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A Critical Review of Infant Mortality in Kalamazoo County

December 2014 Honors Thesis

Audrey Jensen

The following is a review of the state of infant and fetal health in Kalamazoo County in the 21st century. Since infant health is a marker for the effectiveness of health care, this review will analyze the leading causes of infant mortality in Kalamazoo County. Statistical indicators show that Kalamazoo County falls below both state and national IMR averages. The leading causes of infant mortality in Kalamazoo are considered preventable infant deaths. Therefore, this review will make recommendations for the reduction of IMR through the improvement of preventative prenatal healthcare practices.

From the time of conception through infancy, a child's well-being depends entirely on extrinsic factors. Infants have virtually no control over their own fate and their health is contingent on the care they receive from mother, family members, nurses, healthcare providers, nannies, etc. As a result, a human being is more vulnerable in the first year of life than in any other time in development. Because infants are the most dependent and the least able to control their own circumstances, we as a society have responsibility to protect against the risks associated with that vulnerability.

One way to identify those risks is through the use of a measure such as infant mortality rate (IMR), which assesses for every 1000 births the number of infant deaths that occur before the infant reaches one year of age. It is an indicator of the way society treats its most vulnerable population, and therefore a window for comparing the efficacy of healthcare systems in various populations. For this reason, the IMR is widely regarded as an indicator of the overall health of an entire nation.

If infant mortality rate is used to measure the health of the citizens of the United States, the statistics are worrisome. In 2011, there were 6.05 infant deaths for every 1000 children born in the United States, that is 24,000 infants who died before reaching their first birthday (Hoyert & Xu, 2012). And according to the Organization for Economic Co-operation and Development (OECD), an organization which includes 34 of today's most advanced and leading nations, the United States falls at the bottom of the list at number 31 (OECD, 2014). The United States takes pride in its independence, boasting its strides in personal freedoms and tolerance for cultural diversity. Since the birth of the country, immigrants have journeyed from far and wide to America in hopes of building better lives for themselves and their kin, which, over time, has earned it the title of America: The Melting Pot. Yet, with all of its grandiose claims of being a

nation which defends the unalienable rights of life, liberty, and the pursuit of happiness, the United States fails, comparatively, in its ability to protect the lives of its most vulnerable citizens- infants.

Unfortunately, the infants in Kalamazoo County, Michigan do not fare any better than the infants of the rest of the nation. In fact, infants in Kalamazoo County are more likely to die before their first birthday than the average American infant. According to the most recent report from the Kalamazoo County Health and Community Services Department, between 2001 and 2005, infant mortality rates spiked to a shocking 9.0 infant deaths per 1000 births (Kalamazoo County Health and Community Services Department, 2007). During that time, IMR in Kalamazoo County surpassed the national average which was only 6.86 deaths (Mathews & MacDorman, 2008). In a study that reported the infant mortality rates of 67 out of the total 83 Michigan counties from 2001 through 2005, Kalamazoo County was ranked the 16th worst county in the state (Kalamazoo County Health and Community Services Department, 2007). More recent reports from the Michigan Department of Community Health suggest that infant mortality rates in Kalamazoo County are improving; though according to the IMR three year moving average between 2010 and 2012, rates still exceeded the national average at 6.4 deaths per 1000 Kalamazoo County births (Michigan Department of Community Health, 2014).

Causes of Infant Mortality:

In order to begin to address infant mortality in Kalamazoo, it is important to first identify the various causes of infant mortality and to understand that these causes contribute to the stark rate differences present among various races and socioeconomic classes. In a study published in 2013, the Centers for Disease Control and Prevention (CDC) identified the five leading causes of infant death in 2010 (Matthews & MacDorman, 2013). Together, the top five contributors to

infant mortality account for 57 percent of all infant death (Mathews & MacDorman, 2013). The leading cause of infant death is congenital malformations at 21 percent, followed closely by low birth weight, sudden infant death syndrome (SIDS), maternal complications during gestation, and unintentional injuries in that order. (Mathews & MacDorman, 2013).

Congenital malformation is an umbrella category that encompasses any deformities or abnormalities which are genetically inherited and present at birth. Common congenital conditions that can lead to infant death include congenital heart disease, chromosomal disease, and neural tube defects, to name a few (Kurinczuk, Gray, Brocklehurst, Oakley, Boyd, & Hollowell, 2010). To eliminate the underlying causes of genetic abnormalities would require extensive advancements in the research and development of gene therapy beyond the scope of its current understanding. In fact, there is a school of thought among neonatal professionals that separates the congenital anomalies from the other leading causes of infant mortality. According to the Oxford University Infant Mortality Epidemiology Unit, the current prevention and treatments for congenital anomalies do not show significant changes in the infant mortality rate (Kurinczuk, Gray, Brocklehurst, Oakley, Boyd, & Hollowell, 2010). This is not to say that preventable epigenetic factors do not contribute to congenital birth defects; but rather there is no guarantee that any known medical intervention or method of prevention will reduce the occurrence of congenital birth defect. If the goal is to reduce infant mortality rates in Kalamazoo and across the nation, the approach must shift to focus on causes which can be either prevented or, at the very least, greatly diminished. The four leading causes of infant mortality that follow congenital malformation explicitly invite methods of prevention.

Low birth weight and a shortened gestation period constitute the second leading cause of infant mortality at 17 percent of total infant deaths (Mathews & MacDorman, 2013). Low birth

weight and shortened gestation are often lumped together because seven out of ten low birth weight infants are born premature, or at less than 37 gestational weeks (March of Dimes, 2014). Aside from prematurity, fetal growth restrictions can cause low birth weights in full term deliveries simply due to the small size of a parent, not gaining enough weight during pregnancy, or a birth defect (March of Dimes, 2014). According to a 2010 CDC report, the chance of infant death is 24 times greater in low birth weight infants, defined as infants weighing less than 2500 grams, or approximately 5 pounds 8 ounces (Mattews & MacDorman, 2013). In newborns classified as very low birth weight, or less than 1500 grams or 3 pounds 5 ounces, the odds of infant death increase even more dramatically to greater than 100 times than that of infants born within the normal weight range (Mattews & MacDorman, 2013).

In Kalamazoo, the birth weight trends are not promising. In the years between 1989 and 2005, the percentage of low birth weight infants in Kalamazoo steadily increased from 6 percent to 9.3 percent and now exceeds the state average; whereas in 1989, Kalamazoo fell far below the Michigan average for low birth weight (Kalamazoo County Health and Community Services, 2005). In black mothers, low birth weight rates were even more severe, increasing from 11.5 percent to 16 percent in the same 17-year period (Kalamazoo County Health and Community Services, 2005). Even though infant mortality rates due to low birth weight and prematurity rank as the second leading cause of deaths in the United States, in Kalamazoo, low birth weight and shortened gestation are number one, representing 57.9 percent of total infant deaths (Kalamazoo County Health and Community Services, 2005).

Low birth weight can also increase an infant's risk of the next most common cause of infant death, sudden infant death syndrome (SIDS) (Mayo Clinic Staff, 2014). The Mayo Clinic defines SIDS as the unexpected death of an infant, often during sleep, who is under 1 year of age

and believed to be otherwise healthy (Mayo Clinic Staff, 2014). Though the exact cause of SIDS is unknown, there are likely a number of contributing factors including anatomical and environmental factors. As mentioned above, low birth weight can put a child at risk of SIDS, but brain abnormalities that control respiration and respiratory infections have also been associated with SIDS (Mayo Clinic Staff, 2014). SIDS has also been called by another name, crib death, because it has been highly correlated with an infant's position during sleep (Mayo Clinic Staff, 2014). Babies who sleep on their side or stomach, in their parents' bed, or on soft surfaces are more prone to SIDS because it increases their risk of airway impediment (Mayo Clinic Staff, 2014). In Kalamazoo County, SIDS accounts for 5.7 percent of total infant deaths (Kalamazoo County Health and Community Services, 2005). Although, SIDS only represents the fourth leading cause of infant deaths in Kalamazoo, the percentage is still too high for a cause that can be reduced with proper education of parents and infant care.

Maternal complications during gestation and unintentional injury round off the leading causes of infant death as number four and five. Common gestational complications include hypertension, gestational diabetes, infections during pregnancy, problems with the placenta and not gaining enough weight during pregnancy, each of which are linked to low birth rate and by extension increased rate of infant mortality (Reproductive Health: Pregnancy Complications, 2014). Hypertension during pregnancy can cause a gestational condition known as preeclampsia and problems which can lead to both low gestational weight and premature delivery (Reproductive Health: Pregnancy Complications, 2014).

Gestational diabetes mellitus occurs when the body cannot process carbohydrates during pregnancy (Reproductive Health: Pregnancy Complications, 2014). Although the condition

typically disappears after pregnancy, it places the baby at higher risk for early and complicated deliveries resulting in infant deaths (Reproductive Health: Pregnancy Complications, 2014).

Infections during pregnancy place the fetus at risk of higher infant mortality because infection can cross the placenta and cause irreversible damage to the developing fetus with an underdeveloped immune system resulting in premature delivery (March of Dimes, 2014). The placenta delivers oxygen and nutrients from the mother to the developing fetus via the umbilical cord (March of Dimes, 2014). If blood flow is restricted from the placenta to the umbilical cord during pregnancy, the fetus will not be able to obtain all of the necessary nourishment to ensure normal development resulting in low birth weight infants (March of Dimes, 2014). The same concept applies in mothers who do not gain enough weight during pregnancy. If this occurs, the baby will not receive enough nourishment to reach full size before delivery.

Accidental injury represents the fifth and final leading cause of infant death and refers to any accident resulting in a fatal injury to an infant (Mattews & MacDorman, 2013).

Prevention:

As a society, we are not able to directly control the health and well-being of the completely dependent infants, but we are able to influence infant health by ensuring the health of their mother during pregnancy. It is a community's responsibility to ensure that mothers have access to healthcare and other related tools that allow them to provide for their developing infants. Certain maternal characteristics produce especially high rates of infant death in Kalamazoo County. In Kalamazoo County, IMR are the highest in women who gained less than 16 pounds during pregnancy, women with inadequate prenatal care, women who smoked during pregnancy, and black women (Kalamazoo County Health and Community Services Department, 2007). If we consider that infant deaths due to congenital birth defects cannot be prevented, then

low birth weight and premature delivery take the top spot for focus on infant mortality prevention. To ensure that efforts to combat infant mortality yield the greatest return, the focus must be on programs that provide the greatest impact. In Kalamazoo County, where this is the leading cause of infant death, the best course of action is to concentrate on programs that prevent low birth weight and prematurity in the target groups of mothers mentioned above.

In Kalamazoo, IMR is the highest among women who did not gain enough weight during pregnancy (Kalamazoo County Health and Community Services Department, 2007). The IMR is thirty in every 1000 births in those instances where mothers gained less than 16 pounds. Only 6 infants die in women who gained more than 16 pounds (Kalamazoo County Health and Community Services Department, 2007). In Kalamazoo, weight gain during pregnancy is the most influential maternal characteristic of IMR (Kalamazoo County Health and Community Services Department, 2007). The best way to improve proper gestational weight gain is to ensure that pregnant women understand and have access to proper nutrition.

The Kalamazoo County Health and Community Services Department and Family Health Center both offer Women, Infants and Children services (WIC), a federal government program that provides food assistance to pregnant women (Kalamazoo County Health and Community Services). WIC services include nutrition education, counseling, and food vouchers. All pregnant women are eligible for WIC services. Additionally, the State of Michigan offers a program known as Project Fresh which offers food vouchers to WIC members for use at Michigan farmer's markets (Michigan Department of Community Health). In Kalamazoo County, Project Fresh food vouchers are eligible for use at three local farmer's markets (Kalamazoo County Health and Community Services). Despite all of the government food assistance available, IMR improvements has been be seen.

The problem is not in the WIC program itself because studies support that WIC services are associated with longer duration of gestation, increased birth weight, and lowered fetal mortality, (Rush, Alvir, Horvitz, Johnson, & Kenny, 1988). Therefore the problem in Kalamazoo County must rest in the delivery of WIC services to pregnant women. One example shows that Kalamazoo County needs to improve the delivery of its food assistance programs: in order to receive Project Fresh food vouchers in Kalamazoo County, WIC members must attend the Project Fresh and Community Resources Fair. The fair was held on a Wednesday between 9 am and 4 pm at the Kalamazoo Health and Community Services Campus and according to the website that is the only day the vouchers were distributed (Kalamazoo County Health and Community Services). Since the fair was held during normal business hours in the middle of the workweek, working WIC members would be unable to attend the event to pick up the vouchers. Since there are only two WIC clinics in Kalamazoo County, it may be difficult for some pregnant mothers to register for food assistance programs, especially if they live on the outskirts of the community. Incorporating WIC clinics into every OB/GYN clinic in Kalamazoo County for the sake of convenience seems impractical. Instead, it may be easier and more effective to locate popup WIC enrollment clinics inside the major grocery stores in the community. In this way, a pregnant woman can receive her food voucher during one of her weekly trips to the local grocery store and staff can help her shop for eligible food items. This solution is both convenient for mothers and a practical way to reduce the number of premature and low birth weight infants in Kalamazoo County.

The next characteristic closely associated with infant mortality in Kalamazoo County is in mothers who receive inadequate prenatal care. The measurement of the level of prenatal care was based on Kessner Index of Prenatal Care which accounts for the month during pregnancy in

which prenatal care began and the number of prenatal visits (Kalamazoo County Health and Community Services Department, 2007). It is likely that mothers who did not receive adequate prenatal care did not receive proper care because they were uninsured. In 2011, the United States placed dead last in an OECD study that measured the percent of population with health insurance with only 84.9 percent of the population covered (OECD, 2013). Of the group, the United States is only one of two countries that did not offer universal healthcare for its citizens (OECD, 2013). Based on gross domestic product, the United States spends the most on healthcare than any other country in the group; and yet its infant mortality rates are among the worst (OECD, 2014). Therefore the problem does not rest in a lack of health care, but rather in a lack of access to health care.

Between 2008 and 2010, 10.6 percent of the Kalamazoo County population was uninsured (Kalamazoo County Health and Community Services, 2013). Not surprisingly, the percent of uninsured population increased with decreasing employment status, income level, and education level in a similar manner to the trends associated with infant mortality (Kalamazoo County Health and Community Services, 2013). Moreover, in 2009 it is estimated that 13 percent of Kalamazoo County did not have access to health care due to cost and that 18.5 percent of the population deferred medical attention in order to save money (Kalamazoo County Health and Community Services, 2013). If mothers or women of child-bearing age are unable to afford essential medical treatment and preventative care, they not only jeopardize their own maternal health but the health outcomes of future children.

Recently, the United States has made improvements in healthcare policy that increase access to healthcare. The Affordable Care Act of 2010 included programs that lower the cost of prescription drugs, incentivize physician job openings in underserved locations, and allow states

to expand Medicaid coverage (U.S. Department of Health and Human Services, 2014). Specifically for women, the Affordable Care Act increased the coverage of preventative health services including certain services related to prenatal care free of charge (U.S. Centers for Medicare and Medicaid Services, 2014). These new expansions in free prenatal services may increase the number of women in Kalamazoo who receive adequate prenatal care because women who deferred or declined prenatal care due to cost before the ACA will be able to seek care without worrying about expensive medical bills.

Race is a leading maternal characteristic in Kalamazoo County associated with higher infant mortality rates. Between 2001 and 2005, black infants were almost three times more likely to die before reaching their first birthday than white infants (Kalamazoo County Health and Community Services Department, 2007). IMR in white infants was the lowest of the reported races with only 7 infant deaths for every 1000 births, followed closely by 9.5 infant deaths in Hispanics, and an astonishing 19 infant deaths for every 1000 black infant births (Kalamazoo County Health and Community Services Department, 2007). Improving access to health insurance to bolster the level of prenatal care will also effectively reduce the inequalities in IMR due to racial differences. In Kalamazoo County, white residents are more likely to have health insurance and were less likely to forgo medical treatment due to cost (Kalamazoo County Health and Community Services, 2013).

Both inadequate prenatal care and the disparities in infant mortality related to race are a product of deficient access to healthcare. Kalamazoo County needs to continue to strengthen and develop programs in Medicaid enrollment. Increasing the number of insured Kalamazoo County residents will likely reduce the number of residents who defer medical care. It may also be beneficial to begin a registry in Kalamazoo County to identify women of childbearing age who

need healthcare coverage. Increasing the enrollment of women who are of childbearing age will likely increase the number of women who seek prenatal care earlier in their pregnancy, effectively improving the level of prenatal care by Kessner Index of Prenatal Care standards.

According to the CDC, mothers who smoke are more likely to give birth to premature and underweight infants and therefore smoking during pregnancy correlates with higher instances of infant death (Division of Reproductive Health, 2014). Still, ten percent of American women report smoking during the last three months of their pregnancy (Division of Reproductive Health, 2014). In Kalamazoo County, infant mortality rates more than double in mothers who smoke during pregnancy (Kalamazoo County Health and Community Services Department, 2007). There are 16.6 infant deaths for every 1000 births in Kalamazoo County mothers who smoked during pregnancy compared to only 7.2 infant deaths in nonsmokers (Kalamazoo County Health and Community Services Department, 2007). Therefore reducing the number of women in Kalamazoo County who smoke during pregnancy is a high yield intervention.

The challenge is that smoking is a difficult habit to kick and likely even more difficult during the stressful time when preparing for baby during pregnancy. However, the Kaiser Permanente Medical Group of Northern California started a program in their obstetric clinics that has shown significant success at reducing the number of negative perinatal outcomes in mothers with a history of substance abuse (Goler, Armstrong, Taillac, & Osejo, 2008). The program places licensed clinical therapists in each obstetric clinic who provide substance abuse counseling sessions linked with regular obstetric follow-up appointments (Goler, Armstrong, Taillac, & Osejo, 2008). Women are eligible for the program based on their response to a substance-abuse questionnaire, self-referral, a clinical referral from their obstetrician, or a

positive drug screen (Goler, Armstrong, Taillac, & Osejo, 2008). The number of premature and low birth weight birth infants in the group of women who screened positive by questionnaire or drug screen and received substance abuse counseling were cut in half compared to the women who screened positive and did not receive counseling (Goler, Armstrong, Taillac, & Osejo, 2008). Providing in-house substance abuse counseling alongside prenatal appointments makes seeking and receiving substance abuse help very convenient for mothers while simultaneously increasing their accountability for cessation. Adopting a similar model as a standard practice in Kalamazoo obstetrics clinics would go a long way to reduce the number of infant mortalities in women who smoke tobacco during pregnancy.

Conclusions:

In the past century, infant mortality has improved in the United States due to advances in medical care and treatment. The United States offers some of the best medical treatments in the entire world, but still treatment remains unavailable to a large percentage of the population due to cost. As a result, the medical advancements in maternal and fetal medicine are limited in their ability to effectively reduce preventable infant deaths. Infant mortality in Kalamazoo County faces the same challenges as the rest of the nation, but with greater inequalities in healthcare coverage the resulting infant mortality rates are more pronounced. The best way for Kalamazoo County to reduce the infant mortality rate is to help mothers utilize the services known to prevent low birth weight and premature deliveries that already exist within the county. When mothers have the ability to take advantage of the prenatal services and resources babies will ultimately reap the benefits.

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