal race, level of poverty, level of education, and number of live births. I performed a regression analysis to determine if socioeconomic variables have a have a relationship with sleep-related deaths. Care was taken to assure that the identities of the mothers who experienced the tragic loss of their infants remained anonymous. I discussed research methodology in chapter 3.

Research Questions and Hypothesis

It is important to determine whether there are modifiable factors that may reduce racial disparity and the tragedy of infant death. The overarching research question for this study was whether there is a relationship between socioeconomic factors pertaining to the mother and infant sleep-related deaths. I put forth the following research questions and hypotheses as the basis for this study:

Research Question 1: Is there a relationship between the level of poverty of the mother and infant sleep-related deaths?

H_{01}: There is no relationship between the level of poverty of the mother and infant sleep-related deaths.

H_{a1}: There is a relationship between the level of poverty of the mother and infant sleep-related deaths.

Research Question 2: Is there a relationship between the race of the mother and infant sleep-related deaths?

H_{02}: There is no relationship between the race of the mother and infant sleep-related deaths.

$H_{a2:}$ There is a relationship between the race of the mother and infant sleep-related deaths.

Research Question 3: Is there a relationship between the level of education of the mother and infant sleep-related deaths?

$H_{03:}$ There is no statistical significance in the relationship between the level of education of the mother and infant sleep-related deaths.

$H_{a3:}$ There is a statistical significance in the relationship between the level of education of the mother and infant sleep-related deaths.

Research Question 4: Is there a relationship between the number of children born by the mother (parity) and infant sleep-related deaths?

$H_{04:}$ There is no statistical significance in the relationship between the number of children born by the mother (parity) and infant sleep-related deaths.

$H_{a4:}$ There is a statistical significance in the relationship between the number of children born by the mother (parity) and infant sleep-related deaths.

Theoretical Base

Compared to models of behavioral change, there has not been ample research conducted to analyze the determinants of injury-related behaviors within the context of a health promotion framework (Gielen & Sleet, 2003). Researchers interested in engaging parents in injury prevention initiatives have used the health belief model (HBM), theory of reasoned action (TRA), and family systems theory (Randolf, Fincham, & Radey, 2009). Ashida, Heaney, Kmet, and Wilkins (2011) analyzed the protective motivation theory as a basis for an injury prevention intervention. Each model has a substantive body of literature supporting its usefulness for understanding injury problems.

I further reviewed The HBM for this research. The HBM is built on the assumption that individuals participate in an injury prevention behavior because they desire to avoid the injury, and by participating in the behavior, they will be safe and have well-being (Randolf et al., 2009). Glanz and Rimer (1997) described intrapersonal, interpersonal, and community levels as well as theories useful with each level to translate ecological models into action programs. In the HBM, behaviors are described as a function of people's beliefs about their susceptibility to health issues, the severity of the threat, the perceived benefits of adopting preventative measures, the confidence in their ability to perform the injury prevention measure, as well as the individual's cues to action (Glanz & Rimer, 1995). Froman and Owen (1990) suggested that there was a higher incidence of infant sleep-related deaths among mothers who were not in a relationship; had more than one child, and lived in a socio-economically challenged area. Spencer and Logan (2004) examined how the impact of socioeconomic status affected infant sleep practices. The HBM was utilized in an early review presented by Janz and Becker (1984). This presentation illustrated how the HBM constructs perceived susceptibility, perceived severity, perceived benefits, and perceived barriers that affect health choices. The utility of the HBM is summarized in the literature review in chapter 2.

Definition of Terms

Infant: a child less than 1year of age (World Health Organization, 2011).

Infant safe sleep surface: an approved crib mattress that is covered by a fitted sheet without the addition of pillows, quilts, sheepskins, bumper pads, soft objects, toys, or other soft surfaces (National Institute of Child Health and Development, 2005).

Parity: the number of times that a mother has given birth to a fetus with a gestational age of more than 24 weeks, regardless of whether the child was born alive or stillborn (Opara & Zaidi, 2007).

Poverty: According to the federal government, poverty is defined as having a before-tax income less than the cost of the economy food plan multiplied by 3. The economy food plan, according to the United States Department of Agriculture (USDA), is the lowest cost of a nutritionally adequate diet (Proctor, 2010).

Sleep-related infant death: Death caused by unintentional suffocation or strangulation (asphyxia); entrapment or wedging; overlaying as a result of shared-sleeping; Sudden unexpected infant death (SUID); and death due to undetermined causes (Task Force on SIDS, 2011).

Sudden infant death syndrome (SIDS): Term used to describe deaths of young infants when death investigations fail to demonstrate a clear-cut cause of death (Krous et al. 2004). In 1989, the National Institute of Child Health and Human Development defined SIDS as "the sudden death of an infant under one year of age, which remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history" (Willinger, James, & Catz, 1991, p. 677).

Sudden unexpected infant death (*SUID):* Defined by the Office of the Chief Medical Examiner (2007) as a diagnosis made in cases in which autopsy does not reveal a definitive medical or traumatic cause of death and the circumstances surrounding the death suggest that there is an associated risk factor for dying, such as unsafe bedding or co-sleeping, or some other external factor, but the contribution of this factor cannot be determined with certainty. The

diagnosis may also be used in the situation where a medical disease is identified, but it is uncertain that this disease caused death.

Assumptions, Limitations, Scope, and Delimitations

Assumptions

This study rested on the assumption that there are identifiable and modifiable factors present in impoverished African American populations that educational safe sleep campaigns can specifically addressed. I assumed that all data for demographics and other characteristics were accurately recorded for both cases and controls. I further assumed that the cause of death was accurately identified and recorded on death certificates included in the study.

Limitations

Potential limitations include:

- Accuracy of the completion of the birth or death certificate instrument.
- Accuracy of the SIDS diagnosis as the infant's cause of death, though efforts have been made to alleviate the misdiagnosis by the development of a national standard for death-scene investigation of SIDS deaths (Tomashek & Shapiro-Mendoza, 2005).
- Confusion generated by an undetermined cause of death. The undetermined diagnosis readily falls into the definition of SIDS as the sudden death of an infant younger than one year of age that remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and a review of the clinical history (Hoffman, Damus, Hillman, & Krongrad, 1988).
- Potentially limited generalizability because the data were collected in a primarily African American population. The results may be useful when generalized to other similar African American or urban populations, but limited in other populations.

Scope and Delimitations

Despite the limitations of this study, I analyzed matched birth/death records for a period of 5 years examining maternal characteristics and their potential relationships with infant sleep-related deaths. Information not available in the birth and death certificates that may have impact on infant sleep-related deaths includes previous safe sleep education that the mother may have received, previous infant sleep-related deaths that the mother experienced, and family support that the infant and mother received. The current study is limited to the population of infants in St. Louis who were born and lived or were born and died between January 1, 2005 and December 31, 2009. The study population was limited to those infant births and deaths which occurred in the city of St. Louis. The size of the population was determined by the number of sleep-related infant deaths that occurred between 2005 and 2009. A qualifier for the limitation is that I used the entire population of infant deaths. How socioeconomic factors affect African American infants living in poverty with multiple siblings and mothers with limited education was beyond the scope of this study. The data included in the analysis were limited to information gathered from birth and death certificates with no additional attempts to clarify or collect additional information.

Significance of the Study

A goal of this study was to determine if there are socioeconomic and personal factors affecting infant sleep-related deaths in the African American population that targeted educational programs for infant safe sleep practices can address by providing population-specific information to decrease racial disparity and cause positive social change. The socioeconomic status of the caregiver may impact his or her knowledge, attitudes, and beliefs about infant sleep practices. Research reviewed for this study had varying conclusions about the primary causes of racial

disparity in deaths by unintentional suffocation and SIDS. By analyzing the literature and the study populations, progress may be made towards understanding how to develop useful educational programming to target urban African American populations to decrease disparity. By comparing African American matched birth/death records with birth records of African American infants who survived their first year of life, I conducted an analysis to determine if there were relationships between the variables and if they were race-related or universal among low-income populations. The outcome of the analysis may be useful for the development of population-specific educational programs aimed at decreasing the racial disparity in infant sleep deaths. Potentially, such programs may result in a decrease in infant sleep-related deaths in the African American population.

Summary

The Back to Sleep campaign was introduced in the United States in 1994, resulting in a reduction in infant mortality due to SIDS and unsafe sleep practices (NICHD, 2010). The reduction in deaths has been attributed to educational programs and single-message teaching (NICHD, 2010). Prior to the Back to Sleep campaign, the SIDS rate was 1.4 deaths per 1,000 live births, dropping to 0.55 deaths per 1,000 live births after the implementation of the campaign, a reduction of more than 50% (NICHD, 2010). According to the 1992 National Infant Sleep Position (NISP) Household Survey, only 13% of U.S. infants were positioned on their backs for sleep (NICHD, 2010). In the 2006 NISP survey, 75.7% of infants were positioned in the supine position for sleep (NICHD, 2010). The 2006 NISP survey found, however, that a significant portion of African American babies were still sleeping on their stomachs, resulting in African American infants being 2.2 times more likely to die of SIDS than Caucasian infants. Racial disparity remains in 2011.

I addressed socioeconomic factors that may be associated with sleep-related infant deaths by analyzing data from birth and death records collected from Missouri Department of Health records for St. Louis, MO between 2005 and 2009. To date, no other researcher has analyzed this data over these years. The results of this study may be effective for use in creating strategies to reduce the tragedy of sleep-related infant death. Analysis of this data may increase our understanding of the HBM as it applies to barriers to mothers who attempt to provide safe sleep practices for their infants. Chapter 2 provides an in-depth review of the literature that is relevant to this study. Chapter 3 is a description of the research method for this study. Chapters 4 and 5 will present the results and conclusions respectively.

Chapter 2: Literature Review

Introduction

Researchers of health disparities have examined the relationship between health outcomes and risk factors such as race, socioeconomic status, level of education, and residential segregation (Demont-Heinrich & Bol, 2008; MacDorman & Mathews, 2011; Wise, 2003). Similarities exist between findings in these studies and research that analyzes disparities in SIDS and unintentional suffocation (Hunt & Hauck, 2006; Pickett, Luo & Lauderdale, 2005; Singh & Kogan, 2008). However, very few researchers attributed disparities to oftentimes modifiable risk factors embedded in impoverished communities, such as maternal level of education, maternal age, dual parenting, and number of children by the same mother.

Kemp et al. (2000) published a 4-year study ending in 1997 that reviewed bed-sharing practices in St. Louis. Kemp et al. (2006) also published a paper on prevention strategies in disadvantaged communities based on findings from St. Louis. Unger et al. (2003) researched modifiable risk factors among infants dying suddenly and unexpectedly using a St. Louis population. Vemulapalli et al. (2004) researched safe cribs and bedroom size among African American infants. Additionally, technical reports such as those produced by the Missouri Childhood Fatality Review Panel (2010), the task force on infant positioning and SIDS (1996), the Deaconess Foundation (2010), and FIMR have been produced. Though this list is not exhaustive, the body of existing current literature is small when researching SIDS and unintentional suffocation in St. Louis, MO, which was the focus of this research

In the literature review, I evaluate the effect that demographic and socioeconomic factors have on infant sleep-related deaths. Research I considered for the review included previous studies that evaluated socioeconomic status and infant mortality as it pertained to infant sleep-

related deaths. After a description of search strategies, I will present the HBM, which provides a theoretical basis for the research. Additionally, I will present a historical overview of SIDS and unintentional suffocation to illustrate the progression of public health efforts to educate the public about infant safe sleep practices. The sources I reviewed are divided in order to provide a solid overview of the literature that supports this study. These sources include a description of the population at risk, causative mechanisms of SIDS and unintentional suffocation, as well as risk factors that may have a confounding impact on infant sleep-related, deaths including poverty, race, maternal level of education, and parity.

Search Strategy

I used a three-pronged literature search strategy. The first search used multidisciplinary databases including Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Database of Systematic Reviews (CDSR), MEDLINE, PsychINFO, CINAHL, ERIC, Academic Search Premier, EBSCO databases, and Sage databases. I used a broad-spectrum approach because issues pertaining to infant sleep-related deaths cover a wide range of literature, such as medicine, economics, psychology, and injury prevention. Search terms for this literature search included *infant mortality, SIDS, safe sleep, infant health disparities, SES and infant mortality, infant unintentional suffocation, infant health promotion, infant safe sleep*, and the *Back to Sleep Campaign*. I also reviewed infant safe-sleep Web sites such as the American Sudden Infant Death Syndrome Institute, First Candle, SIDS-Nemours Foundation, SIDS Network home page, SIDS and Kids, and the American Academy of Pediatrics Children's Health Topics: Sleep Issues.

In the second part of the literature search, I focused on finding population-level data pertaining to sleep-related infant morbidity and mortality. Some of this information was published in the scholarly literature, though most of it was published in reports made by agencies

conducting the research. I used government Web sites to find census data and vital statistics in the third section of the search. Web sites I searched included the Centers for Disease Control and Prevention (CDC) and the Missouri Department of Health and Senior Services Missouri Information for Community Assessment (MICA).

History of SIDS and Unintentional Suffocation

Documentation of SIDS and unintentional suffocation of infants is present throughout history and literature. One early nonscientific example occurred in the Hebrew Bible in 1 Kings 3:16-21 (King James Version). In this passage, Solomon had to determine the parentage of an infant claimed by two mothers, one of whom had lost an infant because it had been overlain in the night. Egyptians Diofurus and Siculus recorded efforts to prevent unintentional suffocation of infants in the first century BC (Russell-Jones, 1985). Women found responsible for overlaying their babies during this early time were not executed, as was the practice for murder, but were forced to hold their dead infants for 3 days and nights so that they would have the full effect of the penitence and dreadfulness of their actions (Russell-Jones, 1985). The Greeks and Babylonians were somewhat less condemning, ascribing the infant deaths to demon gods and ghosts of infants.

The term SIDS is used when there is no credible explanation for an infant's death after all possible causes are ruled out through autopsy, death scene investigation, and medical history (Hunt & Hauck, 2006). The diagnosis of SIDS is one of exclusion (Berry, 1992). Because of advances in medical technology and diagnostic procedures, fewer infant deaths are categorized as SIDS (Heinig, 2000). Unintentional suffocation and sudden unexpected infant death (SUID) are more commonly used diagnoses in the 21st century (Vennemann et al, 2007). Bed sharing is a strong risk factor for unintentional suffocation. Many infant deaths due to unintentional

suffocation had previously been diagnosed as SIDS (Heinig, 2000). Many of these infants had either been overlain by an adult or trapped in the bed structure (Kemp et al., 2000). Soft bedding for the infant sleep environment has also been associated with increased risk of infant death (Skadberg & Markestad, 1997).

Scientists recognized SIDS as a disease in 1969, when Valdes-Depena presented the topic of Progress in Sudden Infant Death Research to the National Institute of Health Second International Conference (Valdes-Depena, 1980). Valdes-Depena (1980) outlined proposed theories that had been associated with crib death. Among these theories were stress, adrenal hormone imbalance, mineral deficiency of the parathyroid gland, bacterial infection, spinal cord bleeding due to whiplash injury, infanticide, and obstruction of the nasal passage due to mucus (Valdes-Depena, 1980, p. 611). Although most of these theories were discredited, Valdes-Depena's presentation brought SIDS into the recognized medical arena. Though the medical community had defined and recognized SIDS, it was up to those in the public health arena to formulate and put into practice evidence-based practices that would decrease mortality in infants.

Back to Sleep Campaign

In 1992, the American Academy of Pediatrics recommended placing all healthy infants in the supine or side lying position for sleep (Moon, Oden, & Grady, 2004). This recommendation and the subsequent development of the educational Back to Sleep Campaign in 1994 caused a 40% decrease in the incidence of SIDS in the United States from 1.2 per 1000 live births in 1992 to 0.67 deaths per 1000 live births in 1999 (Hoyert, 2001). Since the inception of the Back to Sleep Campaign in 1994, the rate of decline in infant deaths for African American infants has not kept pace with the decline of infant deaths in Caucasian infants, with African American infants dying at a rate more than double that of their Caucasian infant counterparts (Hoyert, 2001).

Outreach strategies and materials using the American Academy of Pediatrics recommendations were developed to target parents and caregivers of infants. Because of the promotional feature stories and media coverage, which included a nationwide toll-free information hotline and radio, print, and television ads, the campaign gained energy and established awareness of SIDS prevention measures for parents across the United States (Colson et al., 2006). By 2002, the National Center for Health Statistics reported a drop in SIDS-related deaths greater than 50% and a decrease in placing infants in the prone position for sleep from 70% to 15% (Colson et al., 2006). The success of the Back to Sleep Campaign was attributed to the successful dissemination of the message and subsequent change in parental practice. Racial disparity in infant mortality rates continues, creating a need for public health practitioners to develop evidence-based interventions for the African American community.

Nationally, the proportion of infants placed on their backs to sleep has leveled off since 2001 (Von Kohorn et al., 2010). Von Kohorn et al. identified three influencing factors that contributed to the caregiver's decision to place an infant on his or her back: whether the caregiver was instructed to do so by a physician, fear of placing the infant on his or her back due to choking concerns, and concerns about infant comfort in the back-lying position. The study also indicated that between 2003 and 2007 only 53.6% of the parents interviewed had received instructions from a physician regarding the importance of placing the infant on his or her back to sleep (Von Kohorn et al., 2010).

Even though there has been a more than 50% decline in the SIDS rate in the United States, SIDS and SUID remains the leading cause of postnatal deaths, accounting for nearly 25% of all infant deaths that occur between birth and one year of age (Malloy & MacDorman, 2005). Many factors, both modifiable and nonmodifiable, have significant relationships with

unintentional suffocation and SIDS (Hunt & Hauck, 2006). Multiple regression analysis of these relationships has produced consistent findings, suggesting that socioeconomic variables have overall validity (Pickett, Luo, & Lauderdale, 2005). Socioeconomic variables have placed populations at significant risk in St. Louis as well as in the entire United States. In St. Louis, 27.8% of the population lives in poverty (Deaconess Foundation, 2010). Nearly 40% of African Americans in St. Louis live in poverty (Deaconess Foundation, 2010). At least 22% of students drop out of high school in St. Louis (Deaconess Foundation, 2010). More than 16% of all births in St. Louis are to teenage mothers (Deaconess Foundation, 2010). These factors may impact health outcomes.

Disparities in St. Louis

There is a body of literature including Kemp et al., (2000), Kemp et al., (2003), Unger et al., (2003), & Vemulapalli et al., (2004), as well as technical reports by the Missouri Childhood Fatality Review Panel (2010), the task force on infant positioning and SIDS (1996), the Deaoness Foundation (2010), and FIMR written about disparities in the African American infant population in St. Louis. This regional research has occurred because of the significant incidence of unintentional suffocation as well as because of the proximity to Washington University researchers, including Kemp and Thach. In the state of Missouri in 2009, there were 159 sudden unexpected deaths of infants under the age of one year reported to the Child Fatality Review Program. Based on autopsy, investigation, and CFRP panel review, 20 were diagnosed as SIDS, 71 unintentional suffocation, 32 died from natural causes, and 26 of the infant deaths were of undetermined causes (CFRP, 2009)

Since the inception of the Back to Sleep Campaign, parental practices in St. Louis continue to pose serious risks for infant death from SIDS or SUID. St. Louis has experienced a

recent increase in infant deaths compounded by unsafe sleep practices (Graham, 2008). In 2006, 2007, and 2008 unsafe sleep practices led to the deaths of 8, 14 and 19 infants respectively in St. Louis as reported by Graham, Chief Medical Examiner for St. Louis (Graham, 2008). During the period from 2002 to 2004, Graham reported a total of 99 sudden infant deaths in St. Louis City and County, St. Charles, Jefferson, and Franklin counties. Of these deaths, 73% of the infants were found bed sharing or face down and 93% had unsafe sleep marked on the death investigation form, representing a risk factor at the time of death and contradicting the practices recommended by the Back to Sleep campaign. The indication of *unsafe sleep* is not recorded on death certificates, but is indicated by the cause of death, represented by ICD10 codes. Some of the unsafe practices noted were infants placed on sleep-surfaces that were not designed for infant sleep (such as a sofa or adult bed), infants placed on their stomachs for sleep, and/or infants sleeping with an adult (American Academy of Pediatrics Task Force on Infant Positioning and SIDS [AAP], 1996).

The Missouri statewide infant death data reported by the Missouri Child Fatality Review Annual Report (2007) showed 97 deaths of otherwise healthy infants who were found in unsafe sleep positions at the time of death, with the exception of one infant who was found in low risk circumstances (CFRP, 2009). Despite knowledge of the infant health disparities, confounders to the infant mortality gap in St. Louis have not been clarified. Researchers such as Blabey and Gessner (2009) and David and Collins (2007) identified high rates of poverty, political influences, historical context, culturally appropriate health care services, and limited health care access, as well as other socioeconomic factors, as potential reasons for infant health disparities.

Theories Affecting Health Choices

Although the Back to Sleep program has been in practice since 1994, parents in urban environments continue to place their infants in the prone position at least some of the time (Colson et al, 2001, Carlins & Colins, 2007). The Back to Sleep program has been least effective in changing behavior in the impoverished, urban population (Moon et al., 2004). There is not a model or learning theory that can explain or predict all aspects of health behavior. Russell and Champion (1996) studied health beliefs, social influence, and home child-proofing in low-income mothers using the health belief model (HBM) as the framework for study. Russell and Champion (1996) found that a woman's perception of her ability to execute the behavior was the strongest predictor of injury prevention behavior. Mothers with high perceptions of ability to provide safety for their children were more likely to carry out injury prevention initiatives to eliminate hazards (Russell & Champion, 1996).

Conversely, the greatest barriers to providing safety measures correlated with hazard accessibility and frequency (Russell & Champion, 1996). Building on Russell and Champion's findings, the HBM can be used to explain social-behavioral strategies related to a caregiver's compliance with infant safe sleep practices.

According to the HBM, four conditions predict and explain health behaviors. These include the person's belief that his or her health is in jeopardy, that there potentially is a dire outcome, that the benefits of the recommended behavior outweigh the costs and inconvenience and are easily attainable, and the need to take action (Harrison, Mullen, & Green, 1992). When using this model, parents have to see that there is a potential problem with their baby sleeping in the prone position, that the 'fix' for the potential injury is within their reach, and that they have a responsibility as parents to take action (Champion, 1984). African American parents often report

being instructed to place their infants in the prone position while in the hospital after delivery and may be less likely to receive adequate instruction during prenatal visits from their physician or practitioner (Pollack & Frohna, 2002). It is important that parents receive appropriate counseling regarding safe sleep positioning in a variety of verbal and written formats to formulate safe or change unsafe infant sleep practices (Moon, Biliter, & Croskell, 2001).

The HBM acknowledges that individuals have perceptions that determine their HBM likelihood of experiencing a condition that would adversely affect one's safety (Glanz, Rimer, & Lewis, 2002). Perceptions may vary from the low end of the spectrum where parents deny the existence of problems pertaining to their infant's safety to the high end of the spectrum where individuals feel there is the real danger of possible injury (Harrison et al., 1992). Barriers relating to infant safe sleep practices may be perceived as inconvenient, expensive, or unpleasant. Because of variances in perceived levels of threat for the possibility of injury to his/her infant, there needs to be a range of instructional approaches. These include provision of specific educational material, inclusion of champions within communities, and removal of barriers to taking action (Glanz, Rimer, & Lewis, 1997). Threats to be addressed include health values, including interest and concern about health, health beliefs about vulnerability to a health threat, and beliefs about the consequences of the health problem (Harrison et al., 1992).

According to the HBM framework, demographic, socio-psychological, and structural variables are often modifiable factors that may impact an individual's perception of susceptibility and severity of risk factors. They may also impede the parent's decision to take a recommended action (Russel & Champion, 1996; Carpenter, 2010). The HBM was used to provide an organizing framework for describing potential barriers found in communities that prevent caregivers from taking action to provide infant safe sleep practices. Other models used to study

potential barriers to safe sleep practices include the ecological model (Parvanta, Maibach, Arkin, Nelson, & Woodward, 2002), and the triple risk model (Esposito, Hegyi, & Ostfeld, 2007). To date, there has not been a study about sleep-related death that exclusively uses the HBM.

Populations at Risk

Poverty places populations at risk for conditions relating to worsening health, including increased infant mortality. Despite progress in the reduction of infant mortality in the 20th century, low socioeconomic groups remain at a disadvantage for infants to survive their first years of life (Goza, Stockwell, & Balistren, 2004; Kitsantas & Gaffney, 2010). Factors associated with the increase in infant mortality include environmental, social, and behavioral parallels of poverty, and fiscal aspects that determine choices of residency (Hogue & Hargraves, 1993). Populations of poor African Americans have a tendency to live in highly concentrated areas with great poverty, while their Caucasian counterparts live dispersed throughout non-deprived areas (Williams & Collins, 2001; Hearst, Oakes, & Johnson, 2008).

Poverty is often generalized as the primary cause of socioeconomic differences in infant mortality (Hearst, Oakes, & Johnson, 2008). The challenge for assessing disparities in infant mortality and unintentional suffocation is not simply to record the disparities, but to attempt to explain why they are present when there have been significant reductions in the absolute levels of infant mortality due to SIDS and unintentional suffocation (Wise, 2003). Attempts have been made to detach poverty and health by eradicating poverty, providing free high-quality health care, and by eliminating high risk behaviors such as smoking, teenage parenting, and multiparity (Hogue & Hargraves, 1993; Hearst, Oakes, & Johnson, 2008). Several multilevel modeling (MLM) techniques have been utilized to establish the relationship between the importance of individual and community level attributes and infant mortality outcomes (Masi, Kawkley,

Piotrowski, & Pickett, 2007). Masi et al. (2007) used multilevel analyses to model pregnancy outcomes as a function of individual and census tract characteristics. They concluded that group density was associated with infant birth weight and health issues during the first year of life (Masi et al., 2007). LaVeist (1989), Polednak (1996), and Singh and Kogan (2008) cite possible reasons for higher African American infant mortality in highly segregated areas that include lower level quality housing, reduced city services, and poor transportation. Socioeconomics of the population in combination with racial residential segregation was researched with the results of no statistical significance, which surprised both the researchers and this author (Hearst et al., 2008).

SIDS and unintentional suffocation among African Americans have been recognized as a social inequality for decades. Sleep-related infant morbidity and mortality risk factors as well as the extent to which the risk factors are present in the population lead to health outcomes that may be described by determinants of infant unintentional suffocation (Burnett & Adler, 2009). Risk factors directly related to high infant death rates due to SIDS or unintentional suffocation includes non-Caucasian ethnicity, single parenthood, low educational attainment, and poverty (Hoffman & Hillman, 1992). The greatest apparent risk is a lack of education. Women with more education experienced a more substantial decline in infant deaths due to SIDS as compared to women with less education (Pickett, Luo, & Lauderdale, 2005). Not only are there apparent risk factors, there is also a tendency among African Americans living in the inner city to place their infants in the prone position to sleep (Colson, Bergman, Shapiro, & Leventhal, 2001). A correlation exists between the initiation of evidence based strategies to decrease the risk of SIDS and the slow adaptation of those practices among those with lower socioeconomic status (Kemp, Harris, & Chavez, 2006).

Causative Mechanisms of Infant Unintentional Suffocation

Unsafe sleep practices increase the risk of unintentional infant suffocation. Kemp et al. (2000) conducted a 4 year retrospective death-scene analysis with regards to unsafe sleep practices involving infants dying suddenly and unexpectedly. As is in earlier studies (Drago & Dannenberg, 1999, Gibert-Barness et al. 1991; Nakamura, Wind, & Danello, 1999; Smialek, Smialek, & Spitz, 1977; Sturner, 1971), Kemp et al. found that infant deaths previously diagnosed as SIDS had similar characteristics of infants dying from unsafe sleeping practices, including entrapment by bedding or sleep surfaces, involvement of adult beds and couches, and involvement of overlying by a bedmate. Even though there is strong evidence of risks factors associated with sleep practices, there continues to be abundant diagnoses of SIDS as the cause of death. With the inclusion of cause of death undetermined, the diagnoses of SIDS and accidental or unintentional suffocation have many overlapping traits. These overlapping diagnoses give rise to concern that some infant deaths diagnosed as SIDS in recent years were by accidental suffocation or were by undetermined causes (Kemp et al., 2006).

Defining SIDS and unintentional suffocation strategies that interrupt the causal pathway by dissemination of information is an important first step in reducing infant deaths (Willinger, Ko, Hoffman, Kessler, &Corwin, 2000). Willinger et al., Hauck et al (2002), and Hearst et al. (2008) all suggested that economic differences and proximal risk factors such as marital status, parity, and maternal age influenced infant sleep position choice. Willinger et al. recognized the positive influence of medical direction for infant sleep positioning, but none of the studies exclusively examine combinations of socioeconomic characteristics that may be linked to unsafe sleep practices. Multiple researchers have evaluated the occurrence of unintentional suffocation in low socioeconomic populations (Brenner et al., 2003; Kemp et al., 2000; Rasinksi, Kuby,

Bzdusek, Silvestri, & Weese-Mayer, 2003). Only one has compared the risk of suffocation of infants sleeping in cribs, on adult beds, and on other sleep surfaces (Scheers, Rutherford, & Kemp, 2003).

Risk Variables

Using the search strategy described previously in this chapter, research pertaining to maternal age, race, maternal level of education, poverty level, parity, and maternal smoking with regard to infant mortality will be reviewed. Though disparity and societal inequity are a social phenomenon, infant death remains a biological event (Wise, 2003). Ecosocial models of health that describe both biological and social influences as described by Hogue and Vasquez (2002) and Krieger (2000) were reviewed to assist in the analysis of disparate infant mortality. Infant mortality in the United States has decreased, especially over the past four decades. Despite reductions in overall infant mortality, persistent disparity remains between African American and Caucasian infants (Krieger, 2000). Over the past two decades, the steady progress made to decrease infant mortality has stalled in the United States at 6.71/1000 live births, falling short of the Healthy People 2010 goal of 4.5/1000 live births (Kitsantas & Gaffney, 2010).

In attempts to understand overall infant mortality disparities, Hessol and Fuentes-Afflick (2005) and Kitsantas (2008) examined characteristics associated with causes for infant deaths in California and North Carolina respectively. They concluded that there were few differences in neonatal mortality, but increased risks among African American infants for postneonatal death that included younger maternal age, lower educational levels, being unmarried and unintentional suffocation or SIDS related deaths (Hessol et al., 2005).

Kemp et al. (2000) and Vemulapalli et al. (2004) conducted similar studies in St. Louis to determine if factors could be identified for racial disparities pertaining to infant unintentional

suffocation. Between the years 2000 and 2010 in St. Louis, MO, there has been a gradual decrease in infant death rates related to SIDS and unintentional suffocation. During this period, there were 29 Caucasian infant sleep-related deaths (rate of 71.6 per 100,000) compared to 149 African American infant sleep-related deaths (rate of 195.9 per 100,000) (Kitsantas & Gaffney, 2010). The most prevalent factors found by both Kemp et al. and Vemulapalli et al. were bedsharing and unsafe sleep surfaces. In these two studies, neither group analyzed predictors such as maternal education, marital status, maternal age, or parity as confounders to bedsharing or unsafe sleep practices. The difference between the existing studies and the proposed study is that the latter will exclusively use data from St. Louis, which has been determined to be a high risk area for African American infant mortality (St. Louis FIMR, 2007).

Poverty Level

Environmental factors such as poverty are the primary causes of post neonatal mortality (Pharoah & Morris, 1979). SIDS and unintentional suffocation exemplify causes of infant mortality that are largely due to environmental and behavioral factors. In 2006, Hunt and Hauck wrote a review of findings related to SIDS and unintentional suffocation in which they described both physiologic and environmental risk factors. They reported substantiated evidence of genetic risk factors which in combination with often modifiable environmental factors may be of critical importance when establishing an infant's actual risk of SIDS (Hunt & Hauck, 2006). Hunt and Hauck described poverty as a depository of sociodemographic factors that increase racial disparity with regards to SIDS and unintentional suffocation. They concluded that disparity may be related to concentrated poverty with associated environmental risk factors found in communities with high infant mortality incidence (Hunt & Hauck, 2006).

In a similar study, Malloy and Eschbach (2007) described the association of poverty with SIDS in metropolitan counties in the United States between 1990 and 2000. The objective of their analysis was to examine the ecologic relationship between SIDS and poverty by examining populations in all United States counties that were below federal poverty levels according to census data by race for 1990 and 2000 (Malloy & Eschbach, 2007).

Race

Hauck et al. conducted a comprehensive case-control study of SIDS in Chicago. They found the rate of SIDS and infant unintentional suffocation among African Americans to be twice the rate of Caucasians (Hauck et al. 2002). The study assessed the high risk African American population for risk factors associated with SIDS and infant safe sleep practices. Its goal was to reduce the gap in knowledge by establishing the role of unsafe infant sleep practices such as sleeping in the prone position as well as other risk factors such as parental employment, poverty level, parental education, marital status, and maternal age (Hauck et al., 2002). In 1991the Chicago SIDS rate was 2.6 deaths per thousand live births, compared with the US rate of 1.3 deaths per thousand live births. Additionally, the rate of African American was 4.0 deaths per thousand live births (Hauck et al., 2002). Of the 469 infants who met the study inclusion criteria of sudden death before 1 year of age, 260 were determine to have died from SIDS. Of these 260 deaths, the 75% (n=195) that were African American became the focus of the study.

Socioeconomic and demographic characteristics of the inclusion infants were the majority of the deaths occurring by 4 months of age, cold weather predominance, single marital status, high levels of poverty, high parity, and low levels of education (Hauck et al., 2002). The authors concluded that the prone sleeping position in the African American population in combination with other demographic characteristics explained the higher SIDS rates in Chicago.

They went on to say that it was likely that the results could be generalized to SIDS rates found in comparable populations elsewhere (Hauck et al., 2002).

In a similar study conducted in St. Louis between 1994 and 1997, Unger et al. (2003) studied racial disparity and modifiable risk factors in the African American population. The objective of the Unger et al. was to compare SIDS death rates as well as well as the prevalence of unsafe sleep practices at the time of the infant's death. Unger et al. hypothesized that there was a large racial disparity in modifiable risk factors at the time of the deaths that through public awareness could lead to improved intervention strategies. The study was a retrospective population-based study of death scene and medical examiners' investigations of deaths in St. Louis City and County between January 1, 1994 and December 31, 1997. Unger et al. (2003) observed that there was not a difference between African American and Caucasian infants position at the time of death. They concluded that the significant difference was that more African American infants died while bedsharing, creating a need for public health information to be tailored to emphasize the risks of bedsharing as well as promoting the avoidance of the prone position for infant sleep (Unger et al., 2003).

Maternal Level of Education

Maternal level of education is a risk factor that is often described in tandem with race in infant mortality research. Byrd et al. (2007) conducted a regression analysis of relative risks of infant mortality (African American vs. Caucasian). They examined relationships between infant mortality and selected risk factors which included infant mortality as the dependent variable and maternal age, maternal education, and marital status as independent variables. Byrd et al. analyzed data that used only African American women who were less than 20 years old and had less than a high school education. Byrd et al. found that the second cause of death in their

selected Wisconsin population was SIDS and unintentional suffocation with African American infants having a five-fold greater risk compared to Caucasian infants. After further analysis, Byrd et al. (2007) reported a significant interaction between education and race with disparity depending on the mother's education level. The authors found African American women with less than a high school education were 1.4 times more likely to experience an infant death compared to Caucasian women with the same education (Byrd et al., 2007). A surprising fact that they discovered was that African American women with a college education had a three-fold greater risk of infant death compared with college educated Caucasian women (Byrd et al., 2007).

Kitsantas and Gaffney (2010) analyzed linked birth/death records for the period 1999-2007. They developed logistic regression models to estimate the effect of maternal and infant characteristics on infant mortality. As in the research conducted by Byrd et al. (2007), the dependent variable was infant death. The independent variables included maternal race/ethnicity, maternal age, maternal education, marital status, prenatal care, parity, tobacco use, and several other maternal medical variables (Kitsantas & Gaffney, 2010). Similar to the findings of Byrd et al., there were higher levels of infant deaths associated with SIDS in the African American population that related to younger maternal age and lower educational levels. In this study, results were similar to those of the Caucasian population, but higher than the Hispanic population.

The overall infant death rate related to SIDS and unintentional suffocation occurred among women with lower education twice as often than among women with a high school education (Kitsantas & Gaffney, 2010). These data were then merged with US Vital Statistics Linked Birth and Infant Death Certificate data (Malloy & Eschbach, 2007). Malloy and

Eschbach analyzed the relationship between cause of postneonatal mortality including SIDS and SUID using codes of the International Classification of Disease (ICD) versions 9 and 10. Poverty index was divided into quartiles by race. Using logistic regression, strength of association between the poverty quartile and the cause of postneonatal mortality was analyzed (Malloy & Eschbach, 2007). The results of their analysis demonstrated a significant relationship between the degree of poverty and the risk of SIDS and SUDI with 57% of SIDS deaths occurring in the two most impoverished in 1990 and 60% in 2000 (Malloy & Eschbach, 2007). They concluded that the majority of the SIDS cases in the United States occur in impoverished counties. Furthermore, they postulated that poverty is a cause for diminished supportive parenting that may be intergenerational in nature causing impoverished mothers to pass along poor parenting techniques to which they were exposed (Malloy & Eschbach, 2007).

Parity

Parity is the number of times that a mother has given birth to a fetus with a gestational age of more than 24 weeks, regardless of whether the child was born alive or stillborn (Opara & Zaidi, 2007). Parity is a potentially confounding sociodemographic factor associated with SIDS that has no research entirely dedicated to its contribution to SIDS though it is mentioned frequently (Hauck et al., 2003; Malloy & Eschbach, 2007; Wise, 2003). Hauck et al. (2003) described increased risk for SIDS related to parity with a confidence interval (CI) of 95% and an odds ratio (OR) ranging between 0.8 and 2.3 with 2 children to an OR of between 1.6 and 4.0 with 4 or more children.

The Present Study in Relation to Other Studies

Caregiver socioeconomic status impacts knowledge, attitudes, and beliefs about infant safe sleep practices. Research reviewed for this study had varying conclusions about the primary

causes of racial disparity with regard to unintentional suffocation and SIDS. Pharoah and Morris (1979) concluded that environmental factors such as poverty are the primary causes of postneonatal mortality. Hauck et al. (2002) conducted the Chicago Infant Mortality Study, in which they agreed with Pharoah and Morris, but added in further factors affecting infant mortality such as race, maternal education, and the number of children born by the mother. Hauck et al. concluded that rates of SIDS and infant unintentional suffocation are more than twice as high among African Americans compared with Caucasians. This conclusion is generalizable to urban populations outside of Chicago. A goal of the Chicago Infant Mortality Study, as well as a goal of this current research, was to evaluate socioeconomic factors affecting infant safe sleep practices among low income African American families (Hauck et al., 2002). I conducted the current research on a previously understudied population in St. Louis MO using matched birth and death certificates and a regression analysis to determine how variables such as race, poverty, maternal education, and parity affect caregiver infant safe sleep choices. This information will be used as an evidence base for educational materials and programming specific to the St. Louis population.

Literature Related to Secondary Data Collection Methodologies

With recent increases in technological ability to capture and store vast amounts of data, there are large existing data sets available to researchers (Magee, Lee, Giuliano, & Munro, 2006). Secondary data analysis (SDA) uses existing data to research different questions using different methodologies than were originally investigated by the primary investigator who initiated the data collection (Dolan & Froelicher, 2009). Data used for SDA has to meet the same criteria for threats to validity, reliability, and generalizability as in primary data collection (Magee et al., 2006). Methods used to collect data, quality and selection of the data, and lack of

control of the researcher may be disadvantages of using secondary data that make the data unfeasible (Sorensen, Sabroe, & Olsen, 1996). Theoretical frameworks, conceptual models, and strategies to minimize error in SDA are reviewed in this section.

Use of Secondary Data

Researchers such as Bassani, Padoin, and Veldhuzen (2008), Levac, DeMatteo, Hanna, and Wishart (2008), and Russell (1998) used secondary data sets to describe aspects of pediatric injury research. Russell's secondary data were a subset of mothers from data collected in the 1991 Longitudinal Follow-Up to the 1988 National Maternal and Infant Health Survey. Data were collected through contact with the participant's health care providers and from abstraction from the children's medical records after determining eligible participants for this study (Russell, 1998).

Levac et al. (2008) used a secondary data analysis of a longitudinal cohort study design for their research. In this study, mixed effects modeling was used to evaluate intraindividual variability, which they defined as the intra-individual standard deviation of residuals around the recovery line (Levac et al., 2008). They concluded that less intra-individual variability related to recovery is predictive of better health outcomes (Levac et al., 2008).

Bassani et al. (2008) combined information from the Mental Health and Well Being Component of the Canadian Community Health Survey (CCHS) with Canadian Census data to predict the size of the population of children exposed as children of parents with psychiatric disorders (PPD). This study manipulated the known data using three techniques. After exhausting calculations, they concluded that there are massive limitations to the techniques that they developed and only encouraged using the methods with extreme caution.

Though these research examples utilized different techniques with secondary data, they have common design limitations. Use of existing data sets to produce different knowledge than what it was originally intended necessitates conceptual matching between the primary data set and the secondary analysis to ensure rigor of the outcomes (Magee, et al., 2006). The majority of research methods assume that the research design is developed prior to establishing research questions (Froelicher, 2009). Fawcett (2004) emphasizes that research using secondary data begin as in most research by using a hierarchical structure that includes a conceptual model, a theory, and an empirical research method. Berger and Berger (2004) go on to say that secondary data ought to have the same rigorous design as other studies, including use of a hypothesis and estimation of sample size to achieve valid results.

Birth records are collected with each birth in Missouri. They provide a cross-sectional observation of the entire population of births. These data can be queried for specific periods of interest. I will use the data from 2005 through 2009. Death investigations within 24 hours of the infant's death are mandatory occurrences in Missouri for children under 1 year of age. The data from these 2 sets can be linked as were the data sets illustrated in the research of Bassani et al. (2008). The population of infant deaths resulting from unsafe sleep practices will be compared to the population of live births for the same time period. It is my goal to evaluate the impact of the variables race, poverty, maternal education and parity on infant sleep position using matched birth and death investigation records. Though these data have been collected in the 2 data sets, analysis has not been done using regression analysis techniques for modeling and analyzing the variables to focus on the relationship between the dependent variable (infant death) and one or more independent variables (race, poverty, maternal education and parity).

Strategies to Minimize Error in SDA

As with primary data, there are issues associated with use of secondary data. The researcher using secondary data has no control over the quality of collection of the original data. For this reason, reliable data sets have to be used such as those from the department of health, the CDC, and the National Center for Health Statistics. Knowledge of the reliability of the data that is to be analyzed from specific sources is important for the identification of potential bias, errors, or problems with internal or external validity (Lockwood, 2006).

Most logistic regression analyses rely on the method of least squares for the estimation of parameters for analysis that have specifically constructed assumptions (Muthukrishnan & Radha, 2010). When there are outliers in the data, computation of least squares may result in parameter estimates that are not useful for the majority of the data. To reduce the minimize error in secondary analyses, it may be useful to use robust regression analysis such as M-estimators to assist in the detection of outliers, and to produce reliable results in the presence of outliers (Muthukrishnan, & Radha, 2010). Muthukrishnan and Radha went on to say that M-estimators are not affected by outliers, but are almost the same as least squares in normal situations with few outliers.

Literature Related to Case-Control Study Designs

Case-control studies use an analytical observational research design to recognize cases (with) and controls (without) for an outcome of interest in existing data (Morrow, 2010). Because case-control studies are performed by analyzing existing data, they are referred to as retrospective studies. Their main interest is exploring the etiology of the outcome rather than the treatment (Crawford, Garthwaite, & Porter, 2010). Some of the advantages of using a case-control design are that they can provide information in a relatively short period of time, are

straightforward to conduct, and are relatively inexpensive (Greenland, Watson, & Neutra, 1981). The design is useful when the outcome is rare, such as infant sleep-related death (Mann, 2003). The case-control design is capable of generating large amounts of useful data using few cases (Morrow, 2010). Further statistical analysis and methodology will be described in chapter 3.

Summary

The studies presented in this literature review suggest a positive relationship between socioeconomic factors and sleep-related infant deaths as evidenced in epidemiological investigation. The literature demonstrated the relationship between socioeconomic factors that are frequently present in urban infant sleep-related deaths. The literature also described the previous research on commonalities found on racial disparities related to infant sleep-related deaths and discussed the gaps in this research. Regardless of the fact that socioeconomic factors have been established as contributors to sleep-related infant deaths, researchers need to know more about the nature and scope of the contributors that lead to racial disparity regarding infant deaths (Pressley et al., 2007; Unger et al., 2003). This literature review has summarized areas of existing knowledge concerning sleep-related deaths and established the need for additional research.

Chapter 3 presents comprehensive information on the methods used in this study. This includes presentation of the research questions and null and alternative hypotheses. The chapter then discusses the research design and sampling approach. The chapter also provides an explanation of the statistical tests and analytical methods as well as the procedures used to protect human subjects.

Chapter 3: Research Method

Introduction

The literature review highlighted evidence of variables that affect parental choices for infant safe sleep. The goal of examining these variables was to determine if there is a relationship between specific socioeconomic variables and sleep-related infant deaths. With this quantitative case-control study, I sought to determine if there are differences between the population of infants who died in their first year of life and the population of infants who lived. The independent variables were race, poverty, parity, and maternal education. The outcome of interest was sleep-related death. The dependent variable was infant death during the first year of life due to SIDS, unintentional suffocation, or reason for death listed as undetermined. Matched birth/death data were coded according to *International Statistical Classification of Diseases and Related Health* Problems, Tenth Revision (ICD-10) (WHO, 2006). Code R95 was used for SIDS. Code W75 was used for accidental suffocation or strangulation in bed involving linens, caregiver's body, or pillow/mattress (WHO, 2006). Codes R96-99 were used for death for which no cause could be discovered (WHO, 2006).

This chapter focuses on methodological issues found in a non-experimental, nonrandomized case-control design. I discuss design and approach, setting and sample, inclusion and exclusion criteria, instrumentation, reliability and validity, variables, and data collection and analysis. I describe the research design and its appropriateness to the problem statement in this chapter. Additionally, I present the method of sampling as well as the data collection instrument. Lastly, I discuss the analysis.

Research Design and Approach

This case-control study used a quantitative, non-experimental design that examined secondary data collected by the Missouri Department of Health and Senior Services from January 1, 2005 through December 31, 2009. I designed this study to determine if a relationship exists between poverty, race, maternal education level, parity (independent variables), and infant sleep-related deaths (dependent variable). Because there was no manipulation of variables, a non-experimental design was appropriate. Because this observational study compared cases with the outcome of death to cases where there was no death, a case-control study was appropriate. The same independent variables were used in the analysis of the infant death cases and the non-death cases. Once the separate analyses were complete, I compared the two. Since I had no control over the original data collection, the study falls into the category of observational studies using secondary data analysis (Schulz & Grimes, 2005). Because the data being analyzed was categorical, the technique of choice was logistic regression. I used the analysis to establish which independent variables affected the dependent variable to determine if there are characteristics specific to the death cases that are not prevalent in the non-death cases (Munro, 2005).

Setting and Sample

Setting

There were two study populations. The study population of all mothers of infants younger than age 1 year who resided in St. Louis, MO at the time of the infant's birth and whose infants died in St. Louis between January 1, 2005 and December 31, 2009 was included as the case set in the analysis. Because I analyzed the entire population within the sampling frame, the data did not reflect any type of sampling techniques. The control population was a systematic

sampling of all mothers who resided in St. Louis at the time of the infant's birth and whose infants lived passed their first year. I analyzed this second population using random sampling methodology to gather a similar number of birth records from the same time period. This large data set was based on a sample of the general Missouri population, potentially increasing its value for generalizability to populations with similar traits. The sampling frame encompassed January 1, 2005 through December 31, 2009. The source for both data sets was the Missouri DHSS. The Missouri DHSS institutional review board (IRB) requirements were satisfied to obtain de-identified data. The criteria for infant death were identified by ICD-10 underlying cause of death codes R95, R99, W75-77, and W81-84.

The size of the control set was dependent upon the size of the birth/death population. I analyzed one control for every case. I selected cases beginning on January 1, 2005, then selected every k^{th} element onwards, when k=(live population/birth death population). This method produced a probability sampling in which every unit had an equal chance of being sampled, which assisted in producing an unbiased population (Smith, 1993).

Sample Size and Power Calculations

I used a census for the test group because the study population is small (estimated to be less than 200). Use of a census eliminates sampling error and provides analysis of the data for all of the individuals in the target population. I used a random sampling for the control group to assemble a similarly sized sample as the test population.

Inclusion and Exclusion Criteria

All mothers of infants who resided in St. Louis, MO at the time of the infant's birth and whose infants died in St. Louis between January 1, 2005 and December 31, 2009 were included as the case set in the analysis:

- The infant must have lived in St. Louis, Missouri at the time of death.
- The cause of the infant's death must have been unexpected, such as in the case of SIDS, unintentional suffocation, or 'undetermined'.
- The infant must have been under the age of 1 year at the time of death and with no known health risks.

I chose controls included in this study randomly from the Missouri Department of Health birth data base and included all infants who resided in St. Louis, MO at the time of the infant's birth between January 1, 2005 and December 31, 2009.

Because it is mandatory for the medical examiner to investigate all infant deaths, all deaths have been reported to and recorded by the DHSS. The significance of sampling specifically from St. Louis is the uniformity of death investigation and reporting. When a death occurs in St. Louis, trained death investigators are sent to the site of death to observe the circumstances surrounding the event. Other areas of the state lack medical examiners. These areas often depend on coroners with varying degrees of training to determine the cause of death

Instrumentation and Materials

The Missouri DHSS used standardized birth and death certificates to collect birth and death data. These instruments were not designed for this study. The death certificate is a standardized form used by the St. Louis Medical Examiner (Appendix B). The Medical Examiner's office is responsible for reviewing all deaths occurring as a result of unusual or suspicious circumstances as well as for certain deaths which by law fall under its jurisdiction. By Missouri law, deaths following specific circumstances and categories have to be reported to the medical examiner, including all deaths of children younger than age 18 years (RSMo 58.720). Even though deaths in this category have to be reported, it is up to the medical

examiner and the medico-legal death investigators to determine if the case warrants investigation. Detailed training is provided to death scene investigators so that the recorded observations of the death scene, in addition to the autopsy, provide great detail that might aid the medical examiner in determining the cause of death. The data for this study were extracted by the Missouri DOH prior to its release as defined in my Abstract of Protocol agreement (Appendix D). The data subset values are illustrated in Appendix C.

Reliability and Validity

The birth and death certificates currently used by the Missouri DHSS were generated by the U.S. National Center for Health Statistics (National Center for Health Statistics [NCHS], 2001). The most recent revision occurred in 2003 (NCHS, 2001). Use of the standardized certificates provides uniformity for data collection for national vital statistics. The NCHS assures that the standardized certificates meet current needs by periodic reviews and revisions that occur on a 10-15 year cycle (NCHS, 2001). The data collected on the certificates are only as reliable as the persons providing and collecting the data. A well-trained interviewer is integral to the quality of data collected (Trochim, 2001).

The St. Louis Medical Examiner's office requires that death investigators complete a comprehensive training program prior to death scene examination and data collection. By Missouri law, all deaths of children younger than 18 years have to be reviewed by a Child Fatality Review Program panel (Kemp et al., 2000). Death reviews and quality assurance meetings are held each month (Kemp et al., 2000). Formal training is required for birthing center personnel to complete birth certificate data collection. Data pertaining to infants born outside of birthing facilities may require oversight from medical facilities to assure that the data collection is complete.

Variables

Race

This variable on the birth certificate pertains to the mother. It is self-reported by the client and recorded by the birthing hospital. There are seven choices listed on the instrument: White Not Hispanic, Black Not Hispanic, Hispanic, Asian/Pacific Islander, American Native, Other, and Undetermined.

Poverty

This variable is not labeled as poverty on the birth certificate but is implied by the self-reported receipt of the WIC and/or Food Stamp programs. The Missouri WIC guidelines are exhibited in Table 1 (DHSS, 2011). Eligibility criteria for the Food Stamp program is a net income limit for a family of 3 of $16, 608 or a gross income limit of $21, 588 (National Center for Children in Poverty 2010). This is a yes/no variable.

Maternal Level of Education

This variable is listed as a finite number on the birth certificate in the maternal education category as indicated by the last year of school completed.

Parity

This variable is not recorded as parity on the birth certificate, but is the total number of children from the *Now living* and *Now dead* categories.

Table 1

Missouri WIC Income Guidelines April 1, 2011 thru March 31, 2012

Family size	Annual income	Monthly income	Weekly income
1	$20,214	$1,679	$388
2	$27,214	$2,268	$524
3	$34,281	$2.857	$660

4	$41,415	$3,446	$796
5	$48,415	$4,035	$932
6	$55,482	$4,624	$1,067

Note: Data from Missouri DHSS (2011).

Data Collection and Analysis

The study investigated data collected by the Missouri DHSS over a 5-year period from 2005 through 2009. Even though data were available for 2010, the DHSS changed its formatting for data collection in 2010. I selected to use the 2005 through 2009 period to assure congruous data. The sampling frame included all records for infant deaths that occurred in St. Louis, Missouri between January 1, 2005 and December 31, 2009. I analyzed data obtained from the DHSS matched birth/death records and from birth records of children who lived through their first year of life. The DHSS de-identified all data used for this research. Data available on the Missouri birth certificate are listed in Appendix A. Data available on the Missouri death certificate are listed in Appendix B.

I collected information for this study from DHSS Excel spreadsheets. Only data requested by the research was provided by the DHSS. All data provided by the DHSS was de-identified by the DHSS prior to the DHSS sending them to the researcher. I generated descriptive statistics for each variable. I used the variables that were described in Chapter 1 as well as earlier in this chapter. I used a logistic regression model so that the dependent variable (infant death) was expressed as a combination of the independent variables (race, poverty, parity, maternal education). I incorporated a normality test in the testing to demonstrate the distribution of the variables. I completed a frequency distribution histogram using the variables under analysis. Because the dependent variable was categorical, I used a logistic regression to

determine statistical characteristics between the 4 study variables. I used the analysis to establish which independent variables affected the dependent variable (Munro, 2005). I estimated the likelihood of the outcome being present as a measure of association by approximating how likely (or unlikely) it is for the outcome to occur under specific conditions (Munro, 2005). Logistic regression does not assume that there is a linear relationship between the independent and dependent variables. I used the chi-square test to determine if there is a significant relationship between the categorical independent variables. I performed a cross tabulation to determine the frequency with which the variables occur together. I analyzed the two data sets (infants who died within the first year of life and infants who lived past their first year of life) independently for comparison.

I used standard (forced entry) logistic regression to analyze the research questions. Regression analysis was predictive of the relationship between the independent and dependent variables (Nievergelt, 1994). The use of logistic regression is appropriate to analyze statistically significant characterization between multiple variables (Shuttleworth, 2008). Each of the variables used in this study resulted from the birth certificate questionnaire that provided quantitative, categorical results.

SPSS version 12 was used to perform the logistic regression analysis. Missing data were accounted for by the use of the SPSS option "missing cases pairwise." Because the data were de-identified, correction or imputations of discrepant data were not an option. Data used for this research were compiled by the Missouri DHSS, which included data that comprised the research questions (race, parity, education level, and poverty).

Research Question 1

Research Question 1: Is there a relationship between the level of poverty of the mother and infant sleep-related deaths?

H_{01}: There is no statistical significance in the relationship between the level of poverty of the mother and infant sleep-related deaths.

H_{a1}: There is a statistical significance in the relationship between the level of poverty of the mother and infant sleep-related deaths.

Research question 1 explored whether there was a relationship between the poverty level of the infant's mother (independent variable) and infant sleep-related deaths (dependent variable) as measured by the chi-square statistic, which analyzed degrees of freedom to determine if there was significance. I examined expected and observed values to determine which categories contributed to the significance of the test. Poverty was determined using recorded observations taken from birth records in which the mother indicated that she was a recipient of WIC or enrolled in the food stamp program. In addition to the chi-square analysis, a regression analysis was conducted in order to determine how well the poverty of the mother predicted sleep-related deaths.

Research Question 2

Research Question 2: Is there a relationship between the race of the mother and infant sleep-related deaths?

H_{02}: There is no statistical significance in the relationship between the race of the mother and infant sleep-related deaths.

H_{a2}: There is a statistical significance in the relationship between the race of the mother and infant sleep-related deaths.

Research question 2 explored whether there was a statistically significant relationship between the race of the infant's mother (independent variable) and infant sleep-related deaths (dependent variable) as measured by the chi-square statistic. *Race* was determined using recorded observations taken from birth records in which the mother indicated her race (Appendix A). A regression analysis was conducted to determine whether the race of the mother predicted sleep-related deaths.

Research Question 3

Research Question 3: Is there a relationship between the level of education of the mother and infant sleep-related deaths?

$H_{03:}$ There is no statistical significance in the relationship between the level of education of the mother and infant sleep-related deaths.

$H_{a3:}$ There is a statistical significance in the relationship between the level of education of the mother and infant sleep-related deaths.

Research question 3 explored whether there was a relationship between the levels of education of the mother (independent variable) and sleep-related infant deaths (dependent variable). *Level of maternal education* was the value retrieved from the infant's birth record. It was recorded as the number of school years completed by the mother. In order to determine which categories were statistically different, the expected and observed values were examined to determine which categories contribute to the significance of the test. Because the dependent variable was dichotomous and follows Bernoulli distribution, logistic regression was used.

Research Question 4

Research Question 4: Is there a relationship between the number of children born by the mother (parity) and infant sleep-related deaths?

$H_{04:}$ There is no statistical significance in the relationship between the number of children born by the mother (parity) and infant sleep-related deaths.

$H_{a4:}$ There is a statistical significance in the relationship between the number of children born by the mother (parity) and infant sleep-related deaths.

Research question 4 explored whether there was a relationship between the number of children born by the mother (parity) and infant sleep deaths. *Parity* was the recorded value of children the mother has born as recorded on the infant's birth certificate. These data were analyzed using logistic regression which is well suited for testing hypotheses between the categorical outcome variable infant death and the categorical predictor variable number of children.

Human Subjects Protection

This study used secondary data to examine socioeconomic characteristics of infant sleep-related deaths. The investigator had no direct contact with the infants or their mothers. Consequently, active informed consent for participation was not necessary. All data were housed on a password protected computer. To further protect the observed cases, the data were de-identified by the Missouri DOH prior to receipt by the researcher. Because of this precaution, no personally identifiable information, such as name or address, were coded for analysis. All paper data collection materials were secured in a locked location for the duration of the study and were locked in a secure location for five years after the completion of the research to allow for review and potential reproduction of the study. After receiving Missouri DOH approval, the project was submitted for approval through the Walden University's Institutional Review Board.

Summary

Chapter 3 explained the methodology that was used to evaluate the hypotheses and answer the research questions. Using logistic regression, this case-control study determined if there were relationships between the dependent variable (infant death) and the independent variables (race, poverty, maternal education, and parity). A chi square test was used to determine if there was a significant relationship between the independent variables. Additionally, a cross tabulation was performed to assess the frequency in which the variables occur together. This chapter also discussed the data source, research questions, hypotheses, data collection, validity and reliability, and data analysis information pertinent to this study. Chapters 4 and 5 present the results and conclusions.

Chapter 4: Results

Introduction

This chapter presents the study results to determine if there is a relationship between poverty, race, maternal education, parity, and infant sleep-related deaths in the African American population of St. Louis, MO. The study employed a quantitative, non-experimental case-control design that examined secondary data collected by the Missouri Department of Health and Senior Services from January 1, 2005 through December 31, 2009. The target population for this project was mothers of infants who had sleep-related deaths. To address this objective, I performed a statistical analysis of a database obtained from the Missouri DHSS of 26,211 mothers of infants younger than 1 year of age who resided in St. Louis at the time of their infant's birth. The database included information on the study's outcome variable (whether they had a sleep-related death) and on various demographic independent variables, such as the mother's race, whether she was married to the infant's father, whether she received food stamps, years of education, and parity.

I used two data approaches for this study. The case population was comprised of the entire population of infants who had sleep-related deaths within the study time frame. The control population was determined by a random sampling of the entire population of mothers of infants who were born within the study time frame and lived past their first year of life.

Chapter 4 is divided into three sections. The first section presents the descriptive data analysis of the whole dataset and of the random sample that was chosen for use in this study. This section includes frequency distributions for each of the variables. The second section includes the results of the chi-square analyses conducted for the 4 research questions. The final section includes the results of the logistic regression analysis. I conducted these analyses to

determine whether each of the independent variables (race, poverty, maternal education, parity) could be used to predict infant sleep-related deaths.

Descriptive Data Analysis

The dataset, collected between January 1, 2005 and December 31, 2009, included information on 26,211 individuals and represented all births recorded in St. Louis, MO for that time frame. The population of infant deaths was 55. I used a random sample for the control group (n=55). I presented frequency distributions to illustrate whether each of the groups or categories for each variable was represented equally in the data. Included in the distributions are the numbers of occurrences observed for each variable, as well as the percentages of occurrence for each of the categorical variables.

Poverty and Race

For this study, poverty indicators present on the birth certificates were Medicaid, WIC, and/or enrollment in the Food Stamp program. The majority of the represented population was recipients of WIC (54.8%). More than half of the population was enrolled in Medicaid (63.2%), and nearly half received food stamps (45.2%). Most of the observed population was African American (60.2%). The remaining population was 35.8% Caucasian and 3.9% various other ethnicities.

Table 2

Frequency Distribution of Poverty and Race Variables

Variable		Frequency	Percent
Medicaid	No	9518	36.8
	Yes	16366	63.2
WIC	No	11689	45.2
	Yes	14172	54.8
Food Stamps	No	11689	45.2
	Yes	14172	54.8

Race: African American	15789	60.2
Caucasian	9392	35.8

Note. *n*=26,211.

Parity and Maternal Education

Parity is not recorded on the birth certificate, but is the total number of children from the *Now living* and *Now dead* categories of the Birth Certificates. The average number of years of maternal education was 12.74 years.

Table 3

Descriptive Statistics of Parity and Years of Education

Variable	Min	Max	M	SD
Mother's education	1	17	12.74	2.562
Parity	1	15	2.20	1.496

Note. *n* = 26,211.

Table 4 presents descriptive statistics on years of education and parity by group. As demonstrated in this table, on average, mothers in the infant death group had slightly fewer years of education (*M* = 12.19 years vs. 12.53 years for the control group) and a slightly higher parity (*M* = 2.62 vs. 2.58 for the control group).

Table 4

Descriptive Statistics on Years of Education and Parity by Group

	Sleep-related Infant Death			
	No		Yes	
	M	SD	M	SD
Mother's Education	12.53	2.51	12.19	2.10
Parity	2.58	1.82	2.62	1.13

Note. *n*= 110.

The dataset included 55 mothers whose children had experienced sleep-related infant deaths. To conduct the following analyses, I randomly selected a sample of 55 other mothers (for a total of 110) from the dataset. Table 5 presents the frequencies of the individuals' demographic variables by group. Mothers in the "Infant Death" group were generally more likely to be enrolled in Medicaid and food stamp programs, more likely to receive WIC, and more likely to be African American (81.8% vs. 49.1% for the control group).

Table 5

Frequency Distribution of Demographic Variables by Group

		Sleep-related Infant Death			
		No		Yes	
Variable		Count	Column N %	Count	Column N %
Medicaid	No	18	32.7%	12	22.2%
	Yes	37	67.3%	42	77.8%
WIC	No	22	40.0%	15	27.8%
	Yes	33	60.0%	39	72.2%
Food Stamps	No	35	63.6%	18	33.3%
	Yes	20	36.4%	36	66.7%
Mother's Race	Black	27	49.1%	45	81.8%
	White	26	47.3%	9	16.4%
	Other	2	3.6%	1	1.8%

Note. n=110. The entire death population was included (n=55). A random sample (n=55) was collected from the population of infants who did not die in their first year of life.

There were no missing data in the independent data sets. Interestingly, the sample of mothers whose infants lived past their first year of life was nearly racially equal (49.1% African American vs. 47.3% Caucasian). In contrast, mothers of infants who died in their first year of life were primarily African American, the mean years of education was more than 12 years, and most of the mothers had 2 or 3 children at the time of the study.

Data Analysis

Research Question 1: Is there a relationship between the level of poverty of the mother and infant sleep-related deaths?

Results of Chi-Square Analysis of Poverty

For this analysis, I assumed a mother to be poor if she was a WIC recipient or enrolled in a food program. In order to test the null hypothesis *there is no relationship between the level of poverty of the mother and infant sleep-related deaths*, a chi-square analysis was conducted to compare the likelihood of infant death between poor and non-poor mothers. The significance level was set at .05. Results of the chi-squared analysis are presented in Table 6.

Table 6

Cross-Tabulation Analysis Between Poverty and Infant Death

		Sleep-related Infant Death	
Poverty		No	Yes
No	Count	17	7
	% within Poverty	70.8%	29.2%
Yes	Count	38	47
	% within Poverty	44.7%	55.3%

Note. Chi-squared (1) = 5.111, p = .024.

Table 6 indicates that 55.3% of the poor mothers experienced infant death, compared to 29.2% of non-poor mothers. This difference was statistically significant (chi-squared (1) = 5.111, p = .024). Therefore, based on this evidence, it is possible to reject the null hypothesis in favor of the alternative hypothesis that there is a statistical significance in the relationship between infant sleep-related deaths the level of poverty of the mother.

Research Question 2: Is there a relationship between the race of the mother and infant sleep-related deaths?

Results of Chi-Square Analysis of Race

In order to test the null hypothesis *there is no statistical significance in the relationship between the race of the mother and infant sleep-related deaths*, I conducted a chi-squared analysis to compare the likelihood of infant death to the mother's race. The significance level was set at .05. African American mothers had a higher likelihood of experiencing sleep-related infant death (62.5%) than Caucasian mothers (25.7%) or mothers of another ethnicity (33.3%). This difference was significant at the .05 level (chi-squared (2) = 13.090, p = .001). Table 7. It is possible to reject the null hypothesis in favor of the alternative hypothesis that there is a statistical significance in the relationship between the race of the mother and infant sleep-related deaths.

Table 7

Cross-Tabulation Analysis Between Mother's Race and Infant Death

		Sleep-related Infant Death	
Mother's Race		No	Yes
Black	Count	27	45
	% within Mother's Race	37.5%	62.5%
White	Count	26	9

	% within Mother's Race	74.3%	25.7%
Other	Count	2	1
	% within Mother's Race	66.7%	33.3%

Note. n= 110. chi-squared(2) = 13.090, p = .001.

Research Question 3: Is there a relationship between the level of education of the mother and infant sleep-related deaths?

Results of Binary Logistic Regression Analysis of Level of Maternal Education

I conducted a binary logistic regression to test the null hypothesis *there is no statistical significance in the relationship between the level of education of the mother and infant sleep-related deaths*. The dependent variable was whether the mother had experienced sleep-related infant death. The independent variable was the maternal number of years of education. The significance level was set at .05.

Table 8

Logistic Regression of Sleep-Related Infant Death on Mother's Education Level

Variable	B	S.E.	Sig.	OR
Years of Education	-.065	.084	.439	.937
Constant	.785	1.055	.457	2.191

Note. n=110. Chi-squared(1) = .604, p = .439.

The relationship between the mother's education level and the occurrence of infant death was not significant (p = .439). Therefore, it was not possible to reject the null hypothesis. This

suggests that the level of education of the mother is not associated with the likelihood of sleep-related infant death.

Research Question 4: Is there a relationship between the number of children born to the mother (parity) and infant sleep-related deaths?

Results of Binary Logistic Regression Analysis of Parity

In order to test the null hypothesis *there is no statistical significance in the relationship between the number of children born by the mother (parity) and infant sleep-related deaths*, I conducted a binary logistic regression. The dependent variable was whether the mother had experienced sleep-related infant death, and the independent variable was the mother's parity. The significance level was set at .05. Results of the logistic regression are presented in Table 9.

Table 9

Logistic Regression of Sleep-Related Infant Death on Mother's Parity

Variable	B	S.E.	Wald	Sig.	OR
Parity	.016	.127	.016	.899	1.016
Constant	-.042	.381	.012	.913	.959

Note. $n = 110$. Chi-squared (1) = .016, $p = .899$.

The relationship between the mother's parity and the occurrence of sleep-related infant death was not significant ($p = .899$). Therefore, it was not possible to reject the null hypothesis. There is not a significant relationship between sleep-related death and the mother's parity.

Results of Binary Logistic Regression Including all Independent Variables Simultaneously

As a final analysis, I conducted a binary logistic regression including all predictor variables simultaneously (education, parity, race and poverty status). The results are presented in Table 10.

Table 10

Logistic Regression of Sleep-Related Infant Death on Education, Parity, Race and Poverty Status

Variable	B	S.E.	Wald	Sig.	OR
Years of Education	.033	.106	.096	.756	1.033
Parity	-.117	.149	.615	.433	.890
Race = Caucasian	-1.476	.523	7.974	.005	.228
Race = Other	-1.054	1.330	.629	.428	.348
Poverty	.486	.652	.554	.457	1.625
Constant	-.025	1.742	.000	.988	.975

Note. n=110. Race = Black was used as reference category. Chi-squared (5) = 14.303, p = .014.

The overall model was significant (chi-squared (5) = 14.303, p = .014). Consistent with the previous results, Caucasian mothers were significantly less likely than African American mothers (by a factor of OR = .228, p = .005) to experience sleep-related infant death. I found no significant differences between African American and other races. Additionally, I found no significant relationships between the likelihood of sleep-related infant death and mother's education and parity. Although poverty was significant in the chi-squared analysis (see Table 6), it was not significant in this logistic regression. This suggests that, after controlling for mother's education, parity and race, poverty status was not associated with the likelihood of sleep-related infant death. An explanation for this finding may be that poverty is highly associated with race in this population.

Summary

The objective of this quantitative study was determine if there is a relationship between specific socioeconomic variables and sleep-related infant deaths. Chi-squared tests and logistic regressions were conducted to address the study's research questions. The first null hypothesis was rejected, meaning that there is a statistical significance in the relationship between the level

of poverty of the mother and infant sleep-related deaths. Specifically, African American mothers and poor mothers (defined as receiving WIC or food stamps) were more likely to experience infant death than other mothers.

There was a significant relationship between the mother's race and the likelihood of sleep-related infant death. The null hypothesis that there is no statistical significance in the relationship between the race of the mother and infant sleep-related deaths was therefore rejected, indicating a relationship between African American mothers and sleep-related infant deaths.

No significant relationships were found for the third and fourth research questions. The third research null hypothesis was not rejected because there was not a significant relationship between maternal level of education and sleep-related deaths. The forth null hypothesis was not rejected, meaning that there was not a significant relationship between parity and sleep-related infant deaths.

As for the binary logistic regression including all predictor variables simultaneously, the overall model was significant with chi-squared (5) = 14.303, and $p = .014$. Although poverty was significant in the chi-squared analysis (see Table 6), it was not significant in this logistic regression. Since race was significant and contributed most to the regression, none of the other variables were significant. After controlling for mother's education, parity and race, poverty status was not associated with the likelihood of sleep-related infant death. According to these results, the only variable associated with the likelihood of infant sleep-related death was race.

The final chapter includes a discussion of the findings presented in Chapter 4. The implications and significance of the findings for social change are also discussed. Chapter 5 ends with recommendations for action, further study, and final comments.

Chapter 5: Summary, Recommendations, and Conclusions

Introduction

Nationally, the leading cause of death in the postneonatal period is sleep-related and occurs more than twice as often among African American infants as Caucasian infants (Pressley et al., 2007). African Americans have 1.9 times the SIDS and sleep-related infant mortality rate of Caucasians (CDC, 2012). The probability of sleep-related infant deaths in St. Louis, MO is even greater, with sleep-related deaths among African American infants of 2.08 per 1000 live births compared to 0.65 per 1000 live births among Caucasian infants (Unger et al., 2003). Prior to this study, researchers have analyzed and described various sociodemographic characteristics of SIDS and unintentional suffocation deaths in St. Louis but have not simultaneously controlled for multiple risk factors that may contribute to racial disparity, such as race, poverty, maternal education, and number of children birthed by the mother (parity). Results of the analysis of these risk factors may be useful for the development of population specific educational programs that are developed with the intention of reducing sleep related infant deaths in the African American population.

The purpose of this study was to determine if there is a relationship between poverty, race, maternal education, parity and infant sleep-related deaths in the African American population in St. Louis, MO. In previous studies conducted in various urban populations, including St. Louis, some of the most significant contributors to infant sleep-related deaths were socioeconomic factors, co-sleeping practices, maternal education, and race related cultural practices (Hackett, 2006; Presley, et al., 2007; Unger, et al., 2003). However, prior to this study, researchers knew little about relationships between sleep-related infant deaths and specific variables such as race, parity, maternal education, and poverty. In this study, I examined a

database of 26, 211 mothers of infants younger than 1 year of age who resided in St. Louis at the time of their infant's birth between January 1, 2005 and December 31, 2009. Included in the database was information on the study's outcome variable (whether they had a sleep-related death) and on various demographic variables, such as the mother's race, whether she received food stamps, years of education, and parity.

Fifty-five sleep-related deaths occurred during the studied time frame. Most of the observed population was African American (60.2%). The racial findings were consistent with other studies conducted in large urban areas (Hackett, 2006; Presley, et al., 2007; Unger et al., 2003). The overall incidence rate was 2.09 deaths per 1000 live births, similar to the African American rate found of 2.08 per 1000 live births found by Unger et al. in 2003. The national rate in 2008 was 0.6 per 1000 live births (NCHS, 2008). Analysis of the target population in St. Louis indicated that Caucasian mothers were significantly less likely than African American mothers to experience sleep-related infant deaths. Within the study population, the African American death rate is more than 5 times that of the Caucasian rate for 2005 through 2009. Although previous research illustrated racial disparity regarding sleep-related infant deaths that occurred while co-sleeping (Hackett, 2006; Presley, et al., 2007; Unger, et al., 2003), the data presented by the Missouri Department of Health and Senior Services did not provide specific information about the individual deaths beyond unintentional suffocation. Further research may be necessary to examine each death investigation report to determine whether there is a significant relationship between shared-sleeping and sleep-related infant deaths within the target population.

Interpretation of Findings

This study examined four socioeconomic characteristics to assess whether these variables were associated with infant sleep-related deaths. These variables were maternal race, poverty level, level of education, and parity. While previous research has suggested that socioeconomic factors have an impact on infant sleep-related deaths (Demont-Heinrich & Bol, 2008; MacDorman & Mathews, 2011; Wise, 2003), this study found a significant relationship only between race and sleep-related infant death. Although poverty was significant in the chi-squared analysis (see Table 6), it was not significant in the binary logistic regression after controlling for mother's education, parity and race. Further study may be warranted since poverty was significant in the chi-squared analysis and not in the logistic regression, especially considering that several other studies have found poverty to be a significant factor in sleep-related infant deaths (Demont-Heinrich & Bol, 2008; MacDorman & Mathews, 2011; Wise, 2003). I have observed that the occurrences of sleep-related infant deaths do not occur within the same families, but occur among families who live in similar areas of poverty.

Discussion of Findings and Implications

Research Question 1: The Relationship Between Poverty and Sleep-Related Deaths

Fifty-five percent of impoverished mothers experienced infant death, compared to 29% of non-poor mothers. In this case, the null hypothesis that there is no statistical significance in the relationship between the level of poverty of the mother and infant sleep-related deaths was not supported. In previous studies, poverty was a significant factor in sleep-related infant deaths (Demont-Heinrich & Bol, 2008; MacDorman & Mathews, 2011; Wise, 2003). However, upon further investigation using binary logistic regression including all independent variables simultaneously, poverty did not have a significant relationship with sleep-related infant death.

With no significant relationship detected in the logistic regression, the null hypothesis cannot be rejected. These research findings are contrary to results of previous studies. Poverty was found to have a strong relationship to sleep-related infant deaths in large studies, such as the Chicago infant mortality study (Hauck, et al., 2002) as well as in studies conducted in St. Louis (Unger, et al., (2003). This may imply that because poverty was highly associated with race in the study population, significance was not proven in the logistic regression. A recent article posted in the *St. Louis Post Dispatch* cites poverty and new unemployment as reasons for infant unintentional suffocations (Cambria, 2012). Though the article is not scientific, the results, as well as the results of previous research, indicate a need for further investigation regarding poverty and sleep-related infant death.

Research Question 2: The Relationship of Race and Sleep-Related Infant Deaths

I found the one socioeconomic variable in this study associated with sleep-related infant death to be race. Therefore, the null hypothesis that there is no statistical significance in the relationship between the race of the mother and infant sleep-related deaths was rejected. In this current research, mothers in the "Infant Death" group were generally more likely to be enrolled in Medicaid and food stamp programs, more likely to receive WIC, and more likely to be African American (81.8% vs. 49.1% for the control group). This is similar to the findings in previous urban studies (Hackett, 2006; Presley, et al., 2007; Unger et. al., 2003) that demonstrated a significant relationship between maternal race and infant sleep-related death. This finding indicates that because African Americans disproportionately experience infant sleep-related deaths, care needs to be taken in the development of safe sleep messages specific to the population.

Research Question 3: The Relationship of Maternal Education and Sleep-Related Infant Death

I found no statistically significant relationships between maternal education and sleep-related deaths. Therefore, the null hypothesis that there is no statistical significance in the relationship between the level of education of the mother and infant sleep-related deaths was not rejected. The mean education level of the mothers who experienced sleep-related infant deaths was 12.74 years (seen in Table 4). However, previous research has shown a correlation between maternal education and infant deaths (Spiers & Gunteroth, 1999). This discrepancy may be related to the small sample size available for this study. Further research using a larger population may be valuable to determine if there is a relationship between maternal education and sleep-related infant deaths. There is a need for educational programs that teach infant safe sleep practices to be developed at a variety of educational levels and presented to level-appropriate audiences.

Research Question 4: The Relationship of Parity and Sleep-Related Infant Death

After conducting a binary logistic regression, I determined that there was no significant relationship between parity and sleep-related infant death. Therefore, the null hypothesis that there is no statistical significance in the relationship between the number of children born by the mother (parity) and infant sleep-related deaths was not rejected. However, previous research has indicated that parity may be a factor in infant sleep-related deaths (Hackett, 2006), which may point to a need for further research using a larger sample. Vennemann et al. (2007) and Vemulapali et al. (2004) suggested that parity was a factor in sleep choices. Once again, the small sample size used for this research may have been instrumental in determining that there was not a significant statistical relationship between parity and sleep-related infant deaths. If the

mother is living with one or more mothers with children, the number of children recorded on the birth record may not be reflective of the number of children in the residence. Sleep space may be limited, causing the mother to share a bed or place the infant on an unsafe sleep surface.

Disparity Between Races

Previous research described racial disparity in sleep-related infant deaths (Pressley et al., 2007; Unger et al., 2003). This dissertation study focused on an urban population to investigate whether disparity might exist in a specific area (St. Louis, during a specific time frame, 2005-2009). Compared with the disparity observed by Presley et al. (2007) using a broad population and Unger et al. (2003) using an earlier St. Louis population, this study once again found that African American mothers had a higher likelihood of experiencing sleep-related infant death (62.5%) than Caucasian mothers (25.7%) or mothers of another ethnicity (33.3%). While the 3 studies were conducted at different times, and 2 of the studies were conducted in St. Louis, these findings provide a point of comparison for assessing urban populations and infant sleep-related deaths.

Effect of Poverty and Race on Sleep-Related Infant Deaths

I used the HBM as a foundation for this research. Randolf et al. (2009) suggested that individuals participate in an injury prevention behavior because they desire to avoid the injury and by participating in the behavior they will be safe and have well-being. Glanz and Rimer (1995) described individual behavior as a function of people's beliefs about their susceptibility to health issues, the severity of the threat, the perceived benefits of adopting preventative measures, the confidence in their ability to perform the injury prevention measure, as well as the individual's cues to action. Taking into consideration the results of this target population's data, it is apparent that race and poverty have to be addressed. Messages from the Back to Sleep

campaign may be tailored for the target population by using components of the HBM, especially the constructs of perceived susceptibility, perceived barriers, and perceived benefits to decrease racial disparity in sleep-related deaths. According to the research of Spencer and Logan (2004), socioeconomic status directly impacted infant sleep practices. Poverty is important in the understanding of the epidemiology of sleep-related deaths. It cannot be discounted as an unnmodifiable variable (Spencer & Logan, 2004). While impoverished families may not have the money necessary to purchase cribs, through dedicated programming, they can receive education about unsafe sleep surfaces such as drawers or laundry baskets. Since race was shown to have a relationship with sleep-related deaths, further research is necessary to examine cultural norms that may be modified to assure safe sleep practices.

Limitations of the Study

The findings of this study are limited by several factors. First, they are limited by accuracy in the diagnosis of cause of death, and the fact that deaths with undetermined causes are usually classified as SIDS, even though those deaths may be caused by other variables. The study population is also a limitation, since it is largely an African American community. The generalizability of the findings is limited only to this population and cannot be generalized for other populations where the racial distribution is more diverse. The size of the sample may also limit the validity and generalizability of the study. While the sample for mothers who have experienced sleep-related infant deaths is a valid representation, the sample taken from the mothers who have not experienced sleep-related infant deaths may provide an inaccurate basis for comparison, especially given the size of the sample in relation to the total population.

Recommendations

Recommendations for Action

A review of the existing literature suggests that the racial disparity insleep-related infant death occurs in St. Louis, MO at higher levels than the national average and similar levels in previous local studies. Though the data is illustrated in numbers, the numbers represent the tragedy of unnecessary infant deaths. This is undoubtedly a crisis that warrants the attention of health and public health professionals as well as policy makers. It is my hope to disseminate the results of this study to public health officials at state and local levels in order for them to use to promote policies and programs that reduce the racial disparity in infant sleep-related deaths.

To reduce sleep-related infant deaths among all populations, policies might be introduced to clinic and birthing hospital settings that mandate safe sleep education during prenatal visits as well as prior to discharge from birthing hospitals. Education should be reinforced at the infant's first well baby visit or by visiting nurses. It is imperative that hospital policies mandate that infants in well baby nurseries be placed on their back to sleep to model safe sleep practices. The findings of this study indicated that while the Back to Sleep Campaign was effective in addressing the incidence of sleep-related infant deaths in the Caucasian population, it has not worked as effectively for the African American population.

As with the Back to Sleep Campaign, public health initiatives are typically not effective unless they are strongly publicized (NICHD, 2010). Therefore, communications and outreach campaigns are clearly needed in addition to vigorous participation from the health care community to raise awareness of safe sleep practices and the dangers of unsafe sleep practices. For most benefit, in addition to the Back to Sleep Campaign, the resulting programs should target the African American population, be multi-pronged, include education and public

awareness, and be evaluated for effectiveness. Educators should participate in the formative process to develop both educational and social marketing campaigns that target specific populations to provide socially acceptable messages for behavioral changes that result in a reduction in disparity, with emphasis on impoverished African American mothers. Even though maternal education level was not significant, it may be beneficial in high school settings to teach safe sleep practices before pregnancies occur so that when the occasion arises, the information presented to the mother will reinforce information that she has previously received.

In line with these recommendations, policies may need to be revised to find ways to target the African American population, for whom sleep-related infant death is still a pressing issue. The Back to Sleep Campaign can also be retailored to specifically target African American mothers who are considered impoverished. Ways need to be devised to get the message directly to them. For instance, if the primary form of information dissemination is through television ads. It may be that this specific target market does not have access or time to view these ads. Information dissemination may also be done at the areas frequented by impoverished African American mothers, such as the WIC or Medicaid offices or where food stamps are claimed. Health professionals such as nurses or volunteer doctors may be assigned to these offices to speak to the concerned individuals.

Recommendations for Future Research

Several areas for future study emerged as a result of this study. First, the findings showed no significant relationships between maternal level of education and sleep-related infant death. However, previous research has shown that there is a correlation between maternal education and infant deaths (Spiers & Gunteroth, 1999). In this early study, Spiers and Gunteroth (1999) showed the risk of SIDS and sleep-related infant deaths among infants of

mothers with less than 12 years of education was found to be 3.9 times greater than among infants of mothers with greater than or equal to 16 years of education. This leaves the question of whether one might find a greater significance when conducting a larger-scale study. It may be necessary for research to be conducted in multiple urban sights to determine if lack of education plays a significant role in sleep-related infant deaths.

Second, considering poverty, the study finding illustrated a discrepancy between the chi-squared test (chi-squared (1) = 5.111, $p = .024$), and the binary logistic regression including all independent variables simultaneously (Table 10). In the first case, the null hypothesis could be rejected, whereas in the second case, it could not. In previous studies, poverty was clearly a factor in sleep-related infant deaths (Byrd, et al., 2007; Demont-Heinrich & Bol 2008; Hauck, et al., 2003; Kemp, et al., 2006). Once again, sample size may have been a factor in the results of this study. Further research on a larger scale may be beneficial.

Third, this study did not include single parenting or teen parenting as variables to determine if there was a relationship between them and sleep-related infant death. The data requested from the Missouri Department of Health and Senior Services did not include maternal age. Single parenting data was included but not analyzed for this study.

Recommendations to Address Study Limitations

This study had several limitations that need to be addressed through further research. As noted earlier the limitations include small sample size, accuracy of the completion of the birth or death certificate instrument, accuracy of the diagnosis at the infant's time of death, and potentially limited generalizability because the data will be collected in a primarily African American population. Sample size may be rectified by using multiple, similar urban populations from Missouri. Using data from the entire state may lead to incongruous comparisons because of

large rural areas found in the state. Data from urban areas in other states may be used, but may be dissimilar in their collection techniques.

Implications for Social Change

The results of this study have a social change potential. It is evident from previously published research, a portion of which is attributable to poverty and race, that there is disparity regarding infant sleep-related deaths within the African American population nationally and locally in St. Louis, MO. Sleep-related infant deaths are more apparent in the impoverished African American population. This dissertation study provides evidence that there continues to be racial disparity in St. Louis, Missouri despite messages of the Back to Sleep Campaign and drastic reductions in sleep-related deaths in the Caucasian population. Though the sample population is small, the results may be generalizable in impoverished urban areas such as those found in St. Louis. This information is useful particularly for medical professionals or specific government offices in charge of child welfare. The Back to Sleep Campaign was effective for the Caucasian population. The findings of this study serve to inform the concerned offices that there is a specific demographic group for them to target and educate on the dangers of sleep-related infant death. These findings will be valuable to the medical profession, public health, and public policy in developing appropriate program strategies and suitable policies to address the issue of disparity in infant sleep-related deaths thereby contributing to a reduction in mortality associated with improper infant sleep practices. Also, while the findings of this study are not generalizable for more racially diverse populations, areas wherein the population is predominantly African American may benefit from the conclusions of the study. The following section provides recommendations for specific strategies that might be used to achieve these public health benefits.

Conclusions

Racial disparity in sleep-related infant death is a serious issue nationally and, as seen in this study, in St. Louis, Missouri. Multiple studies have been conducted in multiple sites that show similar results with regards to the disparity. Since there has been a drastic overall reduction in SIDS and sleep-related infant deaths after the Back to Sleep Campaign, focus has to change using the foundations of the campaign with the addition of community specific components that address racial and cultural practices and beliefs related to infant care as well as provide avenues of support for new mothers. Health care and public health professionals need to be demonstrating safe sleep techniques, reinforcing parental knowledge, and providing avenues for reduced cost or free cribs so that parents can provide safe sleep environments for the infants. It would be effective for these programs to focus on changing community social norms and must be sustainable over time.

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Appendix A: Birth Certificate Data Elements

Infant information	Mother information	Father information
Record Type	Mother First Name	Father Last
Year Birth	Mother Middle Initial	Father Suffix
Recorded State	Mother Last	Father Birth Month
State File Number	Mother Maiden Name Last	Father Birth Day
Record Indicator	Mother Birth Month	Father Birth Year
Child First	Mother Birth Day	Father Age
Child Middle	Mother Birth Year	Father Nativity
Child Last	Mother Age	Request SSN
Child Suffix	Mother Nativity	Mother Hispanic Origin
Child Birth Month	Residence State	Father Hispanic Origin
Child Birth Day	Residence County	Mother Race
Child Birth Year	Residence City	Father Race
Time of Birth	Residence In/Out City Limits	Child Race
Child Sex	Residence Census Tract	Mother Education
Recorded County	Residence Region	Father Education
Recorded City	Residence Abbreviation	Medicaid
Recorded Region	Years at Present Address	WIC
Recorded Abbreviation	Residence Address One	Food Stamp Program
Place Birth	Residence Address Two	Now Living
Certifier Code	Residence City	Now Dead
Birth Attendant License	Residence Zip Code	Last Live Birth Month
		Last Live Birth Year

Bureau of Health Informatics, Missouri DHSS.

Appendix B: Death Certificate Data Elements

Death Year	Recorded County	Hispanic Origin
Recorded State	Recorded City	Race
State File Number	Recorded Alpha Abbreviation	Education
Decedent First	Recorded Region	Decedent's Family Name
Decedent Middle Initial	Reporting Source	Burial/Cremation
Decedent Last	Marital Status	Funeral Facility Number
Decedent Suffix	Surviving Spouse First	Cause of Death
Decedent Sex	Surviving Spouse Middle Int	First Significant Condition
Death Month	Surviving Spouse Last	Second Significant Condition
Death Day	Surviving Spouse Suffix	Autopsy Completed
Death Year	Occupation Code	Autopsy Findings
Social Security Number	Industry Code	Time of Death
Age	Residence State/Country	Attendant License Number
Birth Month	Residence County	Report Month/Day/Year
Birth Day	Residence City	Cutoff Month
Birth Year	Residence City In/Out Limits	Statistical Month Code
State/Country of Birth	Residence Census Tract	Report Week
Birth State File Number	Residence Alpha Abbreviation	Multi Cause Death 20/4
City/County of Birth	Residence Region	Manner Death
U.S Armed Forces Code	Residence Street Address	Longitude
Place of Recording	Residence City	Latitude
Hospital Location Code	Residence Zip Code	NCHS Place Code
Recorded State	Number Years Present Address	

Note. Bureau of Health Informatics, Missouri DHSS.

Appendix C: Data Element Subset Values

Data Element	Subset Values	Justification
Birth-Death Match File	St. Louis City only	dependent variable as identified by ICD-10 underlying cause of death codes R95, R99, W75-77, and W81-84
	January 1, 2005 through December 31, 2009	
	de-identified	
	maternal level of education	independent variable
	race	independent variable
	parity	independent variable as defined by the combination of 'Now Living' and 'Now Dead' birth certificate data elements
	level of poverty	independent variable as defined by indication of WIC or Food Stamp Program birth certificate data elements
Live Births	St. Louis City only	dependent variable (control)
	January 1, 2005 through December 31, 2009	
	all races	
	de-identified	
	maternal level of education	independent variable
	race	independent variable
	parity	independent variable
	level of poverty	independent variable
	maternal level of education	independent variable

Note. Bureau of Health Informatics, Missouri DHSS.

Appendix D: Abstract of Protocol

Missouri Department of Health and Senior Services
REQUEST FOR REVIEW OF RESEARCH PROTOCOL
ABSTRACT OF PROTOCOL

1. Purpose

The purpose of this study is to determine if there is a relationship between poverty, race, maternal education and parity and infant safe sleep practices in the African American population in St. Louis, MO. Understanding combinations of factors that are predictive of unsafe sleep practices may provide public health practitioners with important guidance for developing educational materials and programs to assist African American mothers to adhere to safe sleep guidelines illustrated in the Back to Sleep Campaign.

Widespread poverty and health disparities plague African Americans at alarming rates. African American women's levels of poverty are disproportionately high, which may contribute to their ability to participate in services that promote healthy outcomes (Krieger, 2000). Nearly 78% of the women living below the poverty level in St. Louis are single parents (City Data, 2009). Nearly 22% of those living in poverty were high school graduates compared to a poverty level of 44.5% for those who did not graduate from high school (City Data, 2009). Tendencies for African American women not to complete high school coupled with the propensity for early pregnancies compound issues found in race and poverty (Moore et al., 2003).

Adolescent mothers have high probabilities of raising their children in poverty (Moore et al., 2003). More than 40 percent of teenage moms reported living in poverty at age 27 (Elder, 2009). African American infants born to mothers regardless of educational and income categories are twice as likely to die from SIDS, unintentional suffocation, and sudden unexpected infant death (SUID) as European American infants (Joyner, Oden, Ajao, & Moon, 2010). African American mothers often view bedsharing as a strategy to keep their infants safe, making them four times more likely to bedshare with their infants (Joyner et al. 2010).

Contributing factors to health outcomes such as infant safe sleep practices often include mistrust of health care providers, neighborhood residential segregation, and lack of access to quality health care (LaVeist, 2000). To decrease African American/European American disparities in deaths due to SIDS and unintentional suffocation, there has to be an understanding of contributing factors (Byrd, Katcher, Peppard, Durkin, & Remmingon, 2007). To aid in the understanding of contributing factors, my study will examine socioeconomic determinants that impact risk factors for SIDS and unintentional suffocation mortality rates of African American children in St. Louis, Missouri. This information will come from the literature search and data analysis.

2. How will the research data be collected? (Questionnaires, interviews, collection of tissue or body fluids, review of existing records, data, etc.) Indicate if researchers will have contact with subjects.

The study will be conducted using secondary data. Infant death certificates will be matched with corresponding birth records to collect maternal demographic data. The data from the years 2005 through 2009 will be analyzed for infant deaths in St. Louis, Missouri. Data will be obtained from the Missouri Department of Health and Senior Services (DHSS). Permission for use of the data will be obtained using the DHSS Internal Review Board process. The data of interest for this research will include maternal race, level of poverty, level of education, and number of live births. The design of the study will be a population-

based cross-sectional study using matched Birth/Infant Death Data Sets. The case group will be infants who died of SIDS and sleep-related deaths using ICD10 codes .R95 (SIDS), R99 (Unknown), W75 (Accidental suffocation in bed), W76-W77, and W81-84 (other accidental suffocation). The control group will be a 10% random sample of infants who beyond one year of life and all infants from the same time period who died of other causes. A regression analysis will be performed to determine if there is a relationship between the variables and racial disparity related to sleep-related deaths. Care will be taken to assure that the identities of the mothers who experienced the tragic loss of her infant remains anonymous.

3. Hypothesis and variables to be investigated

The following research questions are put forth as the basis for this study:

1. Is there a relationship between the level of poverty of the mother and sleep-related deaths?
2. Is there a relationship between the race of the mother and infant safe sleep practices?
3. 3. .Is there a relationship between the education of the mother and sleep-related deaths?
4. 4. Is there a relationship between the number of children born by the mother (parity) and sleep-related deaths?

4. What are the potential risks to the subjects and benefits to subjects and/or society?

None

5. How will anonymity OR confidentiality be assured?

All data will be de-identified.

6. Will informed consent be sought from all subjects and documented in writing? NO

If yes, a copy of the consent form must be included with application for review.

7. Is informed consent waiver or alteration requested? YES NO

If requesting a waiver or alteration of informed consent requirements, what are the reasons?

8. If requesting exemption, explain which category of exemption applies (see 45 CFR 46.101 (b)).

The research will not involve children or pregnant women. The identities of all participants will be removed prior to the analysis.

Appendix E: Bed-sharing with infants is linked to their deaths

JULY 29, 2012 12:10 AM • BY NANCY CAMBRIA NANCY.CAMBRIA@POST-DISPATCH.COM > 314-340-8238

ST. LOUIS • The police detective sees the same tragedy again and again, typically in the dark hours of the night.

Tired mothers or fathers place a baby on a bed or couch with them, or nestle the baby on their chest, and then fall asleep. As they sleep the baby tangles in the bedding, or rolls face-down into a mattress, or gets wedged under an adult or sibling also in the bed.

They wake to find their baby blue and lifeless.

"I respond right away to these calls, and what I see are broken-up families. Torn up people," said Tonya Tanksley, a detective in the St. Louis Metropolitan Police Department's child abuse unit. "And unfortunately, most of the time, when we go into the properties, we see a crib, and the crib is filled with dirty clothes or other things — everything but the baby."

Since the start of this year, the St. Louis Medical Examiner's Office has recorded six infant deaths determined or suspected to be caused by sharing a bed or couch. In 2011 the office recorded seven such deaths for the whole year.

The spike in what health experts consider preventable accidental deaths has led some to tie it to the high foreclosure and eviction rates in a poor economy. It has also prompted the St. Louis Department of Health to issue a public safety warning of the elevated risk of suffocation and Sudden Infant Death Syndrome — or SIDS — from sharing a bed or a couch with a baby.

Babies should always sleep alone, on their backs, in a crib, the health advisory states.

"Parents should never allow a toddler or infant to sleep in an adult's bed, a chair or a sofa, even if the adult is present," said Interim City Health Director Pamela Walker.

Walker said she became aware of the problem after sitting in a city child fatality review session on another matter. She was shocked when she saw the agenda had numerous infant deaths all related to bed-sharing.

"I just don't think people understand the risks that they're taking with their babies," she said. "You love them so much, and you cuddle and you nurse and you doze off. Unless someone puts it in your face, and unless doctors tell you what a risk it is, people do it."

ECONOMIC FACTORS

Tanksley believes the spike in St. Louis this year is tied to the poor economy and the large displacement of families because of foreclosures and evictions. She said the sudden

displacements force families to move in with relatives or friends, where they typically share a bedroom. In some cases, if cribs are available they are used to store items from a move.

When she investigates a sleep death, Tanksley commonly finds whole families sharing beds. Half of the deaths so far this year in the city involved bed-sharing with a parent and also siblings, according to the medical examiner's office.

Dr. James Kemp, a pediatrician who is co-director of Sleep Medicine at St. Louis Children's Hospital and a leading researcher in how sleep environment is linked to sudden unexpected infant death, said Tanksley's theory on economic displacement fell in line with current research.

"One of the factors that leads to bed-sharing is a recent move by the mother," he said.

Officials with St. Louis County, where there has also been a high number of foreclosures, report no such spike. There have been two bed-sharing fatalities since the start of the year.

State officials who compile child fatality data said it was unclear if such fatalities had been increasing statewide with the weak economy. Although bed-sharing fatalities in Missouri appeared to rise by 25 percent from 2010 through 2011, the state also changed its data-gathering guidelines in that period.

Tanksley said the majority of parents losing children to bed-sharing in St. Louis were single mothers with several children. Typically medication, illicit drugs or alcohol usage inhibit the mothers' ability to wake if a rollover occurs, she said.

But Kemp cautioned that parents should not be misled into believing these fatalities occur mostly among the poor or those with substance abuse issues. Parents from every background opt to share sleeping space with their children, putting the children at risk, he said.

At minimum, the risk of sudden infant death rises by 15 percent when parents sleep with infants, Kemp said. If a parent chooses to nap with a child on a couch, the risk increases by 50 percent, Kemp said.

COMPETING MESSAGES

Kemp cited research that suggests more parents are opting to share a bed despite the fact that the American Academy of Pediatrics discourages the practice and public health campaigns have been undertaken nationwide. Ten years ago, 6 percent of parents acknowledged bed-sharing, said Kemp. Now, the amount has doubled to 12 percent.

The 2010 Missouri Child Fatality Review Program tabulated 61 infant deaths statewide from unintentional suffocation. More than half — 33 infants — were found to have been sharing a sleep surface with one or more people. In 12 additional infant fatalities that involved bed-sharing, the cause of death was listed as SIDS or "undetermined."

Preliminary Child Fatality Review statistics for 2011 indicate 57 infants died while sharing a bed or couch. Eighteen of those deaths occurred in the metropolitan St. Louis area: eight in St. Louis County, seven in St. Louis and three in Jefferson County.

Walker said a 2007 Missouri Pregnancy Risk Assessment Monitoring System reported nearly one in four Missouri mothers said they shared beds with their children. More than 30 percent of those were teen mothers.

Kemp said that despite the growing evidence of risk, the general parenting culture in the United States continued to embrace bed-sharing on many levels. A controversial Time magazine piece in May on attachment parenting — which stresses intense bonding with young children — highlighted how bedsharing is encouraged in some upper- and middle-class parenting circles.

And La Leche League International, an organization encouraging breastfeeding, has long promoted bed-sharing as a way to encourage nursing and bonding with infants. Literature on its website provides guidelines for bed-sharing, such as limiting it to nonsmoking parents and telling parents to limit pillows and make sure adult bed sheets are firmly attached to the mattress.

That, says Kemp, is "ludicrous" and misleads parents about their overall risk for a catastrophe.

Lori Behrens, executive director of SIDS Resources of Missouri, said mothers needed to be told they could successfully nurse without bed-sharing. She said she saw first-hand how poor information on the topic affected parents. Her organization offers safe sleep training and bereavement counseling for families that have experienced sudden unexpected infant death.

"We see devastated parents who tell us, 'I thought I was doing the right thing. People told me this was the best thing for my baby.'"

permission to reprint story
Monday, July 30, 2012 4:16 PM
"Nancy Cambria" <NCambria@post-dispatch.com>
I Nancy Cambria, Children and Families Reporter for the St. Louis Post-Dispatch, grant permission for Cathy Hogan to reprint and reference the Sunday, July 29th story on infant bed-sharing deaths in the newspaper and online at Stltoday.com. Under the Post-Dispatch's policies, any reprints of a story must cite the Post-Dispatch.

Sincerely,
Nancy Cambria
Children & Families Reporter
St. Louis Post-Dispatch
314-340-8238

Curriculum Vitae

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Education

Ph.D. in Public Health October 2012
Walden University, Minneapolis, MN
Dissertation Title: Socioeconomic Factors Affecting Infant Sleep Related Deaths in St. Louis
GPA: 4.0

MPH
Walden University, Minneapolis, MN May 2008
Internship SIDS Resources
GPA: 3.96

BSN June 1995
Jewish College of Health and Allied Services, St. Louis, MO
GPA: 3.96

RN
St. Luke's School of Nursing (Diploma Program) St. Louis, MO May, 1981
GPA: 3.0

Relevant Professional Experience:

SSM Cardinal Glennon Children's Medical Center, St. Louis, MO 1983-Present

Safe Kids Coordinator (2000-present *full time)

- Provide data collection and analysis, professional surveys and development of educational materials which results in concise, population directed needs assessments for personalized community services.
- Write, maintain, and implement 5 current grant projects which result in both durable goods and salaries necessary to implement quality programming.
- Facilitate collaboration with more than 50 community agencies for injury prevention activities in service area which includes St. Louis, St. Louis County, Jefferson, Franklin, Washington, and St. Charles Counties.

- Liaison with MoDOT Region 6 to facilitate child passenger safety and car seat distribution which resulted in the distribution of more than 1100 car seats to underfunded families in 2010.
- Committee member for multiple committees including the St. Louis Urban Outreach, the Missouri Violence and Injury Prevention Advisory Committee (MIVPAC), the Health Baby Forum, SSM Advocacy, and Safe Routes to School.
- Participate in research initiatives, currently with SIDS Resources and Maryville University, previously with NHTSA and Safe Kids Worldwide, which results in data for evidence based practices.
- Maintain accurate documentation of direct and indirect services in compliance with SSM Health Care Systems which aid in fulfilling the medical centers non-for profit status, as well as fulfilling requirements of federal pass through monies.
- Provide professional presentations on many topics in a variety of venues including infant safe sleep, child passenger safety, and home safety which not only promote educational opportunities for the participants, but promote Safe Kids and its association with SSM Cardinal Glennon Children's Medical Center.

Pediatric Advanced Life Support (PALS) Nursing Coordinator (Half time both Safe Kids and PALS) 1994-2000

- Maintained hospital and community certification for PALS course.
- Coordinated facility and instructors for 8 annual courses.
- Maintained budget, payroll, and purchasing for courses.

Other Experience:

Adjunct Faculty for Clinical Nursing, Maryville University, St. Louis, MO 2009-Present

Pediatric Intensive Care Unit Staff Nurse 1983-1994

Community Service:

Club member/ injury prevention advisory committee Current

Optimist Club of North County, Florissant, MO

- Participate in fund raising activities to benefit children including the Optimist International Children's Cancer fund.
- Participate in annual toy drive for adoption of a family in need at Christmas
- Participate in clothing and toy drive for St. Louis Crisis Nursery

Licenses and Certifications:

- Registered Nurse with Missouri Licensure MO086265

- NHTSA Certified CPS Technician Instructor TI0974

Professional Presentations

Hogan, C. M. (2012, September). *Socioeconomic Factors Affecting Infant Sleep Related Deaths in St. Louis.* Presented at the Missouri State Safe Kids Conference, Eldon, MO.

Hogan, C. M. (2011, October). *Infant Safe Sleep Practices*. Presented at the Sister Noreen McGowen Nursing Conference, St. Louis, MO

Hogan, C. M. (2011, June). *Child Passenger Safety*. Presented at the National Parents as Teachers Conference, St. Louis, MO

Hogan, C. M. (2010, January). *Home safety: Unintentional injury stage by stage.* Presented at the annual trauma conference at St. John's Mercy Medical Center, St. Louis, MO.

Hogan, C. M. (2010, April). *Playground Safety.* Presented at the SSM Health Care System Nursing Conference

Hogan, C. M. (2009, November). *Home safety: Unintentional injury stage by stage.* Presented at the National Parents as Teachers Conference, St. Louis, MO.

Hogan, C. M. (2009, August). *Playground Safety*. Presented at the Missouri State Nurses Association Annual Meeting, St. Louis, MO.

Hogan, C. M. (2008, October). *Healthy Baby Forum: A successful one day outreach and educational event for the African American Community*. Poster session at the National Safe Kids annual conference, Washington, DC.

Hogan, C. M. (2008, September). *Healthy Baby Forum: A successful one day outreach and educational event for the African American Community*. Poster session at the University of Missouri – Columbia annual research conference, Columbia, MO.

Teaching/Training

Hogan, C. M. (4 times annually). *National child passenger safety certification training program.* Presented to community members for child passenger safety certification.

Clinical nursing instructor for Maryville BSN students

Honors and Awards:

- 2010 Safe Kids Coalition of the Year
- 2006 Recipient of the State of Missouri Family Practice Medicine Award for Outstanding Community Service
- 2002 Recipient of the Optimist Award for Outstanding Community Service for Children

- 1998 Recipient of the SSM Cardinal Glennon for Outstanding Community Service
- 1995 Deans Award of Academic Excellence

Professional Affiliations:

- Missouri MoDOT Region 6 Blue Print Child Passenger Safety liaison
- Missouri Violence and Injury Prevention Advisory Committee
- SSM Cardinal Glennon Children's Medical Center Legislative Committee
- SSM Cardinal Glennon Children's Medical Center Grant Writing Steering Committee
- Back to Sleep Task Force – St. Louis Urban Outreach

Current Research:

Grant # 1 PI: Lori Behrens and James Kemp, MD

Funding Organization: Community Health Innovation and Research Program (CHIRP)- St. Louis Regional Health Commission
Period of Grant Award: Current
Title of Project: Factors affecting Sleep Practices in the African American Community
Role on Project: Consultant and focus group facilitator

Grant #2: PI: Cathy Hogan

Funding Organization: Safe Kids and the St. Louis County Department of Health
Period of Grant Award: Ends August, 2010
Title of Project: Effectiveness of bike helmet ordinance signs in St. Louis County
Role on Project: Primary investigator and coordinator of field survey teams

Completed Research:

Grant # 3 PI: Toby TP, Donahue MP, Quraishi AY, Dukehart J, Wilcox R, Safe Kids Alameda County, Safe Kids Chicagoland, Safe Kids Dallas Area, Safe Kids Mid-South, Safe Kids New York City, Safe Kids Oklahoma State, Safe Kids Orange County, Safe Kids St. Louis, Safe Kids Southeast Wisconsin, Safe Kids Tampa. (Published 2006).

Funding Organization: Safe Kids Worldwide and FedEx
Period of Grant Award: Spring 2004-Spring 2005
Title of Project: Walk a mile in their shoes
Role on Project: Project manager and data collection for St. Louis Area

Grant #4 PI: Larry Decina and Kathy Lococco (Published 2006)

Funding Organization: National Highway Traffic Safety Administration (NHTSA)
Period of Grant Award: Summer 2005

Title of Project: National lower anchor and tether for children study
Role on Project: Project manager and data collection for Missouri

Grant #5 PI: Larry Decina and Kathy Lococco (Published 2005)

Funding Organization: National Highway Traffic Safety Administration (NHTSA)
Period of Grant Award: Fall 2003
Title of Project: National child passenger restraint misuse study
Role on Project: Project manager and data collection for Missouri

References:

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Phyllis Larimore, RN, MPH

Title: Coordinator of Injury Prevention

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