UNIVERSITY OF CALIFORNIA, MERCED

Infant Emergency Department Utilization: Predictors of Use and Mother's Decision-Making about Care

A dissertation submitted in partial fulfillment of the requirements
for the degree Doctor of Philosophy

in

Public Health

by

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The Dissertation of Mechelle Perea-Ryan is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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2018

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Explanation of Acronyms

The definitions that proceed are provided to ensure consistency and a clear understanding of how these terms are used throughout the study. The researcher developed all definitions not accompanied by a citation.

Acronym	Explanation
ED	Emergency Department: "The section of a hospital or other health care facility that is designed, staffed, and equipped to treat injured people and those afflicted with sudden, severe illness (Medical Dictionary for the Health Professions and Nursing, 2012)."
GA	Gestational Age: "This is traditionally calculated as the number of weeks since the first day of an expecting mother's last menstrual period. In evaluating expected development of the baby for a point in pregnancy, this dating method assumes that the mother has a 28-day cycle with ovulation on the 14th day of the menstrual cycle. The average pregnancy with this calculation system lasts about 40 weeks, from the start of the last menstrual period until birth (Danielson, 2014)."
ICD-9	International Classification of Diseases, 9th Revision, Clinical Modification Codes: This is a system of codes used for Diagnostic/screening services and procedures ordered or provided at the time of the visit (Centers for Disease Control and Prevention [CDC], 2010).
PCP	Primary Care Provider: A provider that delivers care for both acute and chronic conditions, as well as health maintenance and promotion in an office setting.
EMTALA	Emergency Medical Treatment and Labor Act of 1986: A law requiring ED's to provide care regardless of ability to pay (Anderson et al., 2016).
OSHPD	California Office of Statewide Health Planning and Development: A department of the California Health and Human Services Agency (HHS) that ensures hospital buildings are safe, offer financial assistance to individuals and healthcare institutions, and collect and publish healthcare data (OSHPD, 2018).

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Finally, thank you to the families who gave their time and shared their experiences when their infant was ill. Without your stories, there would be no learning or change in what we do. In addition, to all those collecting patient intake information, what you do helps researchers examine our health system and the people we serve. With this information, we can improve systems and decrease barriers.

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EDUCATIONAL BACKGROUND

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University of California, San Francisco,
M.S., Family Nurse Practitioner, 1997

California State University, Stanislaus,
B.S., Nursing, 1992

Grossmont Jr. College,
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LICENCES AND CERTIFICATIONS

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- Pediatric Advanced Life Support 2010
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- Public Health Nurse Certificate 1992
- Registered Nurse, California Board of Nursing 1989 - Present

PROFESSIONAL EXPERIENCE

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Associate Professor, Fall 2006 – Present
Director Health Science Program, Spring 2014 - Present

My primary responsibilities include directing the Health Science Degree Completion Program, coordinating the Obstetric/Pediatric clinical instruction and teaching the Health Science and Master of Nursing courses. As the director of the Health Science program and OB/Pediatric clinical coordinator, I evaluate the programs yearly, am responsible for implementing changes to the programs, and organize internship/practice sites in health agencies throughout Merced, Stanislaus and San Joaquin counties.

Modesto Jr. College, Modesto, CA
Clinical Educator, Fall 2004 – 2005
I facilitated groups of students through both their OB and Pediatric rotation.

U.C. Davis Rural FNP/PA Program, Modesto, CA
Facilitator, 1999 – 2003
I facilitated a small group of students through patient based learning seminars during their 2 years in the FNP/PA program.

Practice

Andres Arellano M.D., Oakdale, CA
Family Nurse Practitioner, 2001 – present
Work as Family Nurse Practitioner performing comprehensive histories and physicals on clients of all ages. I assess and manage their health care needs. I also educate and counsel clients in health care maintenance and illness prevention.

Doctors Medical Center, Modesto, CA
RNC – CN III, 1989 – 2007
Worked full time providing direct patient care on an acute medical/surgical pediatric floor to patients ranging from newborn to 18 years of age and per diem in the Emergency Department (ED) providing direct patient care to patients of all ages.

Golden Valley Health Centers, Modesto, CA
Family Nurse Practitioner, 1997 – 2002
Provide comprehensive history and physical exams on clients of all ages, with an emphasis on OB/GYN one day per week.

RESEARCH IN PROGRESS

Public Health PhD Dissertation – Infant Emergency Department Utilization: Predictors of Use and Mother's Decision-Making about Care

Specific Aims:

1. Examine infant, maternal and environmental predictors of ED release utilization versus ED and direct admits.

2. Examine whether the social determinants of health (SDoH) influence when and why infant ED visits versus direct admits occur. And using the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes assigned to the visit assess for urgency.
3. Explore the decision making process of mothers whose infant had a health issue and presented to the ED versus those who did not.

PUBLICATIONS

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Hodge, M., Martin, C., Tavernier, D., Perea-Ryan, M., & Alcala-VanHouten, L. (2008). Integrating simulation across the curriculum. *Nurse Educator. 33*(5), p. 210-214.

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TEACHING EXPERIENCE

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NURS 3810	Pediatric Clinical/Coordinator
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PROFESSIONAL AFFILIATIONS

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Abstract

Infant Emergency Department Utilization: Predictors of Use and Mother's Decision-Making about Care

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Emergency Departments (ED) originated to support people who were involved in traumas or needed emergent care in order to live. However, over the years and especially since the passing of the Emergency Medical Treatment and Labor Act, the ED has been used more frequently for non-urgent reasons. Non-urgent use increases the cost of care, decreases the patient-provider relationship, and interrupts health care maintenance and promotion. Some of the causes of these visits include convenience, trust, and referrals from primary care providers. The largest utilizers tend to be from both ends of the age spectrum; those greater than 75 and infants. No research found has compared infant ED release utilization to ED and direct admits. Therefore, a mixed methods research study was conducted to: 1. Examine infant, maternal and environmental predictors of ED release utilization versus ED and direct admits; 2. Examine whether the social determinants of health (SDoH) influence when and why infant ED visits versus direct admits occur and; 3. Understand how mothers make decisions about care when their infant is ill. The first and second were completed analyzing California Office of Statewide Health Planning and Development hospital data, while the third analyzed narratives obtained from fifteen interviews with mothers of children 12 months of age or less. Many more infant than maternal factors were associated with hospital use within the first year of life. The predictors of ED release visits and direct admits were inversely related to one another. And, as with previous ED studies, this study found a large percentage (~75%) of infant hospital visits were ED release visits. The SDoH did influence the age, day of week and diagnosis at visit. In addition, regardless of the SDoH, the top five diagnoses for a visit were almost identical. These were upper respiratory infection, fever, otitis media, vomiting alone, and acute bronchiolitis. Results from the qualitative portion of the study identified that the decision pathway for mothers who chose to visit the ED and those who did not was similar, with crucial points influencing the final decision. This information will assist health care providers with developing interventions to reduce non-urgent ED visits.

Keywords: infant, Emergency Department Utilization, non-urgent, decision-making, social determinants of health

Infant Emergency Department Utilization: Predictors of Use and Mother's Decision-Making about Care

Chapter One: Introduction

This dissertation will compare the high infant ED utilization rate to those who do not when there is a health concern. The objective of this chapter is to introduce and outline the dissertation. The introduction includes the background, statement of the problem, the research aims, an overview of the methods, a discussion of the theoretical foundation, and a brief discussion of the results. The chapter closes with an introduction to the chapters that follow.

Background

Emergency Departments (EDs) were initially developed to provide care to patients with unforeseen or urgent critical health conditions. However, over the past 30 years, ED use has been on the rise due to providing more non-urgent services than initially planned (Andrew & Kass, 2018). Previous studies have reported that approximately 30% of all ED visits are for non-urgent care (Honigman, Wiler & Ginde, 2013; Phelps et al., 2000; Uscher-Pines, Pines, Kellermann, Gillen, & Mehrotra, 2013). Non-urgent services are services that could have been provided in a primary care practitioner's (PCP) office or would cause no harm had care been delayed 2-24 hours (Cunningham, 2011; Uscher-Pines et al., 2013). The use of the ED instead of an outpatient setting (i.e. physician's office, urgent care) for a non-urgent reason leads to excessive healthcare costs, unnecessary testing and treatment, and missed opportunities for preventative care interventions and decreased opportunities to build relationships with their PCP (Carret, Fassa, & Dominguez, 2009; Cunningham, 2006). It has been projected that $4.4 billion annually would be saved if non-urgent issues were cared for in an outpatient setting, instead of the ED (Weinick, Burn, & Mehrotra, 2010). Unfortunately, the number of patients seen in the ED for non-urgent concerns continues to increase due to the number of hospitals providing emergency care decreasing in number and an increased number of people with insurance under the Affordable Care Act (ACA), with no increase in the number of providers to care for them (Taubman, Allen & Wright, 2014).

In California, even higher increases in ED utilization are found due to being the most populous state in the nation and along with the ACA rollout; it was one of the first states to embrace the expansion of Medicaid (McKinsey & Company Leading States Index, 2018). According to the US Census Bureau, California is home to one-third of the nation's Medicaid population. Patients with Medicaid tend to visit the ED more frequently than those with private insurance or the uninsured due to lack of access to PCPs (Medicaid & Chip Payment & Access Commission, 2016). In addition, even higher ED visit rates may result from California having approximately 1.5 million undocumented immigrants who will not be covered by the ACA or the Medicaid expansion, resulting in the ED being the safety-net for healthcare due to the Emergency Medical Treatment and Labor Act (EMTALA) (McCoville, Hill, Iwunze, & Hayes, 2015).

People choose to visit the ED for various reasons. Some documented reasons for people visiting the ED include systems issues, relationship with providers and provider referral (Gindi & Jones, 2014; Zandieh, Gershel, Briggs, Mancuso, Kuder, 2009). System issues include no appointments available at time of need, the inability to take time off of work when appointments were available, and no usual source of care (Gindi & Jones, 2014). In a study by Gindi and Jones, approximately 75% of ED visits were found to occur on the weekend or at night (2014). The days of the week with the highest number of ED visits were Sunday and Monday, mainly due to patients with a PCP waiting until the last day of the weekend or until the day after the weekend to seek treatment (Sun, Heng, Seow, & Seow, 2009; Kam, Sung, & Park, 2010). One study by Patcher, Ludwig and Groves, found that families visiting the ED at night or on the weekend were more likely to have PCPs, be ill for a shorter period of time, attempt home treatment prior to arrival, and have used the ED as a usual source of care (1991). In contrast, a study conducted with the Medicaid population in New York by Castner, Yin, Loomis, and Hewner found ED use to be lower on weekends than on weekdays (2016). However, there was higher odds of a weekend visit being non-urgent (Pukurdpol, Wiler, Hsia, & Ginde, 2014). In regards to relationship with their providers, some had limited or negative perceptions of the provider and believed ED medical providers were more knowledgeable (Gindi & Jones, 2014). In addition, factors found to contribute to non-urgent ED utilization were lack of available same day appointments with their PCP and low health literacy regarding urgent and non-urgent healthcare conditions (Pomerantz, Schubert, Atherton, & Kotagal, 2002; Uscher-Pines et al., 2013; Zandieh et al., 2009).

Research has revealed the highest utilization of ED services occurs at both ends of the age spectrum, with increased use among children less than one year of age and adults over 75 years of age (Delia & Cantor, 2009). The higher annual per capita ED visit rate involved children less than one year of age (Pitts, Niska, Xu, & Burt, 2008). Studies assessing ED utilization for all age groups typically do not stratify results for children any further than less than 1 year of age (Center for Health Workforce Studies, 2018; Goto, Hasegawa, Faridi, Sullivan, & Camargo, 2017; McDermott, Stocks, & Freeman, 2015; Montalbano, Rodean, Kangas, Lee & Hall, 2016). ED utilization studies completed on the infant population more frequently included the first 30 days of life; and a few included infants at three and six months of age (Donovan, Perlstein, Atherton, & Kotagal, 2000; Kotagal et al., 2002; Kuzniewicz, Parker, Schnake-Mahl, & Escobar, 2013; Lee, Bardach, Maselli, & Gonzales, 2014). The stratification of infant age sub-populations allows for a deeper assessment of factors directly related to visits occurring for each sub-population. In addition, the age of the infant represents key variables in the likelihood of an injury or illness during the first year of life (Hockenberry, Wilson & Rodgers, 2017). Kuzniewicz et al. found late preterm infants (32-36 weeks) had 1.5 to 3 times greater risk of hospital readmission during the first 30 days of life compared to full term infants (2002). Paul et al. who examined infant factors associated with Medicaid hospital readmission and ED use within the first 6 months of life reported increased readmissions for infants who had been in the Neonatal Intensive Care Units and ED use with a fall season birth (2016). Whereas, a higher gestational age, an Apgar ≤ 5 at five minutes, being White, and being part of a multiple birth pattern were associated with lower ED use. Contrary to their expectations, Kotagal et al. found early provider use was associated with increased instead of decreased ED use (2002). Lee et al. assessed the incidence of

neonatal ED visits using the National Hospital Ambulatory Medical Care Survey (2014). They found Blacks were twice as likely as Hispanics and Whites to utilize the ED. Additionally, neonates with Medicaid were also more likely to utilize the ED compared to those with private insurance. Other factors thought to contribute to the high infant ED utilization are short length of stay after birth, barriers to health care access, lack of relationship with their PCP, and low parental health literacy (Berry, Brousseau, Brotanek, Tomany-Korman, & Flores, 2008; Morrison, Myrvik, Brousseau, Hoffman, & Stanley, 2013; Pitts et al., 2008; Sharma, Simon, Bakewell, Ellerback, Fox, & Wallace, 2000). Moreover, in their nationwide survey of 240 EDs, Isaacman and Davis suggest that two-thirds of pediatric ED use was unnecessary; a significant percentage of these patients had illnesses that could potentially have been treated in a clinic or PCP's office (1993).

When assessing infant ED utilization, it is important to assess the mother as well since traditionally she is the main caregiver and decision maker about care when the infant is ill. In addition, children's long-term health and development can be influenced by early life events, beginning even before birth with the health of their mother. In fact, in 2010, the fourth leading cause of infant mortality was maternal complications of pregnancy (Centers for Disease Control & Prevention (CDC). Presently the maternal health conditions and behaviors found to pose the most risks to the infant are Diabetes (DM), Hypertension (HTN), and tobacco (CDC, 2014; Saigal & Doyle, 2008). Because of the rise in sexually transmitted illnesses (STIs) in pregnant females and their association to adverse pregnancy outcomes, they are also important to monitor (CDC, 2018). Paul et al. who examined infant and maternal factors associated with hospital readmission and ED use by infants with Medicaid during their first 6 months of life found increased readmissions for infants whose mothers had a bipolar disorder, along with mothers who were admitted or visited the ED during their pregnancy (2016). In contrast, maternal depression had decreased odds of an infant hospital readmission. Increased ED use was associated with both maternal ED use for her own health care needs, and multiple maternal prescription use. While, being of older maternal age was associated with lower ED use. In addition, Kotagal et al. found full term infants with Medicaid in Ohio had increased ED use when their mother was without a high school diploma, even when there was prenatal care (2002).

The social determinants of health (SDoH) have also been found to be key drivers of health care utilization, and impact individual and population health equity and outcomes (Artiga & Hinton, 2018). The SDoH are defined as conditions in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health risks, utilization and outcomes (Artiga & Hinton, 2018). It is important to study how these social and structural factors influence health service utilization to develop a deeper understanding of the disparities in utilization rates.

Lastly, the final primary diagnosis at visit has been examined with regards to ED use. A study conducted by Schlitz et al. found that jaundice, bronchiolitis, temperature regulation and pyloric stenosis in the neonatal period and bronchiolitis, pneumonia, urinary tract infection (UTI) and other respiratory infection in the 1-12 month period were among the most frequent diagnoses for infants treated in the ED (2014). In studies on pre-term infants, the most frequent diagnoses for infants treated in the ED were jaundice, infection, respiratory problems, gastrointestinal (GI), respiratory problems, fever, and feeding problems (Neuman et al., 2014; William, Johnson, & Rimsza, 2004).

Lee et al. categorized the primary diagnosis for neonates treated in the ED into mild, moderate or severe (2014). Under the mild category, the most frequent diagnoses were benign gastrointestinal (GI) problems, jaundice, routine care, rash, and ophthalmic problems. In the moderate category the most frequent diagnoses were infection, GI problems, respiratory problems, and injury. In the severe category, the most frequent diagnoses were serious infection, respiratory problems potentially requiring admission, surgical condition, major injury, and seizure or neurologic problem. An analysis of healthy, full-term singleton infants born to low-income primiparous women at a hospital in Miami found the most common diagnosis for an infant ED visit to be an upper respiratory illness, followed by feeding problems, rash, ophthalmic discharge and constipation during the first two months of life (Hannan, 2014). During this same time period, respiratory illness was also the leading diagnosis for hospital readmissions. In each of these studies, the majority of ED care for infants was for non-urgent health concerns. Understanding the disease profiles associated with ED utilization, especially non-urgent use can inform interventions.

In addition, the final primary diagnosis coded for a visit, along with triage scores, chief complaint, ED resource utilization, consensus between practitioners and the New York University (NYU) algorithm have been used as a method to evaluate the urgency of a visit (Billings, Parikh, & Mijanovich, 2000; Durand et al., 2011; Honigan et al, 2013; Lee et al., 2014; Mistry, Brousseau & Alessandrini, 2008). The NYU algorithm was developed after an expert panel of ED and primary care physicians reviewed the chief complaint, end diagnosis, procedures and resources utilized from approximately 6,000 ED records. From the data, the following categories developed; non-emergent, emergent/primary care treatable and emergent/ED care needed. The emergent/ED care needed was further categorized into preventable/avoidable or not preventable/avoidable. These categories were then applied by percentages to each final diagnosis (Figure 1) (Billings et al., 2000; NYU, Wagner, n.d.). Unfortunately consensus as to which method is best practice has not been reached.

NYU EMERGENCY DEPARTMENT CLASSIFICATION ALGORITHM [V2.0]

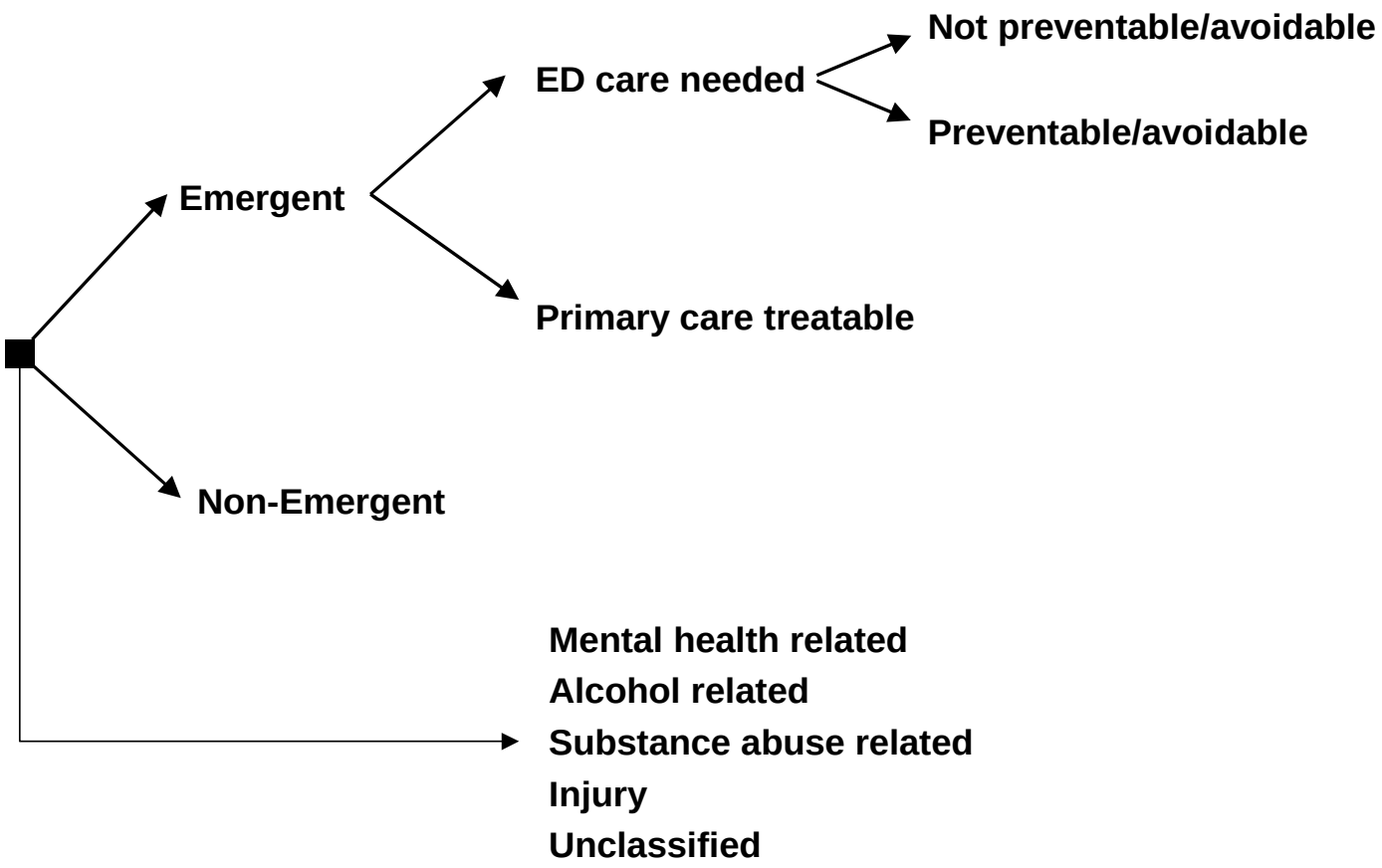

Figure 1. NYU Classification System (NYU, Wagner)

This previous research on ED utilization rests often on unfounded comparisons: Researchers studied ED utilizers with an assumption that there is something unique about the population, especially those who utilize the ED for non-urgent reasons or 'inappropriately.' No studies found compared ED utilizers to non-utilizers or appropriate versus inappropriate utilizers. These comparisons are important to better understand drivers of care. Appropriate utilization of services is defined as a person who utilizes healthcare services that provides the necessary resources for the best health outcome (Combes & Arespacochaga, 2013). In studying hospital visits, direct admits (hospital admission by an outside provider) and ED admits (hospital admission after ED assessment and treatment) are considered appropriate utilization of a service setting. For a direct hospital admission, a medical provider has evaluated the patient, and found a need for care that is more extensive (Leyenaar, Lagu, & Lindenauer, 2015). A hospital admission after ED assessment and treatment indicates the emergent reason for seeking ED care was founded (Traub, 2018). Morganti et al., found that approximately 50% of all hospital admissions were derived from the ED (2013). These admissions typically were derived from the uninsured and those with Medicaid, whereas, people with private insurance were more apt to have a direct admit. In contrast, a large percentage of ED release visits (patient assessed and treated in the ED and released home) are considered inappropriate service setting utilization; could have been seen in an ambulatory care setting (Taylor, 2013; Uscher-Pines, 2013). Examining these three groups allows for comparison of the opportunities and challenges related to each type of visit and better understanding of the predictors and factors related to each. Differences found could also be used to create interventions to improve appropriate utilization of ED services.

Statement of the Problem

When the ED is used for non-urgent issues, added complications such as a lack of continuity of care, increased cost of care, ineffective utilization of resources, and overcrowding arise (Billings et al., 2000; Institute of Medicine, 2007, Kellermann, 1994; Shesser, Kirsch, Smith, & Hirsch, 1991). Non-urgent ED utilization patterns, particularly for infant care, is a good indication of the effectiveness of the healthcare delivery system and is an important indicator of health for the population in that region (Neuman et al., 2014; Paul et al., 2016). In addition, studies have shown that once a patient begins ED utilization for non-urgent care, the higher chance of repeat utilization (Fosarelli, DeAngelis, & Mellitis, 1987; Ruger, Richter, Spitznagel, & Lewis, 2004).

Purpose of the Study

Most studies of urgent and non-urgent ED visits have concentrated on the adult population and have typically been quantitative. Studies that included the pediatric population mostly used large administrative data sets or closed-ended surveys with children who sought ED care in pediatric specialty hospitals within urban areas (Ben-Isaac, Schrager, Keefer & Chen, 2010; Brousseau, Mistry, & Alessandrini, 2006; Doobinin, Heidt-Davis, Gross, & Issacman, 2003; Hummel, Mohler, Clemens, & Duncan, 2014; Jaeger, Ambadwar, King, Onukwube & Robbins, 2015; Kubicek et al., 2012; Mistry, Hoffman, Yauck, & Brousseau, 2005; Phelps et al., 2000; Pomerantz et al., 2002; Sharma et al., 2000). Only two studies in the U.S. examined pediatric ED use qualitatively (Berry et al., 2008; Chin, Goepp, Malia, Harris, & Poordabbagh, 2006). No studies found examined how the SDoH collectively were associated with ED utilization, instead studies typically examined use by a specified factor (i. e. insurance, race) (Ben-

Issac et al., 2010; Brousseau, Bergholte, & Gorelick, 2004; Castner et al., 2016; Flores, Abreu, Olivar, & Kastner, 1998; Johnson & Rimsza, 2004; Montalbano, Rodean, Kangas, Lee & Hall, 2016; Neuman et al., 2014; Pathman, Fowler-Brown, & Corbie-Smith, 2006; Ray & Lorch; Sharma et al., 2000). Although these studies provide important insight into the factors associated with infant ED utilization, this work has not included those who have not chosen ED use or were ED admits. It is imperative to compare the differences between ED utilizers to non-utilizers to unearth protective factors against ED utilization. This study contributes to the gap in knowledge by comparing infants who had ED release visits to those who did not while identifying the factors predictive of infant healthcare service utilization, assessing the influence of the social determinants of health (SDoH) on timing and cause of ED utilization for infants, and understanding the decision-making process for mothers.

Specific Aims of the Study

The specific aims of this study were as follows. First, the researcher identified and compared the characteristics of infants and their mothers, as well as the geographical factors that predict infant after birth hospital utilization. Second, data were analyzed and compared to investigate whether the SDoH influenced an infant's age at visit, day of week of visit, and the five most common diagnosis from the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes (World Health Organization, 1992). Third, the study examined the urgency of the top five diagnosis and whether the SDoH were associated with the urgency level. Each of the previous aims examined data for ED release visits, ED-to-hospital admits, and those who were direct admits. Finally, the decision-making process of mothers whose infant had a health issue and presented to the ED versus those who did not were explored to better understand how decisions are made. .

Organization of the Study

This research project involved three-phases: Phase One was a retrospective review of data collected by California's Office of Statewide Health Planning and Development (OSHPD) to identify variables predictive of ED utilization or readmission through the ED or as a direct admit by infants born from 2008 to 2012 (2010; 2018). Phase Two was an exploration of whether the SDOH influence when and why infants with positive ED visits or readmissions occurred and an evaluation of urgency for the top five diagnoses for each visit type. OSHPD data was utilized for the first two phases of the study as it has the most complete data available for answering the aims of this study. Phase three was a qualitative analysis of mothers', within California's Central Valley, decision making process when seeking healthcare for their infant when there was a concern. A community advisory board consisting of four registered nurses (RN): a PhD prepared RN faculty member with 30 years Maternal/Child experience; a Master's prepared Public Health Nurse with experience in Maternal, Child, and Adolescent Health (MCAH); a BSN-BC RN with 25 years Maternal/Child Experience presently serving as Director of a Hospital Family Birthing Center; and a RN with over 16 years of emergency services experience who presently is currently serving as the Emergency Services Director in a hospital setting were consulted during the development of this study. In addition, a board-certified pediatrician with 40 years of experience in patient care, clinical and basic science research, and teaching, in addition to a family physician practicing in a community health center, were also consulted.

Theoretical Model

Andersen's Model of Healthcare Utilization (Andersen's Model) was the framework used in all three studies (Figure 2) (Andersen, 1995; Andersen & Newman, 1973). For the first study, Andersen's Model was the framework used in both categorizing the variables and interpreting the results. In the second study, the SDoH, which fit into Andersen's predisposing and enabling factors, were used for a deeper look into when and why ED utilization occurred. Lastly, Andersen's Model was the framework used when creating the interview questions and again when categorizing the results found using grounded theory in the qualitative study.

The main components of health care utilization according to Andersen's model are predisposing factors, enabling factors, and need (Andersen, 1995). Each of these main components encompasses subcomponents (Andersen, 1995). Predisposing factors are those that existed prior to seeking health care services. Predisposing factors are not directly responsible for the use of the health care service(s). For instance, age in itself does not necessitate health services but different age groups utilize services more frequently than others due to an increased occurrence rate of illness or injury for that age group. The subcomponents included within predisposing factors include demographics, social structure, and health beliefs. Variables typically included in demographics are age, sex, marital status, and family size. Social structure variables include race, and ethnicity. Health belief variables include any variable distinctly related to the value placed on the utilization of health services by the individual/family prior to any interaction with health services, such as health literacy or culture. Enabling factors are those that affect the ability to acquire health care services. For instance, insurance affects a person's access to care. The subcomponents of enabling factors are family and community resources that give a means or create a barrier for the utilization of services when there is either a predisposition or need. Variables usually placed in the family resource subcomponent are income, insurance, and not having a regular source of care or access to that care. While variables situated within the community resource subcomponent are constructs that affect the availability or location of services, such as physician and facility to population ratios and the regional location of the household. Need is the factor that actually drives or is directly correlated to the use of the health care service(s). For example, a person's presenting signs and symptoms. The subcomponents within need are perceived and evaluated. Evaluated need is defined as an actual diagnosis while perceived need is the person/family's perception. When predisposing and need factors are the drivers of health care utilization, the system is perceived as equitable. If enabling factors are the driver than the system is perceived as inequitable (Andersen, 1995; Andersen & Newman, 1973).

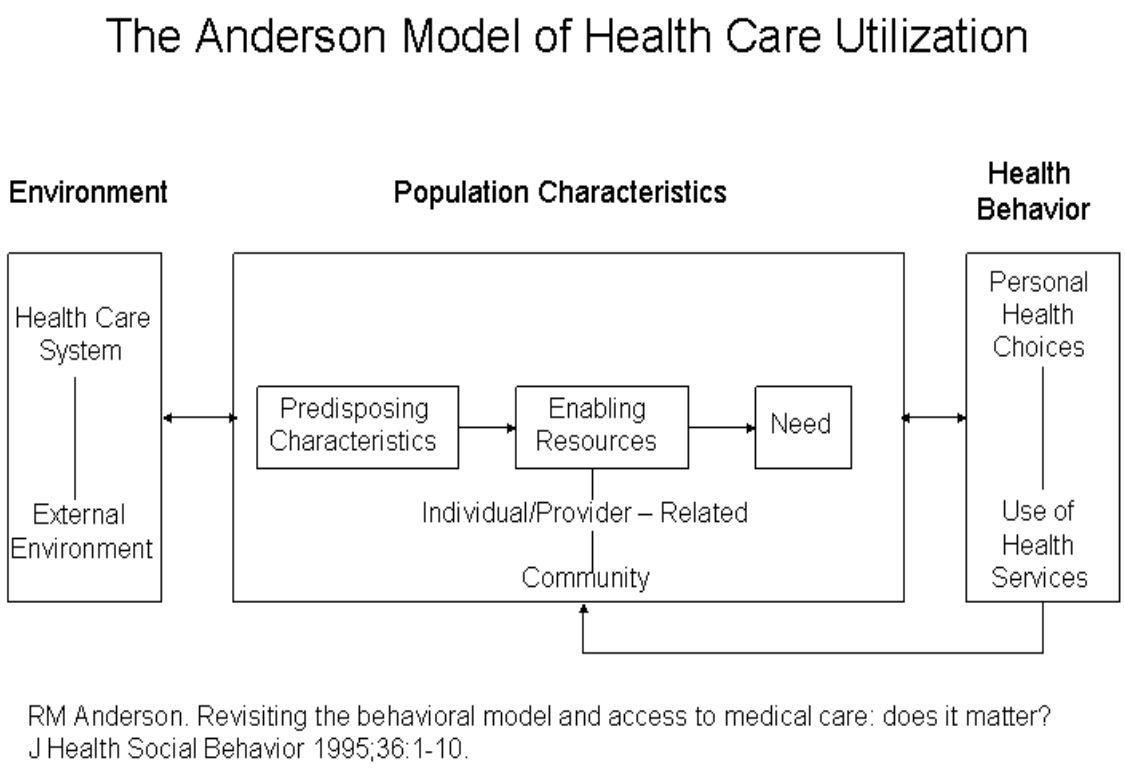

Figure 2. Andersen's Model of Healthcare Utilization

Andersen's Model and Previous ED Utilization Studies

Mian and Pong, using data from a telephone survey of the general population ≥ 16 years of age, examined whether potential access (having a regular healthcare provider) and actual access (healthcare provider available when need arises) had an effect on ED utilization (2012). Need was assessed as having an urgent illness. The other two categories within Andersen's model were not used to delineate the other independent factors. A decreased likelihood of ED use was strongly associated with potential access when people had a chronic illness, while actual immediate access being available was for the general population.

Andersen's Model and Previous Non-Urgent ED Utilization Studies

In 1992, Padgett and Brodsky, adapted Andersen's model to organize results of a review of literature on non-urgent ED utilization (figure 2). Unfortunately, due to most studies only including populations who already sought care from the ED, they were unable to link predictors to the different stages of decision making in the model. Therefore, predictors were only discussed generally in regards to their influence on ED utilization. The most influential predisposing factors noted in the literature were race/ethnicity and a lack of social support. For enabling factors, lack of a primary care provider had the largest influence while for need, psychosocial stressors in addition to the current reason for the visit increased ED utilization.

Afilalo et al., compared non-urgent with urgent and semi-urgent ED visits and examined their rationale for not seeking care with a PCP before presenting to the ED (2004). Patients were ≥ 18 years of age and their characteristics were organized into Andersen's Model. Using multivariate analyses, the predisposing factor "age" was significant with the average non-urgent user approximately 5 years younger than the semi-urgent/urgent user. No significant factors were found for the enabling and need categories when the three groups were compared. When examining need, the predominate reasons for use were either a referral from a PCP or a high perceived need.

Zandieh et al., used a cross sectional study to examine predictors influencing the health seeking behaviors of parents with children from 0-18 years of age who sought care at an inner city hospital in New York (2009). They compared parents seeking nonurgent health care for their child at the ED to those who sought care at the walk-in clinic within the same hospital. Care in both areas was provided by general pediatricians. Two validated questionnaires, the Consumer Assessment Health Plan Survey Child Questionnaire (CAHPS 3.0) and the Child Health Questionnaire (CHQ-PF28) were used to interview a convenient sample of English speaking parents whose children had Medicaid and were patients of the hospital's ambulatory clinic. The interviews were completed after care was received at either the ED or walk in clinic, during normal clinic operating hours to avoid differences in use due to provider unavailability or parental convenience. Logistic regression was used to analyze their results. The predisposing factors included were the child's age, sex, ethnicity, and race, while the parental characteristics were educational attainment, marital status, and work status. Enabling factors assessed were annual income and perceived wait time to be seen. The presence of a chronic health condition and a past history of difficulty obtaining care were placed in the need category. The strongest predictors of ED use were the predisposing factors: being a single parent and of Hispanic ethnicity.

Methodology

Research Design

Triangulation was used as the research method to both improve validity and completeness of the topic of study (Yeasmin & Rahman, 2012). Per Denzin, there are four forms of 'triangulation' (1970):

1. Data triangulation which is the retrieval of data from a number of different sources to form one body of data.
2. Investigator triangulation which is the utilization of multiple observers instead of a single observer in the gathering and interpretation of data.
3. Theoretical triangulation which is the utilization of more than one theoretical approach in the interpretation of the data.
4. Methodological triangulation which is the utilization of more than one research method in the pursuit of understanding a topic.

In this study, the most common triangulation approach, methodological, was used (Cohen & Manion, 2000; Olson, 2004). The methods, quantitative and qualitative, were used to acquire a more in-depth, well-rounded understanding of the who, when and why of infant ED utilization.

Setting

All three studies were conducted in California. California is a majority-minority state whose percentage of Hispanics outnumbers Whites. California has a slightly higher percentage of children under five and poverty rate than the nation (U.S. Census Bureau). It also ranks #11 out of 50 for healthcare (U.S. News & World Report, 2018).

The quantitative studies included information obtained from OSHPD and vital statistics information from the entire state. The OSHPD data include discharge, ED and ambulatory care services from approximately 350 hospitals within the state. These hospitals include general, specialty and teaching hospitals.

The qualitative study was conducted in California's Central Valley, a region rich in agriculture. The Central Valley is ethnically diverse, with Hispanics comprising a greater percentage of the population. Unfortunately, poverty rates tend to be higher and education levels lower than the rest of the state (Public Policy Institute of California, 2006). The Central Valley also suffers from shortages of health care professionals, which in turn contributes to poorer health outcomes for its people (University of California Health, 2018).

Sample

The qualitative study comprised of a purposive sample of 15 mothers. These mothers contacted the researcher after obtaining the study information flyer from two designated ED triage nurses, managers from a public health infant program, or staff from a local clinic. Inclusion criteria included being 18 years of age and older, and speaking English and or/Spanish, and having experienced an infant (<1 year of age) health concern. Exclusion criteria included mothers whose infants were now greater than five years of age to decrease recall bias (Bradburn, Rips, & Shevell, 1987; Coughlin, 1990). The quantitative studies included all infants within the data with a *birth ID* who sought hospital care after birth. There were 2,525,154 infant-level observations and 2,053,852 hospital visits after birth across the state of California.

Applying Andersen's Model to the Quantitative Variables

The independent variables were categorized according to Andersen's Model of Health Care Utilization (Andersen, 1995; Andersen & Newman, 1973). Generally; factors that occurred before the baby was born or did not directly affect the infant were categorized as a predisposing factor (i.e., pre-natal care). The pre and post pregnancy factors that could influence the type of care chosen were considered enabling factors (i.e., insurance type), while those that could directly affect the infant's health, and thus increased healthcare utilization were considered need (i.e., type of birth). Generally, anything that occurred before the baby was born was categorized as a predisposing factor and anything that occurred directly to the infant during birth and afterwards as need

Predisposing Factors Specific to Infant ED Utilization. When categorizing variables, age of the mother was placed in the predisposing category since it is a factor that cannot be changed. Other maternal factors found to be associated with ED utilization in previous studies and fit the criteria of a predisposing factor were the number of prenatal care visits and previous pregnancy/neonatal experience (Bernardes et al., 2014; Chakraborty, Islam, Chowdhury, Bari & Akhter, 2003; Crombag, Bensing, Iedema-Kuiper, Schielen & Visser, 2013). For the infant, race/ethnicity was included. Additionally, even though in previous ED studies gender has not been noted to be a

predictor of ED utilization, it was still included in this study since infant mortality rates are higher for male infants (Fuse & Crenshaw, 2006; Mathews & MacDorman, 2013).

Enabling and Need Factors Specific to Infant ED Utilization. There were no specific enabling factors found in the literature directly related to the infant. However, variables previously reported as important to include were the mother's educational level and language, and the infant's geographical location and type of insurance (Afilalo et al., 2004; Padgett & Brodsky, 1992; Zandieh et al., 2009). Other than current illness, other birth factors reported to directly affect infant health and ED utilization were categorized as need. These variables were birth weight, gestational age at birth, Apgar scores, length of hospital stay, birth season, health of mother while pregnant, type of birth, birth pattern and complications at birth and diagnosis at birth (Kowlessar, Jiang, & Steiner, 2013; Mathews & MacDorman, 2013).

Analysis

Quantitatively, descriptive and correlational statistics were used to analyze the relationship between the independent variables and dependent variables. The NYU program was used to categorize urgency of the visit (Figure 1). The NYU program was chosen as the final primary diagnosis was available, the program encompasses many of the alternate classification methods used in other studies and the program is objective (NYU, Wagner). Qualitatively, a grounded theory approach was utilized to help understand the decision-making process of mothers when their infant had a health concern. Grounded Theory is a method of analysis resulting in the development of new theory through the collection and analysis of data about a phenomenon (Glaser & Strauss, 1967). Through a thorough analysis of interviews, Grounded Theory enables the understanding of new problems with little to no research and/or existing problems needing to be approached in a new way (Strauss & Corbin, 1998; Taylor & Bogdan, 2002). Many researchers qualitatively studying health support the importance of understanding the perspective of how subjects view their world through Grounded Theory (Brown, Stevens, Troiano, & Schneider, 2002; Corrigan et al., 2006; Marcellus, 2005; Morse & Field, 1995). The data gathered often consists of audio-taped interviews that are then transcribed, and field notes from the interviewer after the interview to help with the ongoing analysis. Three processes are blended throughout the research: collection, coding, and analysis of data (Glaser & Strauss, 1967). This approach encourages the kind of flexibility so important to the qualitative researcher who can change a line of inquiry and move in new directions, as more information and a better understanding of what are relevant data are acquired (Strauss & Corbin, 1998; Taylor & Bogdan, 2002). Due to the nature of qualitative research, the orientation of the researcher to the subject is critical to the success of the study. It is very important during the research process that the researcher minimizes possible personal biases or prejudices by thoughtful review and self-examination of his/her thoughts throughout the process of data collection and analysis (Bosk, 1999). These key perspectives provide the rationale for using Grounded Theory when inquiring about a person's decision-making process.

Ethical Protection of Human Participants

Initially, to obtain OSHPD data for the quantitative portions of this study, registration on the California Committee for the Protection of Human Subjects (CPHS) website was needed. Once registered, per CPHS guidelines, the proposal was first submitted to the UC Merced Institutional Review Board (IRB) for approval. Once

approved by the local IRB, the form requesting de-identified Nonpublic Patient Level Data was submitted to OSHPD. Once approved by OSHPD, it was then sent to CPHS for approval. Once approved by CPHS, it was sent to the California Department of Public Health (CDPH) to review due to the data being linked to Birth Certificate data. Once approved by all parties, the data was shipped by OSHPD. The data was sent via an encrypted CD and was only accessed using the designated secure computer per the protocol.

For the qualitative portion of the study, approval from the UC Merced and Dignity Health Institutional Review Boards were sought and received. Even though there was little or no risk to the participants, a page detailing community counseling services was available to the participants in case sharing their story caused an emotional memory. None of the participants expressed a need for services. During the study, paper consents, the recorder and notes were stored in a secured drawer in a locked room, while transcripts were kept on a password-protected computer. To ensure privacy, when the interviews were transcribed, pseudonyms replaced any identifying information, including the participants' names and any other names they identified. The Health Insurance Portability and Accountability Act (HIPPA) was also adhered to.

Key Findings

This dissertation examines infant ED utilization using both qualitative and quantitative data to provide a more in-depth, comprehensive understanding of the issues. The first study quantitatively analyzed and compared predictors of infant hospital utilization after birth. Then, when and why infants utilize the hospital during their first year of life was examined and compared. Lastly, mothers provided a glimpse into how they make decisions about healthcare utilization when their infant was ill through the sharing of their stories during interviews.

Phase I-II of this study were quantitative analysis of the OSHPD data from various points of view. First, 1,210,605 infants who used the hospital after birth of 2,525,154 infants born from 2008-2012 were examined for predictors of infant hospital utilization. The largest number of infants who returned to the hospital did so as ED release (74.77%), followed by direct admits (15.69%) and last, ED admits (9.54%). Many more infant than maternal factors were associated with hospital use within the first year of life. The predictors of ED release visits and direct admits were inversely related to one another. As with previous ED studies, this study supports a large percentage (~75%) of infant hospital visits being ED visits. In the second study, 2,053,852 visits from 2,525,154 infants born from 2008-2012 were examined to establish if the SDoH were associated with when and why infants returned to the hospital during their first year of life. The SDoH did influence the age, day of week and diagnosis at visit. Then, the SDoH were assessed for association with visit urgency. No association was found.

Phase III of this study was a descriptive qualitative study. The sample consisted of fifteen mothers who had an ill infant within the last five years. Eight mothers took the infant to the ED while seven did not. Analysis of mothers' narratives revealed a similar process of observation, consultation, and assessment when making decisions about care for their infant's health concern. Mothers reported noticing a change in behavior or sign of illness, which prompted them to seek advice from the father of the baby and/or Internet. Next steps were influenced by previous experience with the symptoms or an older child. If the mother's reassessment led to a low/uncertain concern, they reported

attempting home interventions or seeking additional advice from immediate family members or friends with experience. If the reassessment led to a high concern, mothers reported calling for medical advice or seeking care from their PCP/clinic or ED. Findings from these studies support the need to improve access to primary care, especially for the most vulnerable populations and to online resources for concerned mothers. In addition, infant characteristics were more predictive of healthcare utilization after birth than maternal characteristics. However, more research comparing those utilizing healthcare services appropriately versus for ED release visits is needed in order to generalize results since these studies took place in California where the demographics are not representative the U.S.

Organization of Chapters

Four chapters follow this introduction. Chapter 2 titled "Babies and their Mothers: Predictors of Infant Emergency Department Utilization" discusses both the maternal and infant predictors of infant ED utilization and will be submitted to *Clinical Pediatric Emergency Medicine*. Chapter 3, titled "When and Why Infants Visit the Emergency Department: Do the Social Determinants of Health Matter?" discusses the association of the SDoH with the age, day of the week and diagnosis at the time of visit. It will be submitted to the journal *Pediatrics*. Chapter 4 titled "Influences on Mothers' Decision-Making When Their Infant is Ill: To Use or Not Use the Emergency Department" is the qualitative study describing mothers decision-making about healthcare utilization after analyzing interviews. It will also be submitted to the journal *Pediatrics*. The final chapter summarizes the findings, possible interventions, and future research needed.

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Chapter Two: Babies and their Mothers, Predictors of Infant Emergency Department Utilization

Abstract

Objective: The purpose of this retrospective study was to identify factors that predict which infants will visit the ED (release and admit) compared to those who return as direct admits within the first year of life.

Methods: Data from California Office of Statewide Health Planning and Development (OSHPD) for infants born between 2008 and 2012 linked by birth ID were used for this study. A logistic regression model was used to examine infant and maternal characteristics that predict infant returns to the hospital during their first year of life as ED release, ED admit, or as a direct admit to the hospital.

Result: Approximately 75% of the infants with a hospital visit after birth had an ED visit. Many more Infant characteristics were more likely to predict hospital use within the first year of life compared to maternal characteristics.

Conclusion: The study results support findings from previous studies reporting ED utilization to be the primary type of hospital visit during the first year of life. A closer examination of ED and direct visit predictors could help health care providers encourage use of PCP's when their infants are ill.

Introduction

The emergency department (ED) of a hospital is meant to be of service to individuals with life altering illnesses or injuries. However, over the last thirty years, use of the ED for non-urgent care has grown to approximately 30% of all visits (Uscher-Pines, Pines, Kellermann, Gillen, & Mehrotra, 2013). With ED's now being utilized for both urgent and non-urgent care, patients experience longer wait times, cost of patient care is increasing, and there has been a decrease in continuity of care (Billings, Parikh, & Mijanovich, 2000; Hermer, 2006; Kellerman, 1994; Shesser, Kirsch, Smith, & Hirsch, 1991). Infants in the ED also experience increased risk of exposure to other illnesses that can become catastrophic for them due to their decreased immune systems and respiratory and vascular reserve (American College of Obstetricians & Gynecologists, 2017; Batu, Yeni, & Teksam, 2015; Melville & Moss, 2013; Robinson, Kumar, & Cadichon, 2008). In addition, infants who receive their routine health care in the ED are much less likely to receive preventative and health promotion information and miss immunizations (Dutra & Rosenblum, 2014).

Parents who decide to bring their infants to the ED for non-urgent care do so for a variety of reasons. It is important to recognize these reasons to improve education and support to those most in need. Andersen's Model of Health Care Utilization identified three types of important factors associated with healthcare utilization: predisposing factors existed prior to seeking health care services and are not directly responsible for the use of the health care service(s) (e.g., race, age, and health beliefs), enabling factors are resources that affect the ability to acquire health care services when there is either a predisposition or need (e.g., access to health insurance, health literacy, education), and need which is the factor that actually drives or is directly correlated to the use of the health care service(s) (e.g., familiarity or severity of infant's symptoms) (Andersen, 1968; 1995). When predisposing and need factors are the drivers of health care

utilization, the system is perceived as equitable. In contrast, if enabling factors are the driver than the system is perceived as inequitable.

Previous infant ED utilization studies focused on insurance coverage, the gestational age (GA), or diagnosis and most were completed in urban pediatric specialty hospitals (Escobar et al., 2005; Isayama, Lewis-Mikhael, O'Reilly, Beyene, & McDonald, 2017; Jain & Cheng, 2006). Kuzniewiez, Parker, Schnake-Mahl, and Escobar found late preterm infants (32-36 weeks) had 1.5 to 3 times greater risk of hospital readmission during the first 30 days of life compared to full term infants (2013). Paul et al. examined infant and maternal factors associated with hospital readmission and ED use within the first 6 months of life for infants with Medicaid (2016). The authors reported increased readmissions for infants who had been in the Neonatal Intensive Care Units (NICU), whose mothers had bipolar disorder, or whose mothers were admitted to or visited the ED during their pregnancy. In contrast, maternal depression had decreased odds of an infant hospital readmission. Increased ED use was associated with a fall season birth, maternal ED use for her own health care needs, and multiple maternal prescription use. While, higher gestational age, an Apgar ≤ 5 at five minutes, being White, of older maternal age, and being part of a multiple birth pattern were associated with lower ED use.

Kotagal et al. studied the effects of early provider use after birth and ED use during the first 3 months of life for full term infants with Medicaid in Ohio (2002). Contrary to their expectations, early provider use was associated with increased instead of decreased ED use. Other factors associated with increased use were mothers without a high school diploma who had prenatal care and infants who were singletons born via C-Section. Lower risk of ED use was noted with primiparous mothers, and infants who were of older gestational age (GA), higher birth weight and came from a non-urban area. Lee, Bardach, Maselli, and Gonzales assessed the incidence of neonatal ED visits using the National Hospital Ambulatory Medical Care Survey (2014). They found Blacks were twice as likely as Hispanics and Whites to utilize the ED. Additionally, neonates with Medicaid were also more likely to utilize the ED compared to those with private insurance. A study by Donavan, Perlstein, Atherton and Kotagal investigated the relationship between maternal prenatal care and ED use at a Children's Hospital in Cincinnati, Ohio by full term infants born vaginally without any health issues (2000). Prenatal care was divided into less than two visits and $\geq$ two visits. Un-expectantly, mothers with less than two visits were less likely to have an ED visit. Additionally, they found no statistical relationship between substance abuse, race, parity or birth weight and ED use. However, the presence of birth defects, length of stay in the Newborn Nursery or Neonatal Intensive Care Unit, and Apgar Scores of ≤ 7 have been found to have an impact on ED utilization (Kowlessar, Jiang, & Steiner, 2013). This study adds to the literature by analyzing maternal and infant (up to age one) data across all California hospitals for predictors of an ED visit in comparison to a direct admit.

Purpose

The purpose of this retrospective study was to identify the factors that predict which infants will have an ED release visit compared to those who return as an ED or direct admit within the first year of life. This comparison is important, as previous research reporting a large percentage of ED release visits as "inappropriate" or non-urgent; could have been seen in an ambulatory care setting, have been based on

unfounded comparisons (Ben-Isaac, Schrager, Keefer & Chen, 2010; Brousseau, Mistry, & Alessandrini, 2006; Doobinin, Heidt-Davis, Gross, & Issacman, 2003; Hummel, Mohler, Clemens, & Duncan, 2014; Jaeger, Ambadwar, King, Onukwube & Robbins, 2015; Kubicek et al., 2012; Mistry, Hoffman, Yauck, & Brousseau, 2005; Phelps et al., 2000; Pomerantz, Schubert, Atherton, & Kotagal, 2002; Sharma et al., 2000; Taylor, 2013; Uscher-Pines, 2013). ED and direct admissions visits are suitable comparisons as they are seen as appropriate utilization of services (Leyenaar, Lagu, & Lindenauer, 2015; Traub, 2018). Appropriate utilization of services are services accessed that utilize the necessary resources for the best health outcome (Combes & Arespacochaga, 2013).

Research Hypothesis

The hypothesis of this study was that mothers who had the following predisposing factors: Non-Hispanic (NH) Whites, multiparous, more than 10 prenatal visits, and the enabling factor: a higher level of educational attainment would be associated with lower odds of having an infant ED release visit and higher odds of a ED admit or direct admit. Conversely, maternal predictors with higher odds of having an infant ED release visit and lower odds of an ED or direct admit were hypothesized to be the predisposing factors: younger aged mothers, first time mothers, mothers whose primary language was not English, and mothers with a medical problem during pregnancy. Infant predictors hypothesized to be associated with higher odds of infant ED release utilization and lower odds of an ED or direct admit were the predisposing factors being male, Non-Hispanic Black or Hispanic; enabling factors, Medi-Cal (Medicaid in California), or living in an urban area; and the following need factors, born in the fall or winter, preterm, abnormal Apgar score, birthweight ≤ 2500 grams, complication(s) during labor and delivery, newborn complication(s), and increased length of stay at birth.

Methods

Data

California Office of Statewide Health Planning and Development (OSHPD) is a department of the California Health and Human Services Agency. OSHPD is the primary source of data for California hospitals, requiring all licensed facilities to submit quarterly financial and utilization reports, as well as an annual Hospital Disclosure Report. The Health Information Division staff are responsible for establishing uniform methods for facilities to collect and report the data and assure data accuracy. To assure data accuracy the staff audits the Hospital Annual Disclosure reports for compliance with OSHPD's annual reporting system requirements and conduct an on-site review of hospitals' accounting systems. Currently 100% of all annual hospital reports are submitted electronically thru MIRCal, OSHPD's secure internet data collection system for patient discharges, ED encounters, and ambulatory surgery (AS) encounters (OSHPD, 2018).For each of these areas, data was recorded each time a patient is treated in a licensed general acute care hospital, ED or AS in California. The recorded data includes patient demographic information, such as age, sex, county of residence, race/ethnicity, diagnostic information, treatment information, disposition, total charges, and expected source of payment (OSHPD, 2010).

Sampling

OSHPD patient discharge data (PDD), ED, and AS data linked with Vital Statistics birth data were used for infants who born in the years 2008-2012 and their mothers. These years were chosen because of the need to have a large enough sample size

to prevent small cell sizes (less than 15 subjects) when making comparisons and data after 2012 being unavailable for this data set. This data set was chosen as the linked data set includes maternal antepartum and postpartum hospital records for the nine months prior to delivery and one-year post delivery. Additionally, the linked file includes the birth records, and all infant readmissions and ED encounters occurring within the first year of life. The linked pairs of birth/delivery records include information from the baby's discharge data record, the mother's discharge data record, and the vital statistics birth record (VSB). Due to there being no universal identifier, the data was linked using the birth hospital, zip code, sex, race and payer source. All associated records (prenatal, postnatal, transfers and infant readmissions and ED encounters) are identified by a *birth ID* variable and are sorted by admission date order. The initial file contained all infant encounters irrespective of whether they were linkable to an infant born in a California hospital. For this study, all encounters not linked were dropped to ensure data were as complete as possible (987,578 observations out of 7,983,930 total observations were dropped; 12%).

Measurements

Dependent Variable. The dependent variables were any infant who had one or more hospital encounter(s) after birth within the first year of life. This included those seen in the ED and subsequently discharged (*ED release*), those that were admitted (*ED admit*) and those admitted to the hospital directly by a medical provider (*direct admit*). Infants with an ambulatory surgery visit were included in the direct admission group since they utilized a hospital and were scheduled by a medical provider. Each of these dependent variables were included in the study as each provided a distinct access point to care or admission and level of urgency/appropriateness of hospital utilization. Prior to creating the dependent variables, a dichotomized *birth visit* variable was generated so only visits after the birth were included as part of the dependent variable visits. The *birth visit* variable was created from birth International Classification of Diseases (ICD) 9^{30} diagnosis codes V3000, V3001, V3100, V3101, V301, V3301, and V3401. The dependent variables were then generated by the patient type and admission source variable. The patient type variable indicates whether the infant's record was from AS, hospital inpatient or the ED. While, the patient's admission source variable indicates if the admission was from the hospital's ED or not. These dependent variables were dichotomized (0 = no ED utilization or admission, 1 = one or more).

Independent Variables. The independent variables were categorized according to Andersen's Model of Health Care Utilization (Andersen, 1968; 1995). Generally; factors that occurred before the baby was born or did not directly affect the infant were categorized as a predisposing factor (i.e., pre-natal care). The pre and post pregnancy factors that could influence the type of care chosen were considered enabling factors (i.e., insurance type), while those that could directly affect the infant's health, and thus increased healthcare utilization were considered need (i.e., type of birth). Generally, anything that occurred before the baby was born was categorized as a predisposing factor and anything that occurred directly to the infant during birth and afterwards as need (Appendix A). All variables were dichotomized (0 = no, 1 = yes). The initial variable available in the OSHPD data, the created variable, and the coding instructions can also be found in Appendix A.

Predisposing Factors.

Age. Maternal age at the time of service has been found to influence both urgent and non-urgent ED utilization patterns (Batu et al., 2015; Calado. Pereira, Santos, Castro, & Maio, 2009; Millar, Gloor, Wellington, & Joubert, 2000; Ung, Woolfenden, Holgate, Lee, & Leung, 2007). The mother's age in years at admission/service were obtained from PDD/ED/AS data. Maternal age was categorized into < 18, 18-35, and > 35 years of age, as these age categories represent when adults enter different developmental stages and maternal pregnancy outcomes change (American College of Obstetricians and Gynecologists [ACOG], 2017; Cavazos-Rehg, 2015; David, 2014; Schimmel et al., 2015).

Gender. In most countries, including the United States, infant mortality rates are higher for male infants (Fuse & Crenshaw, 2006; Mathews & MacDorman, 2013). This is also true for injuries in infants less than one year of age (Borse et al., 2008). The variable was re-categorized into *male, female,* and missing

Race/ethnicity. The patient's racial and ethnic backgrounds were self-reported by the parent in the OSHPD data (OSHPD, 2010). The disparity in the infant mortality rate between Black and NH White women has been more than double over the past decade (Mathews & MacDorman, 2013). In addition, race and ethnicity have been reported to affect both urgent and non-urgent ED utilization in the pediatric population (Batu et al., 2015; Kubicek et al., 2012; LeDuc, Rosebrook, Rannie, & Gao, 2006; Pomerantz et al., 2002; Sharma et al., 2000; Weisz, Gusmano, Wong, & Trombley, 2015). From this previous research, rather than using the race and ethnicity codes separately, they were collapsed into a race-ethnicity variable to provide better information regarding health disparities. Infant race-ethnicity categories used were *Hispanic, NH White, NH Black, NH Asian, and NH Other*.

Maternal Prenatal Visits. Early and adequate prenatal care have been observed to promote healthy pregnancies through screening and management of a woman's risk factors and health conditions, as well as allowing time for education and counseling on healthy behaviors during and after pregnancy (Wymelenberg, 1990). The number of normal prenatal visits is 10-14 (Carter et al., 2016). The *prenatal visit* variable was used to assess the number of prenatal visits from the VSB data within the OSHPD data (OSHPD, 2010). The *prenatal visit* variable was categorized into none, 1-9, 10-14, and greater than 14.

Maternal Parity. Parity is important to assess since primiparous mothers have been reported to have increased non-urgent ED visits (Pomerantz et al., 2002). The parity variable utilized from the OSHPD data included the number of children ever born to the mother, including the current birth (OSHPD, 2010). Parity was categorized into *primigravida*, a woman who is pregnant for the first time and *multigravida*, a woman who was has been pregnant greater than one time (Farlex Inc., 2003-2018).

Enabling Factors.

Health Insurance. Insurance status has been found to be an important indicator of both urgent and non-urgent ED utilization (Jain & Cheng, 2006; Johnson & Rimsza, 2004; Lee et al., 2014; Sharma et al., 2000; Uscher-Pines et al. 2013). The variables used were from both PDD and ED data. The variables available were in payer categories that were divided by the organization that was expected to pay, or did pay, the greatest share of the patient's bill (OSHPD, 2010). For this study, the initial categories were collapsed

into *private, Medi-Cal, uninsured,* and *other insurance*. Even though Medicare is categorized separately in adult studies, it was collapsed into "other" in this study due to the low number of children insured by Medicare (Institute of Medicine, 2002). The PDD and ED payer were then collapsed into one category so the payer could be analyzed regardless of the visit type.

Mother's Language. Although Language was not discussed in the pediatric ED literature, because it can affect access and serve as a proxy for acculturation, it was assessed (Cuellar, Nyberg, Maldonado, & Roberts, 1997). The variable for the mother's primary language spoken was retrieved from the PDD/AS/ED data. There were 58 languages coded (OSHPD, 2010). However, the language categories were collapsed into *English, Spanish,* and *Other* as English and Spanish were the predominant languages observed.

Maternal Education. The higher the mother's education level, the better the health outcome and less utilization of ED services (U.S. Department of Health and Human Services, 2013). All education level data were obtained from vital statistics data (OSHPD, 2010). Educational categories were operationalized to *less than or equal to 12th grade, high school graduate, some college, Bachelor's Degree, greater than or equal to Graduate Degree,* and *unknown* as these are the categories more frequently used (SurveyMonkey, 2018).

Geography. Typically, studies have included only one facility, so not much evaluation into the relationship between the patient's location and ED utilization has occurred. In the few studies that have evaluated this relationship, location was observed to have a direct impact on ED utilization (Cabey, MacNeill, White, James-Norton, & Mitchell, 2014; Sharma et al., 2000). The baby's zip code of residence used all five digits for the infant's residential zip code (OSHPD, 2010). The zip codes were divided into geographical units as defined by OSHPD's Medical Service Study Areas: *Urban, Rural* and *Frontier* (OSHPD, 2016). Some of the zip codes were categorized into more than one unit due to the zip code encompassing more than one type of geographical unit. When this occurred, the zip codes were counted twice.

Need Factors.

Maternal Antepartum and Labor and Delivery Health History. Children's long-term health and development can be influenced by early life events, beginning even before birth with the health of their mother. In fact, in 2010, the fourth leading cause of infant mortality was maternal complications of pregnancy (Mathews & MacDorman, 2013). Presently the maternal health conditions and behaviors found to pose the most risks to the newborn are Diabetes (DM), Hypertension (HTN), and tobacco (Centers for Disease Control and Prevention [CDC], 2014a; b). In addition, there has been a rise in sexually transmitted illnesses in pregnant females (CDC, 2017). Therefore, maternal illnesses during pregnancy were categorized into *Diabetes*, *hypertension* and *sexually transmitted illness*. In addition, the smoking variable was generated from collapsing two variables – if the mom smoked three months prior to pregnancy and if she smoked during any of the pregnancy trimesters (OSHPD, 2010). The variables created were *smoker ever,* meaning that the mother smoked either right before or during the pregnancy, and *non-smoker*. Lastly, a *complications during labor/delivery* variable available from the VSB data was dichotomized (OSHPD, 2010).

Infant Specific Factors. Gestational age (GA), birth weight, Apgar scores, mode of delivery, birth defects, length of stay after birth, birth pattern, and birth season have been correlated with increased morbidity and mortality during infancy, especially during the neonatal period. In fact, the gestational age of an infant is perhaps the most important predictor of his or her survival and subsequent health. The earlier the baby is born, the higher the risk for adverse health outcomes. The closer the newborn gets to a GA of 39 to 41 weeks, the better the health outcomes (Mathews & MacDorman, 2013; Saigal & Doyle, 2008; Teune et al., 2011). The infant's GA was estimated from the last menstrual period (LMP) and coded in weeks in the VSB data. If the date of LMP was missing, the gestational age was left blank (OSHPD, 2010). The GA categories for this study were as defined by the World Health Organization; *< 28 weeks* as extremely premature, *28-32 weeks* as very premature, *32-36 weeks* as moderately premature, *37-41* weeks as term, and *greater than or equal to 42 weeks* as post term (Howson, Kinney, & Lawn, 2012).

In addition, infant mortality and morbidity rates are also high for the smallest infants and decreases sharply as birthweight increases (Mathews & MacDorman, 2013). The birthweight variable was displayed as a four-digit number in grams from the VSB data (OSHPD, 2010). The birth weight was defined as *greater than 2500gms* (normal), *1500-2500 grams* (Low Birth Weight) and *less than 1500 grams* (Very Low Birth Weight) (Sharma et al., 2000).

Kowlessar et al. found Apgar Scores of ≥ 8 or ≤ 7, length of stay in Newborn Nursery or Neonatal Intensive Care Unit, and the presence of birth defects impacted ED utilization (2013). Even though one, five, and 10-minute Apgar scores were available, only the five-minute score was used since it gives information as to how well the baby is doing outside the mother's womb and the 10-minute Apgar was not assessed as frequently (ACOG, 2015). The five-minute Apgar score was categorized into *greater than or equal to seven* (normal) and *less than seven* (abnormal) (AGOG, 2015). Congenital birth defects are a critical factor in infant mortality (Hockenberry, Wilson, Rodgers, 2017). Therefore, the presence of a congenital anomaly at birth was also included.

Previous studies regarding length of stay after birth and ED use have yielded conflicting results (Kotagal et al., 2002; Lock & Ray, 1999; Sacchetti, Gerardi, Sawchuk, & Bihl, 1997). Therefore, it is important to further study this phenomenon. The infant's length of stay after birth was categorized as *less than or equal to one day, 2-3 days* (the norm), *3-7* (old norm), *1-2 weeks, 2-4 weeks* and *greater than four weeks* (Thomas, 2011). The cutoff was four weeks due to the numbers decreasing significantly after this time.

Because infant mortality and respiratory morbidity is higher with cesarean (C-Section) deliveries and there are more delivery complications with vaginal births after C-Section, the delivery method variable was included in the study (Macdorman, Declercq, Menacker, & Malloy, 2006; Signore & Klebanoff, 2008; Mayo Clinic Staff, 2018). The delivery method variable from the VSB data was categorized into *vaginal delivery, primary C-section, repeat C-section,* and *vaginal birth after C-section* (OSHPD, 2010). Being born a twin can also have early impacts on infant morbidity and mortality (Cheung, Yip & Karlberg, 2000). Therefore, the birth pattern variable was assessed and categorized into *singleton* and *twin* from the twin variable in the PDD data.

Many pediatric illnesses have seasonal variances (Hockenberry et al., 2017). Consequently; the season in which an infant was born could increase morbidity. The birth

season variable was created by collapsing the birth month variable from the VSB data (OSHPD, 2010). Since the season solstices occur toward the end of December, March, June, September, and most respiratory illnesses in children occur October through March, the months were categorized into the following seasons: *Winter* – January thru March, *Spring* – April thru June, *Summer* – July thru September, *Fall* - October thru December (National Geographic, 2018; Hockenberry et al., 2017).

Analysis

Before analysis, the data from OSHPD were converted from SAS version 9.3 to STATA version 14 and reshaped from a long (6,996,352 visit-level observations) to wide (2,525,154 infant-level observations) format (StataCorp, 2015). Initially descriptive statistics were conducted. To check collinearity, the variance inflation factors (VIF) and the correlation matrix of the parameter of estimates (VCE) was estimated using STATA; VIF's < 5 and VCE's < 0.5 were used to examine the predictors of an ED visit (Minitab Blog Editor, 2013). If collinearity occurred then the variable included was decided on by its' clinical significance. There were two sets of collinear variables. The first were less than *high school education* and *less than 18 years of age*. *Less than 18 years of age* was retained for analysis because the other educational level variables available would provide enough evidence as to whether educational attainment influences ED utilization. The other set of collinear variables were *less than 28-week GA* at birth and birth weight *less than 1500 grams at birth*. *Less than 1500 grams* at birth was kept for analysis because of mortality rates are poorer for infants born *less than 28 weeks GA* (Glass et al., 2015).

A multiple regression analysis was completed for ED release, ED admit, and direct admit using a stepwise approach to determine each of the most significant covariates in Andersen's model (Andersen, 1968; 1995). Only the covariates that were statistically significant were then incorporated into the full regression model. The final full model was used to estimate odds ratios and 95% confidence intervals. A *p* value of less than .05 was used as the criterion for statistical significance.

Results

From the 2,525,154 infants in the data born from 2008-2012, 1,210,605 (47.94%) infants returned to the hospital within their first year of life. The largest number of infants who returned to the hospital did so as ED release (74.77%), followed by direct admits (15.69%) and the fewest were ED admits (9.54%) (Table 1).

Descriptive Statistics

The frequency at which all factors within the predisposing, enabling and need categories occurred for each type of visit were distributed in the same ordinal position as they occurred at birth except for the following (Table 1). Unlike for all births and admission types whose third highest percentage of patients were Asians followed by Blacks, ED release patients' third largest group was Blacks followed by Asians. Although self-pay was the third most common type of insurance for births, it was the fourth for all return visits to the hospital within the first year of life. For all births and direct admits, mothers with some college were noted more frequently then mothers with less than a high school diploma. However, for both types of ED visits (ED release and admit) there were more mothers with less than a high school diploma then with some college. For season of birth, GA and maternal illness during pregnancy, the deviation came from both admission types (ED and direct). There were a higher number of winter birth admits then summer,

those born at less than 28 weeks than greater than 42 weeks and Diabetes than a sexually transmitted infections.

Table 1: 2008-2012 Infant Level Descriptive Statistics

PREDIS-POSING VARI-ABLE	***Total Births***	Var/ Total Births %	***Total Infants who had Hos-pital visits after birth***	Var/ Total In-fants w visits %	***ED Re-lease***	ED%	***ED Admi t***	ED Ad-mit %	***Direct Admit***	DA %
	2,525, 154	*100.0*	1,210, 605	*47.94*	905, 200	*74.77*	115, 516	*9.54*	189, 889	*15.69*
Infant's Gender										
**Females:*	1,234, 117	*48.87*	551, 043	*45.52*	424, 598	*46.91*	48, 630	*42.10*	77, 815	*40.98*
Males:	1,290, 278	*51.10*	659, 359	*54.47*	480, 470	*53.08*	66, 873	*57.89*	112, 016	*58.99*
.	759	*0.03*	198	*0.02*	132	*0.01*	13	*0.01*	58	*0.03*
Infant's Race/Ethnicity										
**NH White*	785, 158	*31.09*	313, 610	*25.91*	226, 550	*25.03*	26, 895	*23.28*	60, 165	*31.68*
NH Black	142, 039	*5.62*	85,087	*7.03*	66, 831	*7.38*	7,26 0	*6.28*	10, 996	*5.79*
NH Asian	282, 042	*11.17*	92,439	*7.64*	62, 047	*6.85*	8,86 3	*7.67*	21, 529	*11.34*
NH Other	106, 529	*4.22*	41,162	*3.40 %*	29,55 5	*3.27 %*	3,85 6	*3.34 %*	7,751	*4.08 %*
Hispanic	1,174, 267	*46.50*	667, 375	*55.13*	512, 420	*56.61*	67, 865	*58.75*	87, 090	*45.86*
.	35,119	*1.39*	21,212	*1.75*	15, 646	*1.73*	1,57 5	*1.36*	3,991	*2.10*
Mom's Age										
≤18	128, 211	*5.08*	81,460	*6.73*	64, 234	*7.10*	8,14 4	*7.05*	9,082	*4.78*
**19-35*	2,015, 941	*79.83*	955, 940	*78.96*	723, 991	*79.98*	91, 508	*79.22*	140, 441	*73.96*
>35	359, 149	*14.22*	139, 046	*11.49*	99, 460	*10.99*	13, 195	*11.42*	26, 391	*13.90*
.	21,853	*0.87*	34,159	*2.82*	17, 515	*1.93*	2,66 9	*2.31*	13, 975	*7.36*
Mom's Parity										
Primipar-ous	1,008, 626	*39.94*	498, 351	*41.17*	371, 514	*41.04*	43, 022	*37.24*	83, 815	*44.14*
**Multiparo us*	1,516, 528	*60.06*	712, 254	*58.83*	533, 686	*58.96*	72, 494	*62.76*	106, 074	*55.86*
.	0	*0*	0	*0*	0	*0*	0	*0*	0	*0*
Mom's Prenatal Visits										
None	12,161	*0.48*	5,909	*0.49*	4,258	*0.47*	596	*0.52*	1,055	*0.56*
one to 9	420, 033	*16.63*	209, 380	*17.30*	155, 203	*17.15*	20, 317	*17.59*	33, 860	*17.83*

**ten to 14*	1,492,566	*59.11*	692,003	*57.16*	526,312	*58.14*	65,442	*56.65*	100,249	*52.79*
≥14	523,441	*20.73*	239,433	*19.78*	179,343	*19.81*	23,371	*20.23*	36,719	*15.34*
.	76,953	*3.05*	63,880	*5.28*	40,084	*4.43*	5,790	*5.01*	18,006	*9.48*
ENABLING VARIABLES										
Infant's Insurance Type										
Medi-Cal	1,219,757	*48.30*	733,004	*60.55*	563,698	*62.27*	76,667	*66.37*	92,639	*48.79*
**Private*	1,190,470	*47.14*	431,494	*35.64*	309,240	*34.16*	34,971	*30.27*	87,283	*45.97*
Self-pay	60,766	*2.41*	19,673	*1.63*	15,658	*1.73*	1,310	*1.13*	2,705	*1.42*
Other	54,035	*2.14*	26,396	*2.18*	16,578	*1.83*	2,563	*2.22*	7,255	*3.82*
.	126	*0.00*	38	*0.00*	26	*0.00*	5	*0.00*	7	*0.00*
Mom's education										
<High School	583,433	*23.10*	347,256	*28.68*	268,680	*29.68*	37,761	*32.69*	40,815	*21.49*
HS graduate or GED	634,536	*25.13*	334,830	*27.66*	258,179	*28.52*	31,779	*27.51*	44,872	*23.63*
Some College	587,370	*23.26*	267,987	*22.14*	202,586	*22.38*	24,018	*20.79*	41,383	*21.79*
Baccalaureate Degree	403,750	*15.99*	128,180	*10.59*	89,300	*9.87*	11,170	*9.67*	27,710	*14.59*
**Graduate Degree*	217,706	*8.62*	65,120	*5.38*	44,538	*4.92*	5,600	*4.85*	14,982	*7.89*
.	98,359	*3.90*	67,232	*5.55*	41,917	*4.63*	5,188	*4.49*	20,127	*10.60*
Mom's language										
**English*	1,528,541	*60.53*	693,459	*57.28*	521,276	*57.59*	64,066	*55.46*	108,117	*56.94*
Spanish	376,076	*14.89*	210,322	*17.37*	162,590	*17.96*	22,220	*19.24*	25,512	*13.44*
Other	66,467	*2.63*	21,545	*1.78*	15,839	*1.75*	2,111	*1.83*	3,595	*1.89*
.	554,070	*21.94*	285,279	*23.56*	205,495	*22.70*	27,119	*23.48*	52,665	*27.73*
Infant's Geographical Location										
**Urban*	1,956,816	*77.49*	916,880	*75.74*	684,184	*75.58*	87,499	*75.75*	145,197	*76.46*
Rural	466,583	*18.48*	245,839	*20.31*	185,589	*20.50*	23,353	*20.22*	36,897	*19.43*
Frontier	31,109	*1.23*	18,375	*1.52*	13,760	*1.52*	1,928	*1.67*	2,687	*1.42*
.	70,646	*2.80*	29,511	*2.44*	21,667	*2.39*	2,736	*2.37*	5,108	*2.69*

NEED VARI-ABLES										
Infants Birth Season										
Winter Birth	118,296	*4.68*	121,419	*10.03*	41,807	*4.62*	5,329	*4.61*	8,294	*4.37*
Spring Birth	117,182	*4.64*	120,135	*9.92*	40,475	*4.47*	4,452	*3.85*	7,613	*4.01*
**Summer Birth*	125,238	*4.96*	128,640	*10.63*	44,210	*4.88*	5,116	*4.43*	8,027	*4.23*
Fall Birth	127,344	*5.04*	130,494	*10.78*	44,753	*4.94*	6,269	*5.43*	8,887	*4.68*
.	2,037,094	80.67	985,300	*81.39*	733,955	*81.08*	94,350	*81.68*	157,068	*82.70*
Infant's Birth Pattern										
**Singleton*	2,449,766	*97.01*	1,151,160	*95.09*	872,085	*96.34*	110,236	*95.43*	168,839	*88.91*
Twin	75,144	*2.98*	31,016	*2.56*	19,272	*2.13*	3,180	*2.75*	8,564	*4.51*
.	244	*0.01*	28,429	*2.35*	13,843	*1.53*	2,100	*1.82*	12,486	*6.58*
Infants Birth Type:										
**Vaginal Birth*	1,662,197	*65.83*	780,179	*64.45*	592,670	*65.47*	74,898	*64.84*	112,611	*59.30*
Primary C-Section	461,177	*18.26*	215,744	*17.82*	159,783	*17.65*	19,765	*17.11*	36,196	*19.06*
Previous C-Section	374,563	*14.83*	177,191	*14.64*	133,000	*14.69*	17,886	*15.48*	26,305	*13.85*
Vaginal Birth after C-Section	18,613	*0.74*	7,812	*0.65*	5,619	*0.62*	823	*0.71*	1,370	*0.72*
.	8,604	*0.34*	28,959	*2.39*	14,128	*1.56*	2,144	*1.86*	12,687	*6.68*
Infant's Gestational Age										
< 28wks	12,279	*0.49*	7,610	*0.63*	2,803	*0.31*	927	*0.80*	3,880	*2.04*
28-31.6 wks	18,461	*0.73*	11,974	*0.99*	6,050	*0.67*	1,301	*1.13*	4,623	*2.43*
32-36 wks	182,110	*7.21*	99,637	*8.23*	65,305	*7.21*	10,916	*9.45*	23,416	*12.33*
**37-41 wks*	2,280,703	*90.32*	1,052,107	*86.91*	808,959	*89.37*	99,333	*85.99*	143,815	*75.74*
>42	13,698	*0.54*	5,808	*0.48*	4,538	*0.50*	516	*0.45*	754	*0.40*
.	17,903	*0.71*	33,469	*2.76*	17,545	*1.94*	2,523	*2.18*	13,401	*7.06*
Infant's Apgar Scores at 5min										
<7	23,187	*0.92*	12,731	*1.05*	6,604	*0.73*	1,288	*1.11*	4,839	*2.55*
**≥7*	2,468,888	*97.77*	1,157,312	*95.60*	876,148	*96.79*	111,071	*96.15*	170,093	*89.57*
.	33,079	*1.31*	40,562	*3.35*	22,448	*2.48*	3,157	*2.73*	14,957	*7.88*

Infant's Birth weight										
Less than 1500gms	26,765	*1.06*	17,144	*1.42*	7,418	*0.82*	1,962	*1.70*	7,764	*4.09*
1500-2499gms	139,578	*5.53*	74,333	*6.14*	48,519	*5.36*	7,898	*6.84*	17,916	*9.43*
**≥2500gms*	2,349,699	*93.05*	1,089,864	*90.03*	834,935	*92.24*	103,489	*89.59*	151,440	*79.75*
.	9,112	*0.36*	29,264	*2.42*	14,328	*1.58*	2,167	*1.88*	12,769	*6.72*
Complications during Labor and Delivery										
L&D Complications	1,174,275	*46.50*	538,135	*44.45*	400,535	*44.25*	51,065	*44.21*	86,535	*45.57*
** No L&D Complications*	1,342,115	*53.15*	643,400	*53.15*	490,456	*54.18*	62,293	*53.93*	90,651	*47.74*
.	8,764	*0.35*	29,070	*2.40*	14,209	*1.57*	2,158	*1.87*	12,703	*6.69*
Newborn complications										
Positive Newborn Complications	257,076	*10.18 %*	142,508	*11.77 %*	89,193	*9.85 %*	14,320	*12.40 %*	38,995	*20.54 %*
** No NB Complications*	2,259,205	*89.47 %*	1,038,971	*85.82 %*	801,755	*88.57 %*	99,036	*85.73 %*	138,180	*72.77 %*
.	8,873	*0.35*	29,126	*2.41*	14,252	*1.57*	2,160	*1.87*	12,714	*6.70*
Infant's Length of Stay after birth										
≤1 day	624,575	*24.73*	293,467	*24.24*	215,158	*23.77*	26,884	*23.27*	51,425	*27.08*
**2-3 days*	1,542,921	*61.10*	721,626	*59.61*	556,231	*61.45*	69,315	*60.00*	96,080	*50.60*
4-7 days	252,729	*10.01*	114,773	*9.48*	84,392	*9.32*	10,839	*9.38*	19,542	*10.29*
1-2 wks	47,620	*1.89*	29,045	*2.40*	18,143	*2.00*	3,152	*2.73*	7,750	*4.08*
2-4 wks	29,645	*1.17*	19,429	*1.60*	10,963	*1.21*	2,227	*1.93*	6,239	*3.29*
> 4 wks	27,526	*1.09*	20,878	*1.72*	10,187	*1.13*	2,799	*2.42*	7,892	*4.16*
.	138	*0.01*	11,387	*0.94*	10,126	*1.12*	300	*0.26*	961	*0.51*
Maternal Illness during pregnancy										
**None*	98,261	*3.89*	46,797	*3.87*	34,569	*3.82*	4,139	*3.58*	8,089	*4.26*
HTN	12,722	*0.50*	6,542	*0.54*	4,706	*0.52*	638	*0.55*	1,198	*0.63*
DM	20,853	*0.83*	10,072	*0.83*	7,472	*0.83*	1,019	*0.88*	1,581	*0.83*
STI	23,468	*0.93*	10,077	*0.83*	7,630	*0.84*	966	*0.84*	1,481	*0.78*
.	2,369,850	*93.85*	1,137,117	*93.93*	850,823	*93.99*	108,754	*94.15*	177,540	*93.50*

Mother's Smoking Status										
Smoker ever	45,378	*1.80*	24,592	*2.03*	18, 747	*2.07*	2,26 1	*1.96*	3,584	*1.89*
**Non-smoker*	2,399, 147	*95.01*	1,118, 327	*92.38*	842, 827	*93.11*	107, 151	*92.76*	168, 349	*88.66*
.	80,629	*3.19*	67,686	*5.59*	43, 626	*4.82*	6, 104	*5.28*	17, 956	*9.46*

** reference category*

Logistic Regression Statistics

ED Release Visit. Data for predisposing, enabling, and need factors for ED release visits are presented in Table 2. Regarding predisposing factors, male infants had 13% lower odds of having an ED release visit (OR: .87). Black (OR: 1.62) and Hispanic (OR: 1.29) infants had 62% and 29% higher odds, respectively, compared to NH Whites of an ED release visit. Asians were the least likely to have an ED visit with 42% decreased odds (OR: 58). As a mother's age increased, she had lower odds of an ED release visit. Mothers less than 18 years old were had 81% higher odds of an ED release visit compared to mothers 19-35 years old (OR: 1.81). PNVs and parity were not significant predictors.

Assessing enabling factors, infants with Medi-Cal insurance had 62% higher odds of an ED release visit compared to those with private insurance (OR: 1.62). In addition, mothers who had less than a college degree had 19% higher odds of an ED release visit (OR: 1.19) than mothers with a graduate degree. The infant's geographical location, and mothers' education and language were not significant predictors.

Finally, need factors were related to decreased odds of an infant ED release visit. There was an 18% decrease in odds if an infant was born in the Fall , 49% if late-preterm, 48% if there was an Apgar score less than 7, 29% if there was a complication during labor and delivery or 31% if there was a newborn complication (OR: .82; .51; .52; .71; .69, respectively). In addition, the less the infant weighed at birth, the less likely he/she was to have an ED release visit: Infants weighing less than 1500 grams had 73% less odds while those weighing 1500-2500 grams had 27% less odds than infants weighing greater than 2500 grams at birth (OR: .27; .73). Lastly, infants who stayed (LOS) ≤ one day had a 34% lower odds of an ED release visit (OR: .66) than those with longer stays. The longer the stay the higher the odds of an ED release visit (OR: LOS 2-4wks-1.51; LOS >4wks-1.72).

ED Admit. Data for predisposing, enabling, and need factors for infants who were ED admits are presented in Table 2. For ED admits, being a male infant was the only significant predisposing predictor of having an ED admit with 26% higher odds. Infants with Medi-Cal was the only enabling predictor with 32% higher odds of having an ED admit compared to those with private insurance. Need factors predictive of an infant ED admit were being born just slightly premature (32-36 weeks), mother having had an STI during pregnancy and having stayed in the hospital greater than four weeks: 42%, 22% and 120% respectively. While being born by primary C-section and in the spring decreased the odds by approximately 20% (Table 2).

Direct Admit. Data for predisposing, enabling, and need factors for infants who were a direct admit to the hospital are also presented in Table 2. Predisposing factors significant for direct admits were gender, race/ethnicity, maternal age, and number of PNVs. Male infants and Asian infant had increased odds of being a direct admit, 27% and 42%, respectively. In contrast, Black and Hispanic infants had lower odds of being a direct admit, 25% and 19% respectively. Mothers who were less than 18 years old had a 28% less chance of having a direct admit infant. While mothers who had 1-9 prenatal visits had 20%, higher odds of having a direct admit infant.

None of the enabling factors increased the odds of a direct admit infant, but having Medi-Cal or being Uninsured decreased the odds of a direct admit infant by 30% and 37% versus those who had private insurance. In addition, mothers with some college education versus a graduate degree had 14% lower odds of having a direct admit infant.

Regarding need, many factors increased the odds of an infant being a direct admit. Infants born in the fall, Apgar scores less than seven, being late pre-term (32-36 weeks), and having a newborn complication increased the odds; 22%, 106%, 59%, and 71%, respectively. The less an infant weighed at birth, the higher the odds of being a direct admit. Infants who weighed less the 1500 grams had 233% higher odds and those who weighed 1500 to 2500 grams had 60% higher odds. Staying in the hospital less than one day after birth increased the odds of an infant having a direct admit by 81%, whereas staying in the hospital one to two weeks decreased the odds by 40%. Mothers who had a previous C-Section, a complication during labor and delivery or Diabetes had higher odds of their infant having a direct admit. There was a 40% increase in odds of an infant having a direct admit if the mother had a previous C-Section, 28% increased odds if there was a complication during labor and delivery and a 42% increased odds if the mother had diabetes (Table 2).

Table 2: 2008-2012 Final Logistic Regression Statistics

Characteristic	*ED Release*		*ED Admission*		*Direct Admission*	
PREDISPOSING VARIABLES	OR	95% CI	OR	95% CI	OR	95% CI
Gender						
Males:	0.874	0.778-0.982	1.265	1.120 -1.429	1.272	1.146-1.413
Race/Ethnicity						
NH Black	1.617	1.244-2.103			0.754	0.602-0.945
NH Asian	0.579	0.472-0.711	1.117	0.862-1.446	1.422	1.164-1.737
NH Other	0.853	0.623-1.168	0.834	0.562-1.238	0.965	0.714-1.306
Hispanic	1.285	1.010-1.503	1.126	0.966-1.312	0.814	0.706-0.939
Maternal Age						
≤18	1.809	1.266-2.587	0.834	0.611-1.137	0.719	0.543-0.953
>35	0.866	0.737-1.017	1.131	0.950-1.348	1.003	0.864-1.165
Parity						
Primiparous	1.090	0.960-1.239	0.908	0.788-1.046		
Prenatal Visits						
None	1.287	0.744-2.226			1.026	0.648-1.623
one to 9	0.907	0.777-1.059			1.201	1.046-1.380
≥14	1.004	0.870-1.160	1.088	0.946-1.252	1.020	0.897-1.161

ENABLING VARIABLES	OR	95% CI	OR	95% CI	OR	95% CI
Insurance Type						
Medi-Cal	1.623	1.409-1.869	1.321	1.130-1.545	0.696	0.612-0.792
Uninsured	1.414	0.950-2.108	0.984	0.626-1.546	0.631	0.431-0.925
Other	0.788	0.579-1.071	1.290	0.891-1.867	1.063	0.791-1.430
Maternal Language						
Spanish	1.161	0.967-1.395	0.958	0.807-1.137	0.951	0.812-1.113
Other	1.182	0.829-1.685	1.065	0.705-1.608	0.758	0.534-1.075
Maternal Education						
HS graduate or GED	1.133	0.964-1.332	0.963	0.818-1.134	0.898	0.778-1.036
Some College	1.193	1.011-1.407	1.038	0.874-1.232	0.856	0.737-0.993
Baccalaureate Degree	0.920	0.756-1.121	1.025	0.8071-.302	1.145	0.952-1.377
Geography						
Rural	0.998	0.857-1.163	0.908	0.774-1.066	0.909	0.792-1.043
Frontier	0.998	0.571-2.458	1.470	0.743-2.911	1.587	0.898-2.804
NEED VARIABLES	OR	95% CI	OR	95% CI	OR	95% CI
Birth Season						
Winter Birth						
Spring Birth			0.803	0.692-0.933		
Fall Birth	0.817	0.718-0.930			1.217	1.083-1.368
Birth Pattern						
Twin						
Birth Type						
Primary C-Section			0.793	0.678-0.929		
Previous C-Section					1.396	1.220-1.598
Vaginal Birth after C-Section						
Gestational Age						
28-31.6 wks	0.998	0.388-1.005				
32-36 wks	0.512	0.420-0.623	1.422	1.187-1.705	1.586	1.331-1.890
>42						
Apgar Score at 5 min						
<7	0.519	0.363-0.742			2.059	1.482-2.859
Birth Weight						
Less than 1500gms	0.266	0.174-0.408			3.326	2.450-4.515
1500-2499gms	0.731	0.581-0.920			1.603	1.317-1.951

NEED VARIABLES CONTINUED	OR	95% CI	OR	95% CI	OR	95% CI
Complications during L&D and Newborn						
L&D Complications	0.714	0.625-0.816			1.279	1.136-1.439
Newborn Complications	0.688	0.591-0.802			1.712	1.499-1.955
Length of Stay after Birth	OR	95% CI	OR	95% CI	OR	95% CI
≤1 day	0.657	0.572-0.755			1.812	1.598-2.055
4-7 days						
1-2 wks	1.509	1.039-2.192			0.603	0.430-0.843
2-4 wks	1.724	1.154-2.575				
> 4 wks	2.707	1.666-4.397	2.197	1.576-3.063		
Maternal Illness During Pregnancy						
HTN	0.987	0.814-1.198	1.100	0.903-1.341		
DM					1.417	1.231-1.631
STI			1.220	1.030-1.445		
_Cons						
cons	7.941	6.295-10.027	0.086	0.068-0.108	0.125	0.101-0.154

P-value < .05

Discussion

The results for ED release and direct admit were inverse of one another. There were a few predictors of ED admissions, but they did not coincide with the other two types of service utilization. Only predisposing and enabling factors were associated with higher ED release visits. Hypothesized maternal factors found to be associated with ED release utilization were level of educational attainment, younger age, and a medical problem during pregnancy. Infant predictors found to be associated with increased ED release utilization were being male, Non-Hispanic Black or Hispanic, Medi-Cal (Medicaid in California), or living in an urban area. Otherwise, none of the other hypothesized variables was associated with increased ED release utilization. Whereas, all three factors of Andersen's Healthcare Utilization Model were associated with both types of admission (ED and direct). Moreover, need was the factor most associated with admissions, especially direct admissions.

Predisposing Factors

In previous pediatric ED utilization studies, males had a higher percentage of ED visits (Neuman et al., 2014; Sharma et al., 2000; Wier, Hao, Owens, & Washington, 2013). However, in this study, unexpectedly; being female was more predictive of having an ED release visit, while being a male was more predictive of a readmission through the

ED or as a direct admit. This supports Paul et al.'s research, which also found females less likely to be readmitted within the first 6 months of life (2016).

Race and ethnicity have both been noted to affect urgent and non-urgent ED utilization in the pediatric population, with higher visits noted for Blacks (Batu et al., 2014; Lee et al., 2014; Sharma et al., 2000). These differences in use have been attributed to barriers in access (Pathman, Fowler-Brown, Corbie-Smith, 2006). In this study, Hispanic and NH Whites had the highest percentage of all hospital visits. They were followed by Asians and Blacks, except for infants with an ED release visit. For ED release visits, Blacks were third followed by Asians. As predicted, in the logistic regression analysis, there were higher odds of an ED release visit and lower odds of a direct admit when the infant was Black or Hispanic, or if their mothers were younger in age. Asian Americans generally have lower rates of poverty and lack of health insurance in comparison to Blacks and Hispanics (Barnes, Adams, & Powell-Griner, 2008). Given the relationship with ED use and poverty, it is not surprising that that Asians had lower rates of ED utilization than Blacks and Hispanics (DeNavas-Walt, Proctor, & Smith, 2011; Sharma et al., 2000). However, it was surprising that ED utilization for Asians was lower and the direct admissions were higher than NH Whites. This increase in direct admissions might be due to Asians seeking alternative medical care first which can cause them to wait longer to seek care from their primary care provider, therefore being sicker at the time seen and in turn increasing their chance of admission (Jintrawet & Harrigan, 2003; Nuttall & Flores, 1997).

The relationship between prenatal visits and ED use has not been consistent. Paul et al. (2016) found a lack of prenatal visits to be associated with increased ED utilization, while Donovan et al. (2000) found that mothers with less than two prenatal visits were less likely to have an ED visit. In addition, Kotgal et al. (2002) observed mothers who took their infant to the ED were more apt to be primiparous, younger, and have more prenatal visits. This study found that a lack of prenatal visits and being a first time mother were not predicative of any type of hospital utilization after birth as hypothesized.

Enabling Factors

Previous pediatric ED studies reported children with Medi-Cal to have the highest rates of ED utilization followed by private insurance (Ben-Issac et al., 2010; Berry, Brousseau, Brotanek, Tomany-Korman, & Flores, 2008; Garcia, Bernstein, & Bush, 2010). This study also found infants with Medi-Cal were more likely than those with private insurance to have any type of ED visit. However, in contrast to previous studies, the uninsured were also more likely than those with private insurance to have an ED release visit. This could be due to the parents with infants acting quicker when there is an infant concern, but having no usual source of care when they lack insurance (Fontz, Damico, Squires, & Garfield, 2017). Interestingly, infants with private insurance were more likely than any other insurance type to have a direct admit. Previous research reported the higher the mother's education level, the better the health outcome and less utilization of ED services (Sommers, Boukus, & Carrier, 2012). This study also found mothers with less education were more apt to have an ED visit (ED release and admit). However, those with higher education were more apt to have a direct admit. These results support that those with private insurance and higher education have better access and relationships with primary care providers than those with Medi-Cal and the uninsured (Kellermann, 1994; Piehl, Clemens, & Joines, 2000).

Need Factors

The GA of an infant is perhaps the most important predictor of his or her survival and subsequent health (Mathews et al., 2015; Teune et al., 2011). In addition, infant mortality and morbidity rates are high for the smallest of infants and decrease sharply as birthweight increases (Mathews et al., 2015). Kowlessar et al. found Apgar Scores of ≥8 or ≤7, length of stay in Newborn Nursery or Neonatal Intensive Care Unit, and the presence of birth defects impacted ED utilization (2013). Furthermore, births by C-section increased morbidity due to a higher incidence of respiratory issues Jain & Cheng, 2006). Therefore, it was surprising to find infants born by C-section, premature, having a decreased Apgar score at five minutes or birth weight, complications during labor and delivery or at birth, or a maternal illness during pregnancy were less apt to have an ED release visit, but more apt to have a direct admit. This may be due to parents of high risk infants having better knowledge of the health care system and stronger relationships with their providers since infants and mothers with these conditions are observed more closely and have more frequent follow up (American Academy of Pediatrics, 2008; Bockli, Andrews, Pellerite, & Meadow, 2014). However, this does not explain the higher risk of ED release visits by infants with longer length of stay and infants with stays ≤ one day being at higher risk of a direct admit. This phenomenon needs further study.

Limitations of this study were that the even though the literature discussed a few additional variables predictive of ED utilization, the author was limited to examining the variables as defined in the OSHPD data. Also, because this was a retrospective study, there could be no deeper dive with the participants to get a better understanding of the results found. However, this study was able to provide comparisons on predictors of infants who had an ED release, ED admit or were directly admitted. By comparing patients who use the ED to those who see their providers prior to visiting the hospitals, the author was able to see which populations are in need of targeted interventions. In addition, this study provided insight into infant hospital use after birth for their entire first year of life and included both maternal and infant variables. Lastly, with the large number of observations available from throughout California the results are generalizable to the State. However, they are not generalizable to the nation as California's demographics, being a majority-minority state are not representative of the nation.

Conclusion

This study, as well as previous studies, found ED utilization to be the primary percentage of infant hospital visits after birth. Infant need factors were found to be more predicative of infant hospital use after birth than predisposing, enabling and maternal factors within the first year of life. The predictors of an infant having an ED release visit were inversely related to infants with a direct admit. The predisposing, enabling and need factors predictive of infant hospital utilization during the first year of life demonstrate access and health literacy as influencers in type of care utilized when there is an infant health concern. More comparative studies between ED and direct visit predictors would help health care providers better understand how to improve access and health literacy for parents whose infant is ill.

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Appendix A. Variable List

Study Variable	OSHPD Data Variable & Definition	OSHPD Variable Values	OSHPD Source	Coding Instructions
PREDISPOSING VARIABLES				
Infant's Gender *Females: Males:	SEXHI - Baby's sex	Values were: 1 = Male, 2 = Female, 3 = Other, and 4 = Unknown. "Other" was used for live births with congenital abnormalities that obscure sex identification and "Unknown" indicates that the patient's gender was not available from the medical record.	PDD	Values were dichotomized between male and female. "3 & 4" were set to missing.
Mom's Race/Ethnicity: *NH White NH Black NH Asian NH Other Hispanic	RACEH95I - The patient's racial background was self-reported by the patient or parent. HISPHI - self reported ethnicity is Hispanic (a person who identifies with or is of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin).	Reported invalid or missing values for race were defaulted to "0", 1 as white, 2 as Black, 3 as Native American / Eskimo / Aleut, 4 as Asian / Pacific Islander, 5 as Other, and 6 as Unknown. 0 = Missing, 1 Hispanic 2 Non-Hispanic, 3 Unknown = would not declare	PDD	The race categories were left as originally coded in the OSHPD data except for the Native American/ Eskimo/Aleut category was collapsed into the "Other." Race and ethnicity codes were collapsed into a race-ethnicity. Unknown were collapsed into missing.
Mom's Age: ≤18 *19-35 >35	AGEYRSM - Mom's age in years at admission	Continuous Variable	PDD/ ED/ AS	Maternal age was categorized into <18, 19-35, and >35 years of age
Mom's Parity: Primiparous *Multiparous	LLBYR - Year of last live birth	Represented by two-digit numeric codes where months (January=01-December=12). If there was no previous live birth then the variables are left blank.	VSB	Dichotomized to primip = no previous birth and multiparous = previous birth.

Mom's Prenatal visits: None one to 9 *ten to 14 ≥14	PREVSTS - Number of prenatal care visits	Continuous Variable. If the number of prenatal care visits is unknown or not reported then the variable is assigned a value of '99'.	VSB	Placed into dichotomized numerical categories.
ENABLING VARIABLES				
Infant's Insurance Type: Medical *Private Self-pay Other	pay_cati - Baby's Payer Category & PAYER_EDASI - This Code indicates the category of payer (type of entity or organization) who is expected to pay, or did pay, the greatest share of the patient's bill - Only for ED/AS	01 Medicare, 06 Other Government, 02 Medi-Cal, 07 Other Indigent, 03 Private Coverage, 08 Self Pay, 04 Workers' Comp 09 Other Payer, 05 County Indigent Programs 00 Not reported or reported in error; 09 Self Pay, 11 Other Non-Federal Programs, 12 PPO, 13 Point of Service, 14 EPO, 16 HMO, 00 Other, MC Medi-Cal, MA & MB Medicare	PDD & ED/AS	Both categories were collapsed to an all payer category. Medi-Cal and Self-Pay were kept as they came. All private insurers were collapsed into Private and all the other insurances were collapsed into "other"
Mom's education: <High School HS graduate or GED Some College Baccalaureate Degree *Graduate Degree	MEDUC06 - Categories of level of education	0 No Formal Education, 1 8th grade or less, 2 9th grade through 12 grade, no diploma, 3 High school graduate or GED completed, 4 Some college credit, but not degree, 5 Associate degree, 6 Bachelor's degree, 7 Master's degree, 8 Doctorate or Professional degree, 9 Unknown or not available	VSB	Were collapsed to the categories noted.
Mom's language: *English Spanish Other	PLS_IDM - Principal language spoken ID for mother	A value of up to 24 alpha characters was given for each language. Those languages not currently on OSHPD's list were given an ID of "1000" and a code of "OTH".	PDD	English and Spanish were kept as in the data. All other languages were collapsed into "other".
Infant's Geographical Location: *Urban Rural Frontier	PATZIPI - Baby's zip code of residence	This is a unique code assigned to a specific geographic area by the U.S. Postal Service. If the field was coded with XXXXX, the zip code is unknown. If it was coded with YYYYY, the patient is from an area outside the United States. If it was coded with ZZZZZ,	PDD	The zip codes were divided into geographical units as defined by OSHPD's Medical Service Study Areas: Urban, Rural and Frontier. The XXXX,

		the patient has no residence (homeless).		YYYY and ZZZZ codes were collapsed into missing.
NEED VARIABLES				
Infants Birth Season: Winter Birth Spring Birth *Summer Birth Fall Birth	bthmonth - Baby's Birth month	Two-digit month 01-12	VSB	The months were categorized into seasons as follows: Jan-March are winter, April-June are Spring, July-September are Summer, and Sept-December are Fall.
Infant's Birth Pattern: *Singleton Twin	_TWINI - Indicates a multiple gestation	A record with any ICD-9-CM codes of V31.xx, V32.xx, V33.xx, V34.xx, V35.xx, V36.xx, V37.xx, and 761.5x was considered a multiple gestation. The variable is coded as 'Y' if any of these ICD-9-CM codes occur, otherwise 'N'.	PDD	All "N" were categorized as Singletons and all "Y" were categorized as a twin.
Infants Birth Type: *Vaginal Birth Primary C-Section Previous C-Section Vaginal Birth after C-Section	CAESAR05 - Delivery Mode	CAESAR05: 01, 11, 21, 31 Cesarean – Primary; 02, 12, 22, 32 Cesarean – Repeat; 03, 05, 06 Vaginal; 04, 15, 16 Vaginal - after previous cesarean;	VSB	Each category was collapsed into a dichotomized variable.
Infant's Gestational Age: < 28wks 28-31.6 wks 32-36 wks *37-41 wks >42	ESTGEST - GA in weeks @ delivery from the date of last menses.	Gestational age is calculated by subtracting the date of last normal menses (LNMDATE) from the date of birth (BTHDATE) and then recomputed to weeks. If the calculation gives a values of 1,000 days or more then the values "999" was assigned. If only month and year of menses are given, the 15th of the month was assumed as the date. If date of last menses is missing, gestational age is blank.	VSB	Weeks were re-categorized into age categories.

Infant's Apgar Scores at 5min: <7 *≥7	APGAR5 - Apgar score at 5 minutes	The Apgar variable at five minutes was coded numerically 1-10 and "99" for any Apgar scores not recorded.	VSB	Numbers were re-categorized into two categories.
Birth weight: Less than 1500gms 1500-2499gms *≥2500gms	BTHWGHT - Uncorrected birth weight (grams)	This is a 4-digit number. "9998" was used if the infant was not weighed for a hospital delivery and "9999' if there was no birth weight for a non-hospital delivery	VSB	Numbers were re-categorized into categories.
Complications during Labor and Delivery: L&D Complications * No L&D Complications	probl_2 - Complications during labor/delivery	2-digit codes: 10 PROM >12hrs, 26 Amniocentesis, 11 labor Induction 27 Electronic FM, 28 Tocolysis, 13 Abruptio placenta,14 Placenta previa, 30 Maternal death (within 72 hrs of delivery), 15 excessive bleeding, 31 Other, 16 Genital herpes, 00 None, 17 Amnionitis/sepsis	VSB	Was dichotomized into yes or no L&D complications
Newborn complications: Positive Newborn Complications * No NB Complications	probl_3 - Abnormal Conditions & Clinical Procedures Relating to the Newborn	2-digit codes: 00 None; 99 Unknown; 01, 02, 76, 77, 78, 79, 80, 28, 29, 30, 57, 81, 82, 83, 35, 88, 89 & 90 CONGENITAL ANOMALIES (NEWBORN OR FETUS); 66, 71, 85, 73, 86, 87, 70, 4, ABNORMAL CONDITIONS (NEWBORN OR FETUS); 75 Other newborn only, 67 Other fetus only.	VSB	Was dichotomized into yes or no newborn complications
Infant's Length of Stay after birth: ≤1 day *2-3 days 4-7 days 1-2 wks 2-4 wks > 4 wks	_losi - Baby's length of stay	Total number of days between admission and discharge dates for each patient. The days were calculated by subtracting the Admission Date from the Discharge Date. The length of stay for patients admitted on one day and discharged on the next is one day. The length of stay for patients admitted and discharged on the same day was counted as 0 days. These two	PDD	The number in days was re-categorized as noted.

		derived variable have been converted to numeric values for calculation purposes		
Maternal Illness during pregnancy: *None HTN DM STI	PROBL_1 - pregnancy complication or concurrent illnesses during pregnancy	Two codes: 00 None; 40, 41 Pregnancy from Infertility Treatment; 99 Unknown; 09, 31 Diabetes; 42, 43, 44, 45, 16, 46 Infections Present and/or Treated this Pregnancy; 03, 01, 02 Hypertension; 33 Asthma 35 Intrauterine growth restricted birth this pregnancy	VSB	Re-categorized into HTN, DM, STI and Missing
Mother's Smoking Status: Smoker ever *Nonsmoker	CIG3MOS - Number of cigarettes per day 3 mos before preg & CIG1TRI, CIG2TRI, CIG3TRI - Number of cigarettes per day during 1st, 2nd and 3rd trimester	Continues numeric variable	VSB	The two initial variables were collapsed into one and then re-categorized to a dichotomized variable of smoker ever or non-smoker.

Chapter Three: When and Why Infants Visit the Emergency Department: Do the Social Determinants of Health Matter?

Abstract

Objective: To identify if social determinants of health (SDoH) are associated with when and why (non-urgent & urgent) infants visit the Emergency Department (ED) compared to those who return as direct admits within the first year of life.

Study Design: Secondary data from California's Office of Statewide Health Planning and Development, including non-public hospital Patient Discharge data, Emergency Department Ambulatory Surgery data, and Vital Statistics Birth data between the years 2008-2012, were analyzed for associations between the SDoH (gender, race/ethnicity, insurance type, and geography of the infant) and when (age and day of week) and why (diagnosis) infants seek care, using descriptive analysis, logistic regression, and chi-squared tests.

Results: Infants with Medicaid, self-pay insurance, and from frontier areas were noted to have a higher preference for ED utilization during the neonatal period. Black and Hispanic infants and infants with Medi-Cal had more ED visits during the workweek than their Non-Hispanic White, privately insured counterparts. No specific group had only non-urgent visits, but each group had a unique primary diagnosis.

Conclusion: This was the first known study to examine how SDoH correlated to the age, day of week, and diagnosis for infant ED utilization. The increased ED utilization associated with SDoH may be due to parents experiencing difficulty negotiating barriers to primary care services or a knowledge deficit. Further research into these areas is needed, along with additional studies researching the impact of the SDoH on health care utilization.

Introduction

The Emergency Department (ED) provides front line services to the general population and cannot deny care to patients due to the Emergency Medical Treatment and Labor Act (EMTALA) of 1986 (Anderson et al., 2016). EMTALA mandates that EDs provide care regardless of patients' ability to pay. It was created to benefit emergency patients who were being denied care by hospitals due to their inability to pay. An unintended consequence of EMTALA was increased non-urgent ED utilization (Anderson et al., 2016; Hermer, 2006). Non-urgent visits are defined by care for health concerns that could have been provided by a primary care provider's (PCP) office or could have been addressed within 2-24 hours without significant health consequences (Cunningham, 2006; Uscher-Pines, Pines, Kellerman, Gillen, & Mehrotra, 2013).

Non-urgent ED use is associated with overcrowding of EDs, increased cost of care, and decreased provider continuity (Billings, Parikh, & Mijanovich, 2000; Carret, Fassa, & Dominguez, 2009; Cunningham, 2006; Kellerman, 1994; Shesser, Kirsch, Smith, & Hirsch, 1991). Non-urgent ED use increases yearly, especially among the youngest and oldest patients (Delia & Cantor, 2009; New England Healthcare institute, 2010). In addition, for many uninsured and poor children, the ED is often a critical point of entry due to being the safety net of the United States' health care system (Beck et al., 2016).

The social determinants of health (SDoH) refers to a complex set of social and economic systems that are responsible for most health inequities and are shaped by the distribution of money, power, and resources (World Health Organization, 2008). There are five key SDoH. The first is economic stability: employment, and income. The second determinant is education: access to early childhood education, high school graduation, access to higher education, and language, and literacy skills. The third is social and community structures such as levels of discrimination and social cohesion. The fourth determinant is health and health care, meaning access to health care services and health literacy. Finally, the fifth determinant is environment, including housing quality, food swamps, crime and violence, climate, and air (U.S. Department of Health and Human Services, 2018). Even though, some of the SDoH overlap with the predisposing (i.e. race/ethnicity, gender) and enabling factors (i.e. income, education, geographical location, language) within Andersen's Healthcare Utilization Model, specifically focusing on how the SDoH are associated with ED utilization allows for a deeper examination of ED utilization disparities (Andersen, 1968, 1995). Furthermore, examining these factors within the infant population is especially important due to infant health service utilization being an indicator of overall health for the population in that region (Neuman et al., 2014; Paul et al., 2016).

A literature search on the association between the SDoH and ED utilization revealed studies with correlations between particular factors within the SDoH and ED use. However, studies globally inclusive of the SDoH's association with ED use could not be found. Studies by Brousseau, Bergholte, & Gorelick, (2004) and Johnson and Rimsza, (2004) explored ED use among infant and pediatric populations in the U.S. and found an association between lack of a regular source of healthcare and increased ED use. Kangovi et al. interviewed 40 urban, low-socioeconomic status (SES) adult patients and found those with a regular source of care preferred ED care to ambulatory care because of barriers to accessing ambulatory care. These barriers included difficulty getting an appointment, inconvenient office hours, and transportation issues. Many also reported that they stopped attempting to see their PCP because their PCP often referred them to the ED.

Many studies have noted racial, ethnic, and insurance-related disparities in urban ED use and readmissions, with Black children and those with Medicaid comprising a disproportionate share of ED visits (Feudtner et al., 2010; Hernandez & Curtis, 2011; Jiang & Wier, 2007; Schlitz et al., 2014). In previous studies, the increased number of Hispanics in the population has not equated to increased ED utilization in comparison to their population numbers (Allen & Cummings, 2016; Flores, Abreu, Olivar & Kastner, 1998; Johnson & Rimsza, 2004; Neuman et al., 2014; Yu, Huang, Schwalberg, & Nyman, 2006). For Black patients, studies have reported racial disparities in access of care from both PCPs and clinics and higher rates of ED use than their White counterparts (Agency for Healthcare Research and Quality, 2012; Bureau of the Census, 2012; Gaskin et al., 2007; Lillie-Blanton, Martinez, & Salganicoff, 2001; Sharma et al., 2000). The disparity in health utilization for this population has been attributed to distrust, previous health care interactions, and dissatisfaction with lower quality of care (Pathman, Fowler-Brown, & Corbie-Smith, 2006).

ED utilization studies have reported that Medicaid (Medi-Cal in California) is the most widely used payer for ED visits (Ben-Issac, Schrager, Keefer, & Chen, 2010; Berry, Brousseau, Brotanek, Tommy-Korman, & Flores, 2008; Koepsell, Zimmerman, Connell, Christakis, & Mell, 2001; Stockwell, Findley, Irigoyen, Martinex, & Sonnett, 2010; Swayely, Baker, Bilger, Zimmerman, & Martin, 2015). Medicaid beneficiaries have been found to use the ED at an almost two-fold higher rate than the privately insured (Garcia, Bernstein, & Bush, 2010; Sommers, Boukus, & Carrier, 2012). This is often due to many Medicaid patients living in poorer health than their privately insured counterparts, partially due to unmet health needs and lack of access to appropriate settings (Capp, Rooks, Wile, Zane, & Ginde, 2014; Gadomski, Jenkins, & Nichols, 1998; Kellerman, 1994; Piehl, Clemens, & Joines, 2000). Studies of ED utilization by those without insurance have been more variable. Luo, Liu, Frush, and Hey's secondary analysis of the National Medical Expenditure Panel Survey found that uninsured pediatric patients were as likely as insured patients to utilize the ED, both urgently and non-urgently (2003). In contrast, Johnson and Rimsza's 2004 study of pediatric ED utilization in a rural Arizona County found that uninsured children less than 19 years of age were four times more likely to use the ED than insured (public and private) children (2004).

The evidence is also mixed with regards to the role of geography or location. Yamamoto et al. found that children with chronic conditions who lived near a hospital were more likely to visit the ED (1995). Ray and Lorch who studied infants in California, found infants from rural areas had lower odds of hospitalization and shorter length of stay than infants from urban areas (2012). However, Sharma et al. found that infants living in a rural area within Missouri were more apt to have an ED visit than those living in an urban region (2000). They also found the highest rate of ED use to be among white, rural infants on Medicaid, and the lowest by urban white infants with private insurance. Overall, the highest rates of non-urgent use were among Medicaid infants and the lowest was among white urban infants with private insurance.

Diagnosis at visit has also been examined with regards to ED use. A study conducted by Schlitz et al. found that jaundice, bronchiolitis, temperature regulation and pyloric stenosis in the neonatal period and bronchiolitis, pneumonia, urinary tract infection (UTI) and other respiratory infection in the 1-12 month period were among the most frequent diagnoses for infants treated in the ED (2012). In studies on pre-term infants, the most frequent diagnoses for infants treated in the ED were jaundice, infection, respiratory problems, gastrointestinal (GI), respiratory problems, fever, and feeding problems (Johnson & Rimsza, 2004; Neuman et al., 2014). Lee, Bardach, Maselli and Gonzales categorized the primary diagnosis for neonates treated in the ED into mild, moderate or severe (2014). Under the mild category, the most frequent diagnoses were benign gastrointestinal (GI) problems, jaundice, routine care, rash, and ophthalmic problems. In the moderate category the most frequent diagnoses were infection, GI problems, respiratory problems, and injury. In the severe category, the most frequent diagnoses were serious infection, respiratory problems potentially requiring admission, surgical condition, major injury, and seizure or neurologic problem. An analysis of healthy, full-term singleton infants born to low-income primiparous women at a hospital in Miami found the most common diagnosis for an infant ED visit to be an upper respiratory illness, followed by feeding problems, rash, ophthalmic discharge and constipation during the first two months of life (Gaskin et al., 2007). During this same

time period, respiratory illness was also the leading diagnosis for hospital readmissions. In each of these studies, the majority of ED care for infants was for non-urgent health concerns.

Previous studies examining the timing of hospital admissions and ED utilization found a higher percentage of ED utilization occurred on Sundays and Mondays (Faryar, 2013; Kam, Sung, & Park, 2010; Sun, Heng, Seow, & Seow, 2009). In addition, Schoenfeld and McKay, 2010, found that in Nebraska, more ED visits occurred on the weekend, with a higher percentage being non-urgent. Whereas, most hospital admissions occurred during the week. However, a higher percentage of hospital admissions from the ED occurred on the weekends (Ryan, Levit, & Davis, 2010). Only two studies examined descriptive demographics at time of use. Schoenfeld and McKay found private insurance paid for the highest percentage of ED visits on the weekend (2010). Ryan et al. found no difference between age, gender, and household income, for those admitted to the hospital on a weekend versus a weekday from the Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS) (2010). Examining if factors associated with difference in the day of visit between populations allows for a better understanding of issues with accessibility.

Most previous hospital utilization studies examining age, did so as an independent not dependent variable (Ben-Isaac et al., 2010; Brousseau, Mistry, & Alessandrini, 2006; Doobinin, Heidt-Davis, Gross, & Issacman, 2003; Hummel, Mohler, Clemens, & Duncan, 2014; Jaeger, Ambadwar, King, Onukwube & Robbins, 2015; Kubicek et al., 2012; Mistry, Hoffman, Yauck, & Brousseau, 2005; Phelps et al., 2000; Sharma et al., 2000). However, studies examining factors associated with utilization at particular ages assists in understanding why utilization is occurring at these ages and could direct interventions to the populations most in need. Paul et al., found infants in Delaware with Medicaid, were more apt to be hospitalized in the first six months of life if they had been in the neonatal intensive care unit, if the mother had a greater number of hospital admissions or ED visits prenatally, or if the mother had a history of bipolar disease. Whereas, infants who were Black, were born in the fall, had mothers who were younger or a history of prenatal ED visits were more apt to use the ED (2016). Lee et al., found Blacks and those with Medicaid to be the highest utilizers of the ED during the neonatal period (2014).

Few studies have investigated beyond the initial positive correlations found in predictive studies as to when and why infants utilize hospital services after birth. It is important for researchers to look deeper into the causes of increased ED utilization in order to create effective interventions for those most impacted by disparities due to the SDoH. Using California's Office of Statewide Health Planning and Development (OSHPD) data linked with vital statistic data, this study examined how the SDoH (gender, race/ethnicity, insurance type and geography of the infant) were associated with when (day of week and age) and why (diagnosis) ED release, ED admit, and direct admit visits occurred during the infants' first year of life (2010). It was hypothesized that SDoH would be associated with higher ED release and admit utilization, but lower direct admissions. Even though an ED admit indicates an ED visit was appropriate, it was hypothesized there would be increased ED admissions because barriers to health care utilization by those most impacted by the SDoH has been shown to cause these populations to be sicker before seeking care (Braveman & Gottlieb, 2014).

Methods

Purpose and Research Design

The purpose of this retrospective study was to identify if there was an association between SDoH and when and why parents sought health care for their infant children younger than 12 months. Infant ED visits (release and admit) and hospital direct admits within the first year of life were examined using data linked from the California Office of Statewide Health Planning and Development (OSHPD) and Vital Statistics for infants born between 2008 and 2012 (2010). These years were chosen because there was a need to have a large enough sample size to prevent small cell sizes (less than 15 subjects) for making comparisons. Furthermore, data after 2012 was unavailable for this data set.

Data

Secondary data on visits from infants and their mothers were obtained from California's Office of Statewide Health Planning and Development (OSHPD) non-public linked hospital Patient Discharge Data, Emergency Department (ED), Ambulatory Surgery and Vital Statistics Birth data for 7,983,930 infant/maternal observations between the years 2008-2012. The linked file included the birth records, all infant admissions, and ED encounters occurring within the first 12 months of life. Additionally, the linked dataset included maternal antepartum and postpartum hospital records for the nine months prior to delivery and one-year post delivery. Some records were not linkable because the birth did not occur in a facility that reports to them. OSHPD included all records for infants under one year of age and gave a probabilistic percentile as to how well the records were linked. The linkable records were identified by a birth ID and sorted per admission date (2010). Even though the file contained all infant encounters regardless of whether they were linked, those that were not linked (987,578 observations; 12%) were dropped due to the inability to link the birth to subsequent visits. This left 6,996,352 observations. Approval was obtained from the California Committee for the Protection of Human Subjects (CPHS) and the University of California Merced Institutional Review Board.

Prior to creating the hospital visit type variables, a dichotomized birth visit variable was generated so only infant visits after the birth were included (2,053,852; 29%). The *birth visit* variable was created from birth International Classification of Diseases (ICD) 9 diagnosis codes World Health Organization, 1992). For the SDoH analysis the dependent variables were infant age, day of week and diagnosis factor for each hospital visit type (ED release, ED admit, and direct admit). See Table 1 for how these variables were coded. The *age at visit* and *day of visit* variables were created from the infant's age in days and the infant's admission day of week variables (OSHPD, 2010). *Age at visit* was collapsed into three categories: ≤28 days, 29 days to 6 months, and seven to 12 months. These categories were created due to changes in feeding patterns and because physical and cognitive development occurring during these ages impacting health services use (Hockenberry, Wilson & Rodgers, 2017) The variables were obtained from the PDD/ED/AS data (OSHPD, 2010).

Diagnosis Codes were included as a dependent variable as the end diagnosis a patient receives from the visit not only allows for the understanding of the most common causes of ED visits but also allows for the categorization of urgency (Billings et al., 2000). All diagnosis reported in the OSHPD data use the International Classification of Diseases, 9th Revision (2010). The principal diagnosis variable for the infant was the

condition established to be the chief cause of the admission of the patient to the facility for care (2010). Using the NYU classification program, each of the top five diagnosis were evaluated for their classification category. For example, in the case of urinary tract infections (ICD-9-CM code 599.0), each case was assigned 66% "non-emergent," 17% "emergent/primary care treatable," and 17% "emergent - ED care needed - preventable/avoidable." The sum of the values always totaled 100% (Billings et al., 2000).

Table 1. Dependent Variables

Variable	*OSHPD Data Variable & Definition*	*OSHPD Variable Values*	*OSHPD Source*	*Coding Instructions*
Infant Age at Visit *Neonate* *1-6 months* *7-12 months*	AGEDAYSI - Baby's age in days at admission/ service	Continuous numeric variable that is derived from the date of birth and Date of Service	PDD/ AS/ED	Re-categorized to age categories
Day of Visit	ADMDAYI - Baby's admission day of week	Day of Week: One-digit day (1=Sunday, 2=Monday, 3=Tuesday, 4=Wednesday, 5=Thursday, 6=Friday, 7=Saturday.)	PDD	No change
Diagnosis	DIAGI00 - Baby's Principal Diagnosis is the condition established, after study, to be the chief cause of the admission of the patient to the facility for care.	All diagnosis were reported using International Classification of Diseases, 9th Revision, Clinical Modification, U.S. Department of Health and Human Services, Washington D.C. (ICD-9-CM).	PDD	No change

Analysis

Before analyzing the data, the data-set was converted from a Statistical Analysis System (SAS) version 9.3 file to a STATA version 14 file (Statacorp, 2015). Initially descriptive analyses were conducted to test the unadjusted occurrence for each variable in the study. Logistic regression was then used to estimate odds ratios and 95% confidence intervals between the SDoH and the day and age at visit for each type of hospital visit and. To check collinearity, during the logistic regression analysis, the variance inflation factors (VIF) and the correlation matrix of the parameter of estimates (VCE) were estimated using STATA. VIF's less than 5 and VCE's less than 0.5 were used (Minitab Blog, 2013). No collinearity occurred. In addition, the five most frequently occurring diagnoses for each SDoH and type of visit were evaluated using the New York ED

Algorithm to identify whether the diagnosis was urgent/ED needed (ED care was required), urgent/PCP treatable (treatment was required within 12 hours but could have been provided by a PCP), or non-urgent (care was not required within 12 hours) (New York University, Wagner). Lastly, the association between the diagnosis and the SDoH were tested with X^2 tests. Statistical significance was set at a 0.05 alpha level for both the logistic regression and X^2 tests.

Results

Descriptive Results

Upon review of the data, maternal language and education for ED visits after birth were largely missing; consequently, these variables were dropped from the study. Results are available in Table 2. For all hospital visits combined, infants who were male, Hispanic, NH White, with Medi-Cal or private insurance and from urban areas had the most after birth hospital visits.

Gender. Males had the highest percentage of hospital visits after birth. For ED release visits, there was almost a 10% difference between genders. However, for admission (ED & direct) visits, the gap widened with almost a 20% difference between the two.

Race/Ethnicity. When testing for race/ethnicity, the two largest groups for all after birth hospital visits were identical to those at birth: Hispanic and NH White. However, the percentage of ED visits for Hispanics was much larger than for NH Whites than found at birth (Hispanics: 59-60%, 46.50%; NH Whites: 21-22%, 31%, respectively). Blacks were the fourth largest birth group, but the fifth largest direct admit group and third largest ED (release & admit) group. Asians were the third largest birth and direct admit group. However, they were the fourth largest ED admit and fifth largest ED release group.

Insurance Type. Medi-Cal and private pay insurance users were almost equivalent percentages at birth (48% and 47%, respectively). However, for hospital visits after birth, Medi-Cal was the payer at a much higher percentage for all ED visits (release 62% and admit 70%) than private insurance (27 and 23%, respectively). For ED release visits, self-pay was the third most common of the four insurance variables examined while it was the fourth for all admission visits (ED & direct).

Geographical Location. Geographically, the percentage of visits for each hospital visit type corresponded with the birth percentages. Infants from urban areas had the highest percentage of hospital admissions visits (ED and direct). Infants from rural areas had the largest percentage of visits after birth occur as ED release visits.

Table 2: Descriptive Results of SDoH and Type of Visit

	Births		***ED Release Visits***		***ED Admit Visits***		***Direct Admit Visits***	
	Freq.	*%*	Freq.	*%*	Freq.	*%*	Freq.	*%*
Total	2,525,154	*100%*	1,695,644	*100%*	129,095	*100%*	229,113	*100%*
Baby's Gender								
Male	1,290,278	*51.10%*	923,493	*54.46%*	75,261	*58.30%*	135,231	*59.02%*
**Female*	1,234,117	*48.87%*	772,045	*45.53%*	53,832	*41.70%*	93,832	*40.95%*
.	759	*0.03%*	106	*0.01%*	2	*0.00%*	50	*0.02%*

Race/ethnicity group								
**NH White*	785,158	*31.09%*	359,790	*21.22%*	28,765	*22.28%*	69,865	*30.49%*
Hispanic	1,174,267	*46.50%*	1,016,251	*59.93%*	77,211	*59.81%*	105,018	*45.84%*
NH Black	142,039	*5.62%*	145,092	*8.56%*	8,754	*6.78%*	12,498	*5.45%*
NH Asian	282,042	*11.17%*	70,018	*4.13%*	7,332	*5.68%*	21,550	*9.41%*
NH Other	106,529	*4.22%*	78,278	*4.62%*	6,426	*4.98%*	14,296	*6.24%*
.	35,119	*1.39%*	26,215	*1.55%*	607	*0.47%*	5,886	*2.57%*
	Births		**ED Release Visits**		**ED Admit Visits**		**Direct Admit Visits**	
Baby's ED and Admit Payer Category								
Medi-Cal	1,219,757	*48.30%*	1,058,279	*62.41%*	90,752	*70.30%*	110,288	*48.14%*
**Private Coverage*	1,190,470	*47.14%*	452,508	*26.69%*	30,697	*23.78%*	96,791	*42.25%*
Self-Pay	60,766	*2.41%*	144,025	*8.49%*	2,942	*2.28%*	5,710	*2.49%*
Other Payer	54,035	*2.14%*	40,608	*2.39%*	4,700	*3.64%*	16,311	*7.12%*
.	126	*0.00%*	224	*0.01%*	4	*0.00%*	13	*0.01%*
Baby's Geographical Location								
**Urban*	1,956,816	*77.49%*	1,255,616	*74.05%*	97,901	*75.84%*	175,240	*76.49%*
Rural	466,583	*18.48%*	369,664	*21.80%*	26,095	*20.21%*	44,532	*19.44%*
Frontier	31,109	*1.23%*	28,725	*1.69%*	2,120	*1.64%*	3,301	*1.44%*
.	70,646	*2.80%*	41,639	*2.46%*	2,979	*2.31%*	6,040	*2.64%*
Mom's Principal Language Spoken								
**English*	1,528,541	*60.53%*	6	*0.00%*	8	*0.01%*	1,934	*0.84%*
Spanish	376,076	*14.89%*	1	*0.00%*	2	*0.00%*	338	*0.15%*
Other	66,467	*2.63%*	0	*0.00%*	0	*0.00%*	40	*0.02%*
.	554,070	*21.94%*	1,695,637	*100%*	129,085	*99.99%*	226,801	*98.99%*
Mom's Educational Group								
<High School	583,433	*23.10%*	16	*0.00%*	9	*0.01%*	571	*0.25%*
HS graduate or GED	634,536	*25.13%*	27	*0.00%*	17	*0.01%*	788	*0.34%*
Some College	587,370	*23.26%*	24	*0.00%*	17	*0.01%*	844	*0.37%*
Bachelor Degree	403,750	*15.99%*	24	*0.00%*	11	*0.01%*	595	*0.26%*
**Graduate Degree*	217,706	*8.62%*	10	*0.00%*	12	*0.01%*	300	*0.26%*
.	98,359	*3.90%*	1,695,543	*99.99%*	129,029	*99.95%*	226,015	*0.26%*

** equals the reference group*

Age at Visit

Descriptive Analysis. For visit and age, descriptive results see Table 3. Males had the highest percentage of visits at all ages. For ED release visits during the neonatal period, Hispanics had their lowest percentage (57%) of visits, while all other race/ethnicities had their highest percentage of visits. Hispanics had the highest percentage of ED release visits (61%) during the 1-6 month period. For Blacks and NH other the 1-6 month period was their second highest (9%; 5%, respectively). In contrast,

for NH Whites and Asians, the 7-12 month period was their second highest time for ED Release visits (21%; 4%, respectively). Medi-Cal was the largest payer during the neonatal period (64%). Private insurance and other type of insurance were the largest payer during the 7-12 month period (30%; 5%, respectively) and Self-pay was the largest during the 1-6 month old period (10%). The spread geographically was equivalent across all ages for ED release visits.

For ED admit visits, NH Whites (24%) and Asians (6.7%) had their highest percentage of visits during the neonatal period. In contrast, Blacks (5%) and Hispanics (58%) had the smallest percentage of visits during the neonatal period. Hispanics had the largest percentage (61%) of their visits occur during the 1-6 month period and Asians had their lowest (5%) during this age period. Blacks had their highest percentage (8%) of ED admits during the seven to twelve month period, while Whites had their lowest (22%). Medi-Cal (72%) and private pay (2%) had the highest percentage of ED admit visits during the 1-6 month period, while private insurance (21%) had the least. Private insurance had their highest percentage of ED admits during the neonatal period (27%). Again, the spread geographically was equivalent across all ages.

For direct admits, males had the highest percentage of visits during the 7-12 month age period (62%) which decreased with each age that followed (1-6: 60%; Neonate: 57%). Whites (29%), and Asians (8%) had the least percentage of direct admits during the 1-6 month period. In contrast, Blacks (6%) and Hispanics (50%) had the highest percentage of visits during this age period. Asians had the highest percentage (12%) and Blacks the lowest percentage (5%) of direct admits during the neonatal period. Medi-Cal paid for the highest percentage of direct admits at all ages except during the 7-12 month age period when private insurance paid for the highest percentage of direct admits (46%). Medi-Cal paid the highest percentage (52%) for direct admits during the 1-6 month age period and self-pay paid the highest percentage during the neonatal period (3%). Infants located in rural and frontier areas had the highest percentage of visits occur during the neonatal period (22% and 2%, respectively). In contrast, urban areas had the least percentage of visits (77%) occur during this age.

Table 3: Age and Visit Type Descriptive Results

Visit Type	*ED Release Visits*				*ED Admit Visits*				*Direct Admit Visits*			
Age	Neonate	1-6 months	7-12 months	.	Neonate	1-6 months	7-12 months	.	Neonate	1-6 months	7-12 months	.
Gender												
Male	80,183: 53.26%	415,611: 54.56%	425,117: 54.61%	2,582: 53.88%	19,356: 58.39%	39,969: 58.76%	15,858: 57.09%	78: 4.93%	55,795: 57.06%	47,902: 59.68%	31,360: 61.83%	174: 59.39%
**Female*	70,372: 46.74%	346,088: 45.44%	353,375: 45.39%	2,210: 46.12%	13,796: 41.61%	28,053: 41.24%	11,919: 42.91%	64: 45.07%	41,985: 42.94%	32,367: 40.32%	19,361: 38.17%	119: 40.61%
Race/Ethnicity												
**NH White*	34,643: 23.41%	159,623: 21.29%	164,440: 21.44%	1,084: 22.96%	7,965: 24.16%	14,768: 21.80%	6,002: 21.71%	30: 21.13%	30,323: 31.94%	22,850: 29.12 %	16,609: 33.54%	83: 28.92 %
NH Black	13,842: 9.35%	67,508: 9.00%	63,385: 8.27%	357: 7.56%	1,760: 5.34%	4,791: 7.07 %	2,187: 7.91%	16: 11.27%	4,344: 4.58%	5,149: 6.56%	2,977: 6.01%	28: 9.76%
NH Asian	6,819: 4.61%	28,120: 3.75%	34,848: 4.54%	231: 4.89%	2,199: 6.67 %	3,452: 5.10%	1,675: 6.06%	6: 4.23%	11,406: 12.01%	6,154: 7.84 %	3,967: 8.01%	23: 8.01%
NH Other	7,571: 5.12%	35,184: 4.69%	35,301: 4.60%	222: 4.70%	1,690: 5.13%	3,297: 4.87%	1,430: 5.17%	9: 6.34%	5,668: 5.97%	5,099: 6.50%	3,519: 7.11%	10: 3.48%
Hispa-nic	85,126: 57.52%	459,385: 61.27%	468,913: 61.14%	2,827: 59.88%	19,353: 58.70%	41,422: 61.16%	16,355: 59.15%	81: 57.04%	43,205: 45.50%	39,223: 49.98%	22,447: 45.33%	143: 49.83%
Insurance												
Medi-Cal	96,859: 64.34%	487,151: 63.96%	471,544: 60.58%	2,725: 56.88%	22,501: 67.88%	49,250: 72.40%	18,905: 68.06%	96: 67.61%	45,630: 46.65%	41,888: 52.19%	22,636: 44.63%	134: 45.73%
**Pri-vate*	37,734: 25.06%	180,836: 23.74%	232,373: 29.85%	1,565: 32.67%	9,080: 27.39%	14,608: 21.48%	6,975: 25.11%	34: 23.94%	42,402: 43.35%	30,869: 38.46%	23,388: 46.11%	132: 45.05%
Self-Pay	13,304: 8.84%	77,521: 10.18%	52,852: 6.79%	348: 7.26%	794: 2.40%	1,727: 2.54 %	420: 1.51%	1: 0.70%	3,225: 3.30%	1,939: 2.42%	545: 1.07%	1: 0.34%
Other	2,650: 1.76%	16,158: 2.12%	21,647: 2.78%	153: 3.19 %	775: 2.34%	2,438: 3.58%	1,476: 5.31%	11: 7.75%	6,564: 6.71%	5,568: 6.94%	4,153: 8.19%	26: 8.87%

Geographical Location												
**Urban*	112,569: 76.66%	561,580: 75.59%	577,946: 76.09%	3,521: 75.22%	25,182: 77.88%	51,464: 77.43%	21,147: 77.81%	108: 76.60 %	72,548: 76.59%	62,808: 80.09%	39,664: 79.90%	220: 77.46%
Rural	31,620: 21.53%	167,975 22.61%	168,992: 22.25%	1,077: 23.01%	6,556: 20.27%	13,897: 20.91%	5,613: 20.65%	29: 20.57%	20,634: 21.78%	14,479: 18.46%	9,360: 18.85%	59: 20.77 %
Frontier	2,646: 1.80%	13,333: 1.79%	12,663: 1.67%	83: 1.77%	598: 1.85%	1,100: 1.66%	418: 1.54%	4: 2.84%	1,540: 1.63%	1,135: 1.45%	621: 1.25%	5: 1.76%

** equals the reference group*

Logistic Regression Statistics. Gender, race/ethnicity, insurance type and geography were significant for all age groups and hospital visit types. For visit and age, logistic regression results see Table 3.1-3.3. Male infants, Black infants, infants with Medi-Cal or self-pay insurance, and those from rural and frontier areas had higher odds of an ED release visit during the one to six-month period. In addition, male infants, along with Hispanic and Asian infants had higher odds during the seven to twelve-month period (OR respectively: 1.01, 1.07 and 1.12).

All race/ethnicity groups had 7-32% higher odds of an ED admit during the seven to twelve-month period than NH Whites. Male infants and those with Medi-Cal and self-pay had higher odds of an ED admit during the one to six-month period. Infants from frontier areas had 18% higher odds of an ED admit during the neonatal period than those who lived in urban areas. Infants from rural areas had no significant age period for an ED admit.

Male infants and Black infants had lower odds of a direct admit visit during the neonatal period but higher odds during the one to twelve-month period. Male infants had their highest odds (15%) during the seven to twelve-month period, while Black infants had the highest odds (33%) during the one to six-month period. Hispanic infants had 6-7% lower odds of being a direct admit during the neonatal and seven to twelve-month range, but approximately 13% higher odds during the one to six-month range. Unlike Black and Hispanic infants, Asian infants were more likely to have a direct admit during the neonatal period (OR: 1.51). Self-pay infants were at higher odds (OR: 1.14) of having a direct admit during the neonatal period, while Medi-Cal (OR: 1.23) and other type of insurance (1.06) had higher odds during the one to six-month period. Infants from rural and frontier areas had higher odds of having a direct admit visit during the neonatal period (OR respectively: 1.22 and 1.10).

Table 3.1: Logistic Regression Hospital Visit and Neonate

	ED Release		**ED Admit**		**Direct Admit**	
	Odds Ratio	***[95% Conf. Interval]***	***Odds Ratio***	***[95% Conf. Interval]***	***Odds Ratio***	***[95% Conf. Interval]***
Male	*0.947*	*0.937 - 0.958*	*1.006*	*0.981 - 1.032*	*0.870*	*0.855 - 0.885*
NH Black	*0.953*	*0.933 - 0.973*	*0.696*	*0.656 - 0.739*	*0.724*	*0.695 - 0.754*
NH Asian	*1.029*	*1.001 - 1.058*	*1.099*	*1.038 - 1.163*	*1.514*	*1.468 - 1.562*
NH Other	*0.994*	*0.968 - 1.022*	*0.961*	*0.903 - 1.024*	*0.888*	*0.855 - 0.923*
Hispanic	*0.833*	*0.822 - 0.844*	*0.922*	*0.893 - 0.953*	*0.942*	*0.923 - 0.962*
Medi-Cal	*1.157*	*1.142 - 1.173*	*0.825*	*0.800 - 0.851*	*0.952*	*0.934 - 0.971*
Other	*0.803*	*0.770 - 0.837*	*0.484*	*0.446 - 0.526*	*0.890*	*0.859 - 0.922*
Self-Pay	*1.137*	*1.113 - 1.162*	*0.913*	*0.837 - 0.995*	*1.753*	*1.658 - 1.853*
Rural	*0.943*	*0.931 - 0.956*	*0.972*	*0.942 - 1.003*	*1.223*	*1.197 - 1.249*
Frontier	*1.034*	*0.992 - 1.078*	*1.180*	*1.071 - 1.300*	*1.097*	*1.021 - 1.178*

Table 3.2: Logistic Regression Hospital Visits and 1-6 Months

	ED Release		**ED Admit**		**Direct Admit**	
	Odds Ratio	***[95% Conf. Interval]***	***Odds Ratio***	***[95% Conf. Interval]***	***Odds Ratio***	***[95% Conf. Interval]***
Male	*1.009*	*1.003-1.016*	*1.042*	*1.019-1.066*	*1.045*	*1.026-1.064*
NH Black	*1.030*	*1.017-1.043*	*1.068*	*1.017-1.122*	*1.327*	*1.275-1.381*
NH Asian	*0.880*	*0.866-0.895*	*0.847*	*0.804-0.893*	*0.810*	*0.783-0.838*
NH Other	*1.005*	*0.989-1.022*	*0.984*	*0.931-1.040*	*1.096*	*1.054-1.140*
Hispanic	*0.994*	*0.986-1.002*	*1.012*	*0.983-1.042*	*1.126*	*1.101-1.150*
Medi-Cal	*1.269*	*1.259-1.278*	*1.276*	*1.241-1.312*	*1.227*	*1.202-1.252*
Other	*0.985*	*0.965-1.006*	*1.174*	*1.103-1.250*	*1.062*	*1.024-1.102*
Self-Pay	*1.743*	*1.722-1.765*	*1.533*	*1.418-1.656*	*1.043*	*0.985-1.106*
Rural	*1.021*	*1.013-1.028*	*1.009*	*0.981-1.036*	*0.857*	*0.838-0.876*
Frontier	*1.034*	*1.009-1.059*	*0.937*	*0.859-1.023*	*1.028*	*0.954-1.108*

Table 3.3: Logistic Regression Hospital Visit and 7-12 Months

	ED Release		ED Admit		Direct Admit	
	Odds Ratio	***[95% Conf. Interval]***	***Odds Ratio***	***[95% Conf. Interval]***	***Odds Ratio***	***[95% Conf. Interval]***
Male	*1.009*	*1.002-1.015*	*0.934*	*0.910-0.960*	*1.150*	*1.126-1.174*
NH Black	*0,986*	*0.974-0.999*	*1.318*	*1.244-1.396*	*1.060*	*1.013-1.110*
NH Asian	*1.121*	*1.103-1.140*	*1.136*	*1.067-1.209*	*0.706*	*0.679-0.734*
NH Other	*0.996*	*0.980-1.013*	*1.073*	*1.004-1.148*	*1.045*	*1.000-1.090*
Hispanic	*1.068*	*1.060-1.077*	*1.078*	*1.040-1.117*	*0.932*	*0.909-0.955*
Medi-Cal	*0.755*	*0.749-0.761*	*0.875*	*0.846-0.905*	*0.818*	*0.800-0.838*
Other	*1.075*	*1.053-1.098*	*1.536*	*1.435-1.645*	*1.081*	*1.039-1.125*
Self-Pay	*0.546*	*0.540-0.553*	*0.559*	*0.502-0.622*	*0.326*	*0.297-0.357*
Rural	*0.998*	*0.991-1.006*	*1.019*	*0,986-1.054*	*0.920*	*0.896-0.944*
Frontier	*0.956*	*0.933-0.979*	*0.905*	*0.811-1.010*	*0.838*	*0.766-0.918*

Day of Week

ED Release. Gender and geographical location were equally distributed between all days of the week (Table 4). For race/ethnicity, Hispanic, Asian and NH other visits were equally distributed between the days of the week. NH Whites, had a slightly increased percentage (22%) of visits on the weekend, while Blacks had their lowest percentage (8%). Blacks had their highest percentage (9%) of ED release visits on Tuesdays. Private insurance had the highest percentage (28%) of ED release visits, while Medi-Cal and self-pay had the lowest (61%; 7.9%, respectively) on the weekend. Medi-Cal was evenly distributed during the week (62%). Infants who were self-pay had the highest percentage of visits on Tuesdays (9%).

Table 4: Descriptive Results of ED Release and Day of Week

Visit Type	*ED Release*						
Day of Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Gender							
Male	156,017 (54.60%)	130,702 (54.50%)	121,103 (54.39%)	121,442 (54.56%)	120,973 (54.57%)	124,851 (54.25%)	148,405 (54.39%)
**Female*	129,749 (45.40%)	109,116 (45.50 %)	101,558 (45.61%)	101,135 (45.44%)	100,721 (45.43%)	105,305 (45.75%)	124,461 (45.61%)
Race/Ethnicity							
**NH White*	61,915 (22.02%)	50,040 (21.18%)	46,842 (21.35%)	46,822 (21.36%)	46,688 (21.39%)	48,460 (21.39%)	59,023 (21.98%)
NH Black	22,573 (8.03%)	21,194 (8.97%)	20,224 (9.22%)	19,894 (9.08%)	19,648 (9.00%)	19,538 (8.62%)	22,021 (8.20%)
NH Asian	12,713 (4.52%)	9,791 (4.14 %)	8,869 (4.04%)	8,890 (4.06%)	8,753 (4.01%)	9,348 (4.13%)	11,654 (4.34%)
NH Other	13,260 (4.72%)	11,125 (4.71 %)	10,212 (4.65%)	10,144 (4.63%)	10,124 (4.64%)	10,698 (4.72%)	12,715 (4.73%)
Hispanic	170,707 (60.71%)	144,144 (61.00%)	133,241 (60.73%)	133,416 (60.87%)	133,065 (60.96%)	138,542 (61.14%)	163,136 (60.75%)
Insurance							
Medi-Cal	174,942 (61.22%)	150,422 (62.73%)	139,309 (62.57%)	140,127 (62.96%)	139,428 (62.90%)	144,815 (62.93%)	169,236 (62.02%)
**Private*	81,388 (28.48%)	61,818 (25.78%)	58,069 (26.08%)	57,661 (25.91%)	57,980 (26.15%)	60,377 (26.24%)	75,215 (27.56%)
Self-Pay	22,415 (7.84 %)	21,731 (9.06%)	20,001 (8.98%)	19,478 (8.75%)	19,026 (8.58%)	19,563 (8.50%)	21,811 (7.99%)
Other	7,010 (2.45%)	5,819 (2.43%)	5,251 (2.36%)	5,296 (2.38%)	5,245 (2.37%)	5,384 (2.34%)	6,603 (2.42%)
Geographical Location							
**Urban*	210,860 (75.69%)	177,629 (75.93 %)	165,186 (76.02%)	164,963 (75.92%)	164,910 (76.18%)	170,619 (76.00%)	201,449 (75.74%)
Rural	62,977 (22.61%)	52,264 (22.34%)	48,175 (22.17%)	48,479 (22.31%)	47,786 (22.08%)	49,974 (22.26%)	60,009 (22.56%)
Frontier	4,738 (1.70%)	4,036 (1.73%)	3,927 (1.81%)	3,835 (1.77 %)	3,770 (1.74 %)	3,908 (1.74 %)	4,511 (1.70%)

** equals the reference group*

For ED release visits, all days of the week had a significant association with the SDoH (Tables 4.1- 4.2). During the week, most SDoH predicted increased odds of an infant ED release visit. However, Asian infants had lower odds of a visit on Tuesdays (OR: 0.973), Wednesdays (OR: .976), and Thursdays (OR: .959). Male infants and those from rural areas had approximately 1-2% lower odds of an ED release visit on Thursdays and Fridays (OR: .990; 986). On the weekend, SDoH were typically correlated with

lower odds of an infant ED release visit. However, Hispanic infants, infants who were self-pay, and infants from rural areas had 3-8% higher odds of an ED release visit on a Sunday (OR respectively: 1.080; 1.030; 1.043).

Table 4.1: Logistic Regression ED Release Monday-Thursday

	Monday		*Tuesday*		*Wednesday*		*Thursday*	
SDoH	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]
Male	1.001	0.992 - 1.010	0.998	0.989 - 1.007	1.005	0.996 - 1.014	1.005	0.996 - 1.014
NH Black	1.047	1.028 - 1.066	1.073	1.054 - 1.093	1.052	1.033 - 1.071	1.044	1.025 - 1.063
NH Asian	1.015	0.991 - 1.039	0.974	0.950 - 0.998	0.976	0.952 - 1.000	0.959	0.936 - 0.983
NH Other	1.015	0.991 - 1.039	0.999	0.975 - 1.023	0.994	0.970 - 1.018	0.998	0.974 - 1.022
Hispanic	1.016	1.004 - 1.028	1.003	0.991 - 1.014	1.001	0.989 - 1.012	1.004	0.992 - 1.016
Medical	1.043	1.032 - 1.054	1.023	1.012 - 1.034	1.040	1.029 - 1.052	1.029	1.018 - 1.040
Other	1.050	1.019 - 1.081	1.007	0.977 - 1.039	1.020	0.990 - 1.052	1.009	0.978 - 1.040
Self-Pay	1.118	1.099 - 1.137	1.086	1.067 - 1.105	1.066	1.047 - 1.086	1.028	1.010 - 1.047
Rural	1.001	0.991 - 1.012	0.994	0.983 - 1.005	1.000	0.989 - 1.011	0.986	0.975 - 0.997
Frontier	0.994	0.961 - 1.029	1.052	1.016 - 1.089	1.019	0.984 - 1.055	1.009	0.974 - 1.045
_Cons	0.156	0.154 - 0.158	0.147	0.145 - 0.149	0.146	0.144 - 0.148	0.147	0.145 - 0.149

Table 4.2: Logistic Regression ED Release Friday-Sunday

	Friday		*Saturday*		*Sunday*	
SDoH	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]
Male	0.990	0.981 - 0.999	0.996	0.987 - 1.004	0.974	0.966 - 0.981
NH Black	0.990	0.972 - 1.008	0.924	0.908 - 0.940	1.014	0.997 - 1.031
NH Asian	0.993	0.969 - 1.017	1.011	0.989 - 1.033	0.960	0.941 - 0.981
NH Other	1.016	0.993 - 1.041	0.995	0.973 - 1.017	0.990	0.970 - 1.012
Hispanic	1.006	0.994 - 1.017	0.984	0.973 - 0.994	1.080	1.068 - 1.091
Medical	1.030	1.019 - 1.041	0.960	0.951 - 0.970	0.965	0.956 - 0.975
Other	0.994	0.965 - 1.025	0.977	0.950 - 1.004	0.792	0.771 - 0.813
Self-Pay	1.019	1.001 - 1.038	0.901	0.886 - 0.916	1.030	1.013 - 1.047
Rural	0.990	0.979 - 1.001	1.009	0.998 - 1.019	1.044	1.034 - 1.054
Frontier	1.001	0.967 - 1.037	0.967	0.935 - 0.999	0.979	0.949 - 1.011
_Cons	0.155	0.153 - 0.157	0.202	0.199 - 0.204	0.162	0.160 - 0.164

ED Admit. For ED admission descriptive results see Table 5. On Saturday or Sunday, the highest percentage of admissions occurred for females (42%), NH Whites (23%), Asians (6%), Hispanics (60%), private (25%) insurance, and those living in urban

areas (78%). Whereas, Blacks (6.8%), other type of insurance (3.7%) and infants living in frontier areas (1.5%) were the least apt to have an ED admit on the weekend. Males (59%) and infants living in rural areas (21%) were more apt have an ED admit on a Monday. Blacks (7%) and infants with Medi-Cal (70%) were more apt to have an ED admit during the middle of the week.

Table 5: Descriptive Results of ED Admit and Day of Week

Admit Type	*ED Admit*						
Day of Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Gender							
Male	10,048 (57.81%)	11,330 (59.17%)	10,900 (57.91%)	10,515 (57.82%)	10,684 (58.52%)	11,152 (58.81 %)	10,632 (57.97%)
**Female*	7,332 (42.19%)	7,817 (40.83%)	7,922 (42.09%)	7,671 (42.18%)	7,573 (41.48%)	7,810 (41.19%)	7,707 (42.03%)
Race/Ethnicity							
**NH White*	3,960 (22.90%)	4,239 (22.24%)	4,134 (22.06%)	4,059 (22.42%)	4,109 (22.62%)	4,238 (22.46%)	4,026 (22.05%)
NH Black	1,174 (6.79%)	1,273 (6.68%)	1,305 (6.96%)	1,256 (6.94%)	1,276 (7.02%)	1,270 (6.73%)	1,200 (6.57%)
NH Asian	1,033 (5.97%)	1,129 (5.92%)	1,102 (5.88%)	991 (5.47%)	961 (5.29%)	1,047 (5.55%)	1,069 (5.86%)
NH Other	854 (4.94%)	1,004 (5.27%)	906 (4.83%)	892 (4.93%)	887 (4.88%)	939 (4.98%)	944 (5.17%)
Hispa-nic	10,274 (59.40%)	11,414 (59.89%)	11,293 (60.26%)	10,905 (60.24%)	10,934 (60.19%)	11,374 (60.28%)	11,017 (60.35%)
Insurance							
Medi-Cal	12,035 (69.25%)	13,330 (69.62%)	13,301 (70.66%)	12,862 (70.72%)	12,980 (71.10%)	13,354 (70.43%)	12,890 (70.29%)
**Private*	4,302 (24.75%)	4,672 (24.40%)	4,443 (23.60%)	4,225 (23.23%)	4,131 (22.63%)	4,501 (23.74%)	4,423 (24.12%)
Self-Pay	390 (2.24%)	428 (2.24%)	410 (2.18%)	396 (2.18%)	431 (2.36%)	446 (2.35%)	441 (2.40%)
Other	653 (3.76%)	717 (3.74%)	669 (3.55%)	703 (3.87%)	714 (3.91%)	659 (3.48%)	585 (3.19%)
Geographical Location							
**Urban*	13,186 (77.60%)	14,464 (77.28%)	14,205 (77.37%)	13,805 (77.60%)	13,817 (77.56%)	14,464 (78.06%)	13,960 (77.94%)
Rural	3,544 (20.86%)	3,947 (21.09%)	3,840 (20.91%)	3,657 (20.56%)	3,691 (20.72%)	3,751 (20.24%)	3,665 (20.46%)
Frontier	263 (1.55%)	306 (1.63%)	316 (1.72%)	327 (1.84%)	307 (1.72%)	315 (1.70%)	286 (1.60%)

** equals the reference group*

For ED admission logistic regression results see Tables 5.1-5.2. On Tuesday, Wednesday, Friday, and Saturday, the SDoH were not significant for an infant ED admit visit. On Monday, Thursday, and Sunday, the SDoH predicted both higher and lower odds of an ED admit. Male infants had higher odds of a visit on Mondays and Sundays (OR: 1.04 and 1.10). NH Other had 9% higher odds of an ED admit visit on Mondays and Asian infants had 19% higher odds of an ED admit visit on Sundays. Infants with Medi-Cal and other type of insurance had higher odds of an ED admit visit Thursdays and Sundays (OR respectively: 1.08, 1.16; 1.34, 1.43). On Mondays, infants with Medi-Cal had 5% lower odds of an ED admit. On Tuesdays, Asian infants had 9% lower odds of an ED admit visit. In addition, on Sundays, Hispanic and Black infants, and infants who were self-pay and from rural areas had lower odds of an ED admit (OR respectively: .90, .77, .36 and .90).

Table 5.1: Logistic Regression ED Admit Monday-Thursday

	Monday		*Tuesday*		*Wednesday*		*Thursday*	
SDoH	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]
Male	1.042	1.010 - 1.075	0.980	0.949 - 1.011	0.980	0.949 - 1.012	1.011	0.979 - 1.043
NH Black	1.001	0.934 - 1.073	1.036	0.967 - 1.111	1.013	0.944 - 1.086	1.000	0.933 - 1.072
NH Asian	1.051	0.978 - 1.130	1.065	0.990 - 1.145	0.956	0.886 - 1.031	0.910	0.843 - 0.982
NH Other	1.088	1.008 - 1.174	0.979	0.904 - 1.060	0.975	0.900 - 1.056	0.940	0.867 - 1.019
Hispanic	1.023	0.982 - 1.066	1.019	0.978 - 1.062	0.991	0.951 - 1.033	0.968	0.929 - 1.008
Medical	0.954	0.918 - 0.992	1.012	0.973 - 1.053	1.032	0.991 - 1.075	1.076	1.034 - 1.121
Other	1.004	0.921 - 1.095	0.983	0.899 - 1.074	1.095	1.003 - 1.195	1.160	1.063 - 1.265
Self-Pay	0.944	0.847 - 1.052	0.957	0.857 - 1.069	0.972	0.869 - 1.087	1.098	0.985 - 1.225
Rural	1.038	0.999 - 1.078	1.014	0.976 - 1.054	0.997	0.959 - 1.037	0.985	0.947 - 1.024
Frontier	0.971	0.858 - 1.099	1.027	0.909 - 1.161	1.103	0.977 - 1.244	1.031	0.911 - 1.166
_Cons	0.171	0.164 - 0.179	0.168	0.161 - 0.176	0.163	0.156 - 0.171	0.159	0.152 - 0.166

Table 5.2: Logistic Regression ED Admit Friday, Saturday and Sunday

	Friday		*Saturday*		*Sunday*	
SDoH	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]
Male	1.028	0.996 - 1.060	0.983	0.952 - 1.015	1.104	1.070 - 1.138
NH Black	0.976	0.911 - 1.046	0.981	0.913 - 1.053	0.768	0.719 - 0.821
NH Asian	0.960	0.891 - 1.033	1.037	0.963 - 1.116	1.194	1.114 - 1.281
NH Other	0.988	0.914 - 1.069	1.058	0.978 - 1.145	0.990	0.917 - 1.068
Hispanic	0.993	0.954 - 1.035	1.024	0.983 - 1.068	0.898	0.864 - 0.933

Medical	1.008	0.969 - 1.049	0.979	0.941 - 1.019	1.341	1.293 - 1.391
Other	0.947	0.866 - 1.036	0.841	0.766 - 0.923	1.428	1.313 - 1.554
Self-Pay	1.048	0.942 - 1.166	1.047	0.940 - 1.165	0.360	0.324 - 0.400
Rural	0.966	0.930 - 1.005	0.985	0.948 - 1.025	0.904	0.871 - 0.938
Frontier	1.018	0.901 - 1.151	0.950	0.837 - 1.079	0.896	0.791 - 1.015
_Cons	0.171	0.164 - 0.179	0.168	0.161 - 0.176	0.009	0.009 - 0.009

Direct Admit. Direct admits descriptive results are in Table 6. Direct admits occurred on Saturdays or Sundays at a higher percentage for females (42%), Asians (10%), Hispanics (49%), and those with Medi-Cal (50%) and self-pay (3%) insurance. Wednesday had the highest percentage of direct admits for males (60%), and Blacks (6%). Private pay (43%) had the highest percentage of direct admits on Mondays. For all other variables, direct admissions occurred at a higher percentage on either Tuesday or Thursday.

Table 6: Descriptive Results of Direct Admit and Day of Week

Admit Type	*Direct Admit*						
Day of Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Gender							
Male	9,244 (57.53%)	22,688 (59.34%)	23,720 (59.08%)	23,142 (59.92%)	22,281 (58.85%)	23,511 (59.47%)	10,645 (57.26%)
**Female*	6,824 (42.47%)	15,549 (40.66%)	16,430 (40.92%)	15,482 (40.08%)	15,577 (41.15%)	16,023 (40.53%)	7,947 (42.74%)
Race/Ethnicity							
**NH White*	4,664 (29.84%)	11,761 (31.40%)	12,400 (31.75%)	11,840 (31.45%)	11,756 (31.81%)	12,170 (31.61%)	5,274 (29.36%)
NH Black	915 (5.85%)	2,030 (5.42%)	2,195 (5.62%)	2,238 (5.94 %)	2,033 (5.50%)	2,150 (5.58%)	937 (5.22%)
NH Asian	1,614 (10.33%)	3,685 (9.84%)	3,609 (9.24%)	3,533 (9.38%)	3,440 (9.31%)	3,760 (9.76%)	1,909 (10.63%)
NH Other	896 (5.73%)	2,357 (6.29%)	2,527 (6.47%)	2,446 (6.50%)	2,462 (6.66%)	2,571 (6.68%)	1,037 (5.77%)
Hispanic	7,541 (48.25%)	17,624 (47.05%)	18,326 (46.92%)	17,594 (46.73%)	17,269 (46.72%)	17,855 (46.37%)	8,809 (49.03%)
Insurance							
Medi-Cal	8,047 (50.07%)	18,157 (47.49%)	19,273 (47.99%)	18,525 (47.95%)	17,903 (47.29%)	19,079 (48.25%)	9,304 (50.02%)
**Private*	6,465 (40.23%)	16,539 (43.25%)	16,853 (41.96%)	16,307 (42.21%)	16,256 (42.94%)	16,867 (42.66%)	7,504 (40.34%)
Self-Pay	510 (3.17%)	893 (2.34%)	1,019 (2.54%)	869 (2.25%)	899 (2.37%)	945 (2.39%)	575 (3.09%)
Other	1,048 (6.52%)	2,648 (6.93%)	3,016 (7.51%)	2,931 (7.59%)	2,802 (7.40%)	2,649 (6.70%)	1,217 (6.54%)
Geographical Location							
**Urban*	12,338 (78.84 %)	29,356 (78.82%)	30,729 (78.55%)	29,300 (77.90%)	29,129 (78.94%)	30,218 (78.57%)	14,170 (78.33%)

Rural	3,114 (19.90%)	7,316 (19.64%)	7,777 (19.88%)	7,785 (20.70%)	7,225 (19.58%)	7,670 (19.94%)	3,645 (20.15%)
Frontier	197 (1.26%)	572 (1.54%)	615 (1.57%)	526 (1.40%)	544 (1.47%)	572 (1.49%)	275 (1.52%)

** equals the reference group*

On weekdays, most of the SDoH predicted lower odds of an infant visit being a direct admit (Tables 6.1-6.2). Infants with 'other type of insurance' had 8% higher odds of having a direct admit on Tuesdays and Black infants, male infants, and infants from rural areas or with other type of insurance had slightly higher odds of a direct admit on Wednesdays (OR Respectively: 1.073; 1.041; 1.057, 1.067). On weekends, some SDoH had higher odds of a direct admit visit. Specifically, Hispanic infants, Asian infants, and infants with Medi-Cal or who were self-pay had higher odds of being a direct admit on Saturdays, (OR: 1.098; 1.199; 1.067; and 1.330) and male infants, Asian infants, and infants with other type of insurance had higher odds of being a direct admit on Sundays (OR: 1.079; 1.473; 1.642). Interestingly, many SDoH predicted lower odds of infant visits having a direct admit on a Sunday. Black infants, Hispanic infants or infants from other race/ethnicities, those having Medi-Cal or self-pay insurance, and those from rural or frontier areas had decreased odds of having a direct admit on Sundays (OR respectively: .598; .674; .902; .654; .894; .775).

Table 6.1: Logistic Regression Direct Admit Monday-Thursday

	Monday		*Tuesday*		*Wednesday*		*Thursday*	
SDoH	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]
Male	1.017	0.994 - 1.041	1.005	0.983 - 1.028	1.042	1.018 - 1.066	0.991	0.969 - 1.014
NH Black	0.971	0.921 - 1.024	0.980	0.931 - 1.031	1.073	1.020 - 1.130	0.971	0.921 - 1.023
NH Asian	1.010	0.969 - 1.053	0.932	0.894 - 0.971	0.970	0.931 - 1.012	0.933	0.895 - 0.974
NH Other	0.984	0.936 - 1.034	0.988	0.941 - 1.038	1.034	0.984 - 1.086	1.025	0.975 - 1.077
Hispanic	1.014	0.986 - 1.042	0.972	0.946 - 0.999	0.987	0.960 - 1.015	0.987	0.960 - 1.015
Medical	0.955	0.930 - 0.980	1.017	0.991 - 1.043	0.998	0.973 - 1.024	0.958	0.933 - 0.983
Other	0.948	0.905 - 0.993	1.081	1.034 - 1.131	1.067	1.019 - 1.116	1.029	0.983 - 1.077
Self-Pay	0.898	0.833 - 0.968	1.027	0.956 - 1.103	0.884	0.820 - 0.954	0.939	0.871 - 1.011
Rural	0.986	0.958 - 1.014	0.984	0.957 - 1.012	1.057	1.028 - 1.087	0.972	0.945 - 1.000
Frontier	1.055	0.961 - 1.159	1.079	0.985 - 1.182	0.915	0.831 - 1.008	1.006	0.915 - 1.107
_Cons	0.205	0.200 - 0.210	0.213	0.208 - 0.219	0.197	0.192 - 0.202	0.207	0.202 - 0.213

Table 6.2: Logistic Regression Direct Admit Friday-Sunday

	Friday		*Saturday*		*Sunday*	
SDoH	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]	Odds Ratio	[95% Conf. Interval]
Male	1.019	0.997 - 1.042	0.926	0.897 - 0.955	1.079	1.045-1.114
NH Black	0.983	0.933 - 1.035	0.977	0.907 - 1.052	0.598	0.557-0.643
NH Asian	1.001	0.961 - 1.043	1.199	1.134 - 1.267	1.473	1.390-1.561
NH Other	1.027	0.977 - 1.078	0.958	0.892 - 1.030	0.902	0.837-0.972
Hispanic	0.970	0.943 - 0.997	1.098	1.057 - 1.141	0.674	0.649-0.701
Medical	1.007	0.982 - 1.033	1.067	1.027 -1.106	0.654	0.631-0.678
Other	0.925	0.883 - 0.970	0.946	0.885 - 1.010	1.642	1.534-1.758
Self-Pay	0.952	0.885 - 1.025	1.331	1.214 - 1.459	0.331	0.301-0.363
Rural	0.995	0.968 - 1.024	1.011	0.972 - 1.051	0.894	0.859-0.931
Frontier	1.013	0.922 - 1.113	1.027	0.902 - 1.169	0.776	0.669-0.899
_Cons	0.210	0.204 - 0.215	0.083	0.080 - 0.086	0.015	0.014-0.015

Diagnosis

For both genders, all race/ethnicity groups, insurance types, and geographical locations, the most frequently occurring diagnosis for ED Release visits were the same. In order of frequency, they were upper respiratory infection (URI), fever, otitis media (OM), vomiting alone, and acute bronchiolitis. For Asian infants and those with private insurance, one of the top diagnoses was head injury with 2,479 and 15,332 visits, respectively. For ED admit, the top diagnoses in order of frequency were acute bronchiolitis due to an infectious or other organism, pneumonia, jaundice, and UTI. In addition, gastroesophageal reflux (GERD) was one of the top five diagnosis for both NH White and Black infants; URI was also prominent among Black infants, NH Other infants, and infants with other types of insurance. Neonatal conditions originating from the prenatal period was common among infants with private insurance and self-pay. For direct admissions, the top diagnoses in order of frequency were jaundice, bronchiolitis, pneumonia, and neonatal conditions originating during the prenatal period. Outliers were noted among NH White, Black, NH other infants and infants with private, self-pay and other types of insurance (Tables 7.1-7.3). For ED release visits, three diagnoses fell into the Urgent/PCP treatable and non-urgent categories. These diagnoses were URI, Otitis Media, and Vomiting. Two diagnoses, viral infection and acute bronchiolitis, were urgent/ED needed 50% of the time and urgent/PCP treatable and non-urgent 50% of the time, respectively. Fever and head injury were unclassifiable. For ED admit, the top two diagnoses, bronchiolitis due to unknown organism and bronchiolitis due to an infectious organism, were both urgent/ED needed and non-urgent 50% of the time. Pneumonia was dispersed between urgent/ED needed and PCP treatable. Jaundice was categorized as urgent/ED needed 100% of the time. URI and GERD were mostly urgent/PCP treatable and neonatal conditions were unclassifiable (Table 8).

Table 7.1: Top Diagnosis for ED Release Visits

ED Release

Diag-nosis	4659 - URI Unspecified Site	78060 - Fever Unspecified	3829 - Otitis Media	78703 - Vomiting Alone	7999 - Unspecified Viral Infection	46619 - Acute Bronchiolitis d/t Infectious	95901 - Head injury, unspecified (Unclassified)
Female	#1 (123, 648)	#2 (76, 470)	#3 (44, 706)	#4 (30, 124)	#5 (25, 275)	#6 (23, 561)	
Male	#1 (147, 811)	#2 (88, 080)	#3 (58, 615)	#5 (33, 355)	#6 (29, 654)	#4 (36, 524)	
NH White	#1 (50, 091)	#2 (31, 583)	#3 (20, 935)	#4 (14, 059)		#5 (12, 191)	
NH Black	#1 (25, 075)	#2 (11, 396)	#3 (7, 217)	#4 (5, 665)		#5 (4, 883)	
NH Asian	#2 (8, 419)	#1 (8, 883)	#3 (3, 265)	#5 (2, 406)			#4 (2, 479)
NH Other	#1 (10, 873)	#2 (8, 095)	#3 (4, 018)	#4 (3, 130)		#5 (2, 782)	
Hispani c	#1 (173, 084)	#2 (101, 967)	#3 (66, 583)	#4 (37, 216)		#5 (37, 013)	
Medi-Cal	#1 (178, 375)	#2 (103, 041)	#3 (65, 165)	#4 (39, 291)		#5 (39, 010)	
Private	#1 (61, 429)	#2 (44, 736)	#3 (20, 202)	#4 (17, 991)		#6 (15, 329)	# 5 (15, 332)
Self-Pay	#1 (25, 036)	#2 (12, 135)	#3 (7, 140)	#4 (4, 515)		#5 (4, 204)	
Other	#1 (6, 603)	#2 (4, 626)	#3 (2, 799)	#4 (1, 676)		#5 (1, 537)	
Urban	#1 (232, 969)	#2 (143, 125)	#3 (85, 374)	#4 (55, 128)		#5 (51, 958)	
Rural	#1 (64, 965)	#2 (35, 596)	#3 (27, 771)	#5 (14, 022)		#4 (14, 277)	
Frontier	#1 (5, 248)	#2 (2, 216)	#3 (2, 013)	#5 (791)		#4 (1, 176)	

Table 7.2: Top Diagnosis for ED Admit Visits

	ED Admit							
Diagnosis	46611 - Acute bronchiolitis due to other specified organisms	46619 - Acute Bronchiolitis d/t Infectious Organism	486 - Pneumonia Organism Unspecified	7746 - Fetal and Neonatal Jaundice Unspecified Types	5990 - UTI	53081- Gastro-esophageal reflux disease without esophagitis	4659 - URI Unspecified Site	77989 - Neonatal conditions originating in the perinatal period
Female	#1 (6, 252)	#2 (3, 877)	#3 (3, 119)	#4 (2, 568)	#5 (1, 840)			
Male	#1 (8, 444)	#2 (6, 571)	#3 (4, 779)	#4 (3, 875)	#5 (2, 556)			
NH White	#1 (3, 506)	#2 (1, 970)	#4 (1, 407)	#3 (1, 507)		#5 (812)		
NH Black	#1 (910)	#2 (714)	#3 (496)			#4 (291)	#5 (279)	
NH Asian	#1 (756)	#3 (485)	#4 (378)	#2 (628)	#5 (270)			
NH Other	#1 (686)	#2 (473)	#4 (283)	#3 (323)			#5 (203)	
Hispanic	#1 (8, 781)	#2 (6, 752)	#3 (5, 301)	#4 (3, 743)	#5 (3,058)			
Medi-Cal	#1 (10, 765)	#2 (7, 908)	#3 (6, 074)	#4 (4, 503)	#5 (3, 356)			
Private	#1 (3, 239)	#2 (1, 982)	#4 (1, 467)	#3 (1, 688)				#5 (915)
Self-Pay	#1 (327)	#2 (247)	#3 (157)	#4 (124)				#5 (100)
Other	#1 (365)	#2 (311)	#3 (199)	#5 (126)			#4 (146)	
Urban	#1 (12, 493)	#2 (9, 250)	#3 (6, 610)	#4 (5, 616)	#5 (3, 757)			
Rural	#1 (3, 734)	#3 (2, 096)	#2 (2, 108)	#4 (1, 383)	#5 (1, 092)			
Frontier	#1 (262)	#4 (131)	#2 (187)	#3 (183)	#5 (79)			

Table 7.3: Top Diagnosis for Direct Admit Visits

	Direct Admit						
Diagnosis	7746 - Fetal and Neonatal Jaundice Unspecified Types	46611 - Acute bronchiolitis due to other specified organisms	46619 - Acute Bronchiolitis d/t Infectious Organism	486 - Pneumonia Organism Unspecified	77989 - Neonatal conditions originating in the perinatal period	53081- Gastro-esophageal reflux disease without esophagitis	3829 - Otitis Media
Female	#1 (11, 161)	#2 (4,340)	#3 (3,014)	#4 (1, 767)	#5 (1, 735)		
Male	#1 (15, 304)	#2 (5, 768)	#3 (5, 005)	#4 (2, 552)	#5 (2, 212)		
NH White	#1 (7, 743)	#2 (4,785)			#3 (1, 130)	#4 (1, 088)	#5 (698)
NH Black	#1 (712)	#2 (526)	#3 (516)	#5 (235)		#4 (321)	
NH Asian	#1 (5, 100)	#2 (623)	#3 (493)	#5 (296)	#4 (302)		
NH Other	#1 (1, 169)	#2 (477)	#3 (325)		#4 (268)	#5 (176)	
Hispanic	#1 (11, 361)	#2 (5,435)	#3 (4, 849)	#4 (2, 718)	#5 (1, 900)		
Medi-Cal	#1 (11, 946)	#2 (6, 126)	#3 (5, 458)	#4 (2, 867)	#5 (1, 967)		
Private	#1 (13, 057)	#2 (3, 340)	#3 (2, 148)		#4 (1, 560)	#5(1, 165)	
Self-Pay	#1 (962)	#2 (297)	#3 (179)	#4 (166)		#5 (96)	
Other	#1 (499)	#2 (345)	#4 (234)		#3 (255)	#5 (178)	
Urban	#1 (23, 060)	#2 (8, 733)	#3 (7, 150)	#4 (3, 707)	#5 (3, 512)		
Rural	#1 (5, 806)	#2 (2, 095)	#3 (1, 474)	#4 (991)	#5 (689)		
Frontier	#1 (436)	#2 (169)	#3 (101)	#4 (79)	#5 (47)		

Table 8: Diagnosis Urgency and Visit Type

Admit Type	*Diagnosis*	*Urgent/ ED needed/ Unavoidable*	*Urgent/ ED needed/ Avoidable*	*Urgent/ PCP treatable*	*Non-urgent*	*Unclassified*
ED Release	4659 - URI Unspecified Site	0%	18%	82%	0%	0%
	78060 - Fever Unspecified	0%	0%	0%	0%	100%
	3829 - Otitis Media	0%	4%	59%	37%	0%
	78703 - Vomiting Alone	18%	0%	24%	59%	0%
	7999 - Unspecified Viral Infection	50%	0%	50%	0%	0%
	46619 - Acute Bronchiolitis d/t Infectious Organism	50%	0%	0%	50%	0%
	95901 - Head injury, unspecified	0%	0%	0%	0%	100%
ED Admit	46611 - Acute bronchiolitis due to other specified organisms	50%	0%	0%	50%	0%
	46619 - Acute Bronchiolitis d/t Infectious Organism	50%	0%	0%	50%	0%
	486 - Pneumonia Organism Unspecified	0%	67%	24%	9%	0%
	7746 - Fetal and Neonatal Jaundice Unspecified Types	100%	0%	0%	0%	0%
	5990- UTI	0%	24%	30%	46%	0%
	53081- Gastro-esophageal reflux disease without esophagitis	0%	0%	75%	25%	
	4659 - URI Unspecified Site	0%	18%	82%	0%	0%
	77989 - Neonatal conditions originating in	0%	0%	0%	0%	0%

	the perinatal period - unclassifiable					
Direct Admit	7746 - Fetal and Neonatal Jaundice Unspecified Types	100%	0%	0%	0%	0%
	46611 - Acute bronchiolitis due to other specified organisms	50%	0%	0%	50%	0%
	46619 - Acute Bronchiolitis d/t Infectious Organism	50%	0%	0%	50%	0%
	486 - Pneumonia Organism Unspecified	0%	67%	24%	9%	0%
	77989 - Neonatal conditions originating in the perinatal period - unclassifiable	0%	0%	0%	0%	0%
	53081- Gastro-esophageal reflux disease without esophagitis	0%	0%	75%	25%	0%
	3829 - Otitis Media	0%	4%	59%	37%	0%

ED Release Visits. For ED release visits (Table 9.1), gender showed a significant difference ($p<0.05$) for URI, OM, vomiting, and acute bronchiolitis. The widest percentage difference noted was with cases of acute bronchiolitis at 36,524 (60.79%) for males and 23,561 (39.21%) for females, which was almost a 20% gap between the two. For the other three diagnoses, the gap was between 5-9% with males at 52-56% and females at 45-47%.

The relationship between ED release diagnoses and race/ethnicity and insurance type showed a significant difference ($p<0.05$). The diagnoses with the highest percentage of visits from Hispanic infants was OM with 66,583 (65%) visits and the least was vomiting alone at 37,216 (59.57%) visits. Among NH White infants, the highest percentage of visits for a diagnosis was from vomiting alone at 14,059 (22%) of visits. Among Black infants, the diagnosis with the highest percentage of visits was URI at 25075 (9%), followed closely by vomiting alone at 5,665 (9%). Among Asian infants, head injury had the highest percentage of visits with 2,479 (7%), followed by fever with 8,883 (5%) visits. URI, vomiting alone, and OM were close in frequency with a range

from 3-4%. Medi-Cal was the insurance type for 61-68% of infants with the top five ED diagnoses, while private insurance was the payment type for 22-29% of visits except for head injury. Head injury was comparably represented between Medi-Cal and private insurance users at 45%. The highest percentage of visits for self-pay insurance users was for URIs (9%). The other four diagnoses had a narrower visit range of 7-8%. When exploring the relationship between ED release visits and geography, only URI, OM, vomiting, viral infection and acute bronchiolitis had a positive correlation ($p<0.05$).

Table 9.1: ED Release Diagnoses and SDoH

Admit Type	*ED Release*															
Diag-nosis	4659 URI Unspec-ified Site		78060-Fever Unspec-ified		3829 Otitis Media		78703 Vomiting Alone		07999 Unspec-ified Viral Infection		46619 Acute Bronchio-litis d/t Infection		95901 Head injury, unspeci-fied	
Gender														
Male	147811 (54.45%)	p-value=.000	88080 (53.53%)	p-value=.070	58615 (56.73%)	p-value=.000	33355 (52.54%)	p-value=.020	29654 (53.99%)	p-value=.200	36,524 (60.79%)	p-value=.000	17909 (52.37%)	p-value=.200
Fe-male	123648 (45.55%)		76470 (46.47%)		44706 (43.27%)		30,124 (47.46%)		25275 (46.01%)		23561 (39.21%)		16286 (47.63%)	
Race/Ethnicity														
NH White	50091 (18.72%)	p-value=.000	31583 (19.50%)	p-value=.000	20935 (20.52%)	p-value=.000	14,059 (22.50%)	p-value=.000	9114 (16.78%)	p-value=.000	12191 (20.60%)	p-value=.000	11073 (32.94%)	p-value=.000
NH Black	25075 (9.37%)		11396 (7.04%)		7,217 (7.07%)		5,665 (9.07%)		4011 (7.38%)		4883 (8.25%)		2591 (7.71%)	
NH Asian	8419 (3.15%)		8883 (5.49%)		3265 (3.20%)		2,406 (3.85%)		2076 (3.82%)		2301 (3.89%)		2,479 (7.37%)	
NH Other	10,873 (4.06%)		8,095 (5.00%)		4,018 (3.94%)		3,130 (5.01%)		2465 (4.54%)		2782 (4.70%)		1827 (5.43%)	
His-panic	173084 (64.69%)		101,967 (62.97%)		66583 (65.27%)		37216 (59.57%)		36657 (67.48%)		37013 (62.55%)		15648 (46.55%)	

Insurance														
Medi-Cal	178,375 (65.71%)	p-value=.000	103041 (62.62%)	p-value=.000	65,165 (63.08%)	p-value=.000	39291 (61.90%)	p-value=.000	36939 (67.26%)	p-value=.000	39010 (64.93%)	p-value=.000	15375 (44.97%)	p-value=.000
Private	61429 (22.63%)		44736 (27.19%)		28,202 (27.30%)		17991 (28.34%)		12,926 (23.54%)		15329 (25.51%)		15,332 (44.84%)	
Self-Pay	25,036 (9.22%)		12135 (7.38%)		7140 (6.91%)		4515 (7.11%)		3816 (6.95%)		4204 (7.00%)		2669 (7.81%)	
Other	6,603 (2.43%)		4626 (2.81%)		2,799 (2.71%)		1,676 (2.64%)		1239 (2.26%)		1,537 (2.56%)		813 (2.38%)	
Geographical Location														
Urban	198052 (74.74%)	p-value=.000	124524 (77.41%)	p-value=.680	71682 (71.54%)	p-value=.000	47763 (76.98%)	p-value=.030	41,754 (77.60%)	p-value=.020	43,863 (74.88%)	p-value=.000	27,264 (81.48%)	p-value=.220
Rural	61672 (23.27%)		34,125 (21.21%)		26505 (26.45%)		13489 (21.74%)		11,330 (21.06%)		13,542 (23.12%)		5,884 (17.59%)	
Frontier	5248 (1.98%)		2216 (1.38%)		2013 (2.01%)		791 (1.27%)		721 (1.34%)		1,176 (2.01%)		312 (0.93%)	

ED Admit Visits. When testing for relationships between SDoH and ED admits (Table 9.2), there was a significant difference ($p<0.05$) for gender within acute bronchiolitis, pneumonia, UTI, and URI. Male infants held the highest percentage of visits for all significant diagnoses. The widest gap between genders occurred with acute bronchiolitis due to an infectious organism, with males having nearly 63% of the visits and females 37%. Otherwise, visits were between 57-60% for males and 40-43% for females.

Positive relationships ($p<0.05$) for race/ethnicity were found for all ED admit visit diagnoses except for GERD. For all significant diagnoses, Hispanic infants had the largest percentage of visits, followed by NH Whites. Black infants had the third largest percentage of visits for acute bronchiolitis, pneumonia, URI, and neonatal conditions originating during the perinatal period. Asian infants had the third largest percentage of visits for jaundice and UTIs.

The type of insurance was significantly associated ($p<0.05$) with all diagnosis. Medi-Cal users represented the largest percentage of visits, with approximately 64-76% of visits. It was followed by private insurance users with approximately 18-28% of visits.

Geographic location had significant differences ($p<0.05$) within the diagnoses of acute bronchiolitis, pneumonia, jaundice, UTI, and URI. Most the visits were from urban areas (71-80%) followed by rural areas (17-26%) and then frontier areas (1-3%). This coincides with the frequency of births in each area as represented in Table 2.

Table 9.2: ED Admit Diagnosis and SDoH

Admit Type	*ED Admit*																	
Diag-nosis	46611 Acute bronchiolitis due to other specified organisms		46619 Acute Bronchiolitis d/t Infectious Organism		486-Pneumonia Organism Unspecified		7746 Fetal and Neonatal Jaundice Unspecified Types		5990 UTI		53081 Gastro-esophageal reflux disease without esophagitis		4659 URI Unspecified Site		77989 Neonatal conditions originating in the perinatal period	
Gender																		
Male	8,444 (57.46%)	p-value=0.030	6,571 (62.89%)	p-value=0.000	4,779 (60.51%)	p-value=0.011	3,875 (60.14%)	p-value=0.000	2,556 (58.14%)	p-value=0.000	1,330 (51.79%)	p-value=0.378	2,020 (56.95%)	p-value=0.003	1,830 (56.05%)	p-value=0.000
Fe-male	6,252 (42.54%)		3,877 (37.11%)		3,119 (39.49%)		2,568 (39.86%)		1,840 (41.86%)		1,238 (48.21%)		1,527 (43.05%)		1,435 (43.95%)	
Race/Ethnicity																		
NH White	3,506 (23.95%)	p-value=0.000	1,970 (18.95%)	p-value=0.000	1,407 (17.89%)	p-value=0.000	1,507 (23.56%)	p-value=0.000	718 (16.36%)	p-value=0.000	812 (31.69%)	p-value=0.180	642 (18.16%)	p-value=0.000	788 (24.22%)	p-value=0.000
NH Black	910 (6.22%)		714 (6.87%)		496 (6.31%)		196 (3.06%)		217 (4.95%)		291 (11.36%)		279 (7.89%)		205 (6.30%)	
NH Asian	756 (5.16%)		485 (4.67%)		378 (4.81%)		628 (9.82%)		270 (6.15%)		84 (3.28%)		150 (4.24%)		150 (4.61%)	
NH Other	686 (4.69%)		473 (4.55%)		283 (3.60%)		323 (5.05%)		125 (2.85%)		161 (6.28%)		203 (5.74%)		150 (4.61%)	
His-panic	8,781 (59.98%)		6,752 (64.96%)		5,301 (67.40%)		3,743 (58.51%)		3,058 (69.69%)		1,214 (47.38%)		2,262 (63.97%)		1,961 (60.26%)	

Insurance																
Medi-Cal	10,765 (73.25%)	p-value=0.000	7,908 (75.69%)	p-value=0.000	6,074 (76.92%)	p-value=0.000	4,503 (69.91%)	p-value=0.000	3,356 (76.34%)	p-value=0.000	1,669 (64.99%)	p-value=0.000	2,677 (75.47 %)	p-value=0.000	2,201 (67.41%)	p-value=0.000
Private	3,239 (22.04%)		1,982 (18.97%)		1,467 (18.58%)		1,688 (26.21%)		856 (19.47%)		727 (28.31%)		638 (17.99%)		915 (28.02%)	
Self-Pay	327 (2.23%)		247 (2.36%)		157 (1.99%)		124 (1.93%)		92 (2.09%)		83 (3.23%)		86 (2.42%)		100 (3.06%)	
Other	365 (2.48%)		311 (2.98%)		199 (2.52%)		126 (1.96%)		92 (2.09%)		89 (3.47%)		146 (4.12%)		49 (1.50%)	
Geographical Location																
Urban	10,463 (73.18%)	p-value=0.002	8,059 (78.88%)	p-value=0.000	5,455 (71.15%)	p-value=0.000	4,795 (76.74%)		3,169 (73.87%)	p-value=0.000	2,035 (80.91%)	p-value=0.259	2,804 (80.67%)	p-value=0.000	2,571 (80.24%)	p-value=0.076
Rural	3,573 (24.99%)		2,027 (19.84%)		2,025 (26.41%)		1,270 (20.33%)		1,042 (24.29%)		455 (18.09%)		639 (18.38%)		570 (17.79%)	
Frontier	262 (1.83%)		131 (1.28%)		187 (2.44%)		183 (2.93 %)		79 (1.84%)		25 (0.99%)		33 (0.95%)		63 (1.97%)	

Direct Admit Visits. There was a significant difference ($p<0.05$) within gender for acute bronchiolitis due to an infectious organism, neonatal conditions originating during the perinatal period, and OM. Male infants had the highest percentage of visits. Approximately 62 and 63% of visits were for Bronchiolitis and OM, respectively. In contrast, only approximately 52% of the male infant visits were for neonatal conditions.

Race/ethnicity, insurance, and geography had significant differences ($p<0.05$) within all diagnoses. Hispanic and NH White infants had the largest percentage of visits, coinciding with the birth percentages (Table 2). Black infants had the third highest percentage of visits for acute bronchiolitis due to an infectious organism, neonatal conditions originating during the neonatal period, and GERD (7%, 10% and 11%, respectively). Asian infants had the third largest percentage of visits for jaundice, acute bronchiolitis related to another specified organism, and pneumonia (20%, 6%, and 7%, respectively). NH other infants had the third highest percentage of visits for OM (6%). Medi-Cal users had the highest percentage of visits for all diagnoses except jaundice. Private insurance was the highest payer for jaundice. Self-pay users had the least amount of visits, except for jaundice and neonatal conditions originating during the perinatal period (4% and 9%, respectively). Most visits were by those living in urban areas (76-83%), followed by Rural (15-21%) and Frontier (.72-2%) (Table 9.3).

Table 9.3: Direct Admit Diagnosis for SDoH

Admit Type	*Direct Admit*													
Diag-nosis	7746 - Fetal and Neonatal Jaundice Unspecified Types		46611 - Acute bronchiolitis due to other specified organisms		46619 - Acute Bronchiolitis d/t Infectious Organism		486 - Pneumonia Organism Unspecified		77989 - Neonatal conditions originating in the perinatal period		53081- Gastro-esophageal reflux disease without esophagitis		3829 - Otitis Media	
Gender														
Male	15,304 (57.83%)	p-value=0.877	5,768 (57.06%)	p-value=0.465	5,005 (62.41%)	p-value=0.022	2,552 (59.09%)	p-value=0.871	16,111 (52.21%)	p-value=0.000	1,544 (52.43%)	p-value=0.850	821 (63.99%)	p-value=0.000
Female	11,161 (42.17%)		4,340 (42.94%)		3,014 (37.59%)		1,767 (40.91%)		14,748 (47.79%)		1,401 (47.57%)		462 (36.01%)	
Race/Ethnicity														
NH White	7,743 (29.68%)	p-value=0.000	2,785 (28.29%)	p-value=0.000	1,698 (21.55%)	p-value=0.000	886 (20.79%)	p-value=0.000	6,594 (21.76%)	p-value=0.000	1,088 (37.78%)	p-value=0.000	698 (56.47%)	p-value=0.000
NH Black	712 (2.73%)		526 (5.34%)		516 (6.55%)		235 (5.51%)		2,896 (9.56%)		321 (11.15%)		31 (2.51%)	
NH Asian	5,100 (19.55%)		623 (6.33%)		493 (6.26%)		296 (6.95%)		1,243 (4.10%)		128 (4.44%)		64 (5.18%)	
NH Other	1,169 (4.48%)		477 (4.85%)		325 (4.12%)		127 (2.98%)		1,419 (4.68%)		176 (6.11%)		80 (6.47%)	
His-panic	11,361 (43.55%)		5,434 (55.20%)		4,849 (61.53%)		2,718 (63.77%)		18,153 (59.90%)		1,167 (40.52%)		363 (29.37%)	

Insurance												
Medi-Cal	11,946 (45.14%)	p-value=0.000	6,126 (60.61%)	p-value=0.000	5,458 (68.06%)	p-value=0.000	2,867 (66.40%)	p-value=0.000	19,170 (62.13%)	p-value=0.000	1,506 (51.14%)	p-value=0.000	318 (24.79%)	p-value=0.000
Private	13,057 (49.34%)		3,340 (33.04%)		2,148 (26.79%)		1,245 (28.83%)		8,254 (26.75%)		1,165 (39.56%)		894 (69.68%)	
Self-Pay	962 (3.64%)		297 (2.94%)		179 (2.23%)		76 (1.76%)		2,656 (8.61%)		96 (3.26%)		14 (1.09%)	
Other	499 (1.89%)		345 (3.41%)		234 (2.92%)		130 (3.01%)		776 (2.51%)		178 (6.04%)		57 (4.44%)	
Geographical Location														
Urban	19,774 (76.82%)	p-value=0.000	7,690 (78.25%)	p-value=0.000	6,329 (80.78%)	p-value=0.000	3,155 (75.33%)	p-value=0.000	23,515 (78.13%)	p-value=0.000	2,398 (83.32%)	p-value=0.060	987 (78.58%)	p-value=0.000
Rural	5,532 (21.49%)		1,969 (20.03%)		1,405 (17.93%)		954 (22.78%)		5,915 (19.65%)		452 (15.71%)		260 (20.70%)	
Frontier	436 (1.69%)		169 (1.72%)		101 (1.29%)		79 (1.89%)		667 (2.22%)		28 (0.97%)		9 (0.72%)	

Discussion

This study was the first to examine day of visit, age and diagnosis among infant hospital visits by gender, race/ethnicity, insurance, and geography. The SDoH were found to be associated with the day and age at visit. However, there was not one specific diagnosis associated with the SDoH. Instead, each variable was associated with a unique diagnosis. In addition, non-urgent diagnoses were found with each type of visit and all SDoH.

Drawing from the gender mortality-morbidity paradox, which states that even though females have a longer life expectancy, they tend to be in poorer health throughout their lifetime, it was anticipated being female would be predictive of an infant any type of hospital visit after birth (Austed & Fischer, 2016). However, results from this study found that male infants had higher odds of a hospital visit during the first year of life, except during the neonatal period. It may be that the SDoH had their impact in utero or that the gender influence develops over time, as morbidity patterns in the first year of life follow mortality patterns where life expectancy for males is less (Austed & Bartke, 2015; Rieker & Bird, 2005; Strauss, Gertler, Rahman, & Fox, 1993).

Previous research has noted decreased Hispanic hospital utilization in comparison to their population numbers and increased utilization by Blacks (Agency for Healthcare Research and Quality, 2012; Allen & Cummings, 2016; Bureau of the Census, 2012; Flores et al., 1998; Gaskin et al., 2007; Lee et al., 2014; Lillie-Blanton et al., 2001; Neuman et al., 2014; Yu et al., 2006). In this study, the highest percentage of post-birth hospital visits occurred among Hispanic and NH White infants, which was not surprising since they were the top two race/ethnicity birth groups. However, the gap between Hispanic and NH White visits was wider than would be expected from the birth numbers for all ED usage (release and admit) and stands in contrast to the previously cited research (Allen & Cummings, 2016; Flores et al., 1998; Yu et al., 2006). The ED usage (release and admit) findings from this study among Black infants is actually less than other studies, but higher than would be anticipated from the birth numbers (Agency for Healthcare Research and Quality, 2012; Bureau of the Census, 2012; Gaskin et al., 2007; Lee et al., 2014; Lillie-Blanton et al., 2001; Neuman et al., 2014). Furthermore, there were higher odds of ED visits occurring during the week for both Hispanic and Black infants. The increased ED utilization during the week may be an issue of access, as it is evident they are utilizing services, but are the least likely to be admitted by a primary care provider during the week. The lack of primary care access and increased ED utilization found in this study among Hispanic and Black infants impacts their exposure to preventive health care services. This, in turn, influences their overall health and increases the cost of care for this population, especially when the visit is non-urgent (Gaskin et al., 2007; Smedley, Stith, & Nelson, 2003; Starfield, 2012).

In this study, NH White and Asian infants living in urban or frontier areas tended to have higher odds of all visit types during the neonatal period. Infants with Medi-Cal and self-pay insurance had higher odds of ED release visits during the neonatal period and were more likely to be admitted (ED and direct) during the one- to six–month age

period. Hispanic and Black infants were less likely to have any type of hospital visit after birth during the neonatal period. By identifying who is most at risk for a visit during the newborn period, interventions can be created to target these populations during hospital discharge and by maternal-child programs within the community.

Black infants had higher odds for all visit types during the one to six-month period. Because the visits occurred most frequently during this age range, the cause may be due to an illness or another age-related physiological or developmental factor rather than a lack of access. Further research must focus on this phenomenon and explore why Hispanic and Black infants are less likely to visit the ED during the neonatal period.

In previous studies, Medicaid was found to be the payer at higher rates than private insurance for ED visits (Lee et al., 2014; McHale et al., 2013; Niska, Bhuiva, & Xu, 2010; Piehl et al., 2000; Sommers et al., 2012). Also, Witt et al., 2014, found children less than 17 years old who were admitted to the hospital were more apt to have Medicaid insurance than the adults in the study. In this study Medicaid and Private insurance were payers at almost equivalent levels for both birth visits and direct admits. In contrast, as per previous studies, this was not true for ED utilization (release and admit) visits. Medicaid was the payer at a much higher rate than private insurance.

Geography's association with hospital usage has been mixed (Ray & Lorch, 2012; Sharma et al., 2000; Yamamoto et al., 1995). Studying geography's association to day of the week use assists in understanding issues with access for those from rural versus urban areas. Peltz et al.'s study found rural children who were admitted lived farther away, and tended to reside in low income zip codes that were more prone to health professional shortages (2015). Examining the correlation between geography and age and diagnosis at use assists with targeting interventions. Peltz et al. found children living in rural areas to have more chronic conditions than those in urban areas (2015). This study also had mixed results. We found that infants from rural areas had higher odds of admit during the neonatal period and higher odds of an ED release visit during the 1-6 month age range than those from urban areas. Geography was not highly associated with the day of the week or diagnoses at visit.

Past research has noted increased ED utilization on Saturday and Sundays due to decreased access to primary care providers on these days (Lowe et al., 2005; McHale et al., 2013; O'Malley, 2013; Pitts, Carrier, Rich, & Kellerman, 2010). This study was no different, with more ED release visits occurring on the weekend. Previous research found ED use decreased by 20% on weekends when primary care providers provided weekend office hours (Lowe et al., 2005; O'Malley, 2013; Pitts et al., 2010; Swavely et al., 2015). However, these studies also found weekend hours were only provided by 29-44% of the primary care offices queried. This study found that on the weekend, racial and ethnic minorities had lower odds of ED visits and were more apt to have a direct admit than their NH White, privately insured counterparts. It is possible that primary providers whose practice consists of a large percentage of racial and ethnic minorities are providing extended weekday and weekend hours. These might also be Federally Qualified Health Centers who serve diverse racial/ethnic groups and those with Medicaid.

The most frequently occurring diagnoses for ED release visits in the literature have been URI, Acute Bronchiolitis, Jaundice, skin problems, gastrointestinal issues, and feeding difficulties (Hannan, 2014; Isayama, Lewis-Mikhael, O'Reilly, Beyene, &

McDonald, 2017; Jain & Cheng, 2006; Schlitz et al., 2014). For this study, the most frequently occurring diagnoses for ED release visits were URI, fever, OM, vomiting, and acute bronchiolitis. OM and vomiting were not reported in previous studies. However, previous studies were conducted on infants less than six months of age. It could be that if we stratified the diagnosis by age and then by the SDoH that the diagnosis would be different for each age category and better support previous studies. The top diagnosis for ED release and both types of admits (ED and direct) were unique and included both urgent and non-urgent diagnosis. With data from this study revealing healthcare providers admitting for both urgent and non-urgent diagnosis, it is understandable how parents would have difficulty understanding which symptoms occurring in their infant were urgent and which were not.

The uninsured's primary diagnosis for ED utilization was URI, a PCP treatable urgent or non-urgent diagnosis. No studies were found with evidence supporting the cause for this. More studies need to examine the top causes for ED utilization by the SDoH to gain a deeper understanding of how to modify risk factors. Understanding which diagnoses occur most frequently as ED release visits, their urgency, and among whom they occur, will allow physicians, nurses and community educators to better target their needs.

A major limitation of this study is that not all variables featured in the design were used in the analysis due to lack of ED demographic data being collected for visits occurring after birth, making these variables difficult to analyze at the visit level. Also, being a retrospective study, only the variables available within the data set could be utilized. However, this study was the first to examine many variables related to SDoH and when and why infants visit the ED. To strengthen future studies regarding SDoH, variables related to SDoH need to be collected during all visit types by trained personnel.

Conclusion

This study explores the SDoH's relationship to when and why infants visit the ED. The increased utilization found by certain groups of infants may be due to their parents having difficulty negotiating access to primary care services. Further research into these areas is needed, along with additional research on the impact of SDoH on health care utilization. As providers of care, we hold the key to mitigating these differences. As recommended by Healthy People 2020, all Americans deserve the opportunity and supportive environment to make choices that allow them to live long, healthy lives, regardless of their age, where they live, their insurance or racial/ethnic background (U.S. Department of Health and Human Services, Healthy People 2020, 2018).

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Chapter 4: How Mothers Make Decisions When Their Infants Are Ill

Abstract

Objective: To assess mothers' decision-making process about whether to use the ED as a source of health care when there was an infant health concern.

Methods: This was a descriptive qualitative study. The sample consisted of mothers of infants with a reported health concern who were recruited using a study information sheet. Participants spoke English and/or Spanish and were at least 18 years old. Fifteen individual in-depth interviews, each lasting 40-60 minutes, were audio-recorded, and transcribed verbatim. Data were analyzed simultaneously with data collection, guided by grounded theory and used the constant comparative method. Data collection ceased when thematic saturation was achieved.

Result: Analysis of mothers' narratives revealed a consistent process of observation, consultation, and assessment when making decisions about health care for their infant's health concern. Mothers first reported noticing a change in behavior or sign of illness, which prompted them to seek advice from the father of the baby and/or Internet. Next steps were influenced by previous experience with the symptoms or an older child. If the mother's reassessment led to a low/uncertain concern, they attempted home interventions or sought added advice from immediate family members or friends with experience. If the reassessment led to a high concern, mothers reported calling for medical advice or seeking care from their PCP/clinic or ED.

Conclusion: This study describes key points in mothers' decision-making about their infants' care, including reasons prompting their choice. Implications for decreased ED utilization for non-urgent care are discussed. Understanding the process and influential points informs healthcare providers how and when to provide interventions to best support their patients and decrease ED utilization.

Introduction

ED utilization by pediatric patients, especially infants, is a concern due to their increased risk of exposure to acute illnesses while in the waiting room and their decreased immune systems and respiratory and cardiac reserve (American College of Obstetricians & Gynecologists, 2017; Batu, Yeni, & Teksam, 2015; Melville & Moss, 2013; Robinson, Kumar, & Cadichon, 2008). This concern only worsens when the visit is non-urgent; could have occurred in the PCP's office and exposure avoided. The decision-making process for pediatric healthcare utilization is complicated by the fact that unlike adult patients, young children are unable to make these complex decisions for themselves due to their cognitive abilities (Hockenberry, Wilson & Rodgers, 2017). Therefore, parents or guardians who care and know the most about the child are given the authority to make these decisions. Parents are also able to factor in family concerns and values into the healthcare decision. Unfortunately with this great power comes great responsibility to make decisions in the best interest of their child (Diekema, 2014).

Previous research regarding pediatric ED utilization has mostly analyzed large administrative data sets or closed-ended surveys conducted in pediatric specialty hospitals within urban areas to examine predictors or descriptors using Andersen's Model of Health Care Utilization (Andersen's Model) (Ben-Isaac, Schrager, Keefer, & Chen, 2010; Brousseau et al., 2007; Fieldston, Alpern, Nadel, Shea & Alessandrini, 2012;

Hummel, Mohler, Clemens, & Duncan, 2014; Jaeger, Ambadwar, King, Onukwube, & Robbins, 2015; Kubicek et al., 2012; Lee, Bardach, Maselli, & Gonzales, 2014; Mudd et al., 2016; Ogilvie, Hopgood, Higginson, Ives, & Smith, 2016; Phelps et al., 2000; Piehl, Clemens, & Joines, 2000; Stockwell, Findley, Irigoyen, Martinex, & Sonnett, 2010; Winskill, Keatinge, & Hancock, 2011). Two studies that conducted interviews with parents concerning pediatric ED utilization were also found (Berry, Brousseau, Brotanek, Tommy-Korman, & Flores, 2008; Chin, Goepp, Malia, Harris, & Poordabbagh, 2006). Lastly, to improve understanding of concepts related to mothers' decision-making, previous studies of parents decision-making and decisional conflict about healthcare utilization for their child(ren) were examined (Alexander, Brijnath, & Mazza, 2015; Boland, Kryworuchko, Saarimaki, & Lawson, 2017; Carr, Derr, and Karikari, 2016; Ghidini, Sekulovic, & Castagnetti, 2016; Rishel, 2010). The theory and studies are described below.

Andersen's Model

Andersen's Model is frequently used because it embraces key factors involved in a person's decision to utilize services; predisposing, enabling and need. Predisposing factors are those that existed prior to the necessity of enabling and need factors for health care services. Enabling factors are those that affect the ability to acquire health care services, while need is the factor that actually drives or is directly correlated to the use of the health care service(s) (Andersen, 1968; 1995).

Pediatric ED Utilization Survey Studies

In an urban ED study by Phelps et al. the caretakers most apt to use the ED for their child's usual source of care had a history of visiting the ED as a child themselves and were more likely to have Medicaid insurance. In addition, being a single parent increased the risk of a non-urgent visit (2000). Winskill et al.'s survey of parents who brought their child to an ED at a public hospital in South Wales, Australia found urgency due to symptoms and deviation from normal behavior to be the primary driver of ED utilization (2011). Mudd et al.'s survey of parents whose children utilized the ED for Asthma in Baltimore, Maryland found urgency, belief that the ED was better equipped for the illness and access at time of need to be the largest contributors of ED utilization (2016). Stockwell et al., found that ED utilization was unrelated to parental perceived urgency (2010). Instead, limited access to care and greater trust in the medical expertise available in Pediatric EDs in New York were the drivers. In Ogilvie et al.'s survey of parents utilizing a pediatric ED in England, they found that parents with children less than one year of age worried more, but sought advice less than parents of older children (2016). Fieldston et al.'s pediatric ED utilization study with both parents and healthcare providers exposed a difference between each group's perceptions regarding the reasons for use (2012). Parents reported concern with the perceived severity of the illness and need for additional resources, as well as lack of non-ED access at time of need being the main drivers for seeking care. Whereas, healthcare providers focused on systems issues, such as availability of appointments, and parents' health literacy. Fieldston et al's study supports the importance of studies that not only examine epidemiological results, but also include the processes involved in the decision-making.

Pediatric ED Utilization Interview Studies

While these studies provide insight into parental concerns regarding pediatric ED utilization or parental decision-making, only two pediatric ED utilization studies conducted parental interviews in the United States. Berry et al. conducted semi-structured interviews with 31 families who sought non-urgent ED care at the Children's Hospital of Wisconsin during routine office hours to examine the factors influencing ED use (2008). The mean age of the children was three years of age with a range of 1 ½ to 11 years of age. The three main influencing factors cited by parents for seeking ED care for their children were communication problems with their primary care provider (PCP), long wait times, referral from their PCP, and belief that there were advantages to going to the ED over other available choices. Chin et al. conducted semi-structured interviews with 12 families whose children had a low acuity triage score after presenting to a pediatric specialty ED in Rochester, New York, for care (2006). All but two families from their study cited PCP referral as the reason for the visit to the pediatric ED. The results from these previous studies suggest parents who utilized the ED have different influences on their health care decision-making than non-utilizers. However, no research has been conducted with mothers who did not seek ED care when there was an infant health concern.

Decision-Making Studies

Alexander et al., conducted 28 semi-structured interviews regarding preventative care and found that mothers' use of preventive health care for their child was influenced by parity, age of their child, personal experiences, relationship with the health provider and cost of care (2015). They also found that parents with more than one child tended to use their own experiences before professional expertise. Rishel's study of parental end of life decisions for their children found that a parent's spiritual and cultural background, gut feelings, and involvement in previous decisions were important factors in their decision-making process (2010).

Decisional Conflict and Regret

Decisional conflict occurs when competing treatment alternatives lead to uncertainty about the best decision and regret can occur after the decision, treatment, or outcome have transpired (Boland et al., 2017). For pediatric hospital utilization, these concepts have mostly been included in surgical decision-making studies. Ghidini et al.'s study of hypospadias repair found health literacy, familial pressures, outcome expectations, and persistent signs and symptoms were associated with both decisional conflict and regret (2016). Carr et al.'s study of pediatric patients undergoing a tonsillectomy found that increased decisional conflict led to an increased risk of regret (2016). Boland et al., found there was increased decisional conflict when the parents felt uninformed about their choices (2017).

Parents are placed in a difficult situation when their child has a need for care; there are feelings of uncertainty and heightened emotions. The results from previous ED utilization studies suggest parents who utilized the ED were influenced by different factors than non-utilizers. However, no research has been conducted with mothers who did not seek ED care when there was an infant health concern. Previous studies have also occurred mostly in pediatric specialty hospitals situated within urban areas (Ben-Isaac et al., 2010; Brousseau et al., 2006; Hummel et al., 2014; Jaeger et al., 2015; Jain & Cheng,

2006; Kubicek et al., 2012; Phelps et al., 2000). In addition, none of the pediatric ED utilization studies found discussed the process by which parents make decisions. For that reason, a qualitative approach was used to inductively explore the decision-making process of mothers living within a rural agricultural region in the California's Central Valley when choosing or not choosing to use the ED for perceived infant health concerns. By understanding the decision-making process, new individual- and community- based interventions could be created to optimize health system navigation and use.

Methods

Setting

The study took place in four counties within California's Central Valley, which is an area rich in agriculture and diversity. The Valley is the largest agricultural producer in the United States (Assembly Committee on Jobs, Economic Development, and the Economy, 2015). It is also one of the fastest growing areas in California with approximately 7 million people. The population and the ethnic groups within the valley are not evenly dispersed. Even though many counties within the Valley are designated rural, much of the population live in urban areas. Also, despite the fact that the Valley is a Hispanic minority-majority area, there are more Whites living in the northern part of the Valley, especially the Sacramento region. The Valley is also known for being an area high in poverty and low in education (Public Policy Institute of California, 2006). The median household income for the counties represented in the study was $46, 834 in 2010 (U.S. Census Bureau, 2010). In addition, health access is a significant problem with several rural areas being designated health professional shortage areas (Public Policy Institute of California, 2006).

Sampling

A purposive sample of fifteen mothers who experienced an infant health concern in the first year of life and either chose to use the ED (n=8) or not (n=7) were recruited over a nine month period from April 2016 to January 2017. Two designated ED triage nurses, managers from a public health infant program, and staff from a local clinic, supplied a study information sheet to prospective parents (Appendix A). The study information sheet was also posted on two local social media platforms. Snowball sampling facilitated further recruitment. Snowball sampling is when a participant assists in recruiting additional participants for the study (Palinkas et al., 2015). Once contact from a potential participant was received, the author reviewed eligibility. Inclusion criteria included being 18 years of age and older, and speaking English and or/Spanish, and having experienced an infant (<1 year of age) health concern. Exclusion criteria included mothers whose infants were now greater than five years of age to decrease recall bias (Coughlin, 1990; Bradburn, Rips, Shevell, 1987).

Data Collection Procedures

If they qualified for inclusion, the author invited participants to take part in an interview at a time and place convenient to them; locations included participants' homes and public coffee shops. Prior to beginning the interview, the author administered informed consent and a demographic data form to each participant (Appendix B & C)**.** The consent and study protocol were approved by both the University of California, Merced Institutional Board and the Dignity Health Institutional Review Board. To protect

confidentiality, when the interviews were transcribed, all names of individuals and locations were omitted and replaced with pseudonyms.

The author, who is fluent in English and Spanish, conducted all qualitative interviews. Andersen's Model of Health Care Utilization informed the domains explored in the open-ended interviews (Andersen 1968; 1995). The initial interview guide was translated to Spanish and back translated to English by the author and verified for accuracy by a credentialed Bilingual Cross-cultural Language in Academic Development (BCLAD) teacher. Following grounded theory methods, interview questions were added as new themes evolved based on the ongoing analysis that occurred after each interview (Appendix D).

Grounded Theory is used when needing to approach an existing problem in a new way. Three processes are used from the beginning to the end of the research study: collection, coding, and analysis of data (Glaser & Strauss, 1967). This approach allows the flexibility to change a line of inquiry and move in new directions, as more information and a better understanding of what are relevant data are acquired (Strauss & Corbin, 1998; Taylor & Bogdan, 2002).

The interview guide began with background information about the pregnancy and delivery (predisposing) and then asked about the illness (need) and decision-making. Next, further predisposing factors: family history of healthcare utilization and relationship with their healthcare provider and enabling factors; advice, treatment, and resources utilized were integrated. For many participants their stories about decision-making when their infant was ill unfolded naturally and the formal interview questions and probes were only used to explore areas not shared or areas needing further clarification. The interviews lasted 40-60 minutes and were audio-recorded for accuracy. Participants received a $20 gift card as appreciation of their time at the end of the interview. In addition, the author recorded field notes immediately after interviews. Interviews continued until data saturation was reached, and no new themes emerged.

Analysis

The audio- recorded interviews were transcribed and translated as needed by a professional transcription service. Once the transcripts were reviewed by the author for accuracy, they were imported into Atlas.ti, a qualitative software program that facilitates analysis (Scientific Software Development GmbH, 2013). In the course of listening to the audio recordings, reviewing transcripts for accuracy, and reflecting upon particular interviews, the author drafted theoretical memos that informed data analysis. Informed by grounded theory methods, data analysis occurred simultaneously with data collection using the constant comparative approach; each interview was compared and analyzed in relation to the previous (Strauss & Corbin, 1998; Taylor & Bogdan, 2002). Taped interviews, memoranda, and field notes were entered into a computer. The researcher read and re-read all transcripts. Initial coding was done by the researcher and then discussed with a researcher with expertise in qualitative research and a nurse researcher from the community advisory board. Through open and axial coding, categories emerged. For example, if a mother said "my mother told me to rub the baby down with alcohol," this was coded as mother's advice. Subsequently the categories merged into concepts. For example, mother's advice merged with several other codes related to advice to become "second line resources." Respondent validation occurred informally during the interviews

and formally, when the conceptual model was presented to two mothers who participated in the study. The quotations reported in this paper represent the key findings.

Results

Fifteen mothers of White, Asian and Latino infants within California's Central Valley contacted the researcher. All mothers met inclusion criteria and, therefore, were invited to participate in the study. The mothers' mean age was 31.9 (Range: 22-40), language spoken in the home was English (67%), English and Spanish (20%), and Spanish (13%), income was above FPL (73.3%) and at or below FPL (26.7%), type of insurance was private (60%) and public (40%), the provider type was either a pediatrician (80%), or family practice or clinic (20%), and their marital status was married (80%) and single (20%). Eight (n=8) mothers decided to take their infants to the ED when there was a health concern, and seven (n=7) did not (Table 1 & 2). Of the mothers who took their infant to the ED, 4 (50%) were first-time mothers. Of the mothers who did not take their infant to the ED, one (14%) was a first-time mother and six (86%) had other children in the home. The mothers who sought ED care versus those who did not were comparable in age, education, primary language, type of PCP, and marital status. Two areas in which these groups differed were income and insurance type. There were four families who had incomes less than $40,000 in the ED utilization group while only one mother in the non-ED utilization group fell into this income bracket. Mothers seeking ED care had insurance plans that included (a) a Preferred Provider Organization (PPO) (n=2) where providers are contracted with the plan and you are allowed to use out of service providers for an added cost; (b) a Health Maintenance Organization (HMO) (n=4) where a person is only covered when care is sought from a provider within the network; and, (c) Medi-Cal (n=1) which is California's version of Medicaid, a free to low-cost insurance program for those with limited income (HealthCare.gov). Of the non-ED utilization mothers, two had a PPO, one a HMO and four had Medi-Cal. In 2013, 50% of the population in California was covered by some type of private insurance, while 26% of the population had Medi-Cal (Henry J. Kaiser Family Foundation, 2015).

Table 1: Mothers Who Did Not Take Their Infant to the ED

Participant Number	***Age of Mom***	***First-time mom***	***Marital Status***	***Educational Level of mom***	***Income Level***	***Languages Spoken in home***	***Type of Insurance***	***Primary Provider***
3	33	No	Married	Master's Degree/ higher	150+ K	Spanish/ English	PPO	Pediatrician
4	27	No	Married	Bachelor's Degree	40-49,999	English	PPO	Family Practice
5	32	No	Single	Bachelor's Degree	60-69,999	English	Medi-Cal	Pediatrician
8	22	Yes	Married	Associate's Degree	50-59,999	English	HMO	Pediatrician
9	36	No	Married	Bachelor's Degree	80-89,999	English	Medi-Cal	Pediatrician
10	32	No	Married	Bachelor's Degree	50-59,999	English	Medi-Cal	Pediatrician
14	38	No	Married	less than HS	20-29,999	Spanish	Medi-Cal	Clinic Group

Table 2: Mothers Who Took Their Infant to the ED

Participant Number	***Age of Mom***	***First time mom***	***Marital Status***	***Educational Level of mom***	***Income Level***	***Languages Spoken in home***	***Type of Insurance***	***Primary Provider***
1	28	Yes	Married	Master's Degree/ higher	80-89,999	English	PPO	Pediatrician
2	40	No	Married	HS/equivalent	10-19,999	Spanish/ English	Medi-Cal	Pediatrician
6	30	No	Single	less than HS	10-19,999	Spanish/ English	Medi-Cal	Clinic Group
7	32	No	Married	Bachelor's Degree	150K +	English	HMO	Pediatrician
11	32	No	Married	Bachelor's Degree	30-39,999	English	HMO	Pediatrician
12	36	Yes	Married	Master's Degree/ higher	50-59,999	English	HMO	Pediatrician
13	31	Yes	Married	Bachelor's Degree	90-99,999	English	HMO	Pediatrician
15	29	Yes	Single	Some college	20-29,999	Spanish	PPO	Pediatrician

In-depth analysis of interviews identified a standard decision-making process from which the conceptual model emerged (figure 1). The process began with mothers in both groups reporting a change in behavior or a sign of illness in their infant (nausea/vomiting, fever, jaundice, eye discharge, feeding issues, fall, discoloration of extremities, nasal congestion) as their primary cause for concern. Once mothers were concerned, they initially sought advice from the father of the baby and/or the Internet, which were eventually fell under the theme, "first-line resources". When asked why they sought advice from the baby's father, mothers reported doing so because "*we're a team*" and because they felt the father would bring a "*calmer*" perspective to the situation.

Mothers who turned to the internet reported a desire to acquire background information on the health concern to help with their assessment of the situation. The following quote is representative of comments made by mothers who reported utilizing the Internet: "...my first thing is I looked it up online to see if it was common" [Interviewee #1, ED Utilizer]. Mothers reported utilizing several self-selected sites prior to making a decision. Typically, they would start the search by placing the symptom or concern into the search bar. Most mothers discussed a desire to utilize credible sites. However, none reported being educated on how to measure credibility. Instead, the following quotations represent how mothers self-selected, "*usually the ones that are close to the top …more popular*," or "*if it's a website that I recognize,"* or *"as long as it was a medical site."* Some mothers also discussed going to chat rooms or blogs to "*see what they (other mothers) did*" or *"what did your pediatrician say?"*

After seeking advice from their first line resources, mothers reported reassessing the situation, evaluating how serious it was, and making a decision about next steps. All mothers discussed feeling responsible for their infants' health, and being more proactive about seeking care for their infant then they would have been for themselves. One mother described how seeking care for her infant is different from how she cares for her own health: *"We're mostly a tough-it-out kind of family. For her we're better... in general, our threshold for seeking care for her is much lower than for either of us."* [Interviewee #1, ED utilizer]

The assessment of seriousness (uncertain/low vs. high) was moderated for most mothers by their previous experience with similar symptoms and/or with older children. One mother's description of how previous experience influenced her decisions: *"When she was a baby, like if she got a cold, I would take her in, or if she got a fever, it would totally freak me out. Those things, as like a second-time parent now, I'm not going to take him to the doctor for."* [Interviewee #4, Non-ED utilizer]

Some mothers also discussed being influenced by feeling some responsibility for the illness. One mother described how a change in the birth plan influenced feelings of inadequacy and in turn her actions: *"From night one in the hospital he was colicky. He just cried and cried and cried and I was already feeling inadequate because of my birth (C-Section vs. Vaginal), so I felt like I was doing everything wrong so I was really looking into everything."* [Interviewee #8, Non-ED utilizer]

Mothers who decided the situation was less serious or of low concern sought advice from immediate family members or friends with experience. This advice was consolidated under the theme "second line resources", or implemented home interventions (i.e. giving Tylenol, breast-feeding, applying a cool cloth, putting the baby

in indirect sunlight). If there was no improvement from these interventions or the second line resources advised seeking care, mothers reported their concern escalating. As one mother recounted: *"We had given her a Tylenol, and it hadn't come down. That's what made me nervous."* [Interviewee #13, ED utilizer]

Once feeling highly concerned, mothers reported seeking medical advice by phone, or bringing the infant to the PCP/clinic, or to the ED. The mother's decision was influenced by her relationship with her healthcare provider, concerns about cost, the day of the week and time of day, and her gut feeling about the need to act. A few mothers also discussed how their decision-making was influenced by how their family of origin sought care.

Mothers who chose not to seek care from the ED highlighted the importance of their trust in and relationship with their PCP in decision-making: *"...we're creating a relationship with the pediatrician. So I'd much rather go there than the ER."*[Interviewee #4, Non-ED Utilizer]. However, one mother described how she made the decision to seek ED care because of her trust in the PCP and the PCP's referral to the ED, *"Dr. XXXX is not an alarmist at all. She's pretty much "you're fine" unless it's something pretty real. We trust her"* [Interviewee #1, ED Utilizer]. Mothers who chose to seek care from the ED described difficulties in attaining an appointment and/or distrust of advice given by the provider. As one mother reported, getting an appointment was a barrier: *"Well, if I would take him to the doctor…it would take days... that's why I took him to the emergency room"* [Interviewee #6, ED Utilizer]. Another mother reported, *"You can't trust the doctors, whether it's because … they're not as knowledgeable, or whether it's because they are just too busy, or because it's just really hard to diagnose kids"* [Interviewee #7, ED Utilizer].

Only mothers who had insurance discussed how the cost of the co-pay for being seen at the ED influenced their decision-making. As one mother noted: *"...I remembered that with our insurance we had to pay two hundred dollars for an emergency room visit and then I was like I'm not going to pay two hundred dollars for them to just turn me around to go home and wait for it to get better so I just went home."* [Interviewee #8, Non-ED utilizer]

Mothers discussed how the day of the week (e.g. weekend or holiday) and/or time of day (e.g. evening) influenced their decision-making to seek care sooner than typical. Two mothers reported: *"Saturday night, his congestion sounded worse…I don't want him to stay the night like that. So I went to the hospital."* [Interviewee #15, ED Utilizer]. However, another mother who chose to avoid an ED visit shared: *"...if it's a Friday and it's getting close to maybe Friday afternoon and I think that I might want her to be seen then I'm a little bit more proactive on going in or making the appointment so that we don't have to deal with going to the ER"* [Interviewee #3, Non-ED utilizer].

Mothers discussed how a gut feeling or instinct influenced their decision-making. As one mother stated: *"We took her to the emergency room and she did have jaundice. I was right, so now we go with my instincts. Moms know."* [Interviewee #2, ED Utilizer]. Lastly, a factor discussed by a few mothers, as influencing their decision-making about healthcare utilization was the manner in which healthcare was sought by their family of origin. As one mother discussed, *"I think I learned it from my mother because she says if*

someone is sick, they need to see the doctor… right away, it isn't something you let wait because it can get worse" [Interviewee #14, Non-ED Utilizer].

Mothers who were highly concerned and whose decisional conflict resulted in choosing to go to the ED versus taking the infant to their PCP/clinic more often described "*fear*" of a bad outcome or *"not normal"* behavior. The mothers feeling responsible for the baby and the baby's inability to verbalize how she/he was feeling heightened this fear. As one mother shared, "*I feel I have the whole responsibility. I am the one taking care of him"* [Interviewee #15, ED Utilizer]. Another mother shared, *"I have no clue what they're feeling. So I think the sense of urgency is gonna be a lot, you know, higher"* [Interviewee #7, ED Utilizer].

In addition, mothers voiced the inability to contact the PCP/clinic due to it being a weekend, evening, or holiday as the enabling factors in their decision-making. Two mothers were referred to the ED for care, one by an advice nurse and the other by the PCP. Mothers whose decisional conflict resulted in choosing the PCP/clinic or calling for medical advice instead of the ED discussed that although there was a health concern, the infant was still displaying more "*normal*" behaviors. Furthermore, they were able to obtain an appointment with the PCP/clinic the same day it was requested.

Most mothers reported that they preferred to consult the PCP than go to the ED when a concern arises. The recommendation by most mothers to decrease infant ED utilization was the need to have "actual communication with the doctor", instead of a "middleman." Methods recommended for this communication were "e-mail," "talk by phone," "text", or "instant messenger." The main reasons for this recommendation was "the one that knows your child so you don't have to give the whole story." Mothers also discussed the desire for providers to share information on what is "normal" or "acceptable," and understand even though this information is shared, there are still going to be "questions that come up." Lastly, mothers recommended having "open appointments" for urgent appointments and the ability to "make appointments online.'

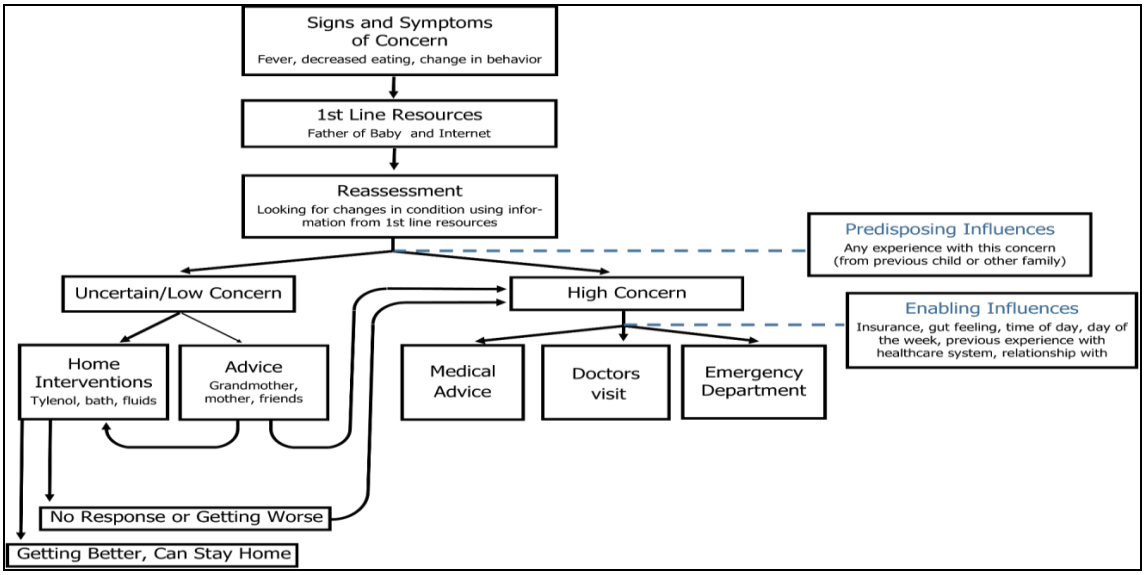

Figure 1: Conceptual of Mothers Decision-Making When Concerned About Their Infant

Discussion

Previous research derived solely from patients in urban areas who utilized pediatric specialty ED's suggested that reasons for parents' choosing to use the ED would be unique from non-ED utilizers (Ben-Isaac et al., 2010; Brousseau et al., 2006; Hummel et al., 2014; Jaeger et al., 2015; Jain & Cheng, 2006; Kubicek et al., 2012; Phelps et al., 2000). The results from this study showed that all mothers felt responsible for making decisions about how best to care for their infants when there was a health concern and their final decision was derived from decisional conflict and a fear of regret (Carr et al., 2016; Ghidini et al., 2016). The results do not support two unique decision-making pathways for ED utilizers versus non-utilizers. Rather, after a need was established, both groups of mothers described a process of observation, consultation, and assessment, with differences occurring instead at two points in the process where influential factors moderated decision-making. The first occurred when the mother was assessing the seriousness of the situation as an uncertain/low concern versus a high concern. Influencing factors that occurred at this point fit generally within what are defined as predisposing factors in Andersen's Healthcare Utilization model (Andersen, 1968; 1995). The most influential predisposing factor described by mothers was whether they had previous experience with the infant health concern. In their study about parental use of a pediatric ED, Woolfenden and colleagues also noted being a first time parent and past experiences with medical illnesses as influencing parental decisions about the infant's vulnerability (Woolfenden, Ritchie, Hanson & Nossar, 2000).

The second point in the pathway where decision-making differed between ED utilizers and non-utilizers occurred when deciding where to seek help once a high concern was identified. These results support enabling factors as defined within Andersen's Healthcare Utilization Model (Andersen 1968; 1995). For those who sought care from the ED, the primary factors influencing this decision were PCP referral, fear of bad outcome, and inability to get an appointment. Fear of a bad outcome seemed to influence a mother's decision from fear of decisional regret. Previous research about decisional conflict and regret have studied the feelings of decisional regret after a decisional conflict (Carr et al., 2016; Ghidini et al., 2016). However, this study found fear of decisional regret to be one of the factors influencing the final decision when there is decisional conflict, instead of a feeling after the decision was made. Further research on this phenomenon needs to be completed. PCP referral and the inability to get an appointment support findings by the two previous qualitative studies (Berry et al., 2008; Chin et al., 2006). Woolfenden et al. also noted a parent's perceived severity of the illness to increase ED utilization (2000).

Several previous quantitative studies noted that low-income families and those with Medi-Cal tend to be higher ED utilizers (Ben-Isaac et al., 2010; Brousseau et al., 2007; Hummel et al., 2014; Jaeger et al., 2015; Kubicek et al., 2012; Phelps et al., 2000; Piehl et al., 2000). In this study; low-income families were also noted more frequently to be in the ED utilization group. However, this study found the non-ED utilization group to have three times the number of mothers with Medi-Cal than the ED utilization group. This finding is in contrast to results of previous studies (Garcia, Bernstein, & Bush, 2010: Lowe, Fu, & Gallia, 2010; Piehl et al., 2000; Price, Norris, Bartleson, Gavin, & Klinnert, 1999). The one mother who had Medi-Cal in the ED utilization group differed from the

mothers in the non-ED utilization group in that both her income and education were lower. This suggests that in this rural setting, income level and education may be more influential on decision-making than insurance type due to their impact on health literacy. Low and/or limited health literacy has shown to negatively influence health service utilization within subgroups such as those with less than a high school diploma and those living in poverty (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011).

Using Andersen's Model to interpret the results found in this study, the results included all the components of Andersen's Model: predisposing, enabling and need (Andersen 1968; 1995). However, there were other components such as seeking advice prior to making a decision that are not included in Andersen's Model. In addition, the predisposing, enabling and need factors in this study, diverged from the standard model. Instead of predisposing, enabling and need factors influencing utilization at the same level, need actually activated the process of utilization. Then, predisposing and enabling factors influenced the decision made about where to seek care (figure 2).

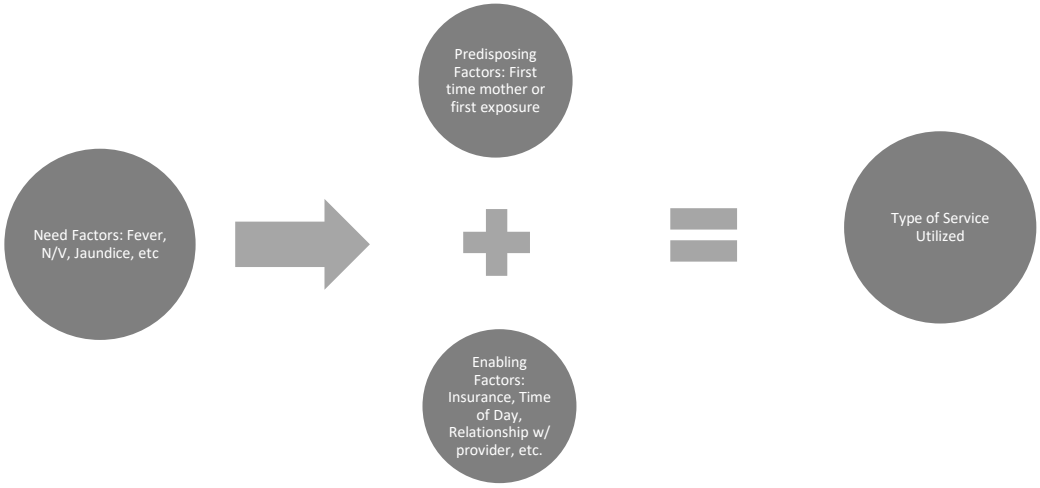

Figure 2: Andersen's Model Applied to Mothers Decision-Making

The findings reported are limited because the study relied on interviews only from mothers; specifically those who chose to call and participate. The decision-making of fathers and mothers who did not choose to participate may not support the process shared by mothers who did. In addition, with the interviewer being a seasoned pediatric nurse and mother, study participants may have shared more medical narrative with the interviewer than they would have with interviewers without these credentials.

Conclusion

The influencing factors and the decision-making process described by mothers in both the ED-utilizing and non-ED utilizing groups suggest that understanding mothers' health care decisions about their infants requires consideration of the broader social network she turns to for information and support, financial resources (e.g. insurance and co-pay), informational resources (e.g. ability to navigate the Internet), and previous parental experience (e.g. first time parent). Being aware of these vulnerable points in the

decision making process, especially when there is a decisional conflict, allows health care professionals to better know where to implement interventions. Results suggest pairing new mothers with mentors who have other children and improving access to their PCP as useful strategies. Also, further research into how familial/generational patterns' influence on healthcare utilization/literacy is warranted from the discussion by some mothers regarding the influence of their present health service utilization being influenced by their family of origin.

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Appendix A. Study Information Sheet

Parents of Infants: We Need You!

We are doing a research study on how parents make decisions about seeking medical care when their infants are ill. If your baby was sick in any way in the first 30 days of life, we would like to talk to you about your experience. We want to hear about how you decided to care for the baby.

If you are willing to share your story, please contact the principle investigator, Mechelle Perea-Ryan, RN, a nurse researcher from the University of California, Merced at (209) 604-3196. Your participation is important to help understand how healthcare professionals can support parents of newborns.

Your participation is voluntary and will require a 30-60 minute interview at a location of your choice (i.e. Starbucks, a diner, the University…). At the end of the interview, you will be given a $20 Target gift card as a token of appreciation for participating.

Appendix B. Consent

CONSENT TO PARTICPATE IN A RESEARCH STUDY
UNIVERSITY OF CALIFORNIA, MERCED

Title of the Study: When Your Neonate Is Ill: Parental Decision Making

INVESTIGATORS:
Mechelle Perea-Ryan Professor Paul Brown

School of Social Science, Humanities and Arts
University of California, Merced
209-228-2251

WHY IS THIS STUDY BEING DONE?
You are being asked to participate in a research project examining the decision making process of parents when their newborn is ill. This research project is being performed as a part of the course work in a Doctor of Public Health program. We hope to understand how parents make decisions about the care of their newborns. We also hope to examine who parents turn to for support when their baby is sick and the types of treatments they use. In addition, we want to explore ways that healthcare providers can better support parents during the newborn's first 30 days of life.

WHAT WILL HAPPEN IF I TAKE PART IN THIS STUDY AND HOW MANY PEOPLE WILL PARTICIPATE?
If you decide to volunteer, you will be asked to participate in an interview where you will be asked to describe your experiences during the first 30 days of your baby's life. Interviews will last approximately 30-60 minutes and will be audio-taped for accuracy. We plan to talk with about 20 new mothers.

WHAT RISKS CAN I EXPECT FROM BEING IN THIS STUDY?
There are no known risks to you for your participation in this study. However, some stories shared may include emotional elements. If you experience distress after participating in this study, you can contact your personal healthcare provider or contact the principle investigator about community counseling services available in your area.

ARE THERE BENEFITS TO TAKING PART IN THIS STUDY?
It is possible that you will not benefit directly by participating in this study, however, others might benefit from the findings when published.

WILL MY INFORMATION BE KEPT PRIVATE?
Information collected from the demographic form and the interview will be protected from inappropriate disclosure under the law, including anonymity. However, absolute confidentiality cannot be guaranteed, since research documents are not protected from subpoena. All the data will be kept in a secure location. The researchers are not interested in any single response, only the average responses of everyone in the study.

WILL I BE COMPENSATED FOR BEING IN THIS STUDY?
At the completion of the interview, you will be given a $20 Target gift card as a token of appreciation.

WHAT ARE THE COSTS OF TAKING PART IN THIS STUDY?
There is no cost to you beyond the time and effort required to complete the procedure(s) described above. Your participation is voluntary. Refusal to participate in this study will involve no penalty or loss of benefits.

CAN I STOP BEING IN THIS STUDY?
You may withdraw at any time without penalty or loss of benefits at any time.

QUESTIONS?
If you agree to participate, please indicate this decision by signing below. If you have any questions about this research project please contact the principle investigator: Mechelle Perea-Ryan at the University of California, Merced (209) 604-3196. If you have any questions regarding your rights and participation as a research subject, please contact the Office of Research at (209) 383-8655 or write to the Office of Research, 5200 North Lake Rd, UC Merced, Merced, CA 95343. The Office of Research will inform the Institutional Review Board which is a group of people who review the research to protect your rights. If you have any complaints or concerns about this study, you may address them to Ramesh Balasubramaniam, Chair of the IRB at (209) 383-8655 or irbchair@ucmerced.edu

By signing below, you agree that you are at least 18 years old and are freely consenting to participate in this research study.

Sincerely,
Mechelle Perea-Ryan, RN, FNP, PhD (c)
Doctoral Student
University of California, Merced

_____ _____
Signature Date

Appendix C. Study Demographic Form

Please answer the following questions by placing an X or filling in the blank.

Gender of baby: Male___ Female___

Gestational age of newborn at birth: _____ weeks

Present age of Baby: _____

Number of Siblings: _____ **Age of Siblings:** _____

Age of mom and dad: Mom _____ Dad _____

Educational level of mom: Less than high school____ High school diploma or equivalent_____ Professional training or some college, no degree_____ Associate's degree _____ Bachelor's degree _____ Master's degree or higher _____

Educational level of dad: Less than high school_____ High school diploma or equivalent_____ Professional training or some college, no degree_____ Associate's degree _____ Bachelor's degree _____ Master's degree or higher _____
Marital Status: Single, never married_____ Married or domestic partnership_____ Widowed _____ Divorced_____ Separated_____

Family Income: Less than $10,000 ____ $10,000 to $19,999 _____

$20,000 to $29,999 _____ $30,000 to $39,999 _____ $40,000 to $49,999 _____ $50,000 to $59,999 _____ $60,000 to $69,999 _____ $70,000 to $79,999 _____ $80,000 to $89,999 _____ $90,000 to $99,999 _____ $100,000 to $149,999 _____ $150,000 or more _____

Ethnicity/Race of baby: Hispanic_____ Non-Hispanic (NH) White_____ NH Black_____ NH Asian_____ Other (please expand) _____

Language(s) spoken in the home: _____

What kind of insurance do you have: Private Insurance HMO _____ Medi-Cal _____ other state-sponsored or government-sponsored health plan _____ Other (explain) _____

Do you have a primary care physician for your baby? Yes___ No___
If yes, is it a Family Practice Doctor____ Pediatrician____ Clinic Group ____ Nurse Practitioner_____

Appendix D. Interview Guide for Parents Whose Infant Was Ill

Tell me about the first 30 days of your baby's life

How was the pregnancy?

How many days was the baby in the hospital after birth?

How many times did a healthcare professional see the baby in the first 30 days?

Tell me about when your baby got sick. When did you first notice or realize something was not right. What were the symptoms?

When you realized he/she was sick, what did you do first?

What other methods did you use to make decisions about the illness?

Who did you reach out to for support in making your decision?

How is the support you receive from your partner when it comes to making decisions about the baby in comparison to other decisions?

Tell me about how you made the decision to take your baby to the …. (Emergency Department, PCP, etc.)

How did the time of the day or the day of the week affect your decision-making?

In general, when someone gets sick in the family, whom do you typically call for advice?

What other methods do you use in making decisions about how to care for the illness?

In general, what methods of treatment does your family usually use for someone who is ill? (herbs, food, hot/cold, etc.)

In general, when someone in the family gets ill, how often or how quickly do you seek professional care? Who is that professional? How is it different for the adults in comparison for the baby (children)?

Now thinking about the baby again, did you use any of these methods (call mom, call Dr., use internet) when you were making decisions about care? How was information you have received when discharged from the hospital or from the HCP office utilized in the decision making process?

How did you come to know about the resources available for you to use?

In the future, if the baby is sick, and you had the choice between going to the Emergency Department and going to the doctor's office, both having the same wait time, how would you decide which one to choose?

What challenges do you encounter when communicating with the baby's healthcare provider office? Or if no HCP, what challenges do you encounter by not having a primary HCP?

If you could improve the communication between you and the baby's healthcare office, what would that look like?

Prompts and Probes:
Could you tell me a little more about …
In what way do you mean …
Could you give me an example of …
I heard you talk about …, what was that like for you

Chapter Five: Dissertation Conclusion

Understanding the infant, maternal, and environmental factors that drive infant ED utilization versus ED admits or direct admits was the aim of this study. The study was mixed methods in design. Quantitative methods were used to examine OSHPD data. The data were initially analyzed to identify the characteristics of infants and their mothers, as well as the geographical factors that predict infant post birth hospital utilization. Then, data were analyzed to investigate whether the social determinants of health (SDoH) influenced an infant's age at visit, day of week of visit, and five most common diagnosis from the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes. Finally, qualitative methods were used to further examine the decision-making process of parents whose infant had a health issue during the first year of life.

Predictors of Hospital Utilization

Using Andersen's Health Care Utilization Model, infant, maternal and environmental factors were analyzed for predictors of infant ED release, ED admit and direct admit utilization during the first year of life. The results for ED release and direct admit were opposite of each other. There were a few predictors of ED admissions, but they were different than those found for other two types of service utilization. The predisposing factors predictive of increased ED release utilization, being Black or Hispanic, or having a mother who was younger in age also predicted decreased direct admissions. In addition, being Asian led to decreased ED utilization, but increased odds of a direct admit. Enabling factors that led to increased infant ED utilization were having Medicaid, being uninsured, and having a mother with low educational attainment. Whereas, having private insurance and a mother with higher educational attainment, led to increased odds of a direct admit visit. Need factors such as being born by C-section, premature, having a decreased Apgar score at five minutes or birth weight, complications during labor and delivery or at birth, or a maternal illness during pregnancy were predictive of an increased odds of an infant having a direct admit, but decreased odds of an ED release visit.

SDOH and ED Utilization

Examining the association between gender, race/ethnicity, insurance, and geography, as well as when and why infants utilized the ED exposed a positive association. NH Whites and Asians living in urban or frontier areas had a higher percentage of all visit types during the neonatal period. Whereas, infants with Medicaid had a higher percentage of ED release visits during the neonatal period. On the weekend, racial and ethnic minorities were found to have a lower percentage of ED visits and were more apt to have a direct admit than their NH White, privately insured counterparts. No specific SDoH was associated with a unique diagnosis and all hospital visits included urgent and non-urgent diagnosis. The most frequently occurring diagnoses for ED release visits were URI, fever, OM, vomiting and acute bronchiolitis.

Mothers Decision-Making for Infant ED Utilization

Analysis of mothers' narratives revealed a consistent process of observation, consultation, and assessment when making decisions about care for their infant's health concern. Mothers reported noticing a change in behavior or sign of illness, which prompted them to seek advice from the father of the baby and/or Internet. Next steps were influenced by previous experience with the symptoms or an older child. If the mother's reassessment led to a low/uncertain concern, they reported attempting home interventions or seeking additional advice from immediate family members or friends with experience. If the reassessment led to a high concern, mothers reported calling for medical advice or seeking care from their PCP/clinic or ED.

Implications for Practice

Inappropriate emergency department (ED) utilization especially for non-urgent issues has been a concern for decades (Andrews & Kass, 2018; Billings, Parikh & Mijanovich, 2000; Usher-Pines, Pines, Kellerman, Gillen & Mehrotra, 2013). The reason tied to this concern is the high cost of care in the ED setting for services that could have been equally cared for in another less costly setting: primary care offices, community clinics or urgent care clinics (Billings et al., 2000; Kellermann, 1994). Unfortunately, over the years, changes in the healthcare system have been unable to curb use of the ED, especially by consumers less than one year of age and over 75 years of age (Delia & Cantor, 2009; Pitts, Niska, Xu & Burt, 2008). Research on infant ED utilization has mostly been conducted with utilizers of pediatric specialty ED's in urban areas or with large pediatric ED data sets (Ben-Isaac, Schrager, Keefer & Chen, 2010; Brousseau, Mistry, & Alessandrini, 2006; Doobinin, Heidt-Davis, Gross, & Issacman, 2003; Hummel, Mohler, Clemens, & Duncan, 2014; Jaeger, Ambadwar, King, Onukwube & Robbins, 2015; Kubicek et al., 2012; Mistry, Hoffman, Yauck, & Brousseau, 2005; Phelps et al., 2000; Pomerantz, Schubert, Atherton, & Kotagal, 2002; Sharma et al., 2000). Comparing healthcare utilization and how decisions are made about healthcare utilization when there is an infant health concern by those who do not utilize the ED or utilize services appropriately to those who utilize the ED for non-urgent concern may be a better method to understanding how to curb non-urgent ED utilization. This study did just that. Discoveries made by this study that can assist in decreasing infant non-urgent ED utilization are focusing on ambulatory care sensitive conditions, including both parents in health education, providing a method for parents to validate online resources, and improving access. In addition, by understanding the populations most at risk for infant non-urgent ED utilization, healthcare providers are better able to focus resources to those most in need.

Previous research has utilized a patient's primary diagnosis at visit as an avenue to assess a hospital visit's appropriateness or urgency (Cabey, MacNeill, White, James Norton, & Mitchell, 2014). However, information garnered from this study indicated that both parents and providers utilize hospital services after birth for primary diagnoses considered non-urgent by the NYU algorithm. Therefore, non-urgent utilization may be the wrong indicator to study or plan interventions around. Instead, providing increased resources, such as education and access for ambulatory sensitive conditions may be a

more effective intervention to decreasing infant ED utilization. The author of this paper defines an ambulatory care sensitive condition as a condition that the NYU algorithm defines as having a 50% or greater chance of being a non-emergent diagnosis. By providing increased parental education and access to primary care providers for these conditions, decreased ED utilization could be actualized. Education about infant care and health concerns is most effective when it begins at the birth admission (Lippincott, 2017; National Institutes of Health, 2017). This statement is further supported by this study finding many racial groups and those from rural areas seeking care for their infant during the newborn period.

In addition, mothers from this study reported seeking the father-of-the-baby's advice when there was a heath concern. In recognizing that fathers are a significant resource in the decision-making for infant healthcare utilization, fathers need to be included in early infant programs and educational endeavors. Unfortunately, most early infant programs only include the mother even though the name may include "family" (California Department of Public Health, 2018; Community First Health Centers, 2018; Health Resources and Services Administration, n.d.; Nurse-Family Partnership, 2014). One early infant evidence-based program inclusive of parents or caregivers that could be implemented on a broader scale is "Parents as Teachers". This program, supports families from the prenatal period to kindergarten with a home based curriculum that promotes child development and health (Parents as Teachers National Center, 2018).

For health educational endeavors, Lippincott Solutions provides three tips for effective patient education: Utilize technology to provide customized printed material, assess the parents' preferred format for learning and literacy level, and provide the background as to why the information is important (2017). A study by Cawthon et al., 2014, found a strategy to improving the health literacy assessment of patients while hospitalized was to include it as part of the admission process in the electronic health record. If parents prefer other modes of teaching such as audio-visual or the internet, educators need to assess whether parents have the necessary tools to utilize these methods (Agency for Healthcare Research and Quality [AHRQ], 2015). AHRQ also adds that if the material is important, hospital personnel need to review the material with the parents and not just hand them the educational material to review on their own. Lastly, because patients forget up to 80% of what has been taught to them, having the information available in a format preferred by the parents (i.e. print, e-mail, text, patient portal) to review at a later time would provide further support (Heath, 2017).

High internet utilization by "Dr. Google" and blogs for healthcare advice is prominent, especially by mothers and mothers-to-be, in this era (AlGhamdi & Moussa, 2012; Fox & Duggan, 2013; Platin & Daneback, 2009). Some reasons reported for this increased use are 24/7 availability of information, minimal cost and effort, and social support (Fox & Duggan, 2013; Platin & Daneback, 2009). There are a vast number of websites a mother could visit when in search of information. Previous research has reported that mothers access sites with varying degrees of accuracy due to difficulty assessing credibility (Corritoire, Wiedenbeck, Kracher, & Marble, 2012; Kitchens, Harle, & Li, 2012; Sbaffi & Rowley, 2017). Results from this study were no different with mothers reporting use of the internet as one of their first line resources and choice of websites accessed for background information were made by personal choice. Because

accessing health information online has an immense influence on healthcare decisions made, it is of the utmost importance for health providers to increase efforts to share information during in-person encounters about high quality, accurate, web sites (Kitchen et al., 2014; Zhang 2013). In addition, due to varying degrees of utilizer literacy, the websites recommended by healthcare providers need to also be easily comprehensible by the population of interest (U.S. Department of Health and Human Services, 2010). Some resources available to healthcare providers to help with the assessment of websites are National Network of Libraries of Medicine, Nursing Education Expert, Joint Commission, the U.S. Department of Health and Human Services' Office of Disease Prevention and Health Promotion and the Centers for Disease Control and Prevention.

A need for increased access to primary care and other alternate care sites has also been reported in the literature as a method to decrease ED utilization (Hudec, MacDougall, & Rankin, 2010; Morgan, Chang, Alqatari, & Pines, 2013; Wang, Villar, Mulligan, & Hansen, 2005). Increased primary care access for infants also decreases an infant's exposure to other illnesses and increases continuity of care, which is essential for the provision of on-time vaccinations and developmental guidance during the first year of life. This study also found issues of access to be a cause for ED utilization. Whites and infants with private insurance were found to have adequate access to primary care providers during the week, but not on weekends. In contrast, infants from minority groups and with Medicaid insurance had decreased access to primary providers during the week, but better access on the weekends. Therefore, more access to primary care providers for those providing care to populations with private insurance is needed on the weekends and increased availability of acute care appointments during the week are needed for minority and Medicaid populations. With ED release utilization occurring during the neonatal period for many infants vulnerable to the social determinants of health, increased access to primary care or community clinics during this stage needs to take priority for these populations. However, to actualize change in behavior or use when improved access points are created, increased education regarding system changes need to be shared to improve the parents' health system literacy. A beneficial place to share this type of information would be during the newborn discharge since both parents could be present and it would be close in time to the typical age at first visit.

Implications for Future Research

Andersen's Model of Healthcare Utilization provided a beginning foundation for the exploration and interpretation of predictors of infant ED utilization. However, results from this study found predisposing, enabling and need were not equivalent predictors of use. In addition, in the qualitative study, need factors were found to initiate use, while predisposing and enabling factors mitigated the type of use, especially for non-urgent care. In addition, from the qualitative study, advice from others was found to be an important factor in mothers' decision-making about healthcare utilization for their ill infant. However, advice from others is a missing component of both Andersen's Model of Healthcare Utilization and other previous research. Therefore, including a question about advice in future research and finding methods to incorporate it into theories of utilization would be important when studying this population.

Even though the qualitative analysis was large enough to reach saturation, it would be beneficial to conduct further research with other populations. It would especially be important to include minorities, particularly Hispanics and Blacks and those with Medicaid since in the quantitative analysis they were a majority of the ED infant visit population. In addition, recognizing that fathers play an important role in the decision making of infant health care utilization, it would be important to research their decision making process and the factors that influence it.

Lastly, since previous research has mainly been conducted in large urban institutions, analyzing predictors according to the type of hospital would allow researchers to examine if predictors are different for such factors as: general versus specialized, multiunit versus individual centers, teaching versus non-teaching, medium versus small or large. In addition, examining the number of providers to the population numbers in the hospital's service area and the ED utilization rates may assist hospitals in understanding how medically underserved areas impact ED utilization.

Strengths and Limitations

The findings reported in the qualitative study were limited because only mothers who contacted the researcher, were interviewed. It could be that the mothers who contacted the researcher had an issue they wanted to share and do not support the view or decision making of the mothers who did not. Also with only mothers being interviewed, the decision-making process of the fathers was not obtained. However, the findings obtained resulted from spending time with the data, being true to the data, and reaching data saturation.

For the quantitative studies, one limitation was the limited nature of variables as defined in the OSHPD data, as opposed to the inclusion of other known variables that have predictive value. The retrospective aspect of this study limited the ability to gather new data during the collection process. Lastly, patients, clinicians, and other hospital personnel provide the data within OSHPD, which could result in errors or missing information. Nonetheless, with the large number of observations available from throughout California there was enough information to analyze and in turn have results generalizable to California.

In summary, this study provided insight into infant hospital use after birth for their entire first year of life and included both maternal and infant variables. The qualitative study revealed that the decision-making process for mothers who took their infant to the ED and those who did not were similar. However, there were unique tipping points during the process that influenced the decision made. This study also explored the predictors of infants with an ED visit and compared them to those who were directly admitted. By comparing patients who used the ED to those who see their providers prior to visiting the hospital, the author was able to assess which populations need targeted interventions and make recommendations to decrease ED utilization.

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