

The Unintended Consequences of Biomedical Advances

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ABSTRACT

Socially advantaged people are better able to avoid newly identified health risks when biomedical information emerges, and they are positioned to make decisions that lead to longer and healthier lives. Over time this results in the formation of a socioeconomic gradient in health—the unintended consequences of biomedical advances. To gain a better understanding of this process, I consider the role of education, health knowledge and social relationships in decisions about health. I focus on a specific empirical example: prenatal health behaviors among women who are pregnant for the first time (prima gravida women). Over the course of sixteen months, 225 prima gravida women from four clinics participated in in-person survey interviews during their first or second trimesters, and 41 participated in in-depth interviews at the beginning of their third trimesters. The results provide evidence that health knowledge and social network processes mediate the association between education and decisions about health behaviors, but education remains a predictor of health behaviors. This example not only advances our knowledge about the processes that contribute to inequalities in health, it also provides insight into decisions about behaviors that lead to unequal health among women and infants.

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CHAPTER 1: INTRODUCTION

Origins of Social Inequalities in Health and Fundamental Causality

From the outset of modern medicine and sociology, scholars have recognized the enduring association between social conditions and the onset of disease and illness. Now recognized as the father of modern pathology, Rudolph Virchow (1848) asserted that “medicine is a social science” when modern biomedicine was in its infancy. With the rise of biomedical research, advances in biomedical technology, standardization of medical training, improvements in hospital sanitation and treatment, and the resulting rise in medical authority, the focus moved away from the social origins of disease and illness and toward individual tertiary treatment in the hospital or clinic (Starr 1982; Bloom 2002). Simultaneously, the rise of modern public health, as well as advances in bacteriology and sanitation, stole the spotlight from the bevy of social conditions that placed people at risk of becoming ill (Institute of Medicine 2002). Instead, empowered by scientists such as Robert Koch, the study of infectious diseases could be “pursued unswervingly without being sidetracked by social considerations and reflections on social policy” (Rosen 1974: 70).

Indeed, in the United States, these advances resulted in a healthier population that benefited from dramatically decreased infant and child mortality rates and increased lifespan (McKinlay and Marceau 2000). Such improvements in quality and length of life prompted Charles Kadushin to conclude that “as countries advance in their standard of living, as public sanitation improves, as mass immunization proceeds...the gross factors which intervene between social class and exposure to disease will become more and more equal for all social classes” (1964:75). Yet, in spite of the monumental progress in biomedicine and public health, the second half of the twentieth century witnessed

persistent, and even widening inequalities, in morbidity and mortality (Kitagawa and Hauser 1973; Elo and Preston 1996; Rogers, Hummer and Nam 2000; Lauderdale 2001; Marmot 2004; Warren and Hernandez 2007; Hummer and Lariscy 2011).

To understand the social origins of health inequalities, scholars in public health, medicine and the social sciences again began to turn their attention to the social conditions that place people at risk of becoming ill or dying. The emergence of social epidemiology, sociology in medicine, and social demography, as well as the formation of interdisciplinary centers (Berkman and Kawachi 2000:ix; Hirschman and Tolnay 2006), provided the perfect breeding ground for explanations such as the fundamental cause theory (Link and Phelan 1995)—also referred to as fundamental causality (Lutfey and Freese 2005)—and an earlier analytic framework put forth by Mosley and Chen (1984).

Fundamental causality is not a novel idea—at its most basic level, it builds upon sociological theories of class conflict and inequality. It elevates the importance of social relationships (Marx and Engels 1848), social position (Weber [1920] 1978) and power (Dahrendorf 1959). Even more, the idea harkens back to Durkheim's (1897) early proposition that social conditions have important implications for individuals' health and well-being. Individuals with better social relationships, higher social status, and more power are consistently able to avoid health hazards, and therefore, as a whole, they live longer and healthier lives.

At its core, fundamental causality argues that social conditions will perpetually drive inequalities in health—regardless of changes in diseases or risks over time—because they are associated with a range of factors that put people at risk of becoming ill. With advances in biomedical knowledge and technology, people with more money,

knowledge, power and prestige will consistently make decisions to avoid health risks, which, over time, lead them to live longer and healthier lives (Link and Phelan 1995; Link, Northridge, Phelan, and Ganz 1998; Phelan, Link and Tehranifar 2010). Fundamental causality unravels the persistent association between socioeconomic factors and health by focusing on the catalysts that promote new inequalities in health: as health knowledge emerges and biomedical technology advances, “those who command the most resources are best able to avoid the risks and take advantage of the protective factors, [which results] in the emergence of an SES gradient in these factors” (Link et al. 1998:377). Thus, biomedical advances, or advances in knowledge about health risks, may have the unintended consequence of contributing to the formation of social inequalities in health.

How Do Social Inequalities in Health Begin?

The search for the origins of social inequalities in health, the root of these persistent inequalities, and the process through which they begin has inspired this research. My overarching goal for this dissertation is to contribute to our understanding of the origins of social inequalities in health. *How are social inequalities in health produced? What factors contribute to, or prevent, their formation?*

To achieve this aim, I use a specific case study: women who are pregnant for the first time, or *prima gravida* women. The fundamental cause theory, and previous evidence (Kenkel 1991; Link et al. 1998; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009), elevates the importance of new health information. This particular example provides an opportunity to observe how women react to the plethora of new health information that they receive when they become pregnant for the first time.

Although I focus on the way these women react to emerging biomedical information about prenatal health, pregnancy represents a *new health event* for these women so I also use this example as an opportunity to observe how women react to health information that is new to them.

The formation of health inequalities is a complex *process*. In order to begin to understand this process I designed a multi-method study to observe factors associated with the way women decide to behave throughout their pregnancies. Over the course of sixteen months I conducted survey interviews with 225 women and in-depth semi-structured interviews with a subset of 41 women at four clinics in the Minneapolis and St. Paul metropolitan area. The survey interviews took place after an early prenatal appointment during women's first trimester, and the in-depth interviews took place at the beginning of their third trimester. To gain a more complete understanding of this case study, I also conducted 15 in-depth semi-structured interviews with the nurses, midwives and obstetricians who provided prenatal care for these women. This study design afforded me the opportunity to observe behaviors at two points in time, and during the latter time point women provided rich details about their health decisions. It also allowed me to understand the information that obstetricians, midwives and nurses provided to women, and, in turn, the information women reported to receive.

Three Approaches to Understand How Health Inequalities Begin

In the three chapters that follow, I pose three research questions with the overarching goal of understanding how social inequalities form. Through these three questions I aim to understand this process from different vantage points. Aside from the role of new health information, I posit that social relationships play an integral role as a source of

information and social influence. With this in mind, each chapter attends to the way that women's relationships with members of their network (i.e., partners, family, friends, co-workers and health care providers) affect their prenatal health behaviors.

Chapter 2: How Are Social Inequalities in Health Produced?

To start, I begin by building upon the aforementioned observations about the unintended consequences of biomedical advances and ask how social inequalities in health are produced. An emerging interdisciplinary literature has used these observations to pinpoint the origin of certain health inequalities. One of the most commonly cited examples of the unintended consequences of health advances is the formation of an education gradient in smoking following the U.S. Surgeon General's warning about the health hazards associated with smoking. For my analysis, I focus on three new prenatal behaviors—health care providers have only recently begun recommending each of them in the past three years—vitamin D supplement intake, omega-3 fatty acid supplement intake, and H1N1 influenza vaccination. Using these health behaviors as an example, the purpose of this analysis is to build a conceptual model that explains how socioeconomic status, health knowledge, and social networks interact to affect health behaviors in such a way that produces social inequalities in health. The results from this analysis provide evidence that health knowledge and social network processes mediate the association between education and decisions about health behaviors. Still, education remains a significant independent predictor of health behaviors.

Chapter 3: Does Socioeconomic Status Affect the Way People Make Decisions When They Receive Conflicting Health Information?

Next, I consider the way that women's socioeconomic status affects their health decisions

in the face of unclear health information. When faced with a new health event people often navigate a maze of information, but we know far less about the way they behave when health information about a behavior is unclear. For this analysis, I depart from the typical approach, which attends to socioeconomic differences in health behaviors following *new* health information, and instead concentrate on two behaviors that are not new—prenatal consumption of caffeine and alcohol. Although the information is not new, again, the pregnancy represents a new health event, and thus provides an opportunity to observe the decisions each newly pregnant woman makes about caffeine and alcohol. As with the first chapter, for this chapter I pay particular attention to the role of social relationships.

Among study participants, results from the survey and in-depth interviews provide evidence that, compared to women with a lower socioeconomic status, women with a higher socioeconomic status were more cautious about their caffeine intake throughout their pregnancy. Surprisingly, this same pattern did not emerge for alcohol intake, as women with a higher socioeconomic status reported consuming *more* alcohol later in their pregnancy. Upon closer investigation, women revealed that members of their network socially influenced them to restrict, limit or imbibe differently depending on their socioeconomic status.

Chapter 4: What Role do Health Care Providers Play in the Formation of Health Inequalities?

For the final question, I ask what role health care providers play in promoting or preventing the formation of social inequalities in health. I return to the observation that advances in biomedicine precede the formation of many health inequalities, and focus again on vitamin D and omega-3 fatty acid consumption. Although both were recently

added to the list of recommended prenatal supplements, health care providers more aggressively recommended vitamin D for all women. Conversely, their recommendations for omega-3 fatty acid supplements differed depending on socioeconomic status, with more highly educated women receiving more recommendations compared to those with less education. Health care providers reported that cost was a primary concern for their differential recommendations. Additionally, women with a higher socioeconomic status were more inclined to seek out additional information about the latter supplement outside of their prenatal appointment. I argue that these two processes contributed to the formation of a socioeconomic gradient in omega-3 fatty acid supplement intake, but the aggressive recommendations for vitamin D prevented the formation of any socioeconomic gradients in intake.

Advancing our Understanding of the Ways that Social Inequalities in Health Begin

Even though we have recognized the presence of social inequalities in health for centuries, our understanding of the ways that they are produced is in its infancy. Bolstered by research conducted in a variety of disciplines, we now recognize that advances in biomedical research or changes in social norms may have the unintended consequence of contributing to the formation of such inequalities. In trying to understand this process, I posit that social relationships play an important role in influencing the way people decide to behave. Through three separate sets of analysis I provide evidence that new health information and social relationships are important factors that influence women's decisions about their prenatal behaviors. Even over the relatively short period between women's first and second trimesters, social inequalities in health behaviors

emerged. These findings provide insight into the way that health inequalities are produced, and the need to account for social influences that affect decisions about health.

CHAPTER 2: THE UNINTENDED CONSEQUENCES OF BIOMEDICAL ADVANCES: SOCIOECONOMIC GRADIENTS IN HEALTH BEHAVIORS AMONG PREGNANT WOMEN

INTRODUCTION

Examining inequalities is a classic sociological aim and, recently, scholars in medical sociology, public health, demography, and health economics have turned their attention to the processes that reproduce inequalities in health (Link and Phelan 1995; Lutfey and Freese 2005; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009). These scholars contend that broader social and economic inequalities contribute to unequal rates of disease and mortality: people with more money, power, prestige, and knowledge live longer and healthier lives (Link and Phelan 1995). These inequalities persist, in part, because people in more socially advantageous positions are better able to avoid newly identified health risks when medical research advances (Link, Northridge, Phelan, and Ganz 1998). At the crux of this idea is the notion that over time, as health knowledge emerges and people learn *new* health information, those in more favorable social positions will continuously adopt advantageous health behaviors (Link et al. 1998; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009). Over time this results in socioeconomic gradients in health—the *unintended consequences of biomedical advances*. Although this explains why social inequalities in health are reproduced, much less is known about the process by which these inequalities are generated.

One possibility is that social relationships play an integral role, providing individuals with new health information and influencing their decision-making about various health behaviors. This conjecture builds upon a bedrock of sociological and public health research, which emphasizes the importance of social ties for both health (Durkheim [1897] 1979; Syme and Berkman 1976; House, Landis and Umberson 1988)

and medical decision-making (Pescosolido 1992), as well as more recent research, which indicates that individuals' social contacts influence their health behaviors (Marsden and Friedkin 1994; Meara 2001; Kohler, Behrman and Watkins 2001; Behrman, Kohler and Watkins 2002; Christakis and Fowler 2007; 2008).

The idea that social relationships influence health behaviors, and the reproduction of health inequalities, is hardly new. The contribution of my research is that I combine this literature with an emerging approach in medical sociology and demography (Chang and Lauderdale 2009; Glied and Lleras-Muney 2008) that focuses on the importance of new health information in reproducing health inequalities, and I delineate specific mechanisms by which social ties influence health behaviors. To evaluate this explanation, I focus on women who are pregnant for the first time—an ideal empirical example because (1) they must navigate a plethora of new health information, newly acquired pregnancy information and emerging biomedical pregnancy information; and (2) their behaviors have a direct and measureable effect on birth outcomes and infant health. Understanding this example will not only advance our knowledge about the processes that contribute to inequalities in health, it will provide insight into decisions about health behaviors that lead to unequal health among women and infants.

The purpose of this chapter is to build a conceptual model that explains how education, health knowledge, and social networks interact to affect health behaviors in such a way that produces social inequalities in health. Although I do not seek to test this model in a definitive way, I do take steps to explore its main implications using a specific empirical example. Using data gathered through surveys and in-depth, semi-structured interviews I examine the influence of socioeconomic status and social network processes

on health behaviors. In the sections that follow I (1) describe the emerging literature that focuses on the evolution of health inequalities; (2) delineate the role that social relationships may play in reproducing health inequalities; (3) explain my empirical example; and (4) interpret my results within the context of my conceptual model.

BACKGROUND

The Fundamental Cause Theory: Why Are Social Inequalities in Health Reproduced?

For over a century, scholars in public health, medicine, sociology, and elsewhere have observed social inequalities in health (Villerme 1840; Virchow 1848; Chapin 1924; Coombs 1941; Antonovsky 1967; Kitagawa and Hauser 1973; Robert and House 2003). Recent research suggests that these inequalities have remained remarkably persistent over the past century, at least in the United States (Warren and Hernandez 2007). Research that uses a variety of socioeconomic measures—including education, income, and social class—demonstrates an inverse relationship between socioeconomic status and health (Pamuk 1985; Duleep 1989; Preston and Elo 1995; Duncan 1996; Crimmins and Saito 2001; Lauderdale 2001; Lynch 2003). The persistent inverse relationship has reinvigorated debates about why there is a socioeconomic gradient in health (Mosley and Chen 1984; Brunner 1997; House et al. 1990; House et al. 1994; Link and Phelan 1995; Phelan et al. 2004), and an emerging literature is beginning to focus on the process by which social inequalities in health are reproduced (Link et al. 1998; Berkman et al. 2000; Lutfey and Freese 2005; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009).

Among theories that have sought to explain persistent inequalities in health, one of the most widely cited is the fundamental cause theory, which posits that persistent health inequalities are a result of unequal access to social resources, such as money,

knowledge, power, and prestige (Link and Phelan 1995). The theory harkens back to Durkheim's (1897) early proposition that social conditions have important implications for individuals' health and well-being. Individuals with better social relationships, higher social status, and more power are consistently able to avoid health hazards, and are therefore able to live longer and healthier lives. These social conditions represent a fundamental cause of health inequalities because they correspond to access to resources that affect a broad range of health outcomes.

The fundamental cause theory requires three conditions: (1) disease preventability, (2) socioeconomic inequality, and (3) change in diseases and risks over time. Health inequality literature is replete with evidence of the association between disease preventability and SES differentials in mortality. As biomedical knowledge advanced the ability to treat and prevent chronic diseases those with a higher SES were better situated to avoid health risks and delay mortality (House et al.1990; 1994). For instance, there is a larger gradient for cancers that have a higher survival rate, compared to cancers that are not preventable (Kogevinas and Porta 1997).

Social inequality is the second necessary condition for the fundamental cause theory. Conditional upon disease preventability, social inequalities perpetuate health inequalities. Socially advantaged individuals possess the power and means to act upon medical knowledge about health hazards. This power, prestige, knowledge, and money has been referred to as human and nonhuman capital (Fuchs 1986; Grossman 1975), which "accrue[s] to members of higher SES strata [and] may repeatedly enable them to avoid health hazards more readily or to mobilize health-protective factors" (House et al.

1990:406). Thus, conditional upon disease preventability, socially advantaged individuals, will be able to avoid deleterious health effects.

For the third condition, health inequality scholars observe that people in advantageous positions will “avoid risks and adopt protective strategies that enhance health and well-being no matter what the risk and protective factors happen to be at a given point in time ” (Link and Phelan 2000:39). The favorable social conditions that accrue to those in higher social positions have a ripple effect across a broad range of health outcomes, regardless of the type of disease. Link, Phelan and their colleagues (1995; 2000; 2002; Link et al. 1998, Phelan et al. 2004) further substantiate this claim by using the change in diseases and risk factors in the U.S. over the past century as an example. In spite of the epidemiologic transition from infectious to chronic diseases in developed nations, the inverse relationship between socioeconomic status and health has remained constant—or declined only modestly—in the United States over the past century (Warren and Hernandez 2007). People with higher SES had better morbidity and mortality rates prior to the epidemiologic transition and they continue to have better rates afterward. The overwhelming evidence indicates that when these three conditions are met, health inequalities not only emerge, they are repeatedly observed (Villerme 1840; Virchow 1848; Chapin 1924; Coombs 1941; Antonovsky 1967; Kitagawa and Hauser 1973; Pamuk 1985; Duleep 1989; Preston and Elo 1995; Duncan 1996; Lauderdale 2001; Robert and House 2003; Lynch 2003).

How Are Social Inequalities in Health Reproduced?

The fundamental cause theory provides three conditions, which, upon being fulfilled, result in a persistent inverse association between socioeconomic status and health. In this

chapter, I build on an emerging literature (Link et al. 1998; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009) that attempts to understand *how* social inequalities in health are reproduced. More specifically, I suggest that social relationships play a role by providing new health information and influencing health behaviors. I explore this possibility by focusing on the role of emerging biomedical knowledge.

At the crux of the fundamental cause theory is the notion that over time, *as health knowledge emerges and biomedical technology advances*, “those who command the most resources are best able to avoid the risks and take advantage of the protective factors, [which results] in the emergence of an SES gradient in these factors” (Link et al. 1998:377). Although the theory describes the role of health knowledge in reproducing inequalities, it does not describe the process in detail.

Familiar examples lend credence to the assumption that new health knowledge influences behavior changes. In the decades after the 1964 Surgeon General’s report about the hazards of smoking, for instance, individuals with more education were more likely to quit and less likely to begin smoking (Kenkel 1991). Even after accounting for individual health knowledge, people with more education were still less likely to smoke than those with lower levels of education (Kenkel 1991), a result that is mirrored in later research on educational differences in maternal knowledge about smoking and actual behaviors during pregnancy (Meara 2001).

Lacking individual measures of health knowledge, another approach considers the emergence of social inequalities in health following exogenous shocks of health information, biomedical technology or abrupt changes in social norms. Indeed, with advances in cancer screening and treatment (Link et al. 1998; Glied and Lleras-Muney

2008), improvements in pharmaceutical drugs (Lichtenberg and Lleras-Muney 2005; Chang and Lauderdale 2009; Price and Simon 2009), technological innovation in infant care (Gortmaker and Wise 1997), and changes in the social stigma associated with cocaine use (Miech 2008), social inequalities in health behaviors and outcomes emerged. These findings indicate that individuals with higher socioeconomic status are more likely to adopt behaviors to avoid health hazards when new health information emerges.

Though promising, accounting for individual health knowledge does not explain the relationship between SES and health behaviors in its entirety (Kenkel 1991; Meara 2001). I contend that, in addition to health knowledge, social networks mediate the relationship between socioeconomic status and health behaviors, and that they confound the relationship between health knowledge and health behaviors. In recent analysis, Cutler and Lleras-Muney (2010) found that knowledge about a health behavior and overall cognitive ability account for about thirty percent of the association between education and health behaviors. Aside from these factors, they found that social integration accounts for an additional ten percent of the association. Most pertinent for this research, social relationships provide social support, pressure behavior through relationships, and influence medical decision-making (Durkheim [1897] 1979; Syme and Berkman 1976; Baronowski, Bee, Rassin, Richardson, Brown, Guenther and Nader 1983; House, Landis and Umberson 1988, Pescosolido 1992, Marsden and Friedkin 1994; Meara 2001; Behrman, Kohler and Watkins 2002; Christakis and Fowler 2007; 2008).

Hypotheses: Health Knowledge & Social Networks Influence Health Behaviors

My aim is to build a conceptual model to understand how education, health knowledge and social networks interact to affect health behaviors in such a way that produces health

inequalities. I put forth the following six hypotheses and provide an empirical example in order to explore the process by which social inequalities in health emerge. Women who are pregnant for the first time provide a distinct opportunity to observe how *new* health information—newly acquired pregnancy information and emerging biomedical pregnancy information—influences health behaviors; the majority of women begin their pregnancy with low levels of knowledge about healthy pregnancy behaviors and they are presented with a plethora of new information about their pregnancy. A portion of women, in particular, those with higher levels of SES (Korenbrot, Steinberg, Bender and Newberry 2002), seek information about preconception health prior to becoming pregnant. I include women with both planned and unplanned pregnancies in order to capture a range of health knowledge levels. In Figure 1, I present a conceptual model of the way these factors interact—based, in part, on the conceptual model put forth by Berkman et al. (2000)—which I use to delineate mechanisms that influence health behaviors.

Hypothesis 1: *Women with higher levels of education will be more likely to engage in behaviors that will promote a healthy pregnancy (Education → Behavior in Figure 1).*

Hypothesis 2: *Women with higher levels of education will be more likely to translate new health information into healthy pregnancy behaviors (Education → Knowledge → Behavior in Figure 1).*

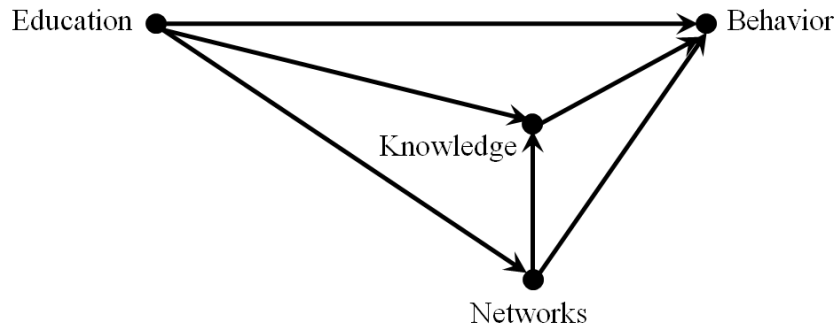
Hypothesis 3: *Women's social contacts serve as sources of new health information about pregnancy (Social Networks → Knowledge in Figure 1).*

Hypothesis 4: *Health information women receive from their social contacts affects their health behaviors during pregnancy through social learning (Social Networks → Knowledge → Behavior in Figure 1).*

Hypothesis 5: *Behaviors and opinions among members of a woman's social network will influence her health behaviors during pregnancy directly through social influence (Social Networks → Behavior in Figure 1).*

Hypothesis 6: *Social learning and social influence processes mediate the education gradient in behaviors (Education → Social Networks → Behavior in Figure 1).*

Figure 1. Conceptual Model



My first two hypotheses replicate previous work from the health inequality literature and the final four examine the role of social networks. I first hypothesize that socioeconomic status, measured as educational attainment is associated with healthy behaviors during pregnancy. I then build on previous literature (Kenkel 1991; Meara 2001; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009; Cutler and Lleras-Muney 2010) and hypothesize that health knowledge accounts for some of the association between educational attainment and health behaviors.

My third hypothesis posits that women will learn about pregnancy behaviors from their social contacts. Demographic models of diffusion—comprised of social learning and social influence—inform my conceptual model (Montgomery and Casterline 1996; Kohler, Behrman and Watkins 2001; Behrman, Kohler and Watkins 2002). Social learning occurs when an actor provides an individual with information that influences their subjective beliefs about a behavior (Montgomery and Casterline 1996; Kohler, Behrman and Watkins 2001). For instance, a woman’s highly educated sister might inform her that consuming omega-3 fatty acids will help with brain development of the fetus, which influences the woman to consume a fish oil supplement. Social influence

arises when social contacts exert normative influences on behavior (Montgomery and Casterline 1996; Kohler, Behrman and Watkins 2001).

My final three hypotheses anticipate that social network processes of social learning and social influence will affect women's behavior. In my fourth hypothesis, I anticipate that women learn health information from their social contacts, which influences their health behaviors. Even so, I expect that women may imitate behaviors, or be influenced by opinions, even though they know nothing about the benefits of the behavior. Therefore, I also posit that women's behaviors are influenced by beliefs and opinions of those in their social network. Finally, in my sixth hypothesis, I predict that these social network processes will mediate the education gradient in health behaviors.

METHODS

Research Design

My empirical example combines a quantitative component (Part A) and two qualitative components (Parts B and C), as shown in Figure 2. For Part A, I sequentially enrolled women from four health clinics in the Minneapolis/St. Paul area over the course of thirteen months (November 2009-November 2010; see Figure 3). These clinics were chosen because they serve women from a diversity of socioeconomic backgrounds in the metropolitan area. To ensure confidentiality, I refer to these clinics as the Red, Orange, Yellow and Green Clinics. Women who were over the age of 18, pregnant for the first time (prima gravida), under 27 weeks pregnant, and who speak English were included.¹

¹ Women were enrolled during their first and second trimesters to ensure that those who lacked access to prenatal health care during their first trimester were included. Women also qualified for the study if they had had an elected or spontaneous abortion (essential prima gravida).

Figure 2. Health Information and Behaviors During Pregnancy Study Design

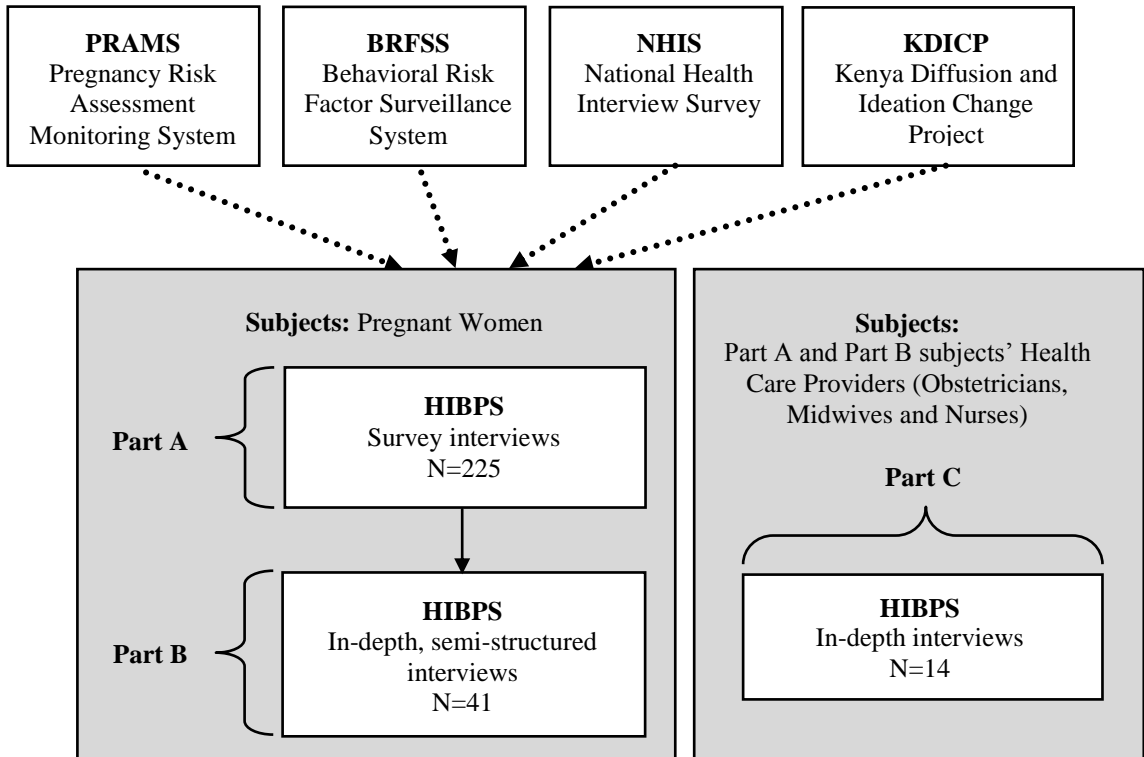
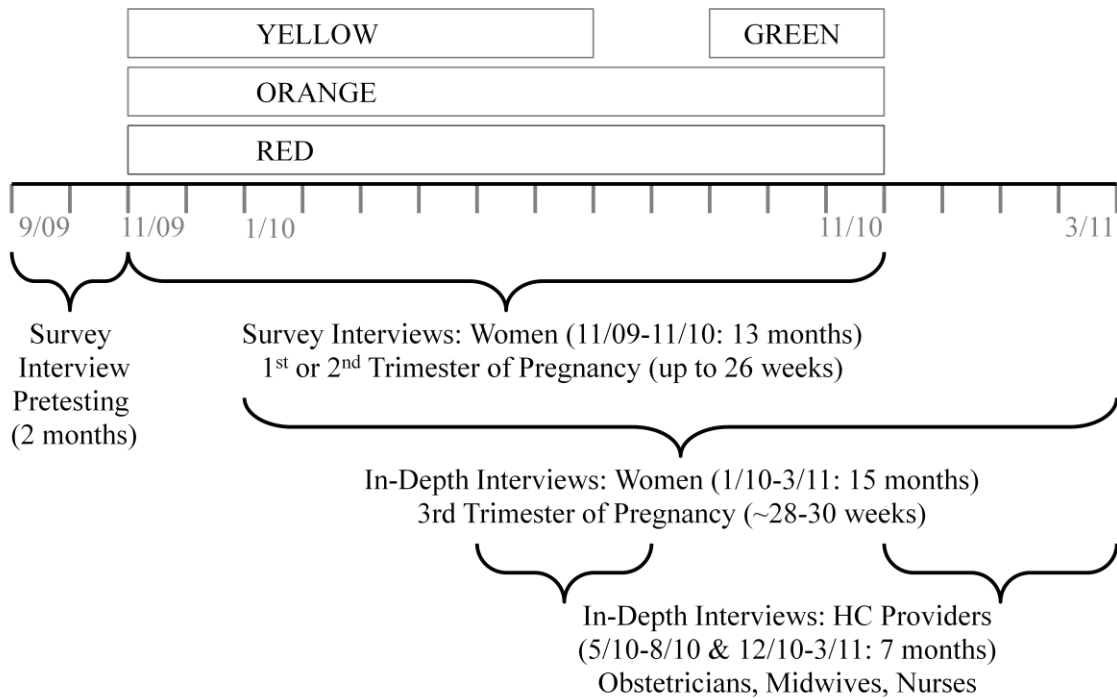


Figure 3. Timeline for Health Information and Behaviors During Pregnancy Study



Women with planned and unplanned pregnancies were also included to capture a range of health knowledge levels and health behaviors.

For Part A, women are asked to complete a 20-minute survey interview, the Health Information and Behaviors During Pregnancy Study (HIBPS) questionnaire. Three obstetricians and obstetrics residents reviewed the questionnaire prior to collecting data, and it was pre-tested on 30 women from the clinics. Each month the enrollment ranged from 10 to 32 women, yielding a final sample size of 225. The preferred mode of administration for the questionnaire was in-person, but participants were also given the option to complete it over the phone, which ensures the most reliable social network data and highest response rate.² All surveys were conducted by me or by a trained survey interviewer and respondents were given a \$5 gift card. Approximately 67.6% of eligible *prima gravida* or *essential prima gravida* women who have been seen in the four clinics agreed to participate in the 20-minute survey interview, either in the clinic following their appointment or by phone at a later time.

The HIBPS questionnaire has five main aims: (1) it assesses women's socioeconomic background; (2) it tests their health knowledge; (3) it inquires about social contacts with whom they discussed their pregnancy; (4) it asks about their social contacts' socioeconomic status, attitudes, and behaviors related to health during pregnancy; and (5) it asks about their health behaviors.³ To create the HIBPS questionnaire, I borrowed questions from the Behavioral Risk Factor Surveillance System (CDC 2009), the Pregnancy Risk Assessment Monitoring System (PRAMS; Gilbert,

² All survey interviews were recorded on paper and digital voice recorder to ensure accuracy. Among women who agree to participate 85% complete the survey in-person and 15% complete the survey by phone at a later time.

³ The HIBPS questionnaire is available upon request.

Shulman, Fischer and Rogers 1999), the National Health Interview Survey (National Center for Health Statistics 2009), and the Kenya Diffusion and Ideational Change Project female questionnaire (KDICP; Kohler, Behrman, and Watkins 2001). By using questions from nationally representative studies, which inquire about pregnancy status, I am able to situate my survey results within a state and national context.

For Part B, I stratified the monthly samples by education-level and randomly selected a subset of two women from each strata—six women total—each month to participate in in-depth semi-structured interviews during the beginning of their third trimester (between weeks 28 and 30). In all, I conducted in-depth interviews with 41 women.⁴ Women who participated in these interviews were given a \$20 gift card. The final component, Part C, is comprised of in-depth interviews with health care providers—including the physicians, midwives, and nurses—who provide care at the four clinics. These interviews allow me to portray a more complete illustration of the ways that these health care providers offer health information or influence women's behaviors during pregnancy.

Measures

HIBPS Survey Interviews

Socioeconomic Status. The health inequality literature represents a diverse spectrum of disciplines, with a variety of approaches to measuring socioeconomic status or position (Robert 1999; Braveman, Cubbin, Marchi, Egerter and Chavez 2001; Lynch and Kaplan 2000; Galobardes, Lynch and Davey Smith 2007). My research focuses on education as an indicator of socioeconomic status for theoretical and methodological reasons. A goal

⁴ This sample includes in-depth interviews with a subset of women (n=4) who participated in a group prenatal class but did not participate in the in-depth interviews.

of my research is to understand how people react to new health information. Aside from the additional human capital bestowed upon those with more years of schooling, education helps people develop cognitive skills, it “develops the habits and skills of communication: reading, writing, inquiring, discussing, looking things up, and figuring things out...” and through the process of learning it “builds the confidence and self-assurance needed to attempt to solve problems” (Mirowsky and Ross 2003: 26-7). Therefore, an individual’s years of schooling are likely to enhance their ability to decipher, understand and react to novel health information to better their health (Rosenzweig 1995; Cutler and Lleras-Muney 2010). From a methodological standpoint, educational attainment is an ideal measure of socioeconomic status for a number of reasons (Elo and Preston 1996; Hummer and Lariscy 2011): 1) in most instances, schooling ends in the beginning of adulthood and does not change; 2) it is a stable measure of socioeconomic status regardless of employment status; and, 3) it precedes, and often directly impacts, other measures of socioeconomic status such as income and occupation, thus reducing the impacts of endogeneity.

For these reasons, I focus on education as my measure of socioeconomic status. My measure of education level is based on a question from the 2009 National Health Interview Survey (NHIS), and is very similar to the 2009 Behavioral Risk Factor Surveillance System (BRFSS) question. I also inquire about the education-level of their significant other (if they are in a relationship) as well as all of the social contacts that women list in their social network using a simplified version of the original NHIS question.⁵ In addition to individual education-level, I include a couple-level measure of

⁵ Nearly all women, 223 out of 225, named at least one person in their pregnancy network—one did not complete the survey and the other did not list any people after three attempts to elicit any social contacts.

education, which represents the highest educational degree between the woman and her partner (Moen and Hernandez 2009). Among the list of social contacts women name, I also ask them, “[i]f the people you mentioned disagree about the health behaviors we just discussed, whose advice or behavior do you trust the most?” Using this question I incorporate a measure of educational attainment for the most socially influential person in their pregnancy network. For my analysis, I coded education as three dummy measures: less than a bachelor’s degree (i.e., less than a high school degree, General Educational Development test, high school degree, associate’s degree or some college), Bachelor’s degree, and graduate degree (master’s degree, professional degree or doctoral degree).

Health Knowledge and Health Behaviors. Based on recommendations from the American College of Obstetricians and Gynecologists (ACOG), the U.S. Preventive Services Task Force (USPSTF) as well as obstetricians at the clinics, the HIBPS questionnaire includes measures of a variety of behaviors, in this chapter I focus on three behaviors: H1N1 influenza vaccinations, vitamin D supplement consumption and omega-3 fatty acid consumption.⁶ Importantly, as preventability is a key component of the fundamental cause theory—SES gradients in health outcomes emerge when diseases are preventable—each of these represent behaviors where women have some agency in deciding how to behave.

Among the entire sample, only 16 women reported that they were not in a relationship at the time of the survey interview.

⁶ The questionnaire includes the following behaviors: (1) preconception preparations (i.e., pre-pregnancy health care appointment); (2) substance use (i.e., alcohol and smoking); (3) diet (i.e., fruit and vegetable consumption); (4) exercise (i.e., light and moderate); (5) immunizations (i.e., seasonal influenza and the H1N1 vaccine), and (6) supplementary vitamin intake (i.e., folic acid, vitamin D and omega-3 fatty acid). These behaviors are associated with a lower risk of infections during pregnancy, low birth weight, miscarriages, fetal alcohol syndrome, neural tube defects, gestational diabetes and macrosomia (very large infants) (Zhang, Solomon, Manson and Hu 2006; Hollander, Paarlberg and Huisjes 2007; Wolff, Witcop, Miller, and Syed 2009).

The Centers for Disease Control and Prevention, the American Medical Association and American Congress of Obstetricians and Gynecologists all uniformly recommended that pregnant women receive both the seasonal and the H1N1 influenza vaccine during the 2009-2010 and the 2010-2011 flu seasons (ACOG 2010). Recommendations to consume vitamin D and omega-3 fatty acids have been slower to emerge. Aside from aiding bone development, recent evidence and emerging literature indicates that vitamin D reduces the odds of pre-term birth, preeclampsia and gestational diabetes, and omega-3 fatty acids help with brain development of the fetus (Ruxton, Reed, Simpson, and Millington 2004; Hollis and Wagner 2006; van der Meer, Nasra, Boeke, Lips, Middlekoop, Verhoeven and Wuister 2006; Hollick 2007). I coded each of these three behaviors as a dichotomous measure, which represents the behavior (supplement consumption or H1N1 vaccination; coded 1) or lack of the behavior (coded 0).

To inquire about vaccinations I used a question from the 2009 NHIS which asks: “During the past 12 months, have you had a flu shot?” I included a second question about the H1N1 influenza vaccine: “Have you had the H1N1 or “swine” flu shot? This shot protects against the H1N1 or “swine” flu.”⁷ I adapted a question about prenatal vitamin consumption from PRAMS to measure vitamin D consumption: “During the past month, have you taken a vitamin D supplement? Do not count your prenatal vitamin.” Similarly, I adapt this question to measure omega-3 fatty acid consumption: “During the past month, have you taken any fish oil or flaxseed supplements?” To measure health knowledge of the benefits of omega-3 fatty acid, I adapt a survey question from PRAMS, which was originally intended to assess women’s knowledge about the benefits of folic

⁷ The NHIS 2010 questionnaire included a question about the H1N1 vaccine, but the exact question wording did not become publically available until after I began collecting survey interviews (December 2010).

acid: “Some health experts recommend consuming omega-3 fatty acids during pregnancy for which of the following reasons?” Response options include the following: to help with brain development (correct); to help prevent a premature delivery; and, to help women sleep well. Women were asked whether each response option was correct and I used their responses to create an index ranging from 0 (low) to 3 (high). To measure vitamin D knowledge I include a similar question with an open-ended response option because of the wider range of health benefits of vitamin D consumption during pregnancy. If women provided an answer that correctly identified one benefit of vitamin D supplements based on a recent review of the literature (Hollick 2007) (i.e., bone development or calcium absorption (n=44), immunity (n=2), cancer prevention (n=2), or a deficiency due to lack of sunshine (n=20), I coded their knowledge level as 1 out of 0.

My final four hypotheses posit that women’s social contacts play an important role, and I use a modified social network name generator (Marsden 1990; Knoke and Yang 2008). Women are first asked to list everyone they talk to about their pregnancy, whether they are female, if they have had a baby in the past ten years or are currently pregnant—to identify pregnant peers—and how long they have known the person. For every social contact listed, they are asked how they are affiliated (e.g., friend or family member), the distance of the tie (stranger, acquaintance, friend, close friend), the frequency of contact (a little, some, a lot) and their education level.

Women are then asked whether they discussed H1N1 influenza vaccination with each of the social contacts that they listed.⁸ For each of these behaviors I ask whether they discussed the topic (i.e., social learning) and whether the social contact agrees or

⁸ Women were also asked about three additional behaviors: prenatal vitamin consumption, caffeine consumption and alcohol consumption.

disagrees with the behavior (i.e., social influence). I then ask whether *each* of their friends and family received the H1N1 or the seasonal flu vaccine (i.e., social influence). The social learning and social influence questions are adapted from the female questionnaire administered as part of the Kenya Diffusion and Ideational Change Project (KDICP) (Kohler, Behrman and Watkins 2001). The KDICP is a project that aims to examine the role of social networks in changing various attitudes related to family planning in Kenya.

Using the social network data, I constructed a measure to reflect the percent of people with whom women discuss the H1N1 vaccine as well as the percent of people in their social network who had received the H1N1 vaccine. Finally, I used the question, “[d]oes ____ agree or disagree with receiving the H1N1 vaccine during pregnancy?” to construct a measure of the percent of social contacts who women perceive as having a favorable opinion about H1N1 vaccination during pregnancy.

There are two important caveats. Often women reported that they did not know about their social contact’s opinions or behaviors, and I excluded this missing data to avoid biasing my sample estimates downward. Aside from the limitations of information derived from one individual about their entire network, similar women may have a higher propinquity due to any number of social, cultural, or educational factors (Haas 2010). Using a social network name generator requires that women *select* a specific pregnancy social network—people with whom they discuss their pregnancy. The HIBPS data are not designed to isolate the selection processes that may influence health behaviors. Rather, the results presented here represent the effect of social network processes on health behaviors net of pregnancy network selection processes.

HIBPS In-Depth Semi-Structured Interviews

During the in-depth interviews, I reviewed women's responses during survey interview to record any changes in knowledge or behavior and asked them to elaborate on their answers in more detail. For example, why did they choose to receive the seasonal influenza vaccine but *not* the H1N1 influenza vaccine, both of which are recommended for pregnant women? I paid particular attention to the social network questions, adding any new social contacts and asking about their behaviors, beliefs and attitudes. Each in-depth interview was transcribed a short time after being conducted and themes that emerge have been content-coded using Atlas.ti version 6.

Analysis

Using data from the survey interviews and in-depth interviews, I explore the main implications of my conceptual model by focusing on the six hypotheses described above. I begin by estimating the likelihood of each health behavior using logistic regression. First, I estimate the effect of schooling on supplement consumption, and then account for individual knowledge about the benefits of supplement consumption. To account for educational differences in supplement consumption, I include measures of the woman's highest educational degree, the highest educational degree between the couple, as well as the highest educational degree attained by the most socially influential person in her network.⁹ Next, I estimate the effect of schooling on H1N1 vaccination, using the same measures of education-level. Finally, I incorporate measures of social learning and social influence to understand how these affect the association between education and H1N1

⁹ During the in-depth interviews, women reported that they consulted their partners prior to consuming a supplement. Sixteen women reported that they did not have a partner and these participants are excluded from this analysis in order to compare the results across models.

vaccination. To understand these processes in more detail, I stratified my sample of in-depth semi-structured interviews by education level (less than a bachelor's degree, bachelor's degree, graduate degree) and analyzed women's medical decision-making processes about supplement intake and H1N1 vaccination.

RESULTS

Three novel health topics comprise the outcomes of interest for this chapter: omega-3 fatty acid consumption, vitamin D consumption and H1N1 vaccination. During the survey data collection period (November 2009-November 2010; see Figure 3) these health behaviors were somewhat novel to the staff at the Red, Orange, Yellow and Green Clinics. Moreover, the spread of information about these behaviors, as well as the health care providers' recommendations for pregnant women, differed.

Women often learn about omega-3 fatty acids supplements, available in the form of fish oil or plant-based supplements, during their initial intake visit at the clinic, outside of their prenatal visit, from pregnancy web sites, books and magazines. It is not a main topic discussed during their initial prenatal visit, but women are encouraged to consume omega-3 fatty acids because they benefit the brain development of their fetus as well as their own cardiovascular and neurological health.

Recommending vitamin D supplement consumption is a new practice, primarily within the two clinics with the most study participants (Orange and Red): One of the Orange Clinic midwives learned about the benefits of vitamin D from a physician and friend in early 2009, and in the early winter of 2009 the clinic began testing all pregnant women's vitamin D levels during their initial visit. The practice soon diffused throughout the Red Clinic as well because many of the providers rotate through both clinics. Both

clinics now aim to raise women's vitamin D levels above the standard levels (minimum 25-35 ng/ML), and have created a target range of 50-80 ng/ML. The nurses, midwives and obstetricians provide a consistent message about the importance of vitamin D consumption, and women are informed that living at higher latitudes (e.g., Minnesota) affords less opportunity for vitamin D absorption from the sun.

In contrast to supplement knowledge levels, all women who participated in the study were aware of the H1N1 influenza pandemic prior to their prenatal visit, which excluded the possibility of incorporating a question about their H1N1 knowledge. The H1N1 virus emerged in Mexico in the spring of 2010 and garnered significant media attention over the course of the year (MMWR 2009). Clinicians identified pregnant women to be particularly vulnerable to the H1N1 virus (MMWR 2010), and placed them on the priority list to receive the vaccine. When it became available in November 2009, the clinics reached out, by phone or mail, to their pregnant patients first. Pregnant women were strongly encouraged to receive the H1N1 influenza vaccine, and were assured that its safety level is equivalent to the annual influenza vaccine.

Descriptive Statistics

In Tables 1 and 2 I provide descriptive statistics for variables used in the analysis. Approximately 32% of women consume an omega-3 fatty acid supplement, and approximately 41% consume a vitamin D supplement. H1N1 vaccination rates were higher, with 53% of women opting to be vaccinated. These differences are not surprising, given the strong recommendations for pregnant women and media coverage of the H1N1 influenza pandemic. About 42% of women chose all of the correct answers on the omega-3 fatty acid knowledge test, and the mean knowledge test score was 1.9 out of 3.

Table 1. Health Knowledge, Social Network and Health Behavior Measures

	n	Valid %	Mean	Standard Error
Omega-3 Fatty Acid (O3FA)				
<i>O3FA Knowledge Test Score</i>				
	0	31	13.78	
	1	47	20.89	
	2	52	23.11	
	3	95	42.22	
	Total	225	1.938	0.073
<i>O3FA Supplement Consumption</i>				
	no	152	67.86	
	yes	72	32.14	
	Total	224	0.318	0.031
Vitamin D				
<i>Vitamin D Knowledge Test Score</i>				
	0	64	50.00	
	1	64	50.00	
	Total	128	0.500	0.044
<i>Vitamin D Supplement Consumption</i>				
	no	133	59.11	
	yes	92	40.89	
	Total	225	0.409	0.033
H1N1 Vaccination				
<i>H1N1 Vaccination</i>				
	no	105	47.09	
	yes	118	52.91	
	Total	223	0.529	0.034
Social Network				
	<i>Percent of Network Vaccinated Against H1N1</i>	205	29.137	2.539
	<i>Percent of Network With Whom Women Discussed H1N1</i>	223	33.839	2.272
	<i>Percent of Network Who Agree with H1N1 Vaccination During Pregnancy</i>	189	81.796	2.546

Table 2. Education and Demographic Measures

	n	Valid %	Mean	Standard Error
Socioeconomic Status				
<i>HIBPS Participant Educational Degree</i>				
High School Degree or less	20		8.97	
Some College or Associate's Degree	28		12.56	
Bachelor's Degree	86		38.57	
Master's Degree	54		24.22	
Professional Degree (MD, JD)	13		5.83	
Doctoral Degree (PhD)	22		9.87	
Total	223			
<i>Highest Educational Degree Between Couple</i>				
High School Degree or less	14		6.31	
Some College or Associate's Degree	20		9.01	
Bachelor's Degree	68		30.63	
Master's Degree	64		28.83	
Professional Degree (MD, JD)	16		7.21	
Doctoral Degree (PhD)	40		18.02	
Total	222			
<i>Highest Educational Degree of Most Socially Influential Network Member</i>				
High School Degree or less	34		15.45	
Bachelor's Degree	73		33.18	
Graduate Degree (Masters, Professional, Doctoral)	113		51.36	
Total	220			
Demographic				
<i>Age</i>				
18-24	36		16.00	
25-29	68		30.22	
30-34	84		37.33	
35-39	25		11.11	
40+	12		5.33	
Total	225		29.969	0.354
<i>Marital Status</i>				
married	171		76.68	
partnered or member of an unmarried couple	31		13.9	
engaged	5		2.24	
divorced	2		0.90	
separated	1		0.45	
never married (single)	13		5.83	
Total	223			

Among a smaller sample of women, 50% correctly identified a health benefit of consuming vitamin D.¹⁰

With regard to the social network measures, women reported discussing H1N1 vaccination with approximately 34% of their social contacts. If women knew their social contacts' vaccination status, they estimated that approximately 29% had been vaccinated to prevent H1N1 infection. If they knew their social contacts' opinions, on average women reported that 82% agreed with H1N1 vaccination during pregnancy.

HIBPS participants are more highly educated than the average prima gravida or essential prima gravida woman: Among participating HIBPS women, 40% completed a master's, professional or doctoral degree, and only 22% did not complete college. Using a pooled sample of women from the 2005-2009 National Health Interview Surveys, I isolated a subset of women over the age of 18 who reported being pregnant and had no other children in their household, as a proxy for prima gravida or essential prima gravida pregnancy status (n=1,202). On average, 68% of NHIS participants had not completed college, and only 14% had completed a graduate or professional degree. The age distribution was more similar between the HIBPS and NHIS samples, though, with means of 29.98 and 28.50 years, respectively.

If women reported that they were in a relationship, approximately 40% were partnered with a person who had the same amount of schooling, approximately 32% with a person who had less schooling than them, and approximately 29% with a person who had more schooling than them. In some cases, neither the woman nor her partner had

¹⁰ The vitamin D knowledge question was added to the survey at the start of month five, in March 2010, because it is such a novel health topic (n=127).

completed college (15%), but about 31% of women were in relationships in which at least one member had completed college. In the majority of cases (54%), women or their partners had completed a graduate degree. Aside from their partner, the majority of women selected a person with a graduate degree as the most socially influential person in their network (51%).

Supplement Intake

Are women who have completed more schooling more likely to consume a supplement (hypothesis 1)? In Tables 3 and 4, I show the results of the logistic regression analysis. With regard to omega-3 fatty acid supplement consumption, women with more schooling were not significantly more likely to consume a supplement. However, during the in-depth interviews women often reported that they made their decision to consume the supplement after consulting with their partner. Moreover, supplement intake is a repeated behavior, and women mentioned that their partners often reminded them to consume the supplement. In the Model 2 of Table 3, I show the association between the highest educational degree between the couple and supplement intake: If a woman or her partner completed a graduate degree the woman was more than five and a half times as likely to consume an omega-3 fatty acid supplement, compared to those without a college degree. Aside from their partners, women also mentioned that they spoke with people in their pregnancy network prior to consuming the supplement. If the most socially influential person in a woman's network completed a graduate degree she was more than two and a half times as likely to consume the supplement.

Does individual knowledge about the benefits of the supplement account for the association between education and supplement intake (hypothesis 2)? Women's

Table 3. Logistic Regression Estimates of Omega-3 Fatty Acid Supplement Consumption on Education Level

	Model 1		Model 2		Model 3		Model 4		Model 5		
	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.	
<i>Education Level</i>											
Highest Educational Degree of HIBPS Participant											
Less than a Bachelor's Degree	<i>Reference group</i>										
Bachelor's Degree	1.376	(0.608)	--	--	--	--	--	--	--	--	
Graduate Degree (Master's, Professional or Doctoral)	1.935	(0.850)	--	--	--	--	--	--	--	--	
Highest Educational Degree Between Couple											
Less than a Bachelor's Degree	<i>Reference group</i>				<i>Reference group</i>						
Bachelor's Degree	3.415 * (2.304)				2.767 (1.906)						
Graduate Degree (Master's, Professional or Doctoral)	5.552 *** (3.598)				4.331 ** (2.885)						
Highest Educational Degree of Most Socially Influential Contact											
Less than a Bachelor's Degree					<i>Reference group</i>			<i>Reference group</i>			
Bachelor's Degree					4.114 ** (2.267)			3.354 ** (1.889)			
Graduate Degree (Master's, Professional or Doctoral)					2.675 * (1.434)			2.080 (1.153)			
<i>Health Knowledge</i>											
Omega-3 Fatty Acid Knowledge Level (0 = low; 3 = high)							1.285	(0.203)	1.352 *	(0.214)	
Constant	-0.956 **	(0.372)	-1.946 ***	(0.617)	-1.569 ***	(0.492)	-2.250 ***	(0.655)	-1.986 ***	(0.552)	
Chi-Square	2.560		10.020 ***		7.770 **		12.590 ***		11.550 ***		
Log-Likelihood	-122.759		-119.028		-120.152		-117.741		-118.265		
<i>n</i>	189		189		189		209		189		

*** = $p < 0.01$ ** = $p < 0.05$ * = $p < 0.10$

knowledge about the benefits of fish oil or flaxseed supplements was only marginally associated with supplement consumption, and only when considering the education-level of the most socially influential person in her network. Accounting for women's knowledge attenuated the association between the couple's education-level and supplement intake, but women were still more than four times as likely to consume the supplement if she or her partner had completed a graduate degree. Likewise, women were more than three times as likely to take the supplement if they chose someone with a college degree as the most socially influential person in their network compared to those who chose someone without a college degree, even after accounting for individual knowledge about the supplement.

I estimate identical models to understand the association between education, women's knowledge levels, and women's vitamin D consumption (see Table 4). One caveat, due to the fact that vitamin D consumption was so new to the clinics, I added the vitamin D knowledge question to the HIBPS questionnaire during at the beginning of month five, which resulted in a smaller overall sample for this analysis. Unlike the previous results, no measure of education-level was associated with her consumption of a vitamin D supplement, nor was it was associated with the highest educational degree between the couple. Individual knowledge about the benefits of the vitamin D supplement was not associated with vitamin D supplement intake either.

To further explore these relationships, I stratified my in-depth interviews by education level and selected quotes to represent women with varying levels of education.¹¹ In the first example, I show an excerpt from an in-depth interview with Danielle, who has completed 12th grade. She scored 0 out of 3 on the knowledge test, and

¹¹ All names have been changed to protect the identity of each participant.

Table 4. Logistic Regression Estimates of Vitamin D Supplement Consumption on Education Level

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.
<i>Education Level</i>										
Highest Educational Degree of HIBPS Participant										
Less than a Bachelor's Degree	<i>Reference group</i>									
Bachelor's Degree	0.966	(0.552)	--		--		--		--	
Graduate Degree (Master's, Professional or Doctoral)	1.345	(0.554)	--		--		--		--	
Highest Educational Degree Between Couple										
Less than a Bachelor's Degree			<i>Reference group</i>				<i>Reference group</i>			
Bachelor's Degree			2.250	(0.687)	--		2.268	(0.693)	--	
Graduate Degree (Master's, Professional or Doctoral)			2.700	(0.659)	--		2.677	(0.664)	--	
Highest Educational Degree of Most Socially Influential Contact										
Less than a Bachelor's Degree					<i>Reference group</i>				<i>Reference group</i>	
Bachelor's Degree					0.538	(0.629)	--		0.547	(0.634)
Graduate Degree (Master's, Professional or Doctoral)					1.632	(0.609)	--		1.628	(0.614)
<i>Health Knowledge</i>										
Vitamin D Knowledge (0 = no knowledge; 1 = knowledgeable)							1.709	(0.401)	1.663	(0.408)
Constant	-0.105	(0.459)	-0.811	(0.601)	0.000	(1.000)	-1.072	(0.639)	-0.254	(0.576)
Chi-Square	0.640		2.430		6.560 **		4.240		8.130 **	
Log-Likelihood	-71.765		-70.873		-68.805		-69.969		-68.023	
<i>n</i>	104		104		104		104		104	

*** = $p < 0.01$ ** = $p < 0.05$ * = $p < 0.10$

she chose not to take the omega-3 fatty acid supplement because she was fearful that it would harm her baby.

EH: So, what do you know about [omega-3 fatty acid supplements]?

Danielle: Um...I just know that it helps the baby out. And it helps me. I have them at home; I don't really take them. I'm going to...I'm scared it's going to hurt the baby but like I know that...they told me that I should start taking them...but I just worry! (laughs) **I worry that the baby's going to get harmed or something by something that's in a pill.** Even though it's probably made for that exact reason, so...to take while you're pregnant.

For the second example, I selected an excerpt from an interview with Julie, a college graduate who reported taking omega-3 fatty acids and scored 1 out of 3 on the knowledge test. She clearly takes the supplement because they aid fetal development, and she educates her husband about the health benefit as well.

EH: And then how about omega-3 fatty acids? Fish oil, flax seed...

Julie: Yeah, I take the Expecta. I can actually look at it, it says DHA on it.

EH: Did you talk about [taking Expecta] with your husband again, or any of your other friends?

Julie: **I told him that they recommended that I take it and he said, "Why," and I said because it helps with brain and eye development and he said, "Okay." And off to Target we went!** (laughs)

As evidenced by this quote, Julie understands the health benefits and it leads her to purchase and consume the supplement. This example also demonstrates that couples discuss prenatal behaviors together—Julie discussed the omega-3 fatty acid supplement with her husband prior to purchasing it.

Do women learn health information from their social contacts (social learning; hypothesis 4)? Even more, are they influenced by the information they learn from their social contacts (social influence; hypothesis 5)? Using the in-depth interview data, I was able to delve into the social processes of social learning and/or social influence that affect women's decisions to consume a supplement. For instance, Isabel, who has a Ph.D. in biology, mentions her mother when discussing the health benefits of consuming omega-3 fatty acids:

EH: Right, right. So what about omega-3 fatty acids? Have you ever heard of those? Can you tell me what you know about them?

Isabel: They're supposed to be good fat. Lower, does it lower your cholesterol? And like for baby, baby-wise it will help with the brain development and stuff like that. **My mom always said, "Eat more fish! It'll make you smart!"** And then I've been taking that for a while. Just for the baby's sake.

The information that Isabel learned from her mother when she was growing up influenced her behaviors later. In an example of social influence, Vanessa mentions that her decision to consume an omega-3 fatty acid supplement was influenced by the intake nurse during her initial prenatal visit:

EH: How about the omega-3, the DHA, why are you taking that supplement?

Vanessa: Just for brain development of the children...I think [the intake nurse] even said something like, **"Yeah, all the doctors here who have babies have been taking it."** Kind of like, "Yeah, we really think that's a good idea."

In this example, the nurse specifically created a pregnancy peer group of physicians to influence Vanessa's behavior through social influence.

H1N1 Vaccination

If women have completed more schooling are they more likely to be vaccinated against H1N1 (hypothesis 1)? In Table 5, I show the results of the logistic regression analysis of education, social network processes and H1N1 vaccination.¹² As with the omega-3 fatty acid supplement intake, women's education-level was positively associated with H1N1 vaccination: If they completed college, they were over two times as likely to receive the vaccine as those with less than a college degree, and if they completed a graduate degree they were over three times as likely have been vaccinated. Unlike the models for supplement consumption, I did not account for the education-level of other members in their network for two reasons: the vaccination was a singular event, versus a repeated behavior, and during the in-depth interviews women often reported that they did not consult with other members of their network prior to being vaccinated.

¹² Again, I did not test women's knowledge about the benefits of H1N1 vaccination because virtually all women knew that it prevents infection with the H1N1 influenza.

Table 5. Logistic Regression Estimates of Social Network Processes and H1N1 Vaccination on Education Level

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.
<i>Education Level</i>										
Highest Educational Degree of HIBPS Participant										
Less than a Bachelor's Degree	<i>Reference group</i>		<i>Reference group</i>		<i>Reference group</i>		<i>Reference group</i>		<i>Reference group</i>	
Bachelor's Degree	2.367 **	(0.436)	2.169 *	(0.449)	2.371 *	(0.444)	1.711	(0.476)	1.615	(0.487)
Graduate Degree (Master's, Professional or Doctoral)	3.150 ***	(0.445)	2.861 **	(0.457)	3.621 ***	(0.459)	3.135 **	(0.496)	3.419 **	(0.512)
<i>Health Knowledge</i>										
Social Network Measures: Percent of Network...										
...Who Received H1N1			1.143 ***	(0.050)					1.089	(0.053)
...With Whom Women Discussed H1N1					1.109 **	(0.052)			1.107 *	(0.058)
...Who Agree with H1N1 Vaccination During Pregnancy							1.325 ***	(0.060)	1.305 ***	(0.063)
Constant	-0.431	(0.356)	-0.726 *	(0.383)	-0.895 **	(0.434)	-2.574 ***	(0.629)	-3.122 ***	(0.724)
Chi-Square	7.020 **		14.750 ***		11.150 **		37.150 ***		42.540 ***	
Log-Likelihood	-106.879		-103.016		-104.817		-91.816		-89.118	
<i>n</i>	163		163		163		163		163	

*** = $p < 0.01$ ** = $p < 0.05$ * = $p < 0.10$

Note: The social network measures reflect a 10% change in the proportion of the network who engaged in each behavior.

Do women act upon the health information that they learn from their social networks (hypothesis 4)? Are they influenced by the behaviors of those in their social network (hypothesis 5)? In models 3-6 (Table 5), I include the measures of social network processes (social learning and social influence). Each of the social network measures was significantly associated with H1N1 vaccination, when considered in individually or in conjunction with the education measures.¹³ The percent of social contacts who agree with H1N1 vaccination during pregnancy, a measure of social influence, emerged as the strongest predictor of women's H1N1 vaccination (see Model 5). The social network measures reflect a 10% change in the proportion of the network who engaged in each behavior. Specifically, for every 10% increase in the number of network members that agree with H1N1 vaccination during pregnancy, women are about 30% more likely to be vaccinated. Once again, it is important to note that if women did not know their social contacts' opinions or behaviors their social contact was not included in the overall mean value. Nevertheless, given my hypotheses about the role of social relationships on health behaviors, women's *perceptions* of their friends, family, or provider's opinions are of primary importance.

During the in-depth interviews, it became apparent that the social learning and social influence processes often occurred in concert, as shown in conversations with Carrie, Megan and Vanessa:

EH: Right. I want to hear a little bit more about your [H1N1 decision-making] process. What happened?

Carrie: I guess just education a little bit more...Hearing [health care providers'] personal and professional opinions. What they've done for their families as someone who is very clear of medicine in that field. So I think that was the main thing. There was definitely some influence by my mother. She researches everything to death and also is one of a science background and I trust her opinion and was given lots of material via her, too, to kind of look over and stuff. **So just research and study I guess. Education is what brought me to that decision.**

¹³ The additional models are not included in Table 5, but are available upon request.

Carrie asked her health care providers for more information and she received information from her mother. Specifically, she asked about her health care providers' own behaviors, and she mentioned the importance of her mother's opinion. Megan and Vanessa emphasize the importance of other peoples' behaviors:

Megan: Well, **[the doctor] had encouraged me in the appointment** before but then I wanted to think about it and then the next appointment my husband came with me and I ended up getting it.

EH: So what happened between [the two prenatal visits]?

Megan: ...**I had talked to other friends who had friends who were pregnant and they all got it so I just kind of felt a little bit better.**

EH: So when you said that you felt a little safer, what specifically made you feel safer about it?

Megan: **I just read more articles about how pregnant women had been getting the flu shot for a long time and the H1N1 is basically the same thing as that.**

Megan's decision to receive the H1N1 vaccine was swayed by more information about the vaccine safety and more information about the ways that other pregnant women behaved.

In an attempt to understand how social learning and social influence affect the association between educational attainment and vaccination (hypothesis 6), I estimated Model 6 in Table 5. When I accounted for each social network process together, the measure of social influence ("does ___ agree or disagree with receiving the H1N1 vaccine during pregnancy?") was most strongly associated with women's vaccination. Yet, even after accounting for all of the social network processes, an education gradient in vaccination remained: Women with a graduate or professional degree were almost three and a half times as likely to receive the vaccine compared to those with less than a college degree.

DISCUSSION

Disentangling the effect of education and social network processes on prenatal behaviors is a complex task. The aim of this chapter has been to build a conceptual framework to

understand how these factors influence the ways that women decide to behave when pregnant, in order to understand how educational inequalities in prenatal health behaviors emerge. By melding the results from in-depth semi-structured interviews as well as survey interviews, I have put forth an explanation for the emergence of inequalities in two new health behaviors during pregnancy: omega-3 fatty acid supplement intake and H1N1 vaccination. As with other health behavior inequality research (Lynch 2003; Phelan et al. 2004), I found education gradients in supplement intake and H1N1 vaccination rates among *prima gravida* or *essential prima gravida* pregnant women. I also found an education gradient in health knowledge, yet even after accounting for differences in health knowledge I found a consistent education gradient in prenatal behaviors—a result consistent with prior work in health economics on the association between education and health behaviors (Kenkel 1991; Meara 2001; Cutler and Lleras-Muney 2010).

Aside from education and individual knowledge about the benefits of behaviors, my results suggest that women's decisions are also influenced by a combination of social learning and social influence processes. Focusing solely on H1N1 vaccination, these social processes only partially accounted for educational differences in women's receipt of the vaccine. Social influence, measured as the attitudes and opinions about H1N1 vaccination during pregnancy held by those in their pregnancy network, emerged as the strongest predictor of their receipt of the vaccine. The results from the in-depth interviews reiterate the idea that women turned to their partners, friends and families when deciding whether or not to receive the vaccine or take a supplement, and their discussions and decisions differed by education-level.

Given that my results differed depending on the type of novel health behavior, future analysis should examine how these examples are qualitatively different. Although each of the behaviors in this chapter are new to the obstetrics literature, the recommendations for supplement intake are aimed to *enhance* the health of the mother and fetus but the recommendation to receive the H1N1 vaccine is designed to *avoid* a specific health risk to the mother and fetus. The motivation to enhance or avoid health risks may operate differently, and may be associated with educational attainment. In spite of these different motivations, recent evidence by Cutler and Lleras-Muney (2010) find little support that discounting and risk aversion account for the education gradient in health behaviors.

Another potential avenue to explore is the role of the health care provider in enhancing or preventing the emergence of health inequalities. Health care providers (nurses, midwives, and physicians) were more aggressive about recommending, even prescribing, vitamin D supplements. The main clinic from which I derived my sample, the Orange Clinic, tests each woman who visits the clinic during their prenatal appointment, and conducts an additional test during a later visit if her level is very low. In comparison, women are told about the benefits of omega-3 fatty acid supplement intake during their initial visit, and, occasionally, reminded during later prenatal visits, but they are never prescribed the supplement. This more intensive outreach by health care providers to increase vitamin D intake may, inadvertently, prevent the emergence of an education gradient in vitamin D intake. In an analogous argument, Harper and colleagues (2008) suggest that state laws may also enhance or prevent the emergence of socioeconomic inequalities in health behaviors. They find that states that enforce stricter

seat belt laws have smaller socioeconomic gradient in seat belt use compared to those that enforce more lenient laws (Harper, Strumpf, Davey Smith and Lynch 2008). Indeed, one factor that fosters or prevents the emergence of a gradient may be the role of the health care provider.

CONCLUSION

I combine the bedrock of literature on social relationships and health and medical decision-making (Durkheim [1897] 1979; Syme and Berkman 1976; House, Landis and Umberson 1988; Pescosolido 1992; Marsden and Friedkin 1994; Meara 2001; Kohler, Behrman and Watkins 2001; Behrman, Kohler and Watkins 2002; Christakis and Fowler 2007; 2008) with an emerging approach in medical sociology and demography (Phelan et al. 2004; Chang and Lauderdale 2009; Glied and Lleras-Muney 2008) that emphasizes the role of *new* health information and disease preventability in the production of social inequalities in health—the *unintended consequences of biomedical advances*. Borrowing from these literatures, I then derive a conceptual framework to understand how education and social network processes affect decisions about health behaviors. My approach uses demographic models of the diffusion of health information and behavior to delineate specific mechanisms by which social ties influence health behaviors (Kohler, Behrman and Watkins 2001). In combination, my empirical example provides a unique illustration of the processes by which health inequalities are produced, and invites further research on the emergence of health inequalities. Understanding this example will not only advance our knowledge about the processes that contribute to inequalities in health, it will also provide insight into decisions about health behaviors that lead to unequal health among women and infants.

CHAPTER 3: EXPANDING OUR UNDERSTANDING OF THE FORMATION OF SOCIAL INEQUALITIES IN HEALTH: EDUCATION, NETWORKS AND HEALTH BEHAVIORS IN THE FACE OF UNCERTAINTY

INTRODUCTION

In an emerging interdisciplinary literature, researchers have begun to identify the origins of health inequalities by concentrating on the ways that advances in biomedicine or changes in social norms impact individuals' decisions about health behaviors (Kenkel 1991; Gortmaker and Wise 1997; Link, Northridge, Phelan, and Ganz 1998; Lichtenberg and Lleras-Muney 2005; Glied and Lleras-Muney 2008; Miech 2008; Chang and Lauderdale 2009; Price and Simon 2009). By observing socioeconomic differences in health behaviors after exogenous shocks of health information, such as the U.S. Surgeon General warning about smoking, or abrupt shifts in the acceptance of a behavior, they have found that people in more socially advantageous positions alter their behavior more than others to avoid deleterious health effects. Undoubtedly such shocks or changes impact behavior, and they may promote the formation of health inequalities, but the majority of new health information is not as definitive as the Surgeon General's warning about smoking. Most often people must navigate a maze of information, but we know far less about the way people behave when health information about a behavior is unclear. When navigating this maze of unclear health information, does socioeconomic status affect the way people make decisions?

My aim is to advance the literature on the origins of social inequalities in health by examining factors that influence people's decision-making when information about a health behavior is uncertain. To evaluate this process, I use a specific empirical example,

women who are pregnant for the first time, or *prima gravida* women.¹⁴ Unlike previous examples, the health information is not new, but the pregnancy represents a new health event, and an opportunity to observe the how women of varying socioeconomic statuses, specifically education levels, make decisions. Even though pregnancy is not a true exogenous shock, as with other new health events, it provides an opportunity to observe differences in decisions about health behaviors (Smith 1999; 2004).

Pregnancy is also an ideal case study to understand how people make decisions when health information is conflicting or unclear—outside of their frequent prenatal appointments pregnant women are a magnet for a variety of health information from their networks. For this specific case study, during their first prenatal appointment women are provided information about two health behaviors that *may* have detrimental effects on their fetuses according to current biomedical knowledge: caffeine and alcohol consumption. These behaviors will be the focus of this chapter. Aside from the information from their health care providers, women frequently receive conflicting information from other members of their network. Together, this confluence of information provides an ideal opportunity to observe the way their decisions differ by socioeconomic status.

Using data from survey interviews conducted during women’s first trimester of pregnancy and in-depth interviews conducted at the start of their third trimester, I examine factors associated with changes in caffeine and alcohol consumption during pregnancy among women with varying education levels. By restricting my attention to educational differences in caffeine and alcohol consumption among *prima gravida* women, my results describe mechanisms influencing decision-making about these

¹⁴ *Prima gravida* is a term used to describe women who are currently carrying their first child to term.

specific behaviors during pregnancy. Given this narrow focus of analysis, I provide one illustration of specific proximate mechanisms (Lutfey and Freese 2005) that produce educational inequalities in behaviors for which health information is unclear.

This illustration provides one unique counter-example to the typical socioeconomic gradient in health behaviors. As expected, highly educated women were more cautious about their caffeine intake compared to women with less education, yet, in contrast to their typical risk avoidant behavior, they also reported consuming *more* alcohol later in their pregnancy. Results from the in-depth interviews provide evidence that members of their network socially influenced them to restrict, limit or imbibe differently depending on their education level. I argue that to understand this counter-example we should expand our understanding of fundamental causality to consider the value associated with risky behaviors, and the lifestyle they signal.

After providing a description of previous attempts to understand the effect of health information, advances in biomedicine, and sociocultural shifts in norms on changes health behaviors by socioeconomic status, I provide a description of current biomedical recommendations for prenatal caffeine and alcohol consumption in the United States. Next, I describe changes in consumption among women over the course of their pregnancy and put forth potential explanations, or specific proximate mechanisms, that influence women's decisions during pregnancy. Finally, I discuss the potential implications of this specific empirical example for our understanding of the ways that social inequalities in health are produced.

In Search of the Origins of Social Inequalities in Health

In spite of the significant improvements in quality and length of life in the United States

and other developing countries, an array of interdisciplinary research provides evidence of long-standing social inequalities in health (Villerme 1840; Virchow 1848; Chapin 1924; Coombs 1941; Antonovsky 1967; Kitagawa and Hauser 1973; Pamuk 1985; Duleep 1989; Preston and Elo 1995; Duncan 1996; Lauderdale 2001; Robert and House 2003; Lynch 2003). One of the most prominent explanations for these long-standing inequalities, fundamental causality, posits that socially advantaged people have more money, knowledge, power and prestige that enable them the opportunity to avoid deleterious health effects when biomedicine advances (Link and Phelan 1995). Thus, even though proximate causes of disease change with improvements in treatment, screening or the discovery of health hazards, by and large people with better social conditions live longer and healthier lives.

In recent decades, researchers have begun to search for the origins of such inequalities, a journey that has led them to consider the ways that external shocks of health information or changes in social norms prompt differential reactions depending on an individual's socioeconomic status. This approach posits that such shocks or changes serve as a type of catalyst for the formation of health inequalities. A variety of approaches have revealed that advances in biomedical knowledge, the emergence of new technology and abrupt changes in social norms foster the emergence of health inequalities. In the decades after the 1964 U.S. Surgeon General's report about the hazards of smoking, individuals were much more likely to quit and less likely to begin smoking if they had completed more schooling (Kenkel 1991). With advances in cancer screening and treatment (Link et al. 1998; Glied and Lleras-Muney 2008), new drug technology (Chang and Lauderdale 2009), and technological innovation in infant care

(Gortmaker and Wise 1997), over the course of a few decades income and education disparities in morbidity and mortality caused by specific health behaviors emerged.

Advances in biomedical treatment and technology are not the only catalysts for the production of health inequalities, though. Changes in the social stigma associated with cocaine use during the late 1980s prompted more highly educated people to quit using at higher rates, and over the course of the next decades an education gradient in use emerged (Miech 2008). Each of these findings supports the central idea behind this emerging literature: Individuals with more education and income are more likely to adopt behaviors to avoid health hazards when biomedical knowledge or social norms change.

New Health Events, SES, Social Relationships & Unclear Health Information

New Health Events

The emerging literature on the production of health inequalities has revealed that external shocks of information or changes in social norms serve as catalysts, but what if the evidence about the health behavior and its associated risks is unclear? Instead of observing differences in health behaviors after an exogenous change, in this chapter I observe decisions about health behaviors after a new health event, or health transition: first pregnancy. Previous research has used new health events as a type of health shock to estimate the effect of an illness diagnosis on employment and earnings (Smith 1999; 2004). Arguably, learning about a new illness or pregnancy is not a true health shock, given that people are often aware of factors that may influence the onset of diseases or health events. Even so, Smith (1999; 2004) argues that “the actual realization [of a chronic illness diagnosis] and especially its timing may be unanticipated” (1999:152). Amid the plethora of health information provided to newly pregnant women, I focus on

caffeine and alcohol consumption because the messages women receive about these behaviors from their health care providers and their networks are often conflicting or unclear.

Socioeconomic Status

The health inequality literature represents a diverse spectrum of disciplines, with a variety of approaches to understanding the role of socioeconomic status or position (Robert 1999; Braveman, Cubbin, Marchi, Egerter and Chavez 2001; Lynch, Kaplan 2000; Galobardes, Lynch and Davey Smith 2007). Various components of socioeconomic status or position may be more or less salient depending on a specific health behavior. Given that the goal of this chapter is to observe how prima gravida women decide to use or avoid caffeine and alcohol, I focus on education as a measure of socioeconomic status. Aside from the additional human capital bestowed upon those with more years of schooling, education helps people expand their cognitive skills, it “develops the habits and skills of communication: reading, writing, inquiring, discussing, looking things up, and figuring things out...” and through the process of learning it “builds the confidence and self-assurance needed to attempt to solve problems” (Mirowsky and Ross 2003: 26-7). A woman’s years of schooling are likely to enhance her ability to decipher, understand and react to health information to better her health and the health of her fetus (Rosenzweig 1995; Cutler and Lleras-Muney 2010).¹⁵

Social Relationships

Excluding the notable exception of the emergence of education trends in cocaine use

¹⁵ For the specific case of pregnancy, as a measure of socioeconomic status or position income was less salient. In the process of conducting the in-depth interviews, it became apparent that financial considerations do not enhance or hinder women’s access to either caffeinated or alcoholic beverages.

(Miech 2008), less attention has been paid to the role of social norms in creating social inequalities in health. Yet, the idea that social relationships influence health behaviors predates most sociological research (Durkheim [1897] 1979), and resonates with our current understanding of the way people decide to behave. Social relationships provide social support, pressure behavior through relationships, and influence medical decision-making (Syme and Berkman 1976; Berkman and Syme 1979; Baronowski, Bee, Rassin, Richardson, Brown, Guenther and Nader 1983; House, Landis and Umberson 1988, Pescosolido 1992, Marsden and Friedkin 1994; Meara 2001; Behrman, Kohler and Watkins 2002). As social norms, expectations and stigma change, social relationships act as one mechanism influencing change in behavior (Christakis and Fowler 2007; 2008; Hruschka, Brewis, Wutich and Morin 2011). Two processes that sway a change in health behaviors are social learning and social influence. Social learning occurs when an actor provides an individual with information that influences the individual's subjective beliefs about a behavior, and social influence arises when social contacts exert normative pressure on behavior regardless of their knowledge of the benefits (Montgomery and Casterline 1996; Kohler, Behrman and Watkins 2001).

As a new health event, pregnancy presents a unique case study to observe how people interact with members of their network, including those outside of their *social* network. Early in their pregnancy women often wait to inform all members of their network that they are expecting, but they still make decisions about how to behave. As women progress in their pregnancy, they begin to inform their network of their impending parenthood *and* they begin to show outward signs that they are pregnant. In turn, they begin to become “magnets” for health information from their friends, family,

co-workers and even people they have never met. Over the same ten-month period, pregnant women undergo a process of early health decision-making. Later in their pregnancy they must negotiate the influx of health information and social influence from people in their network.

Previous evidence about health care utilization reinforces the expectation that women are influenced by their network when they become pregnant. In an analogous example, people who have a mental illness are also frequent users of the health care system, and the extent to which they utilize care, or follow recommendations from their health care provider, depends upon their social ties (Pescosolido 1992; Pescosolido, Boyer, and Lubell 1999). Aside from the personal, socioeconomic or environmental factors associated with utilizing health care, Pescosolido and colleagues argue that after a new health event individuals' behaviors are guided by people in their networks. In combination with the long history of research on the influence of social ties on health behaviors, this example further supports the idea that networks matter during pregnancy.

Recommendations about Prenatal Caffeine and Alcohol Consumption in the U.S.

In the United States, the leading association for biomedical physicians that aid with prenatal care and delivery is the American College of Obstetricians and Gynecologists, or ACOG. These physicians often provide care in conjunction with certified nurse-midwives and certified midwives, a group lead by the American College of Nurse-Midwives, or ACNM. Both of these associations put forth official position statements about various behaviors during pregnancy, which are occasionally supplemented by official statements from the U.S. Surgeon General.

Caffeine Intake

ACOG acknowledges that that literature on the adverse outcomes associated with caffeine consumption during pregnancy is conflicting (ACOG 2011a). In their most recent recommendation, ACOG distinguishes between moderate levels of consumption—less than 200 milligrams of caffeine per day—and high levels of consumption—more than 200 milligrams of caffeine per day, and notes that only high levels of consumption are associated with miscarriage or preterm birth (ACOG 2011). The stance that moderate prenatal caffeine consumption is acceptable has been adopted by ACOG and ACNM, and is commonly discussed with women during early prenatal appointments.

Previous studies had elevated the level of concern associated with caffeine intake (Morris and Weinstein 1981; Infante-Rivard, Fernández, Gauthier, David, Rivard 1993; Mills, Holmes, Aarons, Simpson, Brown, Jovanovic-Peterson, Conley, Graubard, Knopp, Metzger 1993; Infante-Rivard, Cnattingius, Signorello, Annerén, Clausson, Ekbom, Ljunger, Blot, McLaughlin, Petersson, Rane, and Granath 2000; Weng, Odouli and Li 2008), however. These studies prompted many pregnant women to reduce their intake or abstain completely during the past few decades. Although it is now deemed safe, in moderate quantities, caffeine consumption during pregnancy has been a common source of anxiety and concern in the United States among pregnant women and members of their network. Quite simply, information about its safety in moderate quantities has not disseminated throughout pregnant women’s networks.

Alcohol Intake

As with caffeine consumption, there is a lack of clarity in the research on adverse effects associated with prenatal alcohol consumption. ACOG and ACNM recommend abstaining

from alcohol during pregnancy because they conclude that biomedical research has not determined a safe level for consumption (ACOG 2011b; ACNM 2011). To supplement these recommendations, in 2005 the U.S. Surgeon General released an advisory about the hazards of drinking alcohol during pregnancy, including Fetal Alcohol Spectrum Disorders (FASD). According to the Surgeon General warning, these disorders are a direct result of a women drinking alcohol while pregnant, which are manifest in the form of growth deficiencies, abnormal facial features and abnormalities of the central nervous system. The 2005 warning advised women who were pregnant or may become pregnant to abstain from alcohol entirely, and it superseded a 1981 warning that suggested that pregnant women limit the amount of alcohol they consume (United States Department of Health and Human Services 2005).

Aside from this strong public position, women receive conflicting information from people in their networks. Some of the mixed messages stem from the official policies put forth by governments and medical associations in the United Kingdom, Ireland, Australia, and Canada (O’Leary 2007), which range from advising that pregnant women avoid alcohol to advising that they avoid binge drinking. For example, in the United Kingdom, the Royal College of Obstetricians and Gynaecologists, advises women to limit their intake to 1-2 units once or twice a week. The Australian College of Midwives provides a similar recommendation, which states that women should have fewer than two drinks per day and less than seven in a week. Given these guidelines, prenatal alcohol consumption is more socially acceptable in these countries. Women or members of their network who have traveled or lived abroad have likely received conflicting information about the safety of alcohol during pregnancy.

Beyond these international discrepancies, the change in U.S. policy over the past half century has created confusion. During pregnancy, women frequently receive information from other women in their network, many of whom experienced their pregnancies prior to the warnings about alcohol and pregnancy. Due to these generational differences in prenatal behaviors, women's mothers, aunts and grandmothers frequently advise that alcohol is safe during pregnancy, which contributes to the mixed message women receive.

DATA AND ANALYTIC STRATEGY

Data

Research Design

My research design combines a quantitative component (Part A) and two qualitative components (Parts B and C), as shown in Figure 1. For Part A, I sequentially enrolled women from four health clinics in the Minneapolis/St. Paul area over the course of thirteen months (November 2009-November 2010; see Figure 2). To ensure confidentiality, I refer to these clinics as the Red, Orange, Yellow and Green Clinics. To draw the sample, I selected women who were over the age of 18, pregnant for the first time (prima gravida), under 27 weeks pregnant, and who speak English.¹⁶ Women with planned and unplanned pregnancies were included to capture a range of health knowledge levels and health behaviors.

For Part A, women were asked to complete a 20-minute survey interview, the Health Information and Behaviors During pregnancy Study (HIBPS) questionnaire,

¹⁶ Women were enrolled during their first and second trimesters to ensure that those who lacked access to prenatal health care during their first trimester were included. Women also qualified for the study if they had had an elected or spontaneous abortion (essential prima gravida).

which I created for this study. The HIBPS questionnaire has five main aims: (1) it assesses women's socioeconomic background; (2) it tests their health knowledge; (3) it inquires about social contacts with whom they discussed their pregnancy; (4) it asks about their social contacts' socioeconomic status, attitudes, and behaviors related to health during pregnancy; and (5) it asks about their health behaviors.¹⁷ The HIBPS data are not designed to isolate the selection processes that may influence health behaviors. Rather, the results presented here represent the effect of social network processes on health behaviors net of pregnancy network selection processes.

For Part B, I stratified the monthly samples by education level and randomly selected a subset of two women from each strata—six women total—each month to participate in in-depth semi-structured interviews during the beginning of their third trimester (between weeks 28 and 30). This design allowed me to assess changes in women's behaviors between her first and third trimesters. In all, I conducted in-depth interviews with 41 women.¹⁸ Women who participated in these interviews were given a \$20 gift card. The final component, Part C, is comprised of in-depth interviews with health care providers—including the physicians, midwives, and nurses—who provide care at the four clinics, specifically those who cared for at least five respondents from Part A. These interviews allow me to portray a more complete illustration of the ways that these health care providers offer health information or influence women's behaviors during pregnancy.

¹⁷ The HIBPS questionnaire is available upon request.

¹⁸ This sample includes in-depth interviews with a subset of women (n=4) who participated in a group prenatal class at the Green Clinic, but did not participate in the in-depth interviews.

In-Depth Semi-Structured Interviews

The first in-depth interviews were conducted in January 2010, as the first survey participants transitioned into their third trimester (see Figure 2 for study timeline). During the early in-depth interviews, I reviewed women's responses to the survey interview to record any changes in knowledge or behavior and asked them to elaborate on their answers. We discussed the majority of the topics included in the questionnaire, and I asked about their decision-making processes in more detail. Each in-depth interview was transcribed a short time after being conducted and themes that emerge were content-coded using Atlas.ti version 6 (Loflan, Snow, Anderson and Lofland 2006).

During the in-depth interviews, at one point or another about half of all women mentioned that a given behavior made them feel anxious or guilty, caused concern, or that others in their network were concerned about it. Even if they did not mention it directly, they often alluded to such concerns during the interviews indirectly. Health care providers also concurred that these issues are frequently brought up during prenatal appointments. Amid all of the prenatal behaviors they discussed with health care providers, family, friends, co-workers and strangers, caffeine and alcohol intake emerged as two that frequently produced these concerns.¹⁹ During the interviews, to elicit responses, I asked women "are you drinking any [caffeine/alcohol]?" However, because this emerged as an important topic early in the data collection process (January 2010-April 2010), during later interviews (May 2010-December 2010) I devoted more time to discussing the factors that influenced their decision. As with the survey interview, during the in-depth interview we discussed her behaviors before discussing her health

¹⁹ Women also frequently cited their decision about whether or not to be vaccinated against H1N1 as a source of guilt, anxiety or concern, especially in late 2009 and early 2010.

knowledge or other people's attitudes/opinions, in order to prevent women from changing the way they report their own behaviors.

If women had discussed the topic with others, most often the initial question would prompt women to recall information, advice, comments and judgment from those in their social network, and from people they did not know. My questions delved into social learning and social influence from their social contacts, specifically three areas: 1) specific advice received about caffeine/alcohol (social learning), 2) intake or behaviors among pregnant peers (social influence); 3) perceived opinions about caffeine/alcohol (social influence). Although the survey interviews took place in the health clinic, in a private room, or by phone at a later time, the in-depth interviews took place at a coffee shop, a private room at their place of employment or their home. The locations for the second interview led women to be more open about their decision-making processes.

Measuring Socioeconomic Status

Aside from the previously mentioned theoretical reasons for using education as a measure of socioeconomic standpoint, it is also an ideal measure from a methodological standpoint for a number of reasons (Elo and Preston 1996; Hummer and Lariscy 2011): 1) in most instances, schooling ends in the beginning of adulthood and does not change; 2) it is a stable measure of socioeconomic status regardless of employment status; and, 3) it precedes, and often directly impacts, other measures of socioeconomic status such as income and occupation, thus reducing the impacts of endogeneity. The educational distribution of respondents who participated in the survey and in-depth interviews was very similar. Among survey respondents, 21.5% completed some college or less, 38.6% completed their bachelor's degree and 39.9% completed a graduate degree (i.e., master's,

professional or doctoral degree). Similarly, about 18.4% of in-depth interview respondents completed some college or less, 42.1% finished their bachelor's degree and 39.5% completed a graduate degree.

Measuring Caffeine and Alcohol Intake

The HIBPS questionnaire includes questions borrowed from the Pregnancy Risk Assessment Monitoring System (PRAMS) and the Behavioral Risk Factor Surveillance System (BRFSS) questionnaires to measure beverage consumption at the beginning of pregnancy (Gilbert, Shulman, Fischer and Rogers 1999; Centers for Disease Control and Prevention 2009). To assess alcohol intake, women were asked the BRFSS question “During the past 30 days, have you had at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor?” with response options “yes” or “no.” Although women may abstain during pregnancy, they may have consumed more prior to knowing that they were pregnant. Therefore, women were asked the following questions from the PRAMS questionnaire about the previous three months: “how many alcoholic drinks did you have in an average week?” and “how many times did you drink 5 alcoholic drinks or more in one sitting?” None of the questions included in the PRAMS or BRFSS questionnaires inquired about caffeine consumption, so I developed a variant of the BRFSS question about alcohol, “[d]uring the past 30 days, how many times a week did you have at least one drink with caffeine?” Women were also asked about their tobacco use (e.g., smoking cigarettes) before they were asked about their alcohol or caffeine intake. This question was strategically placed prior to the other questions to minimize the perceived stigma associated with drinking caffeine or alcohol during pregnant and improve the chance that women would report their true consumption.

Intentional and Unintentional Pregnancies

Accounting for pregnancy intention is important, especially as it relates to alcohol consumption—although the majority of women in this study quit drinking alcohol when they become aware that they are pregnant, many still consume alcohol during the first month of pregnancy. Women most often learn that they are pregnant when they miss a menstrual period, at which point they are four weeks pregnant. During this month, ovulation occurs at about week two, and implantation of the embryo may begin as early as a few days later.

On the HIBPS questionnaire, women were asked “[w]hen you got pregnant, were you trying to get pregnant?” The question was borrowed from the pregnancy Risk Assessment Monitoring System Questionnaire. Among HIBPS survey respondents, 68% of women had planned their pregnancy, a figure that is similar to recent findings from the National Survey of Family Growth (NSFG), which found that about 1 in 3 births are unplanned (Taylor, Cohn, Livingston, Wang and Dockterman 2010). By education level, the proportion of unplanned pregnancies was similar among NSFG and HIBPS respondents: approximately 29% of NSFG and 26% of HIBPS respondents with a college degree or more did not plan their pregnancy. Given that my sample is restricted to those 18 years of age and older, comparisons to those with fewer years of schooling are more challenging. Still, about 56% of HIBPS respondents with some college or less did not plan their pregnancy and about 51% of NSFG respondents with some college (not including those with a high school degree) had unplanned pregnancies.

Analytic Strategy

To understand how educational level may influence women to react differently to unclear

information after they learn about a new health event, my analysis centers around *changes* in health behaviors. The central tenets of fundamental causality imply that, when presented with health information, women with more education (i.e., a higher socioeconomic status) should make decisions to avoid risks to them or to their fetus. To assess these differences I adopted a simple three-level classification system that indicates whether women increased, decreased or did not change their intake of caffeine and alcohol. Using detailed conversations about each substance, I examined factors that women identify as salient when they are choosing what to avoid or drink.²⁰ In order to assess the information being provided to women during their prenatal appointments, I used the same approach to code health care providers' recommendations about caffeine and alcohol.

UNDERSTANDING DECISION-MAKING ABOUT CAFFEINE AND ALCOHOL CONSUMPTION

Information Provided During the Patient-Provider Interaction

The Red, Orange, and Green clinics specialize in obstetrics and gynecology, and the Yellow Clinic is a general practice clinic. The majority of in-depth interviews were conducted with patients at the Orange Clinic (73%), which closely reflects the proportion of survey participants from the Orange Clinic (76%). Health care providers at the Orange Clinic also rotated through the Red Clinic (93% of patients visited the Red or the Orange Clinic).

At each of the clinics, pregnant women were first seen for a “prenatal intake visit,” conducted by a nurse or a midwife. Most often women found out about their

²⁰ During both the initial and focused coding for behaviors and decision-making, I did not identify women's education level, in order to avoid biasing my interpretation of their reported behaviors, knowledge, and decisions.

pregnancy by the sixth week (86% of HIBPS respondents), and the intake visit took place very early in the pregnancy, around weeks 6-10. During the intake visit, the health care provider would run through a list of health topics ranging from supplement intake (e.g., prenatal vitamins, vitamin D, and omega-3 fatty acid supplements) to substance use (e.g., alcohol, tobacco, and drug use). Throughout their first and second trimesters women are seen monthly by a midwife or a nurse, until they begin to have weekly appointments during their third trimester. At the Orange and Red Clinics, the default practice was to assign women to visit a midwife, and during subsequent visits she rotated through the remaining midwives. The purpose of this practice is to ensure that women have some familiarity with the midwife who aids with her delivery. If women have a medical complication (e.g., twin pregnancy) or they request a physician, they will see an obstetrician instead. As a result, the majority of women at the Orange and Red Clinics interacted with a variety of health care providers. Women at the Green Clinic often visited different midwives as well, but at the Yellow Clinic women tended to see one health care provider throughout their entire pregnancy.

At the Red and Orange Clinics, during the “prenatal intake visit,” if women report that they drink caffeinated beverages their health care provider encourages them to limit their intake to a moderate level, but “moderate” is not always well-defined. Among providers who saw women for their intake appointment, the upper-limit they gave for moderate intake ranged from 4-5 cups per day to 3 cups per day, and at least one provider recommended that they “limit it” with no reference to a distinct quantity.²¹ On the other hand, if they said that they did not consume caffeine during the intake visit it is not discussed, during that visit or during other visits, unless the patient brings it up. Thus, some

²¹ These recommendations are higher than the upper limit recommended by ACOG.

patients may not receive the message from their provider that moderate consumption is acceptable. If the patient brings it up during a later appointment with their midwife or physician, they learn more information about the amount of caffeine in common beverages and they are taught about the number of ounces in an average drink. One midwife and one physician mentioned that they advise that patients reduce their intake or abstain specifically during the first trimester because there is a higher risk of miscarriage, indicating that providers recommend a range of intake levels throughout trimesters.

With regard to alcohol intake, although most health care providers do not support any intake, their recommendations varied somewhat, particularly during the last trimester. During early prenatal visits all providers interviewed reported that they give a uniform recommendation that no safe limit had been determined, or according to one obstetrician: “I give the party [ACOG] line!” During in-depth interviews, though, many health care providers, including those who saw women for their initial intake visit, stated that they felt it is okay to have a sip or a glass [of wine or champagne], especially if it is during a special occasion like a wedding or an anniversary. Unlike caffeine consumption, alcohol intake is addressed as a part of the substance use/abuse section of all of the intake visits. If women report that they do not drink, though, the majority of health care providers do not address it during subsequent prenatal appointments. Health care providers reported that very few women inquired about a “safe level” of alcohol intake during pregnancy. When pressed, though, they reported that during prenatal appointments later in pregnancy their responses varied from the standard recommendation that there is no safe limit to the recommendation that women should only “indulge” on special occasions in small quantities (e.g., one glass of wine only). Of note, providers only

mentioned wine or champagne—drinks associated with celebratory events at certain gatherings—not beer or hard liquor.

The Impact of the New Health Event on Consumption during Early Pregnancy

Caffeine Intake during First Trimester

Immediately after becoming aware that they are pregnant, and at times prior to becoming pregnant, most women consumed very moderate quantities of caffeine or quit entirely—only 20% consumed caffeine seven or more times a week. The vast majority of women were cognizant of the guidelines to drink caffeine in moderation, even if they did not discuss the reasons why it was important to limit it in the first trimester. In conversations during the third trimester, women who had consumed caffeine prior to becoming pregnant commonly complained about the “challenge” of giving it up earlier in their pregnancy, and spoke about being “tough enough” to quit in spite of caffeine withdrawal symptoms. On the other hand, about 1 in 4 women mentioned that they felt nauseated earlier in their pregnancy, and they reacted by changing their food and beverage intake. A few women mentioned that caffeinated beverages were a specific source of nausea for them. According to results from the HIBPS survey, women did indeed restrict their intake of caffeine. Early in their pregnancy, 35.6% of women reported that they did not drink any caffeine. If they drank caffeine, 38.7% of women limited their intake to 1-3 drinks per week, 6.2% had between 4-6 drinks per week and only 19.6% consumed caffeine daily.

Some differences in intake emerged by education level, as shown in Table 6. Women who had not completed college were most likely to drink a moderate amount of caffeine (1-3 drinks/week) or abstain (77.1%), and only 1 in 5 (18.8%) reported drinking caffeine daily. A similar number of those women with a college degree abstained or

drank a moderate amount (78.2%), and 1 in 7 (13.8%) drank caffeine daily. A slightly smaller proportion of women with a graduate degree abstained or drank in moderation (68.9%), but a higher number—1 in 4 (25.6%)—drank caffeine daily. In comparison to the overall distribution of caffeine consumption, women who had not completed college were more prone to limit their drinking to moderate amounts and those with a graduate degree were slightly more inclined to drink caffeine on a daily basis. These early behaviors contrast what would be expected according to fundamental causality: women with more schooling chose to consume more caffeine during early pregnancy.

Alcohol Intake during First Trimester

Before the New Health Event. Women, and their providers, often reported that they had consumed some quantity of alcohol prior to realizing that they were pregnant. Given that ACOG and the U.S. Surgeon General recommend that women reduce their alcohol intake, or abstain entirely, when they are trying to become pregnant, it seems reasonable to expect that these behaviors differ depending on whether the pregnancy was planned or not. In Tables 7 through 11, I divide alcohol consumption into two behaviors, which reflect the standard approach to studying alcohol consumption during pregnancy (Gilbert et al. 1999): the number of drinks the participant consumed per week in the past 30 days and the number of times the participant consumed five or more drinks in one sitting (i.e., binge drinking). Drinking differences by pregnancy intention are shown in Tables 7 and 8 and drinking differences by education level are shown in Tables 9 through 11.

Among those who had planned their pregnancy, 30.5% had abstained completely, and 61.5% had more than zero but fewer than five drinks in a week—only 7.9% had more than five per week. Half as many women with unplanned pregnancies had abstained

Table 6. Caffeine Consumption by Education Level during First Trimester of Pregnancy

	Some College or Less		College Degree		Graduate Degree		Total	
No caffeine	13	27.1%	34	39.1%	33	36.7%	80	35.6%
1-3 drinks/week	24	50.0%	34	39.1%	29	32.2%	87	38.7%
4-6 drinks/week	2	4.2%	7	8.0%	5	5.6%	14	6.2%
Daily or more	9	18.8%	12	13.8%	23	25.6%	44	19.6%
	48		87		90		225	

Table 7. Alcohol Consumption by Pregnancy Intention during Three Months Prior to Pregnancy*

	Not Planned		Planned		Total	
zero	9	15.0%	46	30.5%	55	26.1%
than 1 drink/week	5	8.3%	20	13.2%	25	11.8%
1-4 drinks/week	32	53.3%	73	48.3%	105	49.8%
5 or more	14	23.3%	12	7.9%	26	12.3%
	60		151		211	

Table 8. Five Alcoholic Beverages or More During One Sitting by Pregnancy Intention in Three Months Prior to Pregnancy*

	Not Planned		Planned		Total	
zero	38	63.3%	114	78.1%	152	73.8%
1 time	9	15.0%	23	15.8%	32	15.5%
2-10 times	9	15.0%	8	5.5%	17	8.3%
11-20 times	2	3.3%	1	0.7%	3	1.5%
30 times or more	2	3.3%	0	0.0%	2	1.0%
	60		146		206	

*Note: All women under age 21 (n = 13) were excluded.

Table 9. Alcohol Consumption by Education Level during Three Months Prior to Pregnancy*

	Some College or Less		College Degree		Graduate Degree		Total	
zero	11	31.4%	21	24.1%	23	25.6%	55	25.9%
than 1 drink/week	2	5.7%	17	19.5%	7	7.8%	26	12.3%
1-4 drinks/week	18	51.4%	35	40.2%	53	58.9%	106	50.0%
5 or more	4	11.4%	14	16.1%	7	7.8%	25	11.8%
	35		87		90		212	

Table 10. Five Alcoholic Beverages or More During One Sitting by Education Level in Three Months Prior to Pregnancy*

	Some College or Less		College Degree		Graduate Degree		Total	
zero	22	62.9%	62	72.9%	69	78.4%	153	73.6%
1 time	6	17.1%	10	11.8%	17	19.3%	33	15.9%
2-10 times	5	14.3%	11	12.9%	1	1.1%	17	8.2%
11-20 times	0	0.0%	2	2.4%	1	1.1%	3	1.4%
30 times or more	2	5.7%	0	0.0%	0	0.0%	2	1.0%
	35		85		88		208	

Table 11. Alcohol Consumption During the Past 30 Days by Education Level During First Trimester of Pregnancy*

	Some College or Less		College Degree		Graduate Degree		Total	
no	32	91.4%	83	96.5%	84	93.3%	199	94.3%
yes	3	8.6%	3	3.5%	6	6.7%	12	5.7%
	35		86		90		211	

*Note: All women under age 21 (n = 13) were excluded.

(15.0%), but about the same number had more than zero but fewer than five drinks in a week (61.6%). A higher percent (23.3%) of those with an unplanned pregnancy consumed five or more drinks per week. A much smaller proportion of women reported having five or more drinks in one sitting during the three months before she became pregnant, but this behavior differed depending on pregnancy intention. Only 9 out of 146 women with planned pregnancies reported that they binge drank more than two times, but about 1 in 5 women with unplanned pregnancies reported it. These two measures of drinking behavior indicate that those with unplanned pregnancies were more likely to consume alcohol, and consume it in larger quantities. Women with a lower education level were less likely to have a planned pregnancy, therefore, they were more likely—advertently or inadvertently—to drink more heavily during very early pregnancy. In contrast to the prevalence of caffeine intake during the first trimester, these results support the basic premise of fundamental causality: women with more education were less likely to drink alcohol early in pregnancy.

There was little variation in reported alcohol consumption by education level during the three months pre-pregnancy, especially after accounting for differences in access to alcohol by excluding women under the legal drinking age who had less schooling (13 women were under age 21). Educational differences emerged in the quantity consumed, though, as only 2 women out of 88 (2.2%) with a graduate degree reported consuming more than 5 drinks in one sitting at least twice in the three months pre-pregnancy. A higher proportion of college graduates (15%) and those with some college or less (20%) reported binge drinking twice during the same period. This binge drinking behavior is potentially more detrimental to fetal development than an occasional

alcoholic beverage. These early pregnancy behaviors support the central tenets of fundamental causality: regardless of whether they became pregnant intentionally or not, women with a higher socioeconomic status (education level) were more liable to consume alcohol in “safe” quantities (i.e., less than five drinks in one sitting or fewer drinks overall) compared to those with a lower socioeconomic status.

After the New Health Event. Upon learning that they are pregnant, the vast majority of women reported that they immediately stopped drinking alcoholic beverages. If their pregnancy was unanticipated, they often express remorse about drinking alcohol during the very early weeks of pregnancy. Health care providers reported that it is a common source of anxiety for women early in their pregnancy, and one obstetrician mentioned that she frequently told such women that the “likelihood of there being any consequential health risks to the fetus are very, very low.” Guilt and anxiety were common themes among women who unintentionally imbibed while pregnant. By the time women were receiving prenatal care, regardless of education level, the majority of women (94.3%) reported that they had no alcohol during the past thirty days (all survey respondents were at least 6 weeks pregnant; see Table 11).

Changes in Consumption throughout Pregnancy: Decisions about Caffeine Intake

Caffeine and Guilt

When describing their decisions about drinking caffeine at the beginning of their third trimester, a common theme emerged about increasing their intake. After reading information from books, on web sites, or speaking with their health care provider they were often cautious about their early intake because of the higher overall risk of a miscarriage during the first trimester, but after reaching the second trimester milestone

about half began to increase their intake to moderate levels. Even with the ACOG guidelines on their side, though, their caffeine confessions were often laced with guilt, and they were quick to clarify their specific intake:

EH: How about caffeine? Are you drinking caffeine now?

Jane: I drink a little bit of caffeine, not every day ...and I'm trying to think what it would be. **This is lemonade, by the way. No caffeine, that's what it said in there.** I've had a couple of Diet Cokes every now and then, but it's interesting because my husband, he's particular about that stuff."²²

By their third trimester, simply discussing caffeine elicited feelings of anxiety or guilt, or as in the discussion with Jane, a need to explain her current intake.²³ In her response, without prompting, she also described her husband's concerns about it. At the root of a woman's anxiety or guilt is the fear that they will, inadvertently, cause harm to their fetus. Such concerns were amplified by questions and opinions from people in their social network, and others outside of their network.

Educational Differences in Caffeine Consumption

Although guilt and anxiety cut across educational boundaries, educational differences in social influence from women's networks emerged. When asked about their pregnant peers—other women (or partners of women) who have had a baby within the past ten years—more women *without* a graduate degree reported that their friends and co-workers consumed caffeine while pregnant. Aside from this peer group, important people in their networks gave approval to drink soda or coffee, or did not express opinions either way, as shown in this quote with Sarah, who has a bachelor's degree and is married to a man with an associate's degree:

²² Throughout the quoted text in the results section I have bolded portions to add emphasis.

²³ Pseudonyms are used to protect the identity of participants. In this conversation, I had asked Jane about her caffeine consumption during the first trimester of her pregnancy. Within this context, when I ask about her current caffeine intake we were discussing it in terms of her consumption around week 28, rather than her consumption during the actual interview.

EH: What does he [your husband] say?

Sarah (college degree): He says it's fine, I mean, it's like one of those guilty pleasure things that I can still do and not feel too bad about it...

Among women with a college degree or less, the behaviors and opinions of those in their network were not uniformly positive, though, as some mentioned that their husbands or friends questioned their caffeine consumption. The guilt associated with drinking caffeine commonly elicited imagery of the fetus being harmed. Even though her friend drank small or moderate amounts of caffeine while pregnant, and socially influenced her to drink caffeine, after discussing it together, Anna, who has a college degree, decided against it:

EH: And what did she tell you about caffeine?

Anna (college degree): Oh, I just remember when she was first pregnant...and I was like, "Oh, are you going to drink caffeine," and she said no because she knew it made her jittery and she didn't like picturing the baby getting so jittery. **And she went on to have a little bit of caffeine, but I haven't had an ounce of caffeine because I have that little jittery baby image in my head,** you know? (laughs) And I say, "Oh, I don't need it. It's fine." Which is hard and fine also.

The guilt and concern invoked by the image of a fetus being harmed acted as a powerful force that moderated women's decisions, even though, based on their peer's behaviors, they were socially influenced to drink caffeine.

These same social processes swayed decisions among women with a graduate degree, yet if they reported that people in their networks influenced them, most often (7 times out of 10) they pressured them to decrease their intake or abstain entirely. Among those who were aware of their pregnant peers' behavior, nearly all reported that their peers had chosen not to drink caffeine or to limit their intake severely, an approach with which many of their husbands concurred. At times, though, women would report that their husbands approved of caffeine in moderation, but another member of their network strongly disapproved. For example, Eleanor, who has a master's degree, had received her

husband approved to drink coffee daily, but she changed her behavior because of a negative comment from a co-worker:

EH: How about caffeine? Are you drinking caffeine now?

Eleanor (graduate degree): I'm drinking caffeine. It's hopefully diluted but ... well, okay...After my first trimester, I started gradually drinking it and then I noticed that it became more of a daily routine for me. And ...**I recently had a coworker make this comment to me about the fact that I was drinking coffee.** And she made me feel guilty about it. I don't know if she intentionally meant to make me feel that way but she made a comment like, "**Oh, is drinking coffee good for the baby?**" **And she was recently pregnant last fall and I'm assuming that she probably didn't drink caffeine then either.** And I took that as kind of like a passive aggressive way to say like you shouldn't be drinking caffeine. And I have kind of felt guilty about my one...six ounce cup of coffee a day...I don't even know if it would be considered a "moderate" amount. I mean it's probably like a very minimal amount. **So like the last ten days I haven't had any coffee.**

EH: Okay. So, tell me a little bit more about your reaction to her comment about the caffeine.

Eleanor: Well, I mean internally I was really annoyed and thought that it really wasn't any of her business because I felt like I'd made an informed decision and had been given the go-ahead by even my medical ... the midwives, and I thought that it was a very judgmental kind of comment even though I could tell she was trying to make it in this kind of passive way. **And then it also made me feel guilty and it played into that ten percent doubt or questioning of me drinking caffeine in general during my pregnancy which, you know, I would say her comment did influence me to not ...** And I wanted to see how I would do, you know, without. And it's been fine. So I feel good about it.

Eleanor described a multilayered decision-making process, and in spite of approval from her husband, she was more influenced by the guilt invoked by her co-worker's comment *regardless* of how close she was with her. Of note, aside from her co-worker's explicit comment, Eleanor also mentioned that she believed that her co-worker probably did not drink caffeine when she was pregnant, which exerted social influence in another form. Both the verbal comment and the perceived behavior contributed to her decision to limit her caffeine intake, in this instance.

The Role of Health Care Providers

In the face of questions, advice, or comments from those in their network, and to allay their own anxieties, women of all educational backgrounds sought professional opinions from their midwives or physicians, but women *without* a graduate degree were more inclined to follow this advice. For instance, Jodi, who has a college degree, struggled

with her decision to drink caffeine throughout her pregnancy, but reassurance from her health care provider gave her the resolve to stand up to social pressures and absolve her own guilt:

EH: Okay. So tell me what you mean. You mentioned the term “guilt.” What do you mean by that?

Jodi (college degree): ...I think about the decisions that I’m making and how they would impact my baby and then I feel bad. If I think there could even possibly be one consequence to the decision that I’m making then I feel bad about it. I still do it, I just feel bad about it for the time period and then move forward. Caffeine is a good example because when I first got pregnant, I thought really long and hard about whether or not I should completely give up caffeine. I have a full-on caffeine addiction. **There’s no reason to deny it and so I ended up talking it over with the midwives and saying to them, “Is there any consequence if I severally cut back and have one cup of coffee a day.” And up to that point I still had one cup of coffee a day, I just felt bad about it. And then they told me it was okay and the guilt is gone now.** So I just need that like confirmation, I guess, that the consequences are not so significant that you need to really be worried about it.

After discussing her intake during a prenatal appointment, Jodi received conflicting information from others, many outside what she considered to be her *social* network:

EH: And so did someone say something to you about it or ...

Jodi: My boss has told me that I shouldn’t drink caffeine. Several of my co-workers have told me that I shouldn’t drink caffeine. Strangers in coffee shops tell me that I shouldn’t drink caffeine. Strangers in airports tell me that I shouldn’t drink caffeine...**it seems like probably once a week or so I get somebody that I don’t know that’s not in my circle of people, giving me a judgmental, “Are you sure that’s good for your baby?”**

In response, Jodi mentioned these concerns to her midwife during a prenatal appointment, and the midwife again recommended that moderate consumption is safe:

Jodi: I asked [the midwife], **I said that I had heard from a variety of other people that you shouldn’t have any caffeine at all when you were pregnant. And she said to me, “It’s something where we would like you to be sure that you’re very moderate about how much you’re having but it should be a small amount, no more than two cups a day.** And that as long as you’re within that range, it should be okay.” So she had said there’s not any lasting consequences, of course you don’t want to have six Mountain Dews in a day but if you’re having one or two cups of coffee, it’s fine.

Armed with this information, Jodi continued to drink coffee at work, in spite of reservations from her boss and co-worker.

EH: Do you have an example of what they would say to you or ...

Jodi: My boss looked at me and said, “You know, I see you’re still drinking coffee. You know that’s *really* bad for your baby, right?” **And I looked at her and said, “Well, I asked my doctor and she said that it was okay, so I’m actually going to go with her advice on this one.”** And that ended that.

Throughout the course of her pregnancy Jodi wrestled with her decision to drink caffeine. An avid coffee drinker, she restricted her consumption to one cup of coffee early in her pregnancy because of advice from her midwife. Drinking coffee daily still elicited concern among people in her network, so she again asked for a professional opinion during her prenatal appointments. She then used the information provided by the midwife, as well as the medical authority associated with a health care professional's opinion, to respond when people in her network questioned her decisions. In fact, although she received the advice from a midwife, Jodi used the term "doctor" when describing her response to her boss.

In a similar example, Stephanie, who has a Ph.D., faced social pressures to avoid caffeine, but in the face of these concerns she decided to quit, or severely limit, her caffeine intake. Even after discussing it with her midwife, she mentioned the prominent role social influence played in her decision to quit drinking coffee:

EH: Okay. What did [the midwife] say?

Stephanie (graduate degree): I believe that she said like a cup of coffee or like a caffeinated drink is okay. Per day. They haven't really seen that it affects the baby, like one cup of caffeine a day. **And, my friends, I think they're not...some people are like, "Oh, I gave it up," or some people said that they kept drinking.** And other people ask me, like, "Do you still drink coffee," you know, because I love like lattes. And, I said, "No. I have it maybe like once a week." But, I said, "I usually don't." **And then they're like, "Oh! You're so disciplined!"** So, I don't know. I guess it just kind of depends. **Nobody says like, "Oh, you shouldn't." But, like I know my sister-in-law, she thinks I shouldn't.**

EH: Okay. Has that come up in conversations with her?

Stephanie: ...Yeah, I mean...Oh, yeah. Yeah. Definitely. But, she; **I think she has said it to me before but like not, not like you shouldn't, but like that she didn't, and that she just doesn't see the point of having it if you don't really need to.**

For Stephanie, even the reassurance provided by the midwife was not enough to influence her decision, and she did not mention the midwife's professional recommendation with others in her network. Even though not all of the pregnant peers in her network gave up caffeine, she zeroed in on her sister-in-law's behaviors and opinions when discussing her

decision-making. Her sister-in-law socially influenced her in two ways: she made Stephanie aware of her previous prenatal behaviors and she gave her opinion that caffeine should be avoided during pregnancy. Aside from this relationship, Stephanie also received positive reinforcement from friends when she mentioned that she only has a latte once a week. Although she was given the same information during her prenatal appointment Stephanie was more swayed by the behaviors and opinions held by people in her network than the professional medical advice from her midwife. This type of decision-making process was more common among highly-educated women.

Summary of Changes in Caffeine Consumption by Education Level

Although all women tended to decrease their intake during their first trimester and increase their intake starting with the second trimester, their social interactions varied by education level. These social interactions, as well as their acceptance or rejection of the health care provider's recommendations, guided them to make different decisions. Even though the results from the survey interviews revealed that early prenatal behaviors did not align with the typical SES-health gradient—women with a graduate degree were slightly more inclined to drink caffeine on a regular basis rather than restrict it compared to those with less schooling—results from the in-depth interviews revealed different behaviors later in pregnancy. Throughout their pregnancy, women with a graduate degree received more social influence to limit their intake, and, in the face of this pressure, they were less inclined to follow the recommendation that moderate caffeine consumption is acceptable. Among in-depth interview participants, this social influence encouraged more women with a graduate degree, to restrict their intake compared to women with a college degree or less. This, more cautious, behavior was more in line the typical “risk averse”

health behavior found among more highly educated individuals. Of note, women rarely described instances of social learning—the people in their networks did not provide information about the detrimental or harmful effects of consuming caffeine during pregnancy.

Changes in Consumption throughout Pregnancy: Decisions about Alcohol Intake

Analogous themes emerged when women described changes in their alcohol consumption, but there were a few important differences between these two examples. First, messages about the potential hazards of prenatal alcohol consumption are ubiquitous; pregnant women are screened for alcohol use or abuse during their prenatal appointments, they are reminded in public health advertisements (e.g., March of Dimes), and they see warning labels on alcoholic beverages. Second, in the face of these strong biomedical and public health messages, women described lively debates about it among members of their social networks, many of whom questioned the recommendations that health care providers gave during prenatal appointments. As with caffeine intake, women's network members socially influenced them to alter their behaviors later in pregnancy. Compared to caffeine, though, changes in alcohol consumption, specifically increases in intake, after the first trimester were more subtle, and usually occurred late in the second trimester or during the third trimester. Finally, later in their pregnancy, rather than consuming alcohol alone as a “guilty” pleasure, women reported drinking an occasional glass of wine as a part of social event.

Alcohol Consumption and Fear of Judgment

Even though there was considerable discussion about drinking, the majority of women (3 out of 4) abstained from drinking alcohol completely—they even avoided an occasional

“sip” of alcohol. When asked about their conversations related to alcohol consumption, women commonly responded that it did not come up in conversation because people knew that they had chosen not to drink. For these women, in spite of what their friends or family believed, guilt was a strong motivator that prevented them from drinking. If women did choose to drink alcohol, in any quantity, anxiety and guilt were not as salient as their fear of judgment from others. Quite simply, they were not anxious about the detrimental effects of alcohol on their fetus but they were concerned that their friends or family would judge them for drinking.

Elisabeth: ...But like there's part of me (laughs), like so even so, I still feel like I'm breaking like this horrible rule if I have anything. But like **my actual like logical decision is that I'm sure it's fine to have like a drink a week**, which is all I ever had anyway... So, that one I actually like thought about a lot more. **I didn't talk to a lot of people because people are very judgmental about it.** And we talked about it in the group [prenatal class] and it was a very spirited discussion...

Unlike the conversations about caffeine, Elisabeth is less concerned about her own guilt, and more fearful of being judged by others. This fear of social judgment resonated with women of all education levels:

Lisa: ...I mean, it is kind of funny because it's not something I would want to be like out in public like super pregnant drinking a huge...you know what I mean? Drinking a huge beer or glass of wine. I mean, it's something like yeah, I'll have a sip of my husband's, but...I was actually talking to one of my friends, one of my other friends about it because she was at...we're in a kick-ball league, although we're both pregnant so neither of us play. **But she had a sip of her husband's beer and she was like getting dirty looks from people like on the other side of the field. And so, she didn't, she was like, "Whatever. They're going to judge me; I can't do anything about that,"** but I, to me, I'm like, "Oh, my God! I wouldn't, I don't want people to look at me like that!"

Although she did not drink alcohol early in her pregnancy, by the beginning of her third trimester she had begun to drink “sips” of alcohol. After observing the negative social influence from people in public, she decided to only consume small quantities in private, with her husband.

Educational Differences in Alcohol Consumption

As with caffeine consumption, these concerns about judgment, as well as other social influences were evident in each educational group, but the degree to which they influenced women's decisions differed according to their education level. At the beginning of their third trimester, approximately 1 in 8 women with a college degree or less consumed any alcohol, compared to about 1 out of 2 women with a graduate degree. Women with the least education were most likely to be socially influenced to avoid alcohol completely:

Samantha (some college): Hmm, like since I found out I was pregnant, **like all my friends'll be like, "You can't come cause we're going to drink."** Like they're very like ... and like my best friend, he's a guy. And like one of my co-workers is joking and saying for my birthday she's going to buy me a huge bottle of wine. And he was like, "If you buy her a bottle of wine, the air will drink it!"

EH: Oh!

Samantha: So, like everyone's all like down my throat about not drinking. But, I didn't drink before I got pregnant so it's not a problem for me.

EH: So there's no issue. But, everybody's telling you to not drink at all.

Samantha: Yeah.

EH: And what, did they say why?

Samantha: (laughing) **They said cause something's gonna; my child's gonna come out wrong, or something's going to be wrong with him and fetal alcohol syndrome.** Like everyone stresses that.

EH: Okay. So, what about just a glass or a few sips?

Samantha: Everyone's like no.

Samantha, who has completed some college courses but has not graduated, encountered significant negative social influence from her friends and co-workers to avoid alcohol, in any quantity. The majority of the friends who she mentions completed some college or graduated with a bachelor's degree, including her "best friend" who completed some college. Due to her pregnancy, her friends even restricted her participation in social events to prevent her from being around people who were drinking. Samantha's interaction with her friends also exemplified a social learning process, because they provided information about the specific detrimental effects associated with prenatal

drinking. This social learning process was an exception. When asked about their interaction with people in their network, no other woman reported that their friends, family, or co-workers provided any information about alcohol's detrimental effects.

If they chose to drink, women with a graduate degree, and some women with a bachelor's degree, were judged less harshly by people in their network. Rather than judging them, their friends and family socially influenced them to accept that it is safe to consume moderate amounts of alcohol. Lisa, who has a master's degree, describes a conversation with a college friend who is a lawyer and drank wine during her pregnancy:

EH: And then when it comes to alcohol, can you tell me about your discussions with [your friend]?

Lisa (graduate degree): We talked a lot about whether or not it was okay to have a little bit. And both her and her husband are of the thinking that **a little bit's not going to do anything**. And when she was pregnant, she'd have like - **when we were together - she'd have like a small**, like a really small, but I don't know how many ounces it was or anything, but like a really small **glass of wine**. When she was in her second and third trimester at that point. But she didn't see any harm in doing it.

After relaying the positive social influence she received from her friend, Lisa goes on to describe her own decision to only drink an occasional sip of alcohol. Around her friends, though, if she had chosen to drink more they would have accepted her decision.

Not all highly educated women encountered the same social acceptance, however.

Eleanor, who completed a master's degree, conveyed a story about her pregnant friends:

EH: And so has that come up, have you seen other women drinking during pregnancy?

Eleanor (graduate degree): Hmm-mm, no, because I've actually been around a few pregnant women throughout my pregnancy. I've had two friends that are in town that were pregnant and the one had a baby in March. The other one just had hers in June. So we've all been about twelve weeks apart and none of us have drunk. **If we'd get together, we'd buy the fake like sparkling apple juice as like a replacement or whatever. But yeah, no drinking.**

Outside of these interactions with her pregnant friends, a brother of one of Eleanor's friends said that she could "have a little bit [of champagne]" when they were celebrating the birth of her friend's baby, but she declined the offer. Her decision was reinforced by her pregnant friends who also abstained—together, they socially influenced each other.

Of note, in this instance all of the women were *concurrently* pregnant, compared to other women who received input from women who had been pregnant in the past, which served to further cement their decision to avoid alcohol.

Among women who had not completed their bachelor's degree, all but one uniformly abstained from all alcohol, including small "sips" of wine or beer. Behaviors among women who had completed college were more mixed, but, compared to women who had completed a graduate degree, they did not receive as much social influence to drink alcohol:

Helen (college degree): And so I thought of all the times [to drink], if I'm pregnant, it should not absolutely be worth it at all. So, I was like I don't need to drink that.

EH: Okay. So, did that come up in any conversations? Do you have any friends that are pregnant or anybody else that you know?

Helen: Yeah, actually, just one of my coworkers is pregnant and she did not know that she was pregnant and then she had a couple times where she had a drink and then **she asked if I thought it was okay and I'm like, "I don't know! As your doctor and don't do it again!"** So, yeah. But with me drinking, not really, because most of my friends know I don't really drink. So, it wasn't really something that came up.

Helen, who has a college degree, chose not to drink any alcohol, and *she* socially influenced her co-worker not to drink alcohol in the future. When asked about her opinion, rather than describe her own behavior Helen recommended that her pregnant friend seek a professional opinion. Jodi, the woman who received significant social pressure not to drink caffeine, imparted her own judgment upon women who chose to drink:

EH: I know you mentioned that your friends did not drink when they were pregnant.

Jodi (college degree): No. None of them did.

EH: But have you seen other women who were pregnant drinking?

Jodi: **I have and I judge them.**

EH: You have. At parties or ...?

Jodi: You'll see people at parties or you'll see people in social situations, not anybody that I know or that I'm friends with, **and I do feel judgmental of that.** I don't think they should be doing that. Because I feel like if you're going to do it out in public, that means you're probably doing it a lot at home. I don't know where I come up with that crazy notion but ...

Although neither Helen nor Jodi was socially influenced to abstain, they recalled socially influencing, or judging, other pregnant women. As with the caffeine examples, they were

more inclined to call upon the professional advice from their health care provider when they made their decision about alcohol consumption.

The Role of Health Care Providers

Due to the ubiquitousness of health information about alcohol and pregnancy, as well as the lower prevalence of drinking, very few women brought up questions during their prenatal appointments—a finding confirmed during in-depth interviews with the intake nurses, midwives and physicians. Women avoided the subject because their opinions contradicted their health care provider’s advice and they feared judgment. Such fears were not without merit: Midwives and physicians were frequently unaware of their patient’s alcohol consumption, and, when pressed about the subject, many reported that if they found out a patient had consumed alcohol later in pregnancy they would have concerns about an addiction problem. When discussing the issue, one midwife noted that screening is less common at the clinic because it does not serve a population of high social risk:

Midwife: I don’t think...**I don’t think I’ve ever had a woman hint to regular use even if it’s really minimal.**

EH: Right.

Midwife: But now I kind of have to backtrack. At this clinic, it’s not addressed again second and third trimester. But, **at the community clinic**, we have a lot of grants so there’s a lot more intervention socially and risk assessment, lifestyle assessments done by the RNs because they room all of our patients and they’re got grant parameters and requirements to meet...And so those patients, **that whole population of our patients are being screened.**

EH: And that’s serving the lower income ...

Midwife: Mm-hmm, **high risk, socially higher risk.**

This lack of communication during the patient-provider interaction was consequential: The midwives and physicians deemed their population to be at a low risk for alcohol consumption during pregnancy even though the highly educated women were most likely to be drinking minimal to moderate amounts of alcohol. In turn, women were having few discussions with their providers about a “safe” amount of alcohol to consume.

Outside of the patient-provider interaction, these highly educated women often expressed opinions that moderate alcohol consumption during pregnancy is both safe for their fetus and socially acceptable in their networks. In explaining their decisions, these women were inclined to openly question the provider's recommendation, or relay a secondhand recommendation from a different physician.

Jane (college degree): Yeah. So, like **my aunt is like, "My doctor said I could have a glass of wine every single week." She's like, "And I always did and my kids were fine."** And my friend Sarah, again, she was like, "You can have like on average, as long as you never, ever get to the point where you feel the alcohol," she's like, "you can have like a half a beer everyday if you want to." And I actually believe you probably can, I just ...

EH: You just ...

Jane: I don't even want it.

Based upon these secondhand discussions with physicians, highly educated women often cited that there was an "informal" guideline that health care providers will not discuss during the official prenatal appointment, as reported by Kelsey, who has a master's degree:

Kelsey (graduate degree): And I've heard...I never asked them specifically about alcohol either, but from what I've heard from other people...You know, everything you read is like, "Oh, of course it's best to not have any at all." **But what I've read between the lines is pretty much every doctor is like yeah, but it probably won't hurt to have a couple a week, either!** So, and just judging on that people did it forever before the last like fifteen years, I don't think it hurts. And I'm a little...I don't like to eat a lot of crap and I'm conscious of like what I put in my body and I really don't think that that is harmful.

Among the health care providers (i.e., nurses, midwives and obstetricians) interviewed, all but one responded that there is no safe limit and women should not consume any alcohol. On the other hand, when discussing alcohol consumption, 7 out of 14, were of the opinion that a small amount of alcohol is safe—they often mentioned that a glass at a special occasion is acceptable. None of the providers approved of daily or weekly consumption of alcohol, in any amount. Clearly, Kelsey accurately assessed the divide between the official recommendation that health care providers give during prenatal appointments and the personal opinions that they harbor. Yet, she inaccurately assessed

their actual opinions about a safe limit, which are lower than a “couple a week.” Women who had completed more schooling, typically those with a graduate degree, commonly came to a similar conclusion as Kelsey. Their inaccurate assessments of their health care provider’s opinions were only exacerbated by the lack of communication about alcohol consumption during their prenatal appointments.

International Differences in the Cultural Acceptance of Alcohol Consumption

One final topic emerged as a common theme: Women questioned the official recommendation by describing behaviors among pregnant women in Europe.

Elisabeth (master’s degree): That one is one that has bothered me for years, like before I even thought I was going to get pregnant because it really ticks me off the way they’ve simplified it so much...**I had a friend who was pregnant and she was in France and she had some issue come up and she went to the doctor. And he said, “Well, you should just have a drink and relax. And he said, “Oh, wait. I’m sorry, you’re American. You probably won’t do that.”** And it just got me thinking like well this isn’t like a ... like obviously if every baby born in France had fetal alcohol syndrome, they would not be doing...like it’s a developed country and **it seems like we just have like gone to the easier message to tell people, “Just don’t do it,” because it’s easier.** And I always felt like I was sort of talking down to women and sort of obnoxious, so I had opinions about it!

As a whole, women with more education, including those with a bachelor’s degree or higher, cited this as a reason to question the current U.S. guidelines or justify prenatal alcohol consumption. In this example, women used the authority provided by physicians in other countries to question the U.S. guidelines. Beyond questioning these guidelines, though, they deduced that the *lack* of fetal alcohol symptoms among babies born in European countries verified their opinions. In doing so, the pregnant European women became a large reference category, or peer group, upon which they based their opinions. In essence, this logic allowed them to imply that they are being socially influenced by prenatal behavioral norms an ocean away.

Summary of Changes in Caffeine Consumption by Education Level

Between the first and the third trimesters, the majority of women continued to avoid alcohol entirely. Women were more inclined to increase their intake after their first trimester if they had completed a bachelor's, master's, professional or doctoral degree. As with the caffeine example, social interactions played a prominent role in their decision-making about alcohol: Highly educated women were socially influenced to drink alcohol more frequently than other women. In contrast to the prominent role that social influence played in their decision-making, women very rarely reported that anyone in their network provided information about why they should avoid drinking alcohol.

Prior to learning that they were pregnant, the education gradient in alcohol consumption reflected the typical socioeconomic gradient in health behaviors—women with less schooling were more likely to drink in amounts that were potentially unsafe to their fetus (i.e., five drinks or more in one sitting). During the first trimester, this education gradient in consumption disappeared, as nearly all women abstained completely. Later in their pregnancies, due in part to greater social acceptance and a questioning of the prenatal guidelines for consumption, women with more education imbibed more frequently. These changes in alcohol consumption mirror both the changes in caffeine consumption and the expected results based on fundamental causality.

DISCUSSION

Observing the way people behave differently based upon advances in biomedicine or abrupt changes in social norms provides one vantage point to understand the emergence of social inequalities in health. I have taken a different approach by examining changes in behavior after a new health event. Aside from this alternative approach, unlike previous

studies that have attended to changes in a specific health behavior after the emergence of *new* health information, I focus on the way people decide to behave if the information that they receive about these behaviors is conflicting or unclear. Thus, I consider the origins of social inequalities in health by examining socioeconomic differences in decision-making from an alternative vantage point.

In light of this aim, concentrating on women's changes in prenatal consumption of caffeine and alcohol over the course of pregnancy provides an ideal illustration of the proximate mechanisms (i.e., social network processes) that act as catalysts for changes in prenatal behaviors among *prima gravida* women. Aside from the changes they make when they learn they are pregnant, the women who participated in the study changed their behavior if or when people in their network influenced them to change their behavior. In turn, these social network processes differed by education level and contributed to the formation of educational inequalities in health behaviors.

Social network processes led women to alter their prenatal caffeine and alcohol consumption such that an education gradient in consumption emerged, but, during the same prenatal period, changes in these behaviors were reversed. Upon learning that they were pregnant, women frequently decreased their caffeine intake but during their first trimester more highly educated women consumed caffeine more frequently. Throughout the course of their pregnancy, these more highly educated women were embedded within networks that socially influenced them to avoid caffeine, and, in turn, these women reacted by reducing their intake. This example aligns with our expectations of the predominant socioeconomic gradient in health behaviors—people with more education will tend to avoid health risks more actively than those with less education.

Changes in prenatal alcohol consumption provide a stark contrast to this example. Prior to learning that they were pregnant, women who had completed less schooling were more likely to drink alcohol at levels that were potentially harmful to their fetus. Although women almost uniformly quit drinking any alcoholic beverages during their first trimester, a subset (about one in four) began to increase their consumption later in pregnancy such that women with higher levels of education were most inclined to drink. Again, these highly educated women were members of networks that socially influenced them to behave differently compared to women with less education, but, in this instance, their social contacts guided them to engage in more risky behavior. Over the course of their pregnancies, the reversal in the education-alcohol consumption gradient provides a unique counter-example to the established literature on socioeconomic gradients in health behaviors (Pampel, Krueger and Denney 2010), and it elevates the role of social relationships as well as the patient-provider relationship.

One important caveat of this research is that it does not attend to the complex interplay between social selection and social influence. Given that the present study focuses on interaction with network members over the course of four or five months—between their first prenatal appointment and the beginning of their third trimester—and the formation or dissolution of relationships was not the focus of the later interviews, it is difficult to disentangle these processes. Indeed, with regard to alcohol and caffeine consumption, some women alluded to processes of social selection. For instance, one participant declined social invitations from a friend because she did not agree with her prenatal alcohol consumption. As mentioned earlier, the present analysis represents the effect of social processes *net* of any social selection.

Interaction with Network Members

Social influences from network members provoked women to alter their behavior over the course of their pregnancy. As women progressed throughout their pregnancy they become a magnet for health information and social influence. Amidst the range of factors influencing women's decisions about prenatal behaviors, they consistently cited the importance of social influence, rather than social learning. The finding that social influence is important resonates with a wide-ranging literature, dating back to very early sociological studies of suicide (Durkheim [1897] 1979), which has emphasized the significance of social relationships on decisions about fertility (Montgomery and Casterline 1996; Kohler, Behrman and Watkins 2001), health behaviors (Umberson, Crosnoe and Reczek 2010), decision-making (Pescosolido 1992) and length and quality of life (House, Landis and Umberson 1988; Syme and Berkman 1976; Berkman and Syme 1979).

In spite of the well-established benefits of network ties for health, at times networks clearly guide people to rebel against established medical guidelines, as seen in the alcohol example. Through social contact people are influenced to alter their health habits; interaction with their peers may present social opportunities to increase their caloric intake (Christakis and Fowler 2007) or foster illicit drug use (Taylor, Repetti and Seeman 1997), for instance. This darker side of social relationships provides one, rather straightforward, explanation for alcohol intake among pregnant women: They are more likely to be a part of networks that encourage deviant health behaviors.

Valuation of Risks and the Metamorphosis of Biomedical Knowledge

A more complex explanation requires that we question *why* some health behaviors are labeled as deviant, and that we examine *why* some people are embedded within these “deviant” networks. Although health inequality research often attends to social conditions that place people at risk of becoming ill, when choosing outcomes of interest we rarely question the valuation of risky behaviors. Current health inequality scholars implicitly assume that each health risk holds the same social status. Yet, social and cultural forces have led particular health behaviors to be deemed risky depending on the value of that particular behavior as well as the type of lifestyle it signals (Nettleton and Bunton 1995; Bourdieu 1984), or the moral issues at hand (Armstrong 1993).

The shift in the socioeconomic gradient in drug use after cocaine became “culturally redefined as unhealthy” (Meich 2008:353) exemplifies the ambiguity associated with the categorization of health behaviors. Previously deemed to be a relatively safe drug (Musto 1999), commonly used by powerful elites, cocaine became the target of the political campaign to “Just Say No” and the social status it garnered fell prey to the increasing availability of variants with much lower social status (i.e., “crack cocaine”) (Hamid 1992; Musto 2002). To be fair, a number of high-profile athletes and celebrities also died after using cocaine, which elevated the public’s awareness of the potential risks of using (Meich 2008). This cultural redefinition incited the socioeconomic gradient in cocaine use to reverse.

Alcohol consumption during pregnancy is another behavior that has been socially and culturally redefined as both safe and unsafe depending on salient social and cultural issues. Apprehension about the detrimental effects of prenatal alcohol use predates current biomedical concerns about Fetal Alcohol Spectrum Disorders (FASD), as pre-

Mendelian physicians originally hypothesized an association between drinking and heredity during the eighteenth and nineteenth century (Armstrong 2003). Such concerns found a welcome audience during the temperance movement, but with the appeal of Prohibition alcohol was again deemed socially acceptable and medically safe during pregnancy (Towler and Butler-Manuel 1973). Over the course of the next decades, though, advances in medical technology fostered the emergence of fetal medicine as a field of specialization, and, simultaneously, concerns about the welfare of the fetus began to increase (Zelizer 1994).

The year 1973 marked a key turning point: *Roe v. Wade* enabled women to legally abort their fetus and Fetal Alcohol Syndrome first appeared in biomedical literature (Armstrong 2003:14). Since its inception as a disorder, biomedical knowledge about FAS or FASD has been murky at best, due largely to the inherent ethical concerns associated with studying it. After early case studies were published in 1973 and 1974, the tally of individual cases quickly began to increase, but the etiology of the disorder remained elusive. Even though a number of physicians questioned the rising trepidation about alcohol consumption, “the bias toward positive results in the scientific literature [was] exacerbated [because there was] an overt moral dimension to the research question at hand” (Armstrong 2003: 83).

Decades later, controversy about the teratogenic effects of alcohol has surfaced in private conversations with health care providers, and in the conflicting recommendations put forth by leading obstetrics societies in various countries. Although feelings of guilt and anxiety were at the forefront of HIBPS participants’ discussions about both caffeine and alcohol, discussions about the controversy most frequently occurred among highly-

educated women. As the obstetricians and midwives who participated in the HIBPS study often observed, they recommend the official ACOG “party line” during the prenatal appointment, but during private conversations they approve of minimal consumption. This informal recommendation diffuses throughout women’s networks, particularly those with more schooling. The result is that minimal or moderate prenatal consumption of alcoholic beverages, particularly those that signal a higher social status such as wine, is *valued* more as a “risk” behavior. As one highly-educated woman, who chose to drink wine, said, “if you drink in moderation and not excessively its okay...I’m not a lush...I’m not drinking like hard liquor.”

Prenatal caffeine consumption does not have the same storied history, in part because very high consumption is associated with miscarriage during the first trimester rather than a visible disorder among children, such as FASD (Källén 1988). Rather, concerns about its teratogenic effects have ridden the larger wave of apprehension about alcohol consumption, as the purview of fetal care extended into additional prenatal behaviors over the past few decades (Armstrong 1993). In spite of a lack of evidence to support abstaining from caffeine entirely, some physicians recommend that pregnant women “stop caffeine intake completely during pregnancy if it is at all feasible” (Weng et al. 2008; Armstrong, Harris, Kulka, Kuppermenn, Little, Lyerly and Mitchell 2008). Amid the current disagreement, the ACOG guidelines have been readily accepted by pregnant women, who rarely reported consuming large quantities. Perhaps because concerns about caffeine intake have not garnered as much attention as alcohol intake (United States Department of Health and Human Services 2005), the message about its associated risks is less ubiquitous, and it is accessible and affordable, highly educated

pregnant women do not rebel against the prenatal caffeine intake guidelines in the same way they question prenatal alcohol guidelines.

Giving the Party Line

Even amid the controversy surrounding alcohol and caffeine consumption, most pregnant women listen to advice from their health care providers, particularly their advice to abstain from drinking alcohol (Terza, Kenkel, Lin and Sakata 2008). During the prenatal period, when women have frequent appointments, their health care providers play a major role in influencing their behaviors. In combination with the ubiquitousness of health information about the risks of drinking alcohol while pregnant, advice from obstetricians and midwives has led to the low prevalence of drinking among women.

The women who deviate from the norm have tended to be older and more educated (Centers for Disease Control and Prevention 2002). In a recent account of prenatal alcohol consumption, compared to women with a high school diploma or less, women with some college or a college degree were 40% and 90% more likely to report alcohol intake, respectively (CDC 2009). Within the context of the patient-provider interaction, these more highly-educated women also tend to be more active participants, question their health care provider's judgment, and seek information from additional sources (Cockerham, Lueschen, Kunz and Spaeth 1986). With regard to prenatal drinking, these more highly-educated women are questioning their health care provider's advice and, in concert with members of their social network, they are aligning with an undercurrent of U.S. society that values and accepts (high class) alcohol consumption during pregnancy. Examining the value of risky health behaviors, and the lifestyles they signal, may help to explain why discounting, risk aversion and the value of the future fail

to account for the association between education and a variety of health behaviors (Cutler and Lleras-Muney 2010).

CONCLUSION

Observing changes in behaviors following a new health event allows us to view the formation of socioeconomic inequalities in health behaviors from a different perspective, and it provides a new window into proximate mechanisms that influence individual behavior. Concentrating on individual decision-making when information about a given health behavior is uncertain adds another layer of complexity. Unraveling the motivations for change in prenatal caffeine and alcohol use reveals that social relationships influence health behaviors differently depending on education level. The finding that the networks of highly-educated women do not uniformly influence them to behave healthier suggests that we need to expand our current understanding of fundamental causality. I argue that we should consider the value of each risk, and the lifestyle it signals, in order to fully understand the catalysts that create socioeconomic differences in health behaviors.

CHAPTER 4: THE ROLE OF THE HEALTH CARE PROVIDER IN THE FORMATION OF A HEALTH DISPARITY

INTRODUCTION

On the heels of significant advances in longevity and quality of life, Charles Kadushin optimistically predicted that as “countries advance in their standard of living, as public sanitation improves, as mass immunization proceeds...the gross factors which intervene between social class and exposure to disease will become more and more equal for all social classes” (Kadushin 1967). This optimistic prediction not only failed to come to fruition, over the past decades health disparities in the United States have remained stable or increased (Kitagawa and Hauser 1973; Elo and Preston 1996; Rogers, Hummer and Nam 2000; Lauderdale 2001; Marmot 2004; Warren and Hernandez 2007; Hummer and Lariscy 2011), and have prompted the U.S. government to develop broad public health goals to eliminate them (U.S. Department of Health and Human Services 2000).

To eliminate, or at least alleviate, such disparities requires that we understand them, however. In an emerging interdisciplinary literature (Kenkel 1991; Link et al. 1998; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009), researchers have pinpointed advances in biomedical information or technology as one point when health inequalities begin: after new information or technology becomes available socially advantaged individuals are better positioned to benefit. Even so, with the notable exception provided by Lutfey and Freese (2005), this research on the emergence of health inequalities has not accounted for the role that health care providers play in the production of health inequalities. What role to health care providers play in the formation of a health inequality?

In this chapter I provide an empirical example of the formation of a health behavior disparity, while paying particular attention to the role played by health care providers. Using a specific case study—women who are pregnant for the first time, or *prima gravida* women—I focus on two new prenatal supplements, omega-3 fatty acid and vitamin D supplements. During pregnancy, a socioeconomic gradient in consumption emerged for the first, but not the second supplement. I argue that two processes contributed to these differences: 1) health care providers provided uniform vitamin D recommendations but provided fewer omega-3 fatty acid recommendations for women with a lower socioeconomic status and 2) women with a higher socioeconomic status were more inclined to seek out additional information about supplements outside of their prenatal appointments. In all, these differential recommendations and patient behavior contributed to the socioeconomic gradient that formed in omega-3 fatty acid supplements, but the uniform recommendations for vitamin D prevented the formation of such a gradient.

The Formation of Health Disparities

Researchers in a variety of disciplines have attempted to understand how health disparities form (Kenkel 1991; Gortmaker and Wise 1997; Kenkel 2007; Glied and Lleras-Muney 2008; Miech 2008; Chang and Lauderdale 2009). This approach builds on the notion that health disparities emerge after people learn new information about health risks from advances in biomedicine (Link and Phelan 1995; Link, Northridge, Phelan, and Ganz 1998). In response to these exogenous shocks of new information or advances in biomedical technology, socioeconomically advantaged individuals are better situated

to avoid health hazards, and thus, over time, socioeconomic gradients in health behaviors develop.

The evolution of the socioeconomic gradient in smoking behavior provides a familiar example: After the U.S. Surgeon General put forth a warning about the risks of smoking cigarettes, more highly educated individuals were more likely to quit and less likely to start smoking in the ensuing decades (Kenkel 1991; 2007). A portion of these educational differences in smoking are attributable to individual-level differences about health knowledge (Kenkel 1991), thus elevating the importance of individual knowledge about new information. An unintended consequence of biomedical advances also emerged after preventive screening procedures were developed for breast and cervical cancer, as individuals with higher education and income levels were more likely to utilize such preventive procedures (Link, Northridge, Phelan, and Ganz 1998). On a larger scale, cancer survival rates provide evidence of the formation of health disparities: Technological advances in screening and treatment have resulted in larger socioeconomic gradients for cancers that have a higher survival rate, compared to those that are not preventable (Kogevinas and Porta 1997; Glied and Lleras-Muney 2008).

The Role of the Health Care Provider

Observing that socioeconomic gradients in health behaviors emerge following exogenous shocks of new health information or technology lends further support to the notion that advances in biomedicine can serve as unintended catalysts for the formation of health disparities. At the individual-level, previous research supports a role for individual knowledge about this new information (Kenkel 1991). Even so, by and large, researchers have focused on the emergence of socioeconomic gradients in health behaviors without

attending to the role of the health care provider.²⁴ They have attended to broad, population-level changes in the adoption of screening behavior, medical technology or the avoidance of newly identified health hazards, but, aside from individual health knowledge they do not describe individual-level factors that may contribute to production of health inequalities.

Yet, amid the potential sources of novel health information and factors influencing individual's decisions about new health information, the patient-provider interaction is often of primary importance for individual's adherence to a range of biomedical approaches (Anderson 1995; Phillips, Morrison, Anderson and Aday 1998; Lutfey and Freese 2005; Franks, Jerant, Fiscella, Shields, Tancredi and Epstein 2006; Boyer and Lutfey 2010; Osterberg and Blaschke 2011). Physicians play a key role as a source of health information (Carcaise-Edenboro and Bradley 2008; Hahn 2009; Hoffman, Lewis, Pignone, Couper, Barry, Elmore, Levin, Van Hoewyk and Zikmund-Fisher 2010), they influence medical decisions (Pescosolido 1992; Lien, Ma and McGuire 2004; Heritage and Maynard 2006) and they provide support when patients utilize the health care system (Haines, Hurlbert, and Beggs 1996). Aside from their explicit role as medical experts and caretakers, at times, their behaviors or implicit biases may also inadvertently contribute to health disparities (Smedley, Stith, and Nelson 2002; van Ryn and Fu 2003; Lutfey, Eva, Gerstenberger, Link and McKinlay 2010). Combined, this evidence further supports the notion that health care providers play an important role when health disparities form.

²⁴ Lutfey and Freese (2005) provide a notable exception in their qualitative description of socioeconomic differences in diabetes treatment.

An Empirical Example: New Prenatal Supplements

To understand this process in more detail, and contribute to our understanding of individual-level factors that influence the production of health inequalities, in this chapter I focus on a specific empirical example, women who are pregnant for the first time, or *prima gravida* women. Given that new health information is important to the emergence of health inequalities, this is an ideal empirical example. *Prima gravida* women are presented with a plethora of information for the first time, including new biomedical information about pregnancy. Amid the range of health behaviors discussed during their prenatal appointments I focus on two new topics: vitamin D and omega-3 fatty acid supplementation. Aside from aiding bone development, recent evidence indicates that vitamin D reduces the odds of pre-term birth, preeclampsia and gestational diabetes, and omega-3 fatty acids help with brain development of the fetus (Ruxton, Reed, Simpson, and Millington 2004; van der Meer, Nasra, Boeke, Lips, Middlekoop, Verhoeven and Wuister 2006; Hollick 2007).

Using this example, the first specific aim of this chapter is to test for an association between women's socioeconomic status and vitamin D and omega-3 fatty acid supplementation, while accounting for differences in knowledge-levels. Given that these represent new health behaviors, according to previous research more socially advantaged women should be more likely to understand the benefits of these supplements and be more likely to consume them. The second specific aim of this chapter is to explore how two different approaches by health care providers contribute to or prevent the formation of a health disparity. Although we know less about the role of providers in the evolution of health disparities, as a source of information and professional influence they undoubtedly play a role in women's decision-making during pregnancy.

METHODS

Research Design

My empirical example combines a quantitative component (Part A) and two qualitative components (Parts B and C), as shown in Figure 1. For Part A, women were sequentially enrolled from four health clinics in the Minneapolis/St. Paul area over the course of thirteen months (November 2009-November 2010; see Figure 2). These clinics were chosen because they serve women from a diversity of socioeconomic backgrounds in the metropolitan area, and will henceforth be referred to as the Red, Orange, Yellow and Green Clinics for the anonymity of study participants. Women who were over the age of 18, pregnant for the first time (*prima gravida*), under 27 weeks pregnant, and who speak English were included.²⁵ Women with planned and unplanned pregnancies are included to capture a range of health knowledge levels and health behaviors.

For Part A, women were asked to complete a 20-minute survey interview designed for this study, the Health Information and Behaviors During Pregnancy Study (HIBPS) questionnaire.²⁶ The preferred mode of administration for the questionnaire was in-person, but participants were also given the option to complete it over the phone, yielding a final sample size of 225.²⁷ All surveys were conducted by me or by a trained survey interviewer and respondents were given a \$5 gift card. Approximately 64% of

²⁵ Women were enrolled during their first and second trimesters to ensure that those who lacked access to prenatal health care during their first trimester were included. Women also qualified for the study if they had had an elected or spontaneous abortion (*essential prima gravida*).

²⁶ Three obstetricians and obstetrics residents reviewed the questionnaire prior to collecting data, and it was pre-tested on 30 women from the clinics. The questionnaire includes questions from the Behavioral Risk Factor Surveillance System (CDC 2009), the Pregnancy Risk Assessment Monitoring System (PRAMS; Gilbert, Shulman, Fischer and Rogers 1999) and the National Health Interview Survey (National Center for Health Statistics 2009).

²⁷ All survey interviews were recorded on paper and digital voice recorder to ensure accuracy. Among women who agree to participate 85% complete the survey in-person and 15% complete the survey by phone at a later time.

eligible prima gravida or essential prima gravida women who were seen in the four clinics agreed to participate in the 20-minute survey interview, either in the clinic following their appointment or by phone at a later time.

For Part B, each monthly sample was stratified by education-level and a subset of two women were randomly selected from each strata—six women total—each month to participate in in-depth semi-structured interviews during the beginning of their third trimester (between weeks 28 and 30). In all, a total of 41 women participated in in-depth interviews.²⁸ The final component, Part C, is comprised of in-depth interviews with health care providers—including the physicians, midwives, and nurses—who provided care for five or more participants at the four clinics. All participants of Part B and C received a \$20 gift card.

Measures

For this analysis, I use education as a measure of socioeconomic status. Education is an important marker because it may help people to develop cognitive skills that would enable them to understand and act upon new health information (Mirowsky and Ross 2003). From a methodological standpoint, it is an ideal measure of socioeconomic status for a number of reasons (Elo and Preston 1996; Hummer and Lariscy 2011): 1) in most instances, schooling ends in the beginning of adulthood and does not change; 2) it is a stable measure of socioeconomic status regardless of employment status; and, 3) it precedes, and often directly impacts, other measures of socioeconomic status such as income and occupation, thus reducing the impacts of endogeneity.

²⁸ This sample includes in-depth interviews with a subset of women (n=4) who participated in a group prenatal class but did not participate in the in-depth interviews.

Survey Interview: Part A

The measure of education level is based on a question from the 2009 National Health Interview Survey (NHIS). Education is coded as three dummy measures: less than a bachelor's degree (i.e., less than a high school degree, General Educational Development test, high school degree, associate's degree or some college), Bachelor's degree, and graduate degree (master's degree, professional degree or doctoral degree). Women were also asked about the education-level of their significant other (if they are in a relationship).²⁹ During the in-depth interviews, women reported both that their partners frequently attended their prenatal appointments and that they consulted with their partners prior to consuming the supplement and/or their partners reminded them to consume the supplement. Thus, I utilize a couple-level measure of education, which represents the highest educational degree between the woman and her partner (Moen and Hernandez 2009).

Health Knowledge and Health Behaviors. The measure of vitamin D consumption is adapted from a question about prenatal vitamin consumption included on the Pregnancy Risk Assessment Monitoring System (PRAMS) study questionnaire: "During the past month, have you taken a vitamin D supplement? Do not count your prenatal vitamin." Similarly, to measure omega-3 fatty acid consumption women were asked: "During the past month, have you taken any fish oil or flaxseed supplements?" These behaviors were coded as a dichotomous measure, which represents the behavior (supplement consumption; coded 1) or lack of the behavior (coded 0).

²⁹ Nearly all women, 223 out of 225, named at least one person in their pregnancy network—one did not complete the survey and the other did not list any people after three attempts to elicit any social contacts. Among the entire sample, only 16 women reported that they were not in a relationship at the time of the survey interview.

To measure health knowledge of the benefits of omega-3 fatty acid, I adapted a survey question from PRAMS, which was originally intended to assess women's knowledge about the benefits of folic acid: "Some health experts recommend consuming omega-3 fatty acids during pregnancy for which of the following reasons?" Response options include the following: to help with brain development (correct); to help prevent a premature delivery; and, to help women sleep well. Women were asked whether each response option was correct and I used their responses to create an index ranging from 0 (low) to 3 (high). To measure vitamin D knowledge women were asked a similar question with an open-ended response option because of the wider range of health benefits of vitamin D consumption during pregnancy. If women provided an answer that correctly identified one benefit of vitamin D supplements based on a recent review of the literature (Hollick 2007) (i.e., bone development or calcium absorption (n=44), immunity (n=2), cancer prevention (n=2), or a deficiency due to lack of sunshine (n=20)), I coded their knowledge level as 1 out of 0.

In-Depth Semi-Structured Interviews: Parts B and C

During the in-depth interviews, we discussed the majority of the topics included in the questionnaire, and I inquired about their decision-making processes in more detail. Each in-depth interview was transcribed a short time after being conducted and themes that emerge were content-coded using Atlas.ti version 6 (Loflan, Snow, Anderson and Lofland 2006). Although the survey interviews took place in the health clinic—in a private room—the in-depth interviews took place at a place of their choosing: a coffee shop, a private room at their workplace or their home.

Analytic Strategy

To explore the association between women's education-level and her supplement intake, I estimate the likelihood of each health behavior using logistic regression, and then account for individual differences in knowledge about the supplements. This approach will simply allow me to ascertain whether educational differences in intake exist, but they will not allow me to account for the underlying processes that contribute to potential disparities. To achieve the second aim, and understand the role of the health care provider, I supplement this analysis with results from the in-depth semi-structured interviews with women and their health care providers.

RESULTS

Education, Health Knowledge and Supplement Intake: Survey Interview Results

Among those pregnant women partnered (93%), over the course of thirteen months, approximately 35% of women consumed an omega-3 fatty acid supplement, and about 42% consumed a vitamin D supplement (see Table 1).³⁰ The group was well educated. Approximately 56% of women or their partner had completed a graduate degree, 33% a bachelor's degree and only 11% less than a bachelor's degree.

In Table 12 the results from the logistic regression analysis include those for omega-3 fatty acid consumption (Models 1 and 2) and vitamin D consumption (Models 3 and 4). Does supplement intake differ by education-level? Focusing on Models 1 and 3, if one member of the couple possesses a higher educational degree the woman is more likely to consume an omega-3 fatty acid supplement, but there are no educational

³⁰ Auxiliary analysis revealed minimal differences in vitamin D intake levels by month in study or season, which suggests a similar vitamin D protocol throughout the study period, as well as minimal seasonal variation in intake.

Table 12. Logistic Regression Estimates of Omega-3 Fatty Acid Supplement Consumption on Education and Health Knowledge

	<i>Omega-3 Fatty Acid Supplement</i>				<i>Vitamin D Supplement</i>			
	Model 1		Model 2		Model 3		Model 4	
	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.	Exp(β)	S.E.
<i>Highest Educational Degree Between Couple</i>								
Less than a Bachelor's Degree	<i>Reference group</i>		<i>Reference group</i>		<i>Reference group</i>		<i>Reference group</i>	
Bachelor's Degree	2.899	(1.955)	2.312	(1.590)	1.371	(0.897)	1.331	(0.874)
Graduate Degree (Master's, Professional or Doctoral)	4.876 **	(3.155)	3.724 **	(2.470)	1.813	(1.129)	1.722	(1.080)
<i>Health Knowledge</i>								
Omega-3 Fatty Acid Knowledge Level (0 = low; 3 = high)			1.349 *	(0.213)				
<i>Health Knowledge</i>								
Vitamin D Knowledge (0 = no knowledge; 1 = knowledge)							1.362	(0.513)
Constant	-1.897 ***	(0.619)	-2.288 ***	(0.663)	-0.470	(0.570)	-0.591	(0.591)
Chi-Square	8.970 **		14.730 ***		1.150		1.820	
Log-Likelihood	-128.394		-126.535		-79.815		-79.478	
<i>n</i>	205		205		116		116	

*** = $p < 0.01$ ** = $p < 0.05$ * = $p < 0.10$

Note: Due to the novelty of vitamin D intake, the vitamin D knowledge question was added four months after the study began, therefore the overall sample size is smaller. Auxilliary analysis conducted on the full sample with partners (N = 205) did not find any educational differences in vitamin D intake.

differences in vitamin D supplement intake. More specifically, if the woman or her partner completed a master's, professional or doctoral degree she was almost five times as likely to consume an omega-3 fatty acid supplement compared to couples where neither member has completed college.

To what extent do individual-level differences in health knowledge about the supplements account for this association? Women who were successfully able to identify the benefits of omega-3 fatty acid supplements during pregnancy were significantly more likely to consume one. Yet, accounting for individual health knowledge only attenuated the educational disparity in intake somewhat; if a member of the couple possessed a graduate degree the woman was still over three and a half times as likely to consume the supplement. Unlike the omega-3 fatty acid supplementation, women's knowledge about the benefits of vitamin D did not increase the likelihood that she would consume the supplement.

The Role of the Health Care Provider: In-Depth Interview Results

The results from the logistic regression analysis reveal two different results when new prenatal supplements were introduced into the protocol for pregnant women: a health disparity formed in omega-3 fatty acid supplementation, but not in vitamin D supplementation. Moreover, individual knowledge was important for the first supplement, but not the second. How can we explain this difference? In this particular example, health care providers at two of the clinics took two different approaches to recommend these two supplements. I argue that the health care providers played a role in influencing the health behaviors of women, and, in this particular case they may have inadvertently prevented the formation of a disparity in vitamin D intake by taking a very

proactive role in recommending it. By aggressively recommending it, they also reduced the importance of individual knowledge about its benefits. Results from in-depth interviews with women further support the notion that providers play an important role, as the primary impediment to intake was a lack of awareness about the supplement.

Vitamin D: Strong Recommendation from Health Care Providers

According to one nurse midwife, at the beginning of 2009, a physician and longtime friend of one of the nurse midwives in the Orange Clinic sent her an email touting the benefits of vitamin D. Upon further investigation, the nurse midwife became convinced that it would be beneficial to recommend the supplement for women and notified the chair of the obstetrics and gynecology department. The practice of testing patient's vitamin D levels spread to pregnant patients and in the fall of 2009 the clinic began testing the vitamin D level of all pregnant patients. Due to their proximity, the same health care providers rotated through the Orange and the Red Clinics, which 93% of participating women visited.

Just prior to the start of this study, providers began to order a vitamin D screening for nearly all women and they recommended a supplement unless women's level fell within a high target range of 50-80 ng/ML.³¹ For these patients, during the initial visit, a nurse told women that they are particularly predisposed to have low levels of vitamin D because they live at a higher latitude, and discussed benefits of what they term the "sunshine hormone:"

"Studies have shown that most women in our state are deficient in vitamin D and we're also finding how important it is. It's actually a hormone and it's actually very, very significant in the baby's development as well as the health of the mother from a cardiovascular standpoint and many other body systems, mental state; all kinds of areas where vitamin D makes a big difference. And we don't

³¹ This level was designated by the staff, but does not reflect guidelines set forth by any medical association or government entity.

get enough sun here in Minnesota and then we put sunscreen on so we're just not soaking up enough vitamin D is what we're finding. I think it's fairly new, all these studies, so we're... But it's also been proven that there's no bad effect from taking it at this point, so that's why we're recommending it."

After this initial visit, women are seen by a midwife or obstetrician during their second appointment, at which point they received a second recommendation to supplement their vitamin D level, unless their level is unusually high. Later in their pregnancy, if women had a very low level, they were frequently screened again at the same time that they were screened for gestational diabetes. Of note, in their recommendation, health care providers also often mention that there are no consequential negative effects or risks associated with consuming it.

Omega-3 Fatty Acid: Limited Recommendation from Health Care Providers

Before the protocol to test and recommend vitamin D supplement began, the health care providers at the Orange and Red Clinics did recommend an omega-3 fatty acid supplement, primarily for brain development of the fetus. Within the Orange Clinic, the chair of the clinic was instrumental in implementing the recommendation of a plant-based version of the supplement to avoid potential contamination with mercury in fish-based versions. No blood tests exist to determine omega-3 fatty acid levels, so there is no standard protocol that aims to raise each woman's level to a target range. Around the time when the health care providers began to recommend that all women have their vitamin D levels tested (fall 2009) they eased off of their recommendations for omega-3 fatty acid supplements because a few providers decided that the evidence of its benefits were less clear. Some women already began to consume one prior to their first prenatal visit, but the intake nurses provided only a portion of the remainder with information about it, as evidenced by one response:

Some days it does [come up], some days it doesn't! It depends on the patient. The patients who do

not...have very low incomes are not going to do that. I mean, they can't afford it. They can't afford the prenatal vitamin. So I'm focusing on getting a prenatal vitamin into them. The other ones I'm not, nothing's been proven. Nothing has said you *have* to take this.

This response, and concern about the financial burden of the supplement, was echoed in additional interviews with midwives. Likewise, during later appointments with midwives the supplement was not recommended uniformly, as one midwife described:

You know, I would recommend it to anybody who asks about it because it's not harmful and it has many benefits. And anything that's not harmful and has many benefits you can't help but recommend. But I would say that comes up a lot less frequently. People don't ask about it as much.

These piecemeal recommendations result in fewer provider recommendations for omega-3 fatty acid overall, and providers are more likely to discuss it if the patient brings it up during the appointment.

Impediments to Supplement Consumption

During the in-depth interviews, health care providers and their patients identified a number of impediments to supplement consumption, but the most frequently mentioned reason was a lack of awareness about the supplement. At the beginning of their third trimester, about one in five women were not aware of the vitamin D supplement, but the majority of these women were seen outside of the Orange Clinic. This high awareness about the vitamin is a further testament to the success of providers in aggressively recommending the supplement. Patients within the Orange and Red Clinics frequently reported that they were consuming the vitamin because their health care providers had prescribed it to them. Results from the in-depth interviews confirm the results from the survey interview analysis: there were no education differences in awareness about or consumption of the supplement and within the Orange Clinic nearly every woman was aware of vitamin D supplements. Although a few women reported reading about vitamin D outside of their appointment, most women learned that it was an "important

supplement” from their provider, even if they could not correctly identify any health benefit for them or their fetus.

Among patients of all clinics, awareness about omega-3 fatty acid supplements varied, and about one in five women were not aware of the supplement. In contrast to vitamin D supplements, women frequently learned about omega-3 fatty acids *outside* of their prenatal appointments on pregnancy web sites or books, or through conversations with other people. Health care providers frequently noted that they began to anticipate this type of patient:

[They are] [t]he same kind that’s probably already read a whole book about pregnancy by the eighth week! And again, that woman lets on by your conversation with her. She’ll say, “oh, I read this on the internet,” or “I heard about this,” or “my friend told me this,” and kind of use those as talking points.

Perhaps surprisingly, few educational differences in awareness about the supplement emerged, but, as with the survey results, women with a college or graduate degree were more inclined to understand why the supplement is beneficial and they were more likely to follow-through and take the supplement. Thus, the “knowledgeable type” of woman described above was more likely to have a higher education-level.

Other impediments reported by women and their providers included cost, side effects, and a desire to obtain the necessary nutrients through other methods. As noted in the earlier quote by the intake nurse about omega-3 fatty acids, at times providers anticipated that women with lower incomes will not be able to afford the supplement, which is more expensive than the vitamin D supplement. However, other providers frequently noted that many health insurance companies provide reimbursement for supplements during pregnancy; thus they recommended the supplement to all women. Regardless of education-level, or income, no women mentioned cost as a factor

preventing them from taking either supplement. Occasionally, they did note that the fish oil version of the omega-3 fatty acid supplement sometimes caused unpleasant side effects, such as “fish burps,” which caused them to avoid them or switch varieties. Even so, women did not report major concerns about side effects for either supplement. Aside from these two impediments, a small number of women with a college or graduate degree were averse to consuming any additional supplements, and sought to supplement their intake through additional exposure to the sun (during summer months) and foods rich in omega-3 fatty acids.

DISCUSSION

Recommendations for vitamin D and omega-3 fatty acid supplementation during pregnancy are relatively new, therefore they provides two opportune empirical examples to understand the emergence of health disparities and the potential role of the health care provider., Within the past three years providers in the two main obstetrics clinics that participated in the study implemented protocols to recommend these two supplements. Due to availability of screening tests, as well as concerns about lower-income patients’ inability to afford omega-3 fatty acids, they more aggressively prescribed vitamin D.

Results from the survey interviews and in-depth interviews confirm that education disparities in intake emerged for omega-3 fatty acid supplements, but not vitamin D supplements. Upon further investigation, the primary impediment to intake was a lack of awareness about the supplement. Coupled with providers’ reports, within the main participating clinics, that they assertively recommend vitamin D but provide inconsistent recommendations for omega-3 fatty acids, these results elevate the role of the nurses, midwives and obstetricians in both educating and influencing women in their decision-

making. With regard to omega-3 fatty acids, providers reported that perceived income also factored into their decision, and women that they perceived to have a higher income were more likely to receive advice to take the supplement. Given that income and education-level were highly associated among participants, this resulted in fewer recommendations for women with lower education-levels.

Factors outside of the prenatal appointment also contributed to the emergence of a gradient in omega-3 fatty acid supplement consumption. Regardless of their providers' recommendation, women who had completed a college or graduate degree read more online or in books about the supplement. Thus, even if a provider inadvertently forgot to recommend the supplement to a more highly educated woman, she was more inclined to learn about it outside of the appointment. Additionally, although women did not specifically report that they avoided the omega-3 fatty acid supplement due to its price, it may have been a factor in their decision. Thus, though not solely the result of differences in health care provider recommendations, the education-level differences in omega-3 fatty acid supplement consumption were likely exacerbated by inconsistent recommendations.

CONCLUSION

In spite of significant advances in health and longevity over the past century, health disparities remain (Kitagawa and Hauser 1973; Elo and Preston 1996; Rogers, Hummer and Nam 2000; Lauderdale 2001; Marmot 2004; Warren and Hernandez 2007; Hummer and Lariscy 2011). Given this, understanding how disparities in specific health behaviors form provides a useful vantage point to intervene. This study builds on an emerging interdisciplinary literature that emphasizes the importance of advances in biomedicine and health information for the formation of disparities (Kenkel 1991; Gortmaker and

Wise 1997; Kenkel 2007; Glied and Lleras-Muney 2008; Miech 2008; Chang and Lauderdale 2009), and merges it with evidence of the role of health care providers on patient decision-making (Pescosolido 1992; Anderson 1995; Phillips, Morrison, Anderson and Aday 1998; Haines, Hurlbert, and Beggs 1996; Smedley, Stith, and Nelson 2002; van Ryn and Fu 2003; Lien, Ma and McGuire 2004; Heritage and Maynard 2006; Franks, et al. 2006; Carcaise-Edenboro and Bradley 2008; Hahn 2009; Boyer and Lutfey 2010; Hoffman et al. 2010; Lutfey et al. 2010; Osterberg and Blaschke 2011).

Using prenatal intake of vitamin D and omega-3 fatty acid supplements as empirical examples, I find that a health disparity emerged only for the latter supplement. In-depth interviews with women and their providers provide a more complete illustration of the processes at work for these two examples. Their influence on patient behavior is not the sole force behind the prevention or formation of disparities, though, as more highly educated women were more likely to avidly seek additional information outside of their prenatal appointments. Yet, in spite of these external forces, results from these examples bring some evidence to bear on the importance of women's interactions with their health care providers, as their more aggressive intervention contributed to the prevention of a disparity. Additional research supports these results: Harper and colleagues (2008) found that states that enforce stricter seat belt laws have smaller socioeconomic gradient in seat belt use compared to those that enforce more lenient laws (Harper, Strumpf, Davey Smith and Lynch 2008). In combination, these results elevate the need to consider the how health care providers disseminate new health information and design new protocols for treatment. Designing thoughtful, carefully planned clinic protocol may prevent or alleviate the formation of a health disparity.

CHAPTER 5: CONCLUSION

How Are Social Inequalities in Health Produced?

Although we have recognized the persistent association between socioeconomic factors and morbidity and mortality for centuries (Virchow 1848; Durkheim [1897] 1979; Kitagawa and Hauser 1973; Elo and Preston 1996; Rogers, Hummer and Nam 2000; Lauderdale 2001; Marmot 2004; Warren and Hernandez 2007; Hummer and Lariscy 2011), an understanding of the origins of these inequalities and the way they begin has eluded us. The fundamental cause theory (Link and Phelan 1995) has brought us one step closer to understanding the process through which social inequalities in health are produced. By elevating the importance of *advances* in biomedical knowledge or technology, fundamental causality has helped us pinpoint the origin of certain inequalities in health. The dissemination of biomedical knowledge about the risks associated with smoking (Kenkel 1991; Adler and Ostrove 1999), diets high in saturated fats (Lauderdale 2001), cocaine use (Meich 2008), infant care (Gortmaker and Wise 1997), cancer screening (Phelan et al. 2004), and treatment of heart disease (Chang and Lauderdale 2009) served as exogenous shocks, or catalysts, for the formation of socioeconomic gradients in morbidity and mortality.

Even so, our understanding of the process through which social inequalities in health are produced is in its infancy. My overarching goal for this dissertation is to contribute to our understanding of the origins of social inequalities in health. *How are social inequalities in health produced?* To provide insight into this process, I merge the literature on the origins of social inequalities in health with the literature on social relationships and health, which has long recognized that social relationships influence health (Durkheim [1897] 1979; Syme and Berkman 1976; Baronowski, Bee, Rassin, Richardson, Brown, Guenther and Nader 1983; House, Landis and Umberson 1988, Pescosolido 1992, Marsden and Friedkin

1994; Meara 2001; Behrman, Kohler and Watkins 2002; Christakis and Fowler 2007; 2008).

Using evidence from these two literatures, I put forth a conceptual model to understand how socioeconomic status, health knowledge, and social relationships interact to produce social inequalities in health (see Figure 1). This model anticipates that an individual's socioeconomic status not only influences their behavior, their health knowledge about that behavior mediates the relationship. It also anticipates that social relationships serve as a source of new health information (social learning), and they influence behavior regardless of health knowledge (social learning). Using this model I posit that individual health knowledge and social network processes mediate the association between socioeconomic status and health behaviors, and they contribute to the formation of social inequalities in health.

By zeroing in on one particular case study, I use this conceptual model to study the emergence of prenatal health inequalities among prima gravida women from three different vantage points. Although I do not claim to test the model definitively, my results speak to the literatures on the emergence of health inequalities as well as the influence of social relationships on health.

In the first set of analyses I use the more standard approach of observing the way women react to advances in biomedicine differentially depending on their socioeconomic status (Kenkel 1991; Link et al. 1998; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009), while considering the role of social network processes. Women's knowledge about a new prenatal supplement did mediate the association between her

socioeconomic status and her consumption of the supplement somewhat, but education still remained a significant predictor of her behavior.

These findings are consistent with previous research, which has found that individual health knowledge mediates the association between education and health behavior (Kenkel 1991), and they support the expectation that people with a higher socioeconomic status, specifically education, are better positioned to benefit from advances in biomedicine. Such highly educated individuals are better equipped in the “skills of communication” (Mirowsky and Ross 2003:26-7), and are better able to decipher and benefit from novel information (Feldman 1966; Rosenzweig 1995; Gottfredson 2004; Cutler and Lleras-Muney 2010). Aside from these learned skills, their socially advantaged position improves their access to health information and increases their demand for better health (Grossman 1972). In short, research on the emergence of health inequalities, and findings from this dissertation, support the claim that when biomedical knowledge advances and begins to disseminate through the population, education matters.

Using the same approach, in the first set of analyses I also found that social network processes were strong predictors of vaccination against the H1N1 influenza. Beliefs about receiving the vaccine during pregnancy among those in women’s pregnancy networks were associated with her vaccination. Yet, even after accounting for these social network processes, education remained a significant predictor of behavior. In the second set of analyses, I use the novelty of first pregnancy as a new health event to observe changes in caffeine and alcohol consumption over the course of pregnancy.

Women reported that they learned information and were influenced by members of their network, but these processes differed by education level.

Finally, in the third set of analyses I make a comparison between the implementation of protocol for vitamin D and omega-3 fatty acid prenatal supplementation. Members of a woman's network, specifically her health care providers, influenced her to consume these supplements, but for the latter supplement provider recommendations differed by education level. Aside from their recommendations, women with higher levels of education sought additional health information outside of their interaction with their health care provider. I argue that these processes contributed to the formation of a health inequality in omega-3 fatty acid prenatal supplementation.

As anticipated, the results from each set of analyses support the idea those social relationships influence the way people behave through social learning and social influence processes. This finding is not new, and dates back to Durkheim ([1897] 1979). The contribution of this research is that it considers the way these social network processes *differ* by education, and mediate the association between education and health behaviors. The results from this dissertation suggest three findings that speak to our understanding of the way that health inequalities begin: 1) health knowledge mediates the relationship between education and health behaviors, 2) social network processes, particularly social influence, mediate the association between education and health, but 3) even after accounting for such processes education remains a significant predictor of health behaviors. Thus, individual differences in health knowledge and social network processes may help to explain *how* social inequalities in health are produced, but differences in education still largely dictate whether a gradient in behaviors will form.

Limitations

Although the case study that I have chosen has afforded me the opportunity to provide a rich description of the ways that pregnant women react to new information, there are important caveats for this research. First, by choosing to limit my attention to pregnant women who visited four clinics in the Minneapolis and St. Paul metropolitan area, my results are not generalizable beyond this population. Rather, the results bring some evidence to bear on the way that social inequalities in health were produced within this population, and they speak to the emerging literature on the origins of health inequalities. Second, although I posit that social relationships influence health, my study design limits my ability to discern whether women selected or avoided interaction with people who would influence them in a particular way (or whether others selected or avoided interaction with them). Thus, as mentioned, my findings reflect social learning and social influence processes *net* of social selection during, and prior to, pregnancy. Third, my study design, methods selected and sample size do not afford me the opportunity to make *causal* claims about the effect of various factors on health behaviors. Using detailed conversations with women and their health care providers I am able to provide a rich description of the information provided to women and the factors that they report influenced their behaviors, but I make no claims that such processes are causal. Fourth, this research focuses on health behaviors, rather than health outcomes. Although health behaviors are often strongly tied to health outcomes, the relationship is not perfect. Fifth, although every effort was made to ensure that survey interviewers conducted the interviews in the exact same way, and all in-depth interviews were conducted by me, standard caveats about survey and in-depth interview biases apply to this research. For instance, compared to women with a lower socioeconomic status, women with a higher socioeconomic status may have identified more with me and felt more at ease providing

information about their caffeine or alcohol consumption. Likewise, even though they were assured that no information from the questionnaire would be reported to their health care provider, the survey interviews were conducted at the health care clinic and women may have misreported their behaviors.

Implications for Future Research

We have identified advances in biomedical research, or changes in social norms, as an important factor for the emergence of social inequalities in health, and I argue that social network processes also play a crucial role in influencing people's health decisions. Even so, our understanding of the ways that health inequalities form is just beginning. We know little about the way that they emerge, or fail to emerge, depending on the type of health behavior or the population at risk. For instance, in observing the way women change their alcohol consumption over the course of their pregnancies, I found that more highly educated women consumed more alcohol—a result that contradicts the anticipated risk avoidant behavior among those with a higher socioeconomic status. I argue that such counter examples elevate the need to consider the valuation of health risks when studying the emergence of health inequalities.

In the simplest terms, certain health behaviors, though potentially harmful, may signal that an individual enjoys a particular lifestyle or social class. From a public health perspective, indulging in a rare hamburger at an expensive restaurant may put one at risk of becoming sick with a food-borne illness. But, aside from enjoying the taste of the burger, people may be more willing to take the risk because eating a gourmet burger is associated with a higher social class. This “rare hamburger effect” permeates any number of health behaviors that we study. Alternatively, people may be more inclined to adopt

certain healthy behaviors that are also associated with a particular lifestyle or social class. For example, they may participate in prenatal yoga classes or consume organic foods. Moving forward, we need to consider the value attached to various behaviors, as well as the lifestyle they signal.

Aside from the type of health behavior at hand, we also need to consider the population at risk when studying the emergence of health inequalities. In prior research, scholars have considered the production of health inequalities within the U.S. population as a whole. My research has focused solely on pregnant women, most of whom were motivated prenatal patients embedded within complex social networks (only one woman out of 225 did not list any people in her pregnancy network). Though fruitful, this lack of attention to gender, age and race/ethnicity begs additional questions. How might these processes have differed for a group of young men? How does age influence the way people respond to new health information? How do these processes differ depending on race or ethnicity? Such questions should be at the forefront of our minds as we explore the processes that contribute to the formation of social inequalities in health.

Preventing or Alleviating Health Inequalities

Identifying how health inequalities begin holds substantial implications for preventing or alleviating them. Explicating the role of social relationships as an important mediator of the relationship between socioeconomic status and health provides an opportunity to create interventions that may have a ripple effect across an entire network (Umberson and Montez 2010). If we are able to further discern the way that these processes differ depending on the type of health behavior and population at risk we may be able to better disseminate new biomedical information and technology, and utilize people's social networks to foster

healthier behaviors. Given that our understanding of these processes is in its infancy, any contributions to public health policy or interventions are a long way away. Yet, studying the complex processes that foster, or inhibit, the emergence of social inequalities in health holds the possibility of preventing them from emerging or alleviating those that have formed.

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