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**Hospital Assessment and Response to Environmental Pollution as a Population
Health Need: Identifying Prevalence and Predictors in Community Benefit Practices**

A Dissertation Presented

by

SARAH K. VALENTINE

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

February 2021

College of Nursing

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Hospital Assessment and Response to Environmental Pollution as a Population

Health Need: Identifying Prevalence and Predictors in Community Benefit Practices

A Dissertation Presented

By

SARAH K. VALENTINE

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Cynthia S. Jacelon, Chair

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DEDICATION

I dedicate this work to Dorothy Kleffel RN, PhD. Her work, located in the deep history and connection of Nursing and Environment and woven through with understandings from Eco-Feminism, has been a source of inspiration.

and

To my children, Abigail and Joseph Tully, who have lived the dissertation process with me. In sharing their experiences of life they, beyond words, enrich mine.

To my parents who have helped me immeasurably, in ways both practical and soulful, through the time of the PhD program and dissertation. Edward, for your great love and support. Diane, for your warm light and love. Frank, for your steady and joyful presence.

and in gratitude for

All persons working to actualize the values of Nursing.

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I am appreciative of the many ways in which Dr Cynthia Jacelon has supported my dissertation work. Perhaps the greatest of these is in setting out a life syllabus for understanding nursing disciplinary knowledge and ways of knowing. Thank you, Dr Jacelon, for welcoming me to participate. My hopes for the meaning of my PhD work, and beyond, are rooted in my understanding of the values, domains, and possibilities of Nursing; an understanding which has been greatly shaped by my study with Dr. Jacelon.

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I want to thank the Jonas Foundation, the American Association of Colleges of Nursing (AACN) and the American Academy of Nursing (AAN). It was through the support of the Jonas Foundation and the AACN, as a Jonas Nurse Leaders Scholar, that I took up a leadership project that led me to work with the AAN Expert Panel on Environmental and Public Health. Here I was welcomed and mentored in policy focused scholarship and advocacy relevant to both community benefit and environmental health. I want to express my appreciation for time and opportunity extended to AAN leaders Dr Patricia Butterfield, Dr Bobbie Berkowitz and Dr Betty Bekemeier.

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ABSTRACT

HOSPITAL ASSESSMENT AND RESPONSE TO ENVIRONMENTAL POLLUTION AS A POPULATION HEALTH NEED: IDENTIFYING PREVALENCE AND PREDICTORS IN COMMUNITY BENEFIT PRACTICES FEBRUARY 2021

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Hospitals have a growing role in improving population health. Environmental pollution is an important determinant of health with disproportionate effects on Communities of Color. This warrants hospital action. To advance such action, it is important to take stock of current hospital engagement with environmental pollution and to identify factors associated with such engagement. I investigated the following. To what extent do New York State (NYS) non-profit hospitals assess, identify, and respond to environmental pollutants as part of community benefit practices? Do factors previously reported as associated with hospital engagement of social determinants predict engagement with environmental pollution as a community health need? For this retrospective non-experimental design, a sample of 53 NYS hospitals was drawn by stratified geographical probability sampling. Hospital data were abstracted from hospital community benefit documents and IRS reporting using a priori coding in a structured categorical approach. County level data for predictive factors were gathered from demographic and epidemiological sources. Of hospitals sampled, 60.4%, 95%CI[.46,.74] included environmental pollution in community health needs assessment, 18.9%, 95%CI[.09,.32] identified a type of environmental pollution as a stated community health need. No hospital acted on a point source, industrial or transportation related pollutant. Two hospitals, 3.8%, 95%CI [.01,.13], conceptualized outdoor cigarette smoke as an environmental pollutant and went on to plan and initiate action on this community health need. Significant positive factors in models predicting hospital assessment and/or identification of environmental pollution as a community health need include: social justice in hospital mission; accountable care organization status; PM 2.5 level, and county population percentage of Persons of Color (with Hispanic). Paradoxically, collaboration on strategic planning and presence of collective impact criteria emerged as negative predictors. The findings of this study establish contextual knowledge upon which nurses, and others, may premise upstream environmental health research and development of community benefit related policy agendas and pathways to address environmental pollution as a health determinant.

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“Human beings create the environments that shape the course of human development. Their actions influence the multiple physical and cultural tiers of the ecology that shapes them, and this agency makes humans –for better or for worse – active producers of their own development.” (Bronfenbrenner , 2005, xxvii)

Prologue: Nature of Study and Relationship to Nursing Knowledge

This project of inquiry is about environment, health care systems and instrumentalization of population health ideas. This is not a direct study of nursing practice *but rather a study of the praxis of a specific population health idea (i.e. environment as a health determinant) in a dynamic health system context. This is a point of praxis in which nursing may take leadership through actualization of nursing roles, ideas, and values linked to the long-claimed nursing domain of environment.* There is a growing emphasis on population health throughout healthcare systems that represents a paradigmatic shift in the perceived responsibilities of healthcare delivery institutions. Given the emerging system changes initiated towards this end; the social contracts between nursing, health care delivery systems, and society are challenged to evolve. The ways in which these social contract expectations, roles and functional realms of operation exist and develop will support or limit the ways in which population health promotion occurs. The results of this study contribute to knowledge scaffolding which the nursing profession may utilize to lead in a progressive shaping of professional and institutional roles to more broadly incorporate an upstream /health determinants approach to population health.

The broad goals of population health must be achieved by addressing determinants of health: individual behavior and direct clinical care as well as environmental and social determinants of health. This study focuses on non-profit, ‘voluntary’, hospital community benefit activities and the assessment and response to environmental pollution as a health determinant and community health need. An interest in and recognition of the instrumentalization of ideas guides my approach in this study. *The subject of study is the extent to which non-profit hospitals in the practice of community benefit activities, assess environmental pollution, identify environmental pollution as a community health need and plan and implement actions to respond to such existing needs. Accordingly, the study investigates factors predicting assessment and identification of environmental pollution.* Findings from this study deepen the state of knowledge regarding non-profit hospital engagement with environmental determinants of health and provides substantive knowledge to better establish environment on a systemic policy agenda related to community benefit and to directly support community benefit practices. The study does not measure health outcomes directly but rather, processes and phenomena associated with addressing the health determinant of environmental pollution.

The first chapter of this work establishes evidence (for the substantial impact of environmental pollutants on health) and warrant (the social contract related role for non-profit hospitals to address pollution-related community health needs) on which a sturdy claim is based that hospitals *should* assess and respond to environmental pollution as a community health need. This normative claim that I establish, that hospitals *should* assess and respond to environmental pollution, becomes the pivotal assumption that underlies the purpose of this research study.

The second chapter is the literature review. The review explores the following questions: How have hospital systems instrumentalized/operationalized population health related ideas of social and environmental determinants of health and/or upstream health interventions? How might community benefit implementation be used to address social and environmental determinants of health generally, and environmental health specifically? What is known regarding predictors, barriers and facilitators, to engagement of social and environmental determinants of health by hospital systems? The literature review widens the scope from environmental pollution to broader social and environmental determinants of health because of the very limited amount of literature that speaks specifically to environmental pollution in community benefit and because of the relevance of this larger category of health determinants to the ways in which population health ideas are instrumentalized and become practice. The findings from Chapter two support the rationale for choice of variables and show the substance and gaps in knowledge that inform the research problem.

In Chapter Three the research problem, goals, specific aims, objectives and hypotheses are laid out; the variables are described, and the methods to test the objectives and hypotheses are explained. Chapter four reports the study findings with reference to the study aims. Chapter five explores the interpretation and implications of the study as it relates to the research problem and larger context of nursing, environmental health and community benefit.

In the article *Upstream Reflections on Environmental Health* the nursing leader Patricia Butterfield writes;

nursing has historically played a uniquely powerful role in environmental health actions, but one that has decreased in substance since at least the 1950s. The scope of nursing is being increasingly defined by those outside the profession...and (there is) the perpetuation of employment conditions that preclude the delivery of comprehensive care. (Butterfield, 2002, p. 41)

The comprehensive care Butterfield speaks to here indicates the inclusion of interactions of the built and natural physical environment with human health. She goes on to say, “There is an opportunity to reestablish the legacy of environmental health vigilance previously held by our profession.” (Butterfield, 2002, p. 41)

The findings of this study advance new knowledge in the profession of nursing. The findings of the study are directly related to the environmental domain of nursing and should provide substance from which nursing may draw to lead in the ongoing shaping of the social contracts of institutions and the profession of nursing in ways which contribute to the improvement of environmental health, thereby improving population health. More specifically, in the case of community benefit, the work of nursing may expand to lead in the establishment of environmental concerns on the agenda of community benefit policy and to innovations in assessment, collaboration, planning and actions to address environment and health. In doing this, nurses would further actualize the environmental domain of our profession and would contribute to a more profound interdisciplinary institutional process of assessment and response to community health needs.

CHAPTER ONE: INTRODUCTION

Overview

The integrity of the natural and built environment shapes the development of health in human beings. Health care institutions can play an important part in influencing this dynamic. There is great potential for nonprofit hospital systems to beneficially transform the health of populations by expanding beyond direct fee for service care to address determinants of health on a community level. Since Patricia Butterfield (1990) first introduced the idea to nursing, “thinking upstream” has developed in nursing and healthcare as a way of understanding the importance of antecedent contributors to states of health and the opportunity to intervene in risk reduction and health promotion before negative health consequences occur. This way of understanding and thinking about health very much aligns with the ways in which the concept of population health identifies specific categories of health determinants as the summative contributors to health status (Kindig and Stoddart, 2003). Notions of upstream health interventions and population health are intertwined in scholarly and grey literature. Both ways of thinking about and describing health are highly relevant to this research project, as environmental pollutants are important health determinants and take an upstream action in health.

In concert with communities and governmental institutions, there is an important role to be taken by non-profit hospital systems in attending to the environmental conditions that shape human health, including the health determinants of air, water and soil pollution. This is a role that finds possibility within the community benefit social contract held by non-profit hospital systems to serve the wellbeing of communities beyond provision of paid services. Notably, legislative reform of community benefit

requirements nudges non-profit hospitals towards engagement of broad determinants of health, as tax exempt status now requires regular assessment of community health needs and reporting of activities to respond to needs.

By assessing and responding to environmental pollution health threats and impacts within community benefit operations, non-profit hospitals have the opportunity to address fundamental determinants of health thereby improving the health of populations and realizing a meaningful pathway to fulfilling the social contract of community benefit. The American Academy of Nursing in a 2017 policy brief endorsed the active engagement of social determinants of health in community benefit practices as a means to improving population health (Swider, Berkowitz, Valentine-Maher, Zenk & Bekemeier, 2017). Some non-profit hospitals are addressing social and environmental determinants of health, yet there is little existing scholarly literature on the extent to which non-profit hospitals are assessing and responding specifically to environmental pollution within communities and the factors associated with such actions.

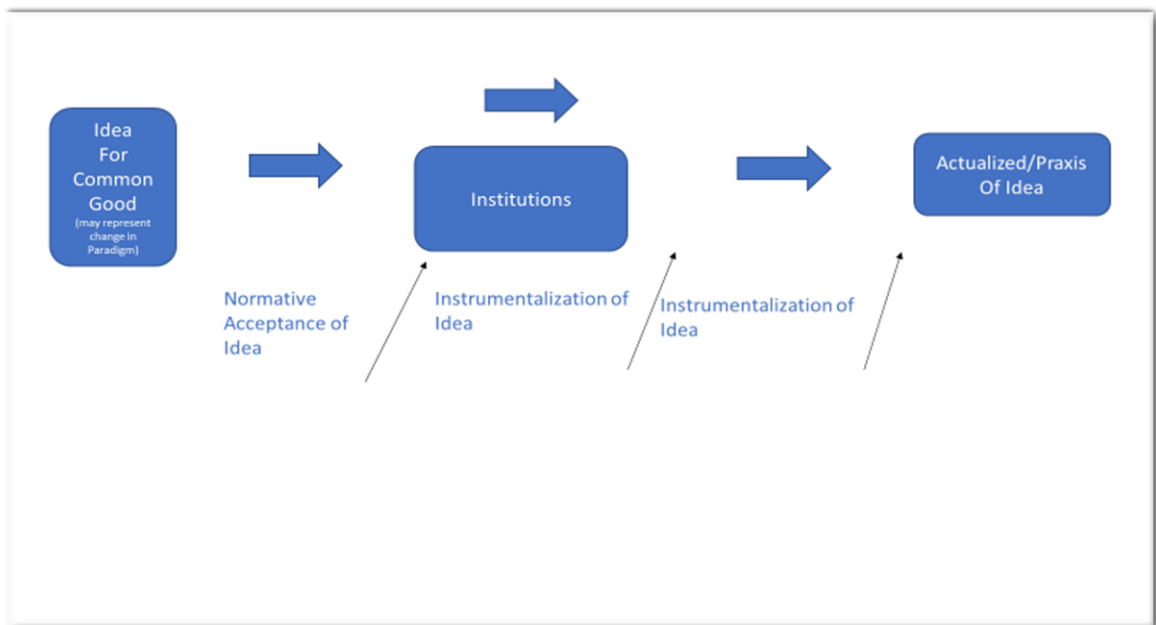
It is important to address this knowledge gap. The results of this study build the base of knowledge and evidence regarding current community benefit practice with regards to assessment and response to environmental health. The attainment of such knowledge is significant because it allows for greater traction in the realm of health policy discourse and action relevant to the promotion of environmental health in community benefit practice. The study results provide a point of reference for where we stand now and what has not yet been realized. Additionally, in identifying factors associated with assessment and identification of pollution as a community health need, the study findings contribute to knowledge that may be used in the identification of

feasible pathways and discernment of best practices for non-profit hospitals in addressing environmental health needs; thereby supporting optimization of community benefit as a mechanism for efficient and effective promotion of population health, and more fully realizing the social contract of community benefit.

Non-profit hospitals are partly creatures of social contracts, bound in mission by these contracts and, through social contracts, connected to the public and other institutions. In order for population health ideas, such as the importance of addressing environmental determinants of health to live as a reality of institutional service, the ideas must be enlivened through process of praxis or instrumentalization that occurs via these social contract bound institutions (Fig. 1).

Figure 1

Dewey's Instrumentalization of Ideas (via Institutions)



The philosopher John Dewey speaks of “an intelligence that conceives ideals and goods which do not enter into present impulse and habit”, that the real vitality of ideas are not as much in the ideas themselves but in the praxis of the ideas, “the import of the problem of actualizing the place of intelligence in conduct.” (Dewey, 1922, p. 275). Dewey speaks most specifically to ideas that have the potential to better the conditions of human life. This is directly applicable to the ideas of population health in health care systems, and environmental determinants of health specifically: these ideas hold great potential for the improvement of human health but will only bring this benefit if there is a shift to facilitate praxis, to allow for the actualization of these ideas within health care systems. The primary subject of interest in this study is the extent to which non-profit hospitals, assess and act on the environmental health determinant of environmental pollution as a community health need. My goals for this study have been to assess the extent of instrumentalization of this idea and to begin to explore the process of instrumentalization through discernment of factors associated with certain community benefit associated environmental health activities.

Non-profit hospital community benefit is both a philosophical idea (an extension of the political theory of social contract); a set of actual governmental regulations; the practice that occurs around that socio-political and regulatory commitment; and the actual benefits that may accrue to a community from these practices. What I measure in this study is community benefit at the point of practice, the actualization of ideas. This is the realm of community benefit praxis, which is nestled in the domain of social contract theory.

As Social Contract theory defines the larger domain: it places the study firmly in the area of public policy and ultimately points to the importance of the relationships between actors in society and how this relates to accountability for common good. Non-profit hospitals are one of the entities that may contribute to the actualization of population health. Other potential actors around this actualization may include governmental departments of health, local government, nursing and other health professions, and community organizations. This study contributes to a better understanding of the instrumentalization of population health (specifically environmental health determinants) within non-profit hospital community benefit practice. This may deepen a consideration of how non-profit hospitals and health professionals may best engage in work with communities and other actors on promotion of environmental health and population health more broadly. In such collaborative work nonprofit hospitals would advance the fulfillment of the social contract of community benefit by making a contribution to upstream interventions to promote health; a contribution to the common good that extends beyond paid services.

The focus of this study is an aspect of population health (the physical natural environment) that may be at the furthest margin of paradigm change for institutions. Population health has been accepted as a normative goal within health care reform agendas (AHA, 2012; Health Research & Educational Trust, 2015; Stoto, 2013). Given this context, It is important to study the process of instrumentalization of environmental health in non-profit hospital community benefit in order to understand if this idea is being actualized and what factors may be associated with such actualization. If this phenomenon is not studied what is risked is the abandonment of an idea whose

actualization has great potential for improving human health. Turning again to John Dewey; he wrote of the fate of an advance in ideas if there is insufficient attention to processes of accordant change in patterns or habits of doing, that is; “making thought abstruse and irrelevant and progress a matter of accident and catastrophe” (Dewey, 1922, p.67). My intention in this research has been to discern a type of knowledge that will aid in advancing discourse and policies regarding environmental health in community benefit and that will support purposeful processes to actualize environmental health action within community benefit practice.

The Relative Importance of Environmental Pollutants for Human Health

The state of the natural and physical environment is a substantial and modifiable determinant of health. In the year 2015 pollution was responsible for 12.6 million deaths globally, or 23% of worldwide mortality 95% CI [13,34], and, for children under five years of age, 26% of deaths 95% CI [16,38] and 22% of all disease burden in disability adjusted life years (DALYs) 95% CI [13-32] (Prüss-Ustün, Wolf, Corvalan & Neira, 2016). The Lancet commission on pollution and health report (Landrigan, 2017) notes that global mortality from diseases caused by pollution is three times higher than combined deaths due to Malaria, HIV and Tuberculosis. Globally air pollution is the 4th leading health risk for women and men, it is associated with cardiovascular and pulmonary disease as well as risk for infectious disease (Global, 2016) and a growing body of evidence supports a relationship between air pollution and cognitive impairment in both children (Peng et al., 2018) and older adults (Bejot, Reis, Giroud & Feigin, 2018; Zhang, Chen & Zhang, 2018) as well a relationship between air pollution and increasing burden of diabetes (Bowe, Xie, Li, Yan, Xian & Al-Aly, 2018). A meta-analysis shows

relationship between PM 2.5 air pollution and mental illness, particularly between long term exposure to PM 2.5 and depression (Braithwaite et al,2019).

Data from 2012 shows that 11% of deaths in high income economy Organization for Economic Cooperation and Development countries [HIC OECD] were attributable to the environment (environment here included natural and built environment but not personal choices such as smoking) (Prüss-Ustün et al, 2016). Based on 2004 World Health Organization (WHO) data, it is estimated that approximately 13% of the burden of disease in the United States could be prevented through improved environmental conditions (built and natural environment) (WHO, 2009; Prüss-Ustün, Bonjour, Corvalán, 2008). More specifically, 406,900 annual deaths in the United States and 19 disability adjusted life years lost per 1000 capita could be prevented by addressing environmental conditions (WHO, 2009 ; Prüss-Ustün , Bonjour, Corvalán, 2008)

A twelve year span retrospective cohort study of the entire Medicare population, with approximately 61 million subjects, evidenced increased mortality associated with increased exposures to air pollution as airborne particulate matter (< 2.5 um diameter) with association seen at high levels and persisting through levels currently below those set by United States national air quality standards (Di et al., 2017). This association between exposure and death was greatest for Black, Hispanic and Asian persons, men, and persons of low economic status (Di et al., 2017). Alarming, the percent point increase in health risk associated with a 10 ug/m³ increase in particulate matter exposure was three times greater for Blacks as compared to the general population (hazard ratio of 1.21 as compared to 1.07). Wu et al. (preprint, 2020) have, in a national study, found that with only a small 1 ug/m³ PM 2.5 increase in long term exposure to airborne fine

particulate matter, there was a an associated 8% (95 CI: 2,15)rise in Covid-19 mortality rate. This is an alarming finding and points to the amplified risk of PM 2.5 exposure in relationship to corona virus. This is particularly of concern for Communities of Color who are negatively disproportionally affected by both.

According to a 2017 Natural Resources Defense Council report (Fedinick.,Wu, Panditharatne, & Olson, 2017); in 2015 there were reported water sources health standards based violations for approximately 5,000 community water systems serving, together, over 27 million people (one twelfth of the entire U.S. population). The standards referenced, established to meet the requirements of the Safe Drinking Water Act, are widely criticized for insufficient stringency; lacking accountability for physiologically vulnerable populations and for inadequately incorporating up to date toxicological science. Most health standards water violations were found in small local water provision systems and nearly 80% of health standards violations had no formal repercussion or enforcement. (Fedinick.,Wu, Panditharatne, & Olson, 2017) . December 2016 minutes of the National Drinking Water Advisory Council (NDWAC) point to the locally based nature of administration of water systems and the great challenges for economically disadvantaged communities in maintaining safe water supplies (NDWAC, 2017).

Current contaminates of concern in US drinking water supplies include heavy metals (particularly lead), cyanotoxins, legionella, perchlorate , perfluoroalkyl compounds, hexavalent chromium, disinfectants and their byproducts , and, more generally, a specific class of unregulated contaminants identified as contaminants of emerging concern. Both water treatment and delivery systems as well as water source

protection (from point and non-point source pollution) are critical concerns in achieving water safe for human health. It is of note that hospital systems are major consumers of water, rely on safe water for vulnerable patients, may be significant contributors to water pollution and may respond to the burden of health effects from water pollution.

The totality of the health threat from water pollution and otherwise compromised water quality in the United States is not as well described as that of air pollution. However, there is an abundance of research that points to chemical specific health risks that have not been incorporated into the already inadequately implemented national water safety standards. Although the totality of health impact is not well known, there is reason for concern that health in the United States may be substantially impacted by compromises to water quality. Soil pollution is also a significant consideration in health as soil may act as the immediate source of exposure to toxins (e.g through childrens' play in contaminated soil) or as a temporary sink for toxins that will eventually become air, food or water borne (Duarte, Cachada, & Rocha-Santos, 2018).

The health of children is particularly sensitive to the influence of environmental degradation. The relatively higher metabolism of children may result in increased effect of toxins. In accordance with the Developmental Origins of Health and Disease (DOHaD) perspective; there are windows of particular developmental vulnerability to toxins during childhood and prenatal development. As described by Grandjean et al. (2016), "When... environmental stressors disrupt early developmental processes they may cause changes in cellular gene expression, cell numbers or location of cells that persist and then lead to increased susceptibility to disease/dysfunctions later in life." Environmental toxic exposures, then, may have impacts that manifest during childhood

and/or adulthood. Another developmental consideration is that of potential toxin induced transgenerational inheritance either through genetic mutation or epigenetic changes (changes in gene expression programming).

A major research initiative supported by the U.S. National Institute for Environmental Health and the U.S. Environmental Protection Agency (EPA) generated research that has linked environmental toxin exposure in childhood with development of asthma, obesity, ADHD, cancer and autism (Louie, Aja, & Szwiec, 2017). In a report on this sponsored research the agencies point to specific environmental interventions to protect childrens' health. These recommendations have implications on a family, community and national level (Louie, Aja, & Szwiec, 2017). In a widely publicized article Hertz-Picciotto et al. (2018) have called for the end of widespread use of organophosphate pesticides due to the compelling evidence of associated neurologic harm from prenatal and pediatric exposure. Bekkar et al. (2020) in a systematic review found that exposure to both environmental heat, elevated ozone and PM 2.5 was associated with preterm birth and low birth weight and that the greatest impact was for infants of Black mothers

There are significant disparities and injustice in both exposure to and risk of health consequences from environmental threats to health. A seminal 1987 study sounded the alarm that persons of color experienced disproportionate residential proximity to hazardous waste sites and facilities (United Church of Christ, 1987). Twenty years later a follow up report found that "race continues to be a significant and robust predictor of commercial hazardous waste facility locations" and that this was true independent of

socioeconomic factors (even as poverty rates were higher in neighborhoods that contained a hazardous waste facility than in those that did not) (Bullard, Mohai, Saha, Wright, 2008). More recent work shows a similar pattern for air pollutant exposure: Mikati, Benson, Luben, Sacks & Richmond-Bryant (2018) in a national study found that exposure to airborne particulate matter, associated with cardiac and respiratory damage, was 1.35 times greater for those in poverty than for the general population, that non-Whites experienced 1.28 times higher exposure and that Blacks, as a specific group, experienced 1.54 times greater exposure. Disparities in risk of health consequences from pollution exposures (Di et al., 2017) may be in part due to disproportionate stress experiences later in life (e.g. poverty, exposure to violence) that potentiate expression of effects from prior environmental chemical exposure (Grandjean et al., 2016). Inequities may carry harm broadly; Ash, Boyce, Chang, & Scharber (2013) found an association between greater degrees of racially based disparities in exposure to air pollutants within neighborhoods and greater overall level of exposure to air borne toxins in the same neighborhoods.

Social Contracts

Social Contract Theory

The concept of social contract, in primary form, is grounded in the relationship between a state power and the people of that state with the power ranging from despotic to democratic and serving as a guard for some form of common good. In a state of nature (without government or external control) humans may engage in distinct “self-regarding and other-regarding actions ” (Joad, 1924,p.29). As there is the potential for self-regarding actions to harm others, the state, according to social contract theory, should

serve as a stabilizing force: a synergistic expression of the will and morality of all. The state should serve to protect one from an other(s) and, in some interpretations, to work for benefit to all and for a conditional protection of individual rights. Here the people have subsumed some individual interest to the common interest/commonwealth and entrust the government to administer this work for the common good. Hegel states (1894, p. 132) “it (the state) carries back both (the family and civil society), and the whole disposition and action of the individual - whose tendency it is to become a centre of his own - into the life of the universal substance.”

Community Benefit as Social Contract

In requiring community benefit as a condition of not for profit status for hospital systems a ripple of social contract is implemented through hospital systems. Through social contract, manifest in governmental regulations, the hospital is held to carry out a benefit to the commonwealth (to the greater good) in lieu of the state providing this same benefit and, in exchange, is exempted from taxation.

The social contract of what non-profit hospitals do for tax exempt status has historically been and continues to be an evolving construct. This construct meets with the broad social purposes that the non-profit hospital holds such as those held in the mission and values of the hospital as well as the historically accumulated standing and relationship to the community served. Additionally, there is the importance of the existence of other institutions and actors that either share a commitment to the common good or whose actions substantially affect the common good.

Non-profit hospitals in their work to promote the common good and realize the principle of community benefit have the opportunity to utilize community benefit

practices to address environmental pollution as it represents a direct threat to health. It is also relevant to note that environmental pollution represents an abuse of the common good and in this way too should speak to the non-profit hospital's charge to accountability for the greater good. Uncompensated or un-remediated environmental pollution represents the use of nature as an economic externality: the cost not borne by the polluter but by those whose health is affected, and this is an insult to the common good.

The nature of community benefit as social contract is open to influence and shaping in directions that will most benefit population health. In the social contract of the state, the nature and extent of wellbeing of the commonwealth of people is substantially affected by the nature of leadership (e.g. extent of democratic input) and of the awareness and interests that guide those in decision making power. So too in hospital community benefit, the issue of how decisions are made and the influences that lead to those decisions have substantial implications for what is done and how what is done contributes, or fails to substantially contribute, to the common good.

Nursing's Social Contract, Environment and Community Benefit

Another entity that holds a social contract related to health is the profession of nursing (Fowler, 2015 , pp. 20-22). As nursing is granted by society the ability to organize autonomously as a profession and to define the scope and limits of nursing practice there is also a covenant to do well for society. More specifically to nursing, to promote health and provide the best possible care for all, without bias. The notion of care in nursing certainly includes direct care but also expands to recognize and incorporate the importance of advocacy and leadership in health policy (ANA, 2010, p. 7, p. 14).

Hospitals systems are, with other professions, units of nursing practice. Nursing as a profession and non-profit hospitals as institutions hold, together, a synergistic potential to each more fully realize respective social contracts through nursing leadership in engagement of social and environmental determinants of health in community benefit implementation. Such leadership will bring the hospital as institution to a greater realization of social contract and a greater realization of the institutions as servant (Greenleaf, 1976) while opening the expression and realization of the nursing environmental ethos through the work of the institution. It is important for nursing leadership to advance not only those areas that are prominent on the systemic agenda (Cobb and Elder, 1972 as cited in Stone, 1989) for community benefit but also those such as environmental pollutants that, although supported in potential utility of action, are not widely on the agenda of hospital system level community benefit actors.

A substantial body of literature supports the abiding presence and importance of an environmental domain in nursing (Butterfield, 2002; Butterfield, 2017; Chopoorian, 1986; Fawcett, 1984; Kleffel, 2006; Selanders, 2010; Valentine-Maher, Butterfield & Laustsen, 2018). Nursing conceptual models, Nursing and Population Health (Fawcett & Ellenbecker, 2015) and Butterfield Upstream Model for Population Health (Butterfield, 2017), incorporate environment as central concepts and an important realm for nursing action in population health. The following excerpt from interpretive statements of The American Nurses Association Code of Ethics for Nursing points to the deep ramifications of the place of environment in the ethos of nursing.

Social justice extends beyond human health and well-being to the health and well-being of the natural world. Human life and health are profoundly affected

by the state of the natural world that surrounds us. Consistent with Florence Nightingale's historic concerns for environmental influences on health, and with the metaparadigm of nursing, the profession's advocacy for social justice extends to eco-justice. Environmental degradation, aridification, earth resource exploitation ecosystem destruction, waste and other environmental assaults disproportionately affect the health of the poor and ultimately affect the health of all humanity. Nursing must also advocate for policies, programs, and practices within the healthcare environment that maintain, sustain, and repair the natural world. As nursing seeks to promote and restore health, prevent illness and injury, and alleviate pain and suffering, it does so within the holistic context of healing of the world. (American Nurses Association, 2015, p.37)

The nursing domain of environment holds great possibility yet is underdeveloped in praxis. Nursing scholarship that advances health care system engagement of environmental determinants of health actualizes an expression of the environmental domain of nursing and advances nursing as a generative source of health policy. Additionally, there is a contribution to the field of nursing in that opening pathways within health care systems to address environmental determinants of health creates further opportunities for a broad swath of nurses to become active in environmental health.

Role of Non- Profit ,Voluntary, Hospitals in Attending to the Environmental Conditions that Shape Human Health

As discussed, environmental pollution has a major effect on health. Evidence based estimations and predictive modeling has indicated that the best way to improve

health in the US is to ameliorate negative environmental conditions and address negative health behavior (Milstein, Homer, Briss, Burton & Pechacek, 2011). If hospital systems do not forge a contributory upstream role in affecting social and environmental health determinants, they will fail to address the etiology of a considerable extent of morbidity and premature mortality (RWJF, 2014; Isham, Zimmerman, Kindig & Hornseth, 2013).

Concurrent with an increased focus on population health throughout health care systems (Stoto, 2013), Community Benefit reform now requires a community health needs assessment, a plan to respond to these needs and later reporting of relevant activities. As environmental pollutants pose a substantial threat to population health, it behooves hospital systems interested in improving the health of communities to assess and address environmental determinants of health in the community (including exposure to environmental pollution). A recent Delphi study of hospital community benefit experts shows favorable opinion in support of environmental protection as an important hospital community benefit activity (Xu et al., 2019).

The parameters and pathways for such a role however are not well laid out for hospital systems. In Chapter two, I review the literature regarding hospital system approaches to addressing broad social and environmental determinants of health, particularly through the processes of Community Benefit. I look specifically at factors associated with such engagement. This literature review, and the theoretical ideas of social contract and instrumentalism, shape the selection of variables that are tested as predictors of engagement of environmental pollutants in community benefit practice. These variables will be described in detail in chapter three.

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CHAPTER II: REVIEW OF LITERATURE

Questions and Approach to The Literature

In chapter one I laid out the relative importance of environmental pollutants for human health and pointed to the potential role of non-profit hospitals in addressing environmental health as part of the social contract of community benefit fulfillment. The review of literature will focus on the questions related to how upstream social and environmental determinants of health have historically been addressed by hospital systems (achievements and limits), understanding of potential pathways forward in this role and identification of areas of knowledge that would facilitate greater progress towards fulfillment of this role. The specific questions asked of this focused review of the literature are as follows. *How have hospital systems instrumentalized/operationalized population health related ideas of social and environmental determinants of health and/or upstream health interventions. How might community benefit implementation be used to address social and environmental determinants of health generally, and environmental health specifically. What is known regarding predictors, barriers and facilitators, to engagement of social and environmental determinants of health by hospital systems.* In all of these questions the subject of inquiry will be the larger domain of which environmental pollutants as health determinants are part, literature relevant to these questions with a specific focus on environmental pollutants would of course be of particular interest.

This chapter widens the lens from the focus in chapter one; from a focus on the health implications of environmental pollutants in chapter one to the larger realm of social and environmental determinants of health (a concept in which natural environment

as health determinant is subsumed) in chapter two. The reason for this broadening in chapter two is that the engagement of environmental pollutants (as determinants of health) by hospital systems is not specifically reflected in a substantive manner in the literature, yet the literature does speak more broadly to hospital engagement of broad social and environmental determinants of health. In understanding what is happening here and the barriers and facilitators to such hospital system engagement of social and environmental determinant of health, the context, for engagement of environmental pollutants in community benefit may be better understood and critical gaps in understanding identified.

The literature search was informed by Whittemore and Knafl's (2005) guidelines for integrative review. Although this literature review is not a stand alone integrative review, several relevant elements were engaged including a protocol for the literature searches, maintenance of an audit trail, use of inclusion and exclusion criteria for extraction of relevant literature, and coding of the extracted literature that moved from a gross classification process to emergent coding within these classes with subsequent merging of codes across classification groups.

In approaching the literature the following technique was used; keyword guided searches via a scholarly database and snowballing of highly relevant references found in these searches. The scholarly database utilized was Web of Science which was chosen for its breadth and depth of inclusion of health care related, science and social science literature. The scholarly database search utilized the key term combinations 1. "hospital" and "community benefit"; 2. "hospital" and "upstream" 3. "hospital" and "social or environment" and "population health". Inclusion and exclusion criteria were applied to

extract papers from the products of these searches. Inclusion criteria for extraction consisted of a focus on a human/community setting and hospital based or collaborative assessment, intervention or initiative or findings that are made directly applicable to hospitals. Also included were United States based broad considerations of inequities in health related to spending (municipal or hospital). Exclusion criteria included value or risk based approaches to population health without explicit focus on social or environmental determinants of health, also excluded were papers with a primary focus on direct clinical care or descriptive demographics.

I perceived four major categories within the selected literature and grouped the papers accordingly. The categories are as follows. *1. The context of where hospitals have stood in relationship to addressing population health via social and environmental determinants of health* 2. *Rationale for engagement of social and environmental determinants of health by hospital systems (whereas in chapter one I made case specifically for environmental pollutants).* 3. *Models, predictors, and empirically perceived barriers and facilitators to hospital system engagement of social and environmental determinants of health (both specific and non-specific to community benefit).* Emergent themes were identified within each of these categories and papers from any category relevant to any given theme were noted and included within theme identification. These themes will be revealed in the following discussion of the literature.

The Population Health Framework and Health Care Systems

Population health has emerged globally as a goal for societies. The responsibilities for achievement are deemed to be not only in governmental public health systems and in regulation of commerce and private actions that may affect public health, but also, in hospital systems that have traditionally focused on direct care of individuals. Although not the initial leader in the ideas of population health, the United States has come to adopt this approach both in the dialogue of healthcare improvement, Law (The Affordable Care Act) and in changing stated purposes and orientation of hospital systems (Stoto, 2013). Paired with overall population health is a concern for health disparities both in health outcomes and in exposure to determinants of health.

A widely accepted formal definition of population health is that of Kindig and Stoddart (2003) “the health outcomes of a group of individuals, including the distribution of such outcomes within the group...population health outcomes are the product of many determinants of health, including healthcare, public health, genetics, behavior, social factors, and environmental factors.” The concept of population health has developed around the ideas of determinants of health and these determinants have been defined by several important bodies. Most relevant in the United States is The US Department of Health and Human services explanation (2018) which denotes the determinants of health as: Policymaking, Social factors, Health services, Individual behavior, Biology and genetics. The DHHS Healthy People 2020 website goes on to detail; “Social determinants of health reflect social factors and the physical conditions in the environment in which people are born, live, learn, play, work and age. Also known as *social and physical determinants of health*” Physical determinants are then described as

containing: “ Natural environment, such as plants, weather, or climate change, Built environment, such as buildings or transportation, Worksites, schools, and recreational settings, Housing, homes, and neighborhoods, Exposure to toxic substances and other physical hazards, Physical barriers, especially for people with disabilities, Aesthetic elements, such as good lighting, trees, or benches” (2018).

When the goals of combined health services (public health and health care delivery systems) share a focus on population level outcomes overtime and health inequities amongst population groups this calls for all actors to take into consideration the full range of determinants of health: quality and access to care, individual genetic factors and individual choices, and social and environmental conditions (HP 2020).

Within healthcare delivery systems there has been a distinct redesign and shifting of health care processes and payment systems to support high quality direct care that is measured and financially rewarded by evidence of engagement of best clinical practices and in evidenced patient outcomes. This phenomenon is often termed value based care or, from the perspective of institutions, risk based, as poor patient outcomes, in this approach, pose a financial risk to providers and institutions. This stands in contrast to a fee for service system which introduces the pressure of a perverse incentive that rewards length, number and resource intensity of episodes of care. The value based approach is often paired with a greater focus on engaging patients in health promotion and disease self-management through integrated care teams that engage behavioral elements of health.

Efforts to advance population health by addressing address social and environmental determinants of health (of which environmental pollutants are one) are on the agenda of

many hospital systems but have been engaged to a much lesser extent than efforts to improve population health through behavioral health and improved clinical care. I pause here to acknowledge the question of ‘why’; why ask of a system of direct care to also address social and environmental determinants of health. This question is taken up in greater detail later in this chapter and involves both the potential magnitude of health impact to be achieved through addressing social and environmental factors and rationale for collaborative and intersectoral work.

Before more fully addressing the rationale of hospital engagement in social and environmental determinants of health I will first discuss the context, or what the literature indicates is the current state of hospital engagement of social and environmental determinants of health. Pursuant to these two sections, I will explore how the current relevant literature speaks to models and predictors for engagement of social and environmental determinants of health in hospital systems. This may shed light on how environmental pollutants as a determinant of health may potentially be engaged in nonprofit hospital systems through fulfillment of community benefit and will inform my consideration of variables for this study.

Context: How Have Hospitals Operationalized/Instrumentalized and Engaged Social and Environmental Determinants of Health to Advance Population Health

Although there are some promising advances in the engagement of population health by hospital systems, the literature indicates major challenges to operationalization of social and environmental determinants of health in the work of these institutions. The literature shows little focus on the natural environment as a point of hospital intervention

to address health determinants even as the magnitude of the impact of such health determinates are significant for health outcomes overall and for malignant influence on health disparities. Engagement of social and environmental determinants of health is a growing aspiration of many hospital systems but in practice, the operationalization of this aspiration is limited and happens in a manner which limits full engagement.

In a paper focused on advancing a culture of health, Perez, Szekendi, Taylor-Clark, Vaughn, and Susman (2016) examined descriptions of 121 self reports of population health focused hospital initiatives (from abstracts submitted to two national associations for considerations of awards). Out of these descriptions of population health work the authors found that 28% targeted a geographic population and 12% targeted a specified group (e.g disease or risk category) within a geographic area, 65% of projects worked with community or social service partners and 13% had community level outcome measurement. These measures are meaningful because they indicate engagement with community partners and with the larger population, rather than a focus only on patients served in direct clinical care by the hospital system. Correspondingly, these broader population foci are more tightly theoretically linked with engagement of broad determinants of health that effect population health (Pennel, McLeroy, Burdine, Matarrita-Cascante, & Wang,2016; Perez et al., 2016). However, most interventions identified as ‘upstream’ in the study by Perez et al. (2016) in fact focused on services that supported direct clinical care, with a smaller proportion of interventions that provided economic or food assistance. Even in hospital initiatives that were described as contributing to population health by addressing social and/or environmental determinants of health, the greatest magnitude of the efforts described are still found in support of

clinical services (e.g care coordination) and behavioral health as compared to the contextual social environment, built and/or physical environment. No actions were identified in this study that address the physical environment.

Murphy et al. (2018) have described efforts begun in 2012 by the Johns Hopkins Community Health Partnership, with funding from the Center for Medicare & Medicaid Innovation(CMMI), to “improve care coordination and address the clinical and social determinants of health” (p. 604) with a primary focus on “high risk, chronically ill Medicaid and Medicare beneficiaries” (p. 604) and efforts anchored in primary care sites. Even though this program was specifically intended to include social determinants of health, and as Murphy et al. (2018) note, “CMMI-supported models have..been designed to achieve a shared vision of improved health across geographic areas by focusing on the social factors that affect population health, in addition to health care”(p.604), the program activities described focused primarily on support of care management and community navigators to facilitate connections to existing community resources. There was no description of efforts to improve the social or physical environment directly.

Constraint in meeting an aspiration to address broad social determinants of health is also seen in a published exploration of approaches to measuring patient risk related to social determinants of health through analysis of structured and unstructured data for patients across 10 federally qualified health centers within one large medical center (Vest, Grannis, Haut, Halverson, & Menachemi, 2017). The authors explicitly define social determinants of health as inclusive of “underlying behavioral, social, contextual, and environmental drivers of health status and health care utilization” (p. 101). However actual operationalization of social determinant of health risk was based on identifying

referrals made for services of social work, behavioral health, nutrition counseling, respiratory therapy, financial planning, medical-legal partnership assistance, patient navigation, and pharmacist consultation” (p.101). In addition to blunting sensitivity by utilizing a limited range of referrals as a proxy for a wide ranging category of health need/determinants; this operationalization essentially rules out any appreciation of risk from built or natural environment. This was a research study not a direct application of risk assessment to guide hospital practice. However, the study is part of the discourse regarding how such applied risk assessments may be undertaken. The paper does make a contribution in exploring and highlighting the importance of data collection and analysis regarding social determinants of health. However, the operationalized limitation of the concept of social determinants of health in the study illustrates the possibility for systematic and positive feedback loops of exclusion of natural environment where the dominant paradigm has previously excluded physical and natural environmental determinants of health from the scope of the work of the hospital as an institution.

A study based in rural Appalachian Ohio (Franz, Skinner & Kelleher, 2019) found that although substance abuse was identified as a substantial community health need by community members, it was not addressed in community benefit actions. The authors probed into this situation and found, through qualitative analysis of interviews with community benefit leaders, that perceptions of lack of resources, stigma, concern regarding ability of hospital to address this issue and concern of potential risks of involvement were reported to have prevented institutional action on substance abuse community needs. This study gives important contextual insight into understanding the

relationship between actual community needs, the community benefit actions, or lack thereof, to address them and the barriers or facilitators to such actions.

In contrast to the limited operationalizations/instrumentalizations of social determinants of health that have been discussed, Whitfield, Machaczek, and Green (2012) discuss an evidence based approach and model for addressing determinants of health that stands out for the depth of appreciation of determinants; looking broadly at both distal and proximal determinants of health and means to measure and examine relationships between determinants. The project described focuses on municipal investment and is based in Europe. However, I include this here because the work is directly relevant to the potential work of hospital institution in addressing health determinants, particularly in collaborative, health in all and collective impact work as it shows a consciousness of appreciating the depth and breadth of determinants that have an actual role in influencing disease on a population level. The approach specifically includes the domain of environment.

There are some examples of population health level projects by hospital systems that show promise for a deeper engagement of social and environmental determinants of health. Pennel, McLeroy, Burdine, Matarrita-Cascante, & Wang (2016) examined Community Benefit related community health needs assessments (CHNAs), ranging from 2011 to 2013, of over half of the non-profit hospitals in Texas ($n = 95$) and compared the reports to criteria for population health which were derived from the literature. The authors explain, “Two criteria for which CHNA/implementation strategies reports were evaluated reflected broader determinants of health: (1) examination of underlying etiologies of health problems (i.e., expressed some understanding of root causation) and

(2) identification of influences and strategies that reflected broader determinants, using a social ecological framework” (p. 182). The authors report that 7% of included CHNAs scored high on the criteria of ‘underlying etiologies of health problems/ root causes’ whereas 43% fell in the midrange of the scale used to assess this criterion. Regarding the criterion of ‘identification of influences and strategies that reflected broader determinants using a social ecological framework’, 2% of CHNAs had a high score and 25% fell in the midrange. Additionally, Pennel et al.(2016) found that “community conditions made up about 5% of the priorities (of the identified needs in the CHNAs), which included environmental and infrastructural conditions, such as air quality, transportation, community collaboration, and access to healthy food and exercise facilities.” (p. 180). The authors’ take on this data overall is pessimistic, finding little support for the promise of improving population health through community benefit community health needs assessments and note that, in an additional qualitative component of their research, key respondents reported that few implemented strategies were a direct result of the findings of the CHNA.

However, I hold a more sanguine interpretation of these study results. As the criterion for deep engagement of social determinants of health are met in a quarter to half of the CHNAs assessed in this study (Pennel et al., 2016); we see that in the first round of new community benefit requirements for CHNA’s a lesser, but substantial, proportion of hospitals were indeed engaging social or environmental determinants of health in a way that moves profoundly beyond a previous paradigm of almost exclusive focus on treatment episodes of illness or injury of individuals.

Overall, in answer to the question of how hospital systems have operationalized social and environmental determinants of health in hospital population health efforts; the literature shows a limited operationalization leading to a potential block to the realization of improved population health. However, there are examples of fuller operationalizations of these concepts in approaches that hold potential for greater impact on population health through addressing social and environmental determinants of health. The ideas surrounding the role of hospitals relevant to population health are in flux (Skinner, Franz, Taylor, Shaw, & Kelleher, 2018) and there is opportunity to more fully effect population health through a more highly realized engagement of social and environmental determinants of health. The literature does not speak in a substantive manner to hospital system assessment and response to environmental pollution.

Rationale: The ‘Why’ of Hospital Engagement in Social and Environmental Determinants of Health

There is great potential for nonprofit hospital systems to beneficially transform the health of populations by expanding beyond direct fee for service care to address determinants of health broadly on a community level (McGinnis, Williams-Russo, & Knickman, 2002; Milstein, Homer, Briss, Burton & Pechacek, 2011). This potential has been further indicated in the work of Chaiyachati et al. (2020); study results show reduced hospital readmissions when hospitals invest more in community directed spending. In addressing social and environmental factors, hospitals have the opportunity to have a great impact on the determination of population health (RWJF, 2014; Isham, Zimmerman, Kindig & Hornseth, 2013).

County Health Rankings, a program now run by the Robert Wood Johnson Foundation and widely used in community health assessment, utilizes a model to assign a ranking value to each US county based on a set of modifiable determinants understood to contribute to health outcomes. The developers of this model explain that the development of the model was “guided by several considerations, including a review of the literature around the impact of various factors on health outcomes, a historical perspective, weights used by other rankings, our own analysis of the variation of outcomes explained by each factor, and pragmatic issues involving communications and stakeholder engagement.” (Remington, Catlin & Gennuso, 2014, p.3). The model holds that social-economic and physical-environmental determinants of health accounted for, 40% and 10% respectively of health outcomes (length and quality of life). As regards physical environment, 2.5% of total health outcome are attributable to air pollution and 2.5% to water quality violations. The sub factors of air pollution and water quality violations are each at the same level in this model as each of the following: violent crime, income inequality, and diabetic monitoring. The remaining two health determinant categories, health behaviors and clinical care, respectively, account in this model for 30% and 20% of health outcomes.

In 2016, Hood, Gennuso, Swain, and Catlin, using data from County Health Rankings, tested the performance of the model. The authors concluded that hierarchical linear regression showed support for the assigned rankings (percentages) of contributing health factors in the model. As a whole the model accounted for 54% of variation in measured health outcomes. It is important to keep in mind that there was considerable variance by state and the factor of physical environment was found to be a significant predictor in only 7 states (in five of these states it was the second most important

contributor to health). However, the authors note that the study may have been underpowered for some states, a power analysis was not provided.

Recent thought and health policy directions, point to hospitals systems as potential agents in affecting social and environmental determinants of health (Butler, S., Grabinsky, J., & Mas, 2015; Erickson et al., 2017). The Robert Wood Johnson Commission to Build a Healthier America (2014) a group charged with advancing the health of the nation (p.2) made three primary recommendations, the third of which is as follows: “The nation must take a much more health-focused approach to health care financing and delivery. Broaden the mindset, mission, and incentives for health professionals and health care institutions beyond treating illness to helping people lead healthy lives” (p.9). In 2019 the National Academies of Sciences, Engineering, and Medicine published *Integrating Social Care into the Delivery of Health Care: Moving Upstream to Improve the Nation’s Health*. In this consensus report the academy call for health care organizations to “..make and communicate an organizational commitment to addressing health-related social needs and health disparities at the community and the individual levels” (NAS,NAM,NAE, p. 10). Non-profit hospital implementation of community benefit has been identified as an important mechanism to accomplish such change (Hester, Stange, Seef, Davis, & Craft, 2015; Rosenbaum, Byrnes, Rothenberg, Gunsalus, 2016).

The current state of knowledge reveals the importance of addressing social and environmental health determinants in order to improve population health. Given that some research indicates that social policies are the most effective mechanism for achieving progress in this realm (McAuley et al., 2016), why not then leave this to the work of government, why expand the focus of the work of non- profit hospitals to include

efforts to address social, economic and physical environment, as well as health behaviors and clinical care? Consideration of the utility of this pathway must take into account the projected magnitude of the health impact of addressing social and environmental determinants of health and the likelihood that non-profit hospital engagement will move the needle forward on improving these determinants. The first part of this equation is supported by the evidence noted in the discussion to this point. The second is currently less quantifiable but is supported by ideas such as collective impact (Kania & Kramer, 2011) that indicate that multi-sectoral work offers greater potential for impact than work within one sector. Another relevant concept here is that of quality in health care. A well know metaphor in healthcare quality is that of layers of swiss cheese in which each additional layer (of quality promotion measure) makes less likely the occurrence of a hole in the layers (the hole representing a potential preventable poor outcome). Population health improvement has been identified as part of the roadmap to quality health care in the Unites States (National Quality Forum, 2014) and efforts across different sectors to address social and environmental determinants of health may be seen as layers that build quality for population health. The National Quality Forum (2016) calls for the importance of assessing where health needs are the greatest and responding to these needs in order to improve population health.

Bernier (2009) has observed that even in nations with strong stated commitments to improving population health (i.e. Canada and Sweden), government language and goals for addressing social and environmental determinants of health have not been fully realized as there are constrictions in government power to address determinants on a broad social welfare level (Canada) or to enforce the implementation of intended

interventions (Sweden). Collective impact ideas tell us that efforts to address social and environmental determinants of health may be most successful if government is joined in shared goals and reinforcing activities by other actors, such as non-profit hospital systems. Given the importance of social and environmental determinants to health and the productive potential in collaborative, and leadership, roles for hospitals in addressing these determinants It will not be a subtraction from the societal contributions of hospitals to broaden the scope of involvement to include social and environmental determinants but rather a deeper saturation of a culture of health.

By engaging social and environmental determinants through community benefit, hospitals more fully assess and respond to realities affecting health and therefore more fully realize the responsibility of social contract inherent in community benefit (to provide benefits to the community, e.g. improved wellness, beyond paid services). Kindig and Millstein (2018) write of a ‘balanced portfolio’ in health care, that is a combination of investments in health that balances what will have the most impact with what is possible with all potential actors. A manifestation of such an approach is described by Hester (2018) who offers examples of Vermont communities that have moved past barriers to deciding rationally how to engage a relevant ‘balanced portfolio’. This, Hester shows, has been done in identifying broad wellbeing goals on a community level, such as a community that is “physically healthy, mentally healthy, financially secure, well nourished, well housed” (p. 576) then developing targeted strategies to reach those visions.

This section of chapter two has primarily focused on the ‘Why’ of non-profit hospital system engagement of social and environmental determinants of health. The next

section will move on to the ‘How’ ; in this I will examine the relevant literature for what is known regarding models and predictors of non-profit hospital system engagement of social and environmental determinants of health. Kindig and Milstein (2018) in speaking to the need for ‘balanced portfolios’ of investments of health directed resources propose that, “Research goals should be to understand what perpetuates imbalanced investment and to inform judgments about promising alternatives.” (p. 583). Based on the content presented in chapter one regarding the relative health impact of air, water and soil pollution and the rationale developed in this section for hospitals to engage in social and environmental determinants of health; it stands that environmental pollution is an important, yet perhaps neglected, health determinant for hospital systems to address. In order to design a study to assess if environmental pollutants are addressed by non-profit hospital systems and how they may be addressed, it was important to first review what is known regarding the factors and practices that may facilitate engagement of the larger category of social and environmental determinants of health.

One of the long range goals of my research is the opening of possibilities for focusing on the impacts of health in ways that appreciate and respond to all significant health determinants (thereby contributing to the potential for improved population health and health equity). Environmental pollution may represent a greater paradigm shift in the work of hospitals than some other socio-environmental determinants of health. There is work to be done in opening pathways to hospital work on the degradation of the natural environment yet, I share here an example of work that may be at the vanguard. Seattle Children’s Hospital Livable Streets Initiative works to create ‘neighborhood green streets’ (Seattle Children’s Hospital, 2014) where, through redesign and plantings, traffic

is slowed, the environment for walking and biking is made more amenable and plantings serve to build beauty as well as improve water quality through improved stormwater drainage. The program also improves and constructs bike pathways in the city. The total reduced automobile use that is encouraged with this program, and other hospital initiatives to reduce automobile use such as ride sharing and funding of a light rail system (Seattle Children's Hospital, 2016), should reduce local air pollution that contributes to cardiac and respiratory disease as well as carbon that has distal health effects via climate change.

Predictors and Models: How Hospital Systems may Address Social and Environmental Determinants of Health

Perez, Szekendi, Taylor-Clark, Vaughn, & Susman (2016). have developed a conceptual model that indicates the elements of difference between a traditional health care system and what is termed a 'health community system' with regards to approaches to population health. The conceptual model is inspired the Robert Wood Johnsons Foundation vision of a Culture of Health in which improved population health is achieved. The conceptual model set forth by Perez et al. shows the 'health care system approach' as one that focuses on patients served by the institution and measures outcomes on the hospital or program level, may engage upstream interventions but that this is done primarily within the health care systems and that most interventions are at the level of detection and treatment of disease. This contrasts to the 'health community system' in which the system focuses on the geographic area as a whole and outcomes are measured on this level, upstream interventions take place at a community level and focus on prevention of disease and screening (Perez, et al 2016). Perez et al emphasize the

relevance of addressing health on a geographic level but also note the importance of all approaches for population health.

Pennel, Burdine, Prochaska & McLeroy (2017) looked at an overview of models for community benefit community health needs assessment (18 models) and identified 11 commonalities amongst these models. Included in these aspects were developing partnerships and developing vision and scope. The authors speak to need for better support (e.g. from government) in maintaining partnerships.

In an earlier work Pennel and colleagues (Pennel, McLeroy, Burdine, & Matarrita-Cascante, 2015) move beyond descriptive information to look at relationships between characteristics of hospitals and engagement of community health needs assessment (CHNA) with measures of CHNA quality. Quality was operationalized with 16 criteria derived from the public health literature:

Partner and stakeholder involvement, organizational structure and personnel considerations, definition of community, examination of data, identification and prioritization of issues, examination of causation of problem, consideration of local context, identification of assets or resources, clear goals and measurable objectives, action plan or strategies to address issues, evidence-based strategies, reflects social determinants of health, description of the process, feasibility and sustainability, evaluation of plan, and accessibility of plan. (p. e104)

The strongest associations with total quality measures were with consultant led CHNA processes and collaboration with local departments of health. In a final regression model, the greatest variance came from collaboration with a local health department (positive relationship) and staff led CHNAs (negative relationship). Weaker positive associations with total quality criteria included hospital -size, urban based location, and system-based hospitals. Faith based hospital showed a weak negative association (even though they were independently correlated with system-based hospitals).

A qualitative, grounded theory approach, study by Skinner, Franz & Kelleher (2018) found, in interviews with community benefit administrators, a perceived valuing of an increased focus on community health related to community benefit. The authors also noted the emergence of an expression of uncertainty related to if and how to move forward on social determinants of health that was related to a perceived lack of guidance on such a course of action. Other relevant findings included a broad sense of financial limitations for community benefit related actions, however some participants from hospitals that were urban or part of larger systems (such as Accountable Care Organizations) spoke not of limitations but of adequate funding and of the integrative and holistic roles that the community benefit processes took on.

Sampson, Gearin, & Boe (2015) describe a community health assessment partnership between a County Department of Health in Wisconsin and three medical centers within that county. The authors judge the partnership to have been successful in both sharing information and ‘reaching upstream’ to identify social and environmental determinants of health. The authors note two processes which are deemed to have contributed to this success. The first being that a priori assessment domains were specifically developed to span broad social determinants of health and that this was felt to have deepened what was being addressed, “(the community health assessment) examines a range of factors that influence health—health behaviors, health care, the physical environment, and the social and economic environments. Emphasis on these broad determinants of health helped elevate social determinants (income, education, and employment) in a way that is new for this county and represents a crucial step toward a longer-term ... goal of mobilizing health improvement activities related to the social

determinants of health.” (p.29). The second process of importance was involvement of community members, the process involved community members not only in identifying community health needs but also prioritizing needs for actions based on the following considerations “How serious are the consequences?, Is it likely that action taken will make a difference? Will it be necessary to change behaviors and attitudes in relation to this issue? Are the necessary resources and leadership available?” (p. 29).

With regards to a different type of community benefit collaboration, Carlton and Singh (2018), using a nationwide sample, found that hospital collaboration with a local department of health in implementation strategies to address community health needs was associated with greater hospital investment in community health improvement.

Cramer, Singh, Flaherty, & Young (2017) also examined relationships between characteristics of hospitals conducting community benefit community health needs assessments and outcomes. In this study of 1,593 hospitals, the outcomes were conceptualized as ‘CHNA progress’ and were derived from an abbreviation of self reported items on the schedule H IRS reporting form for community benefit which question hospital prioritization of community health needs, and development and implementation of relevant hospital plans and response strategies. The authors found greater CHNA progress associated with hospital systems characteristics of urban location and affiliation with a larger healthcare system or accountable care organization. There was as negative association with hospitals serving a higher percentage of uninsured persons, with a higher per capita income in the community and with a religious affiliation.

In a related paper, Singh, Cramer, & Young (2018a) explore the relationship of the same outcome variable of ‘CHNA progress’ with an independent variable of ‘community need’. The independent variable is operationalized as an index created from items from the county health rankings representing physical environment, socio-economic factors, health behaviors and access to direct health care services to the outcome variable in this study. The number of hospitals included this study is 1,331. Participation in a community wide plan (one element of ‘CHNA progress’) was found to differ significantly across quartile groups of community need, with hospitals in communities of greatest need having less participation in a community wide plan than each of the other quartile groups. The relationship between overall community health needs and CHNA progress was not statistically significant in regression analysis (although the authors note a negative association). Factors that did contribute significantly to variance in ‘CHNA progress’ ,in positive relationship, included: system affiliation, accountable care organization membership, market competition index (with increase indicating closer to monopoly), percent of hospital beds in area run by for-profit hospitals. There was a negative significant contribution to variance in CHNA progress from the wage index (an index to compare hospital wages with national average).

In an additional paper written by the same first author (Singh, Young, Loomer, & Madison (2018), older data from 2009 – 2011 was explored to better understand the influence of state level community benefit regulations. The independent variables included four types of state regulation, “(1) report community benefits, (2) conduct community health needs assessments, (3) provide minimum levels of community benefits, or (4) adhere to minimum income eligibility standards for charity care.” (

p.238) The authors found an association between state community benefit regulations and increased spending on community benefit. Johnson et al. (2019) had similar findings, with the presence of state laws on community benefit associated with increased funding for community benefit. Chaiyachati et al. (2020) in a large national study of non-profit hospitals found hospitals spend < 7% of total hospital spending on health care related community benefit spending and < 1 % of total hospital spending on community directed community benefit spending.

Begun & Potthoff (2017) identified hospital characteristics that were predictors of upstream engagement of social and environmental determinants of health. Elements of such engagement were derived from hospital responses to the American Hospital Association's Population Health Survey. The hospital characteristics identified as predictors of upstream engagement included; large hospitals, urban location, non-profit status, teaching hospital status, part of larger healthcare provision systems, full time support for population health efforts, executive support for population health efforts and system level coordination for population health efforts.

Summary of the Relevant Literature

What then is the gestalt of the state of the literature on the question of 'How'; how non-profit hospital systems might best address social and environmental determinants of health to improve population health? The literature based in conceptual models reveals several emergent themes relevant to the closely threaded concepts of population health, upstream health interventions, and social and environmental determinants of health. Among these is the importance of looking with breadth and depth at the root causes of health (including social and environmental determinants) and understanding health in

broad terms of well-being. There is emphasis put on focusing interventions and health outcome measurements not only on patients of a hospital system but also on the population of a geographic area. Finally, the importance is stressed of shared responsibility and partnerships (across sectors and organizations) for identifying and addressing social and environmental determinants of health.

In the analytic literature relevant to this question, there are several dominant themes regarding factors that are associated with higher performance in public health quality measures, progress in implementation of efforts to address community health needs and overall population health orientation. These factors include: hospital membership in a larger health care system or accountable care organization, larger hospital size, urban location, and no explicit faith based association. The socio-economic and health status of the community itself show conflicting influence across studies. For engagement of social and environmental determinants and community health improvement in community benefit: the analytic literature also points to the importance of collaborative work across the stages of community benefit processes with both community organizations and local departments of health and an intentional a priori guided approach to assessment and response of socio-environmental determinants of health. I recall the discussion from earlier in this chapter that indicates the possibilities of limited operationalizations of social and environmental determinant of health as a barrier to intentions of hospital systems to improve population health.

The conceptually proposed hospital contributors to population health, and the identified predictors of hospital engagement with social-environmental determinants of health were drawn on to inform the selection of independent variables that were tested in

this study as predictors of hospital engagement with the specific health determinant of environmental pollution.

For non-profit hospital systems to advance a reality of improved population health via engagement of social and environmental determinants of health, and of environmental pollutants specifically, it will take an instrumentalization of the ideas of population health in the context of systems previously focused almost solely on health care delivery. The knowledge generated by this study may be utilized to develop pathways for nurses to take a leadership role in this instrumentalization.

John Dewey (1922) has told us,

the genuine heart of reasonableness (and of goodness in conduct) lies in effective mastery of the conditions which *now* enter into action. To be satisfied with repeating, with traversing the ruts which in other conditions led to good, is the surest way of creating carelessness about present and actual good. (p. 67)

Chapter II References

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CHAPTER III: METHODS

Rationale For Study

In chapter one, and prologue, I laid out the logic that forms the rationale for this study. The substantial impact of environmental pollutants on population health is established as evidence. The warrant, as explained, is the normative role for non-profit hospitals, which are socially contracted to community benefit and called to improve population health, to engage community benefit processes in ways that will address environmental pollution when present as a community health need. The normative claim established is that non-profit hospitals that hospitals *should* assess and respond to environmental pollution.

In order to support this role, and in doing so build the non-profit hospital contribution to population health, it is important to understand the extent to which non-profit hospital systems currently engage environmental pollutants as community health needs in community benefit processes and subsequently, to identify the factors that are associated with such engagement. The research problem of this study is based on this claim of need and the corresponding gap in knowledge related to this area of understanding.

The review of literature (Chapter II), demonstrates the gap in any substantive published literature specific to U.S. hospitals and actions to address environmental pollution as part of community benefit processes. Importantly, the review of literature, uses a widened lens to explore not only environmental pollution but hospital system based instrumentalization of population health ideas more generally. This exploration of

the larger relevant field helped to identify considerations, and subsequently variables, relevant to the research problem.

Research Problem, Goals, Aims, Objectives and Hypotheses

Research Problem

The identified research problem that this study addresses is as follows: There is a gap in knowledge regarding the presence or absence of non-profit hospital engagement of environmental pollutants as determinants of health and the factors associated with such engagement.

Research Goals and Significance

Goals

The overarching goals of this study are as follows: 1. To evaluate the extent to which non-profit hospitals, engaged in community benefit processes, incorporate assessment and response to environmental pollutants as part of efforts to identify and address community health needs. 2. To evaluate community level and institutional level factors as predictors of such assessment and response.

Relevance and significance of research goals

Given the substantial impact of environmental pollution on health outcomes including cardiovascular disease, asthma, chronic obstructive pulmonary disease, diabetes, immune system compromise, cancer risk and cognitive decline; it is important to know if environmental pollution is recognized and addressed at the community level by non-profit hospitals that hold a social contract to recognize and respond to community health needs. An understanding of where the state of action is on this point is necessary to discern and substantiate this concern as a policy problem and, if warranted, to include

and advance these concerns on health policy agendas. Accordingly, evaluating the relationship between the extent of engagement by non-profit hospital systems with environmental pollutant health threats, the extent of pollution in communities, and the demographic characteristics of race (the greatest disparity in environmental injustice) , serves to shed light on disparity related policy concerns in this manifestation of community benefit. A fuller understanding of institutional level factors associated with engagement of environmental community health needs in community benefit practice is important in order to develop pathways and best practices to transform community benefit to more broadly address population health. An understanding of such institutional factors is also highly relevant to the relationship that nursing holds to the practice environment of hospitals systems and to the practice dimension of environment. An improved understanding here will aid nurses in strategic leadership for a wholistic concern and commitment to person, environment and health (Fawcett, 1984). The aims, objectives, hypotheses and variables for this study flow from the research goals, the significance of the goals and the relevant literature. The rationale for choice of each variable will be further explained in this chapter.

Research Aims with Objectives and Hypotheses

Specific Aim One.

The First Specific Aim for this study is to identify the extent to which non-profit hospitals, within the context of community benefit processes, include assessment of environmental pollutants as an aspect of community health needs assessment. *Objective for Aim One:* From sample of non-profit hospitals, describe proportion that includes

assessment of environmental pollutants in Community Health Needs Assessment (CHNA).

Specific Aim Two.

The second specific aim is to examine the proportion of hospitals that have identified environmental pollutants as specific community health needs/priorities in community benefit processes and to identify the extent to which those hospitals that do identify environmental pollutants as a community health need go on to plan to address and/or implement actions to address these environmental health needs (independently or in partnerships). *Related Objective (first objective for Aim two)*: From sample of non-profit hospitals, describe proportion that identifies/prioritizes environmental pollutants as a Community Health Need in the CHNA as reported on IRS form 990 schedule H.

Related Objective (second objective for Aim Two): From sub-sample of non-profit hospitals that have identified environmental pollution as a community health need, describe proportion that include measures to address these needs in CHNA related strategic planning. *Related Objective (third objective for Aim Two)*: From sub-sample of non-profit hospitals which have identified pollution related community health needs, describe proportion that have implemented primary or secondary prevention measures to address these pollution related community health needs.

Specific Aim Three

The third specific aim for this study is to discern potential relationships between community level factors associated with non-profit hospital system, community benefit related, assessment and engagement of environmental pollutant health determinants.

Related Objectives for Aim 3

Assess difference or relationship of community level factors with 1. Presence or absence of assessment of environmental pollutants in CHNA. 2. Presence or absence of identification of environmental pollutants as a community health need/priority in CHNA 3. Presence or absence of strategic planning to address CHNA identified environmental pollution through primary or secondary prevention 4. Presence or absence of implemented actions to address CHNA identified environmental pollution.

Research Hypotheses 1-4 (non-directional)

There is a relationship between county level *Local Air Pollution PM 2.5* and 1. Presence or absence of assessment of environmental pollutants in CHNA. 2. Presence or absence of identification of environmental pollutants as a community health need/priority in CHNA 3. Presence or absence of strategic planning to address CHNA identified environmental pollution through primary or secondary prevention 4. Presence or absence of implemented actions to address CHNA identified environmental pollution.

Research Hypotheses 5-8 (non-directional)

There is a relationship between county level residents population percentage of *Persons of Color with Hispanic* and 1. Presence or absence of assessment of environmental pollutants in CHNA. 2. Presence or absence of identification of environmental pollutants as a community health need/priority in CHNA 3. Presence or absence of strategic planning to address CHNA identified environmental pollution through primary or secondary prevention 4. Presence or absence of implemented actions to address CHNA identified environmental pollution.

Specific Aim Four

The Fourth Specific Aim_for this study is to *discern potential relationships between institutional level factors* associated with non-profit hospital system, community benefit related, assessment and engagement of environmental pollutant health determinants.

Related Objectives for Aim Four

Assess difference or relationship of institution level factors with 1. Presence or absence of assessment of environmental pollutants in CHNA. 2. Presence or absence of identification of environmental pollutants as a community health need/priority in CHNA 3. Presence or absence of strategic planning to address CHNA identified environmental pollution through primary or secondary prevention 4. Presence or absence of implemented actions to address CHNA identified environmental pollution.

Research Hypotheses 9-12 (non-directional)

There is a relationship between hospital system Accountable Care Organization proximate affiliation and 1. Presence or absence of assessment of environmental pollutants in CHNA. 2. Presence or absence of identification of environmental pollutants as a community health need/priority in CHNA 3. Presence or absence of strategic planning to address CHNA identified environmental pollution through primary or secondary prevention 4. Presence or absence of implemented actions to address CHNA identified environmental pollution.

Research Hypotheses 13-16 (non-directional)

There is a relationship between CHNA a priori social-environmental category for assessment and 1. Presence or absence of assessment of environmental pollutants in CHNA. 2. Presence or absence of identification of environmental pollutants as a community health need/priority in CHNA 3. Presence or absence of strategic planning to address CHNA identified environmental pollution through primary or secondary prevention 4. Presence or absence of implemented actions to address CHNA identified environmental pollution.

Research Hypotheses 17-20 (non-directional)

There is a relationship between Collective Impact Criteria Total 1. Presence or absence of assessment of environmental pollutants in CHNA. 2. Presence or absence of identification of environmental pollutants as a community health need/priority in CHNA 3. Presence or absence of strategic planning to address CHNA identified environmental pollution through primary or secondary prevention 4. Presence or absence of implemented actions to address CHNA identified environmental pollution.

Research Hypotheses 21-37 (non-directional)

There is a relationship between each of the three elements of *Community Collaboration* and the total of *Community Collaboration* with 1. Presence or absence of assessment of environmental pollutants in CHNA. 2. Presence or absence of identification of environmental pollutants as a community health need/priority in CHNA 3. Presence or absence of strategic planning to address CHNA identified environmental

pollution through primary or secondary prevention 4. Presence or absence of implemented actions to address CHNA identified environmental pollution.

Research Hypotheses 38-54 (non-directional)

There is a relationship between There is a relationship between each of the three elements of four elements of *Hospital Mission* and the total of *Hospital Mission* with 1. Presence or absence of assessment of environmental pollutants in CHNA. 2. Presence or absence of identification of environmental pollutants as a community health need/priority in CHNA 3. Presence or absence of strategic planning to address CHNA identified environmental pollution through primary or secondary prevention 4. Presence or absence of implemented actions to address CHNA identified environmental pollution.

Sample

Sampling Approach

The sample was generated from stratified geographical probability sampling (at a county level) of New York State (NYS) private non-profit hospitals. I drew down counties in order from a randomized list of all NYS counties. For each of the counties selected I added all eligible hospitals within the counties to the sample. Counties were excluded if they did not have a qualifying hospital (this occurred with two drawn counties). I continued this process until the number of included hospitals met the desired number of 53, based on a priori power analysis. I later drew further from the county list as some hospitals were eliminated secondary to exclusion criteria. Also, because of the presence of increased air pollution in New York City in comparison to the rest of the state and my desire to include this source of variation, I purposively included/forced at least

one county from New York City. To do this, I selected at random one county from the 5 New York City counties (New York Co., Kings Co., Bronx Co., Richmond Co. and Queens Co.) and include this county first then turned to the process described above. I used the publicly available program, ‘research randomizer’, for both selection processes.

Stratified random sampling has been identified as a rigorous probability sampling approach which supports generalization (Kerlinger & Lee, 2000 p. 179, Polit & Beck, 2017, p. 256). Just as in typical random sampling, stratified random sampling is also informed by the logic of the central limit theorem (Polit, 2010 p. 89, 103). In this case the theoretical sampling distribution would consist of infinite stratified samples.

From each subject (each included non-profit hospital) data was drawn from the most recent community health needs assessment (CHNA), with implementation plan if this existed, that was within the years 2015-2017 (so that the subsequent years nonprofit tax reporting may be included as a data source). Hospital tax reporting (IRS form 990 Schedule H) was also a source of data. To operationalize both institutional and community characteristics, data was drawn from various sources (as described in the variables section).

New York State is an appropriate choice to define the scope of the sample frame as the state holds a variety of wilderness, agricultural, industrial, rural, suburban and urban areas which suggests variance in pollution levels and in types of non-profit hospitals (e.g., size, ACO status). There are 62 counties in NYS with, in 2018, a total of 166 non-profit hospitals and 24 public hospitals. The stratification is appropriate to conduct by county as the county level is widely used for public health data collection and is a widely used framework in population health assessment (e.g. RWJF County Health

Rankings). The sampling frame and population here are the same (NYS non-profit hospitals).

The direct unit of analysis in this study is the private, non-profit hospital. Submission of 990 Schedule H was the determiner of individual hospital status. It is notable that some variables are derived at the county level. Inclusion criteria for hospitals were non-profit private community (non-specialty), acute care or critical access hospitals. This inclusion criteria means that public hospitals, veteran's or military hospitals, and children's hospitals and other specialty hospitals were not included. Exclusion criteria were: lack of CHNA or IRS form 990 within the specified years. CHNA/CHA were included if they were claimed by the hospital even if they were primarily authored by another source, such as local health department.

A priori power analysis

In order to determine appropriate sample size and support adequate statistical power an a priori power analysis was completed for use of multiple logistic regression. An analysis power analysis using the logistic regression calculator from Dartmouth <https://www.dartmouth.edu/~eugened/power-samplesize.php> indicated need for sixteen subjects (hospitals) if estimating with a moderate effect size and seventy-seven subjects if estimating a small effect size. A second analysis was conducted with G*power analysis software with two tails, an alpha of .05, a Beta of .20, an R^2 of 0 and an OR of 3; a projected sample size of 53 hospitals was determined.

Rationale for sampling approach

The proposed sampling strategy allows for an exploration of relative contribution of independent variables to freely varying dependent variables (see plan for analysis) in a manner that is designed to capture the true distribution and relationship of these variables in New York State from a county based perspective. The geographical stratified random sampling approach supports generalization of study findings to the population of interest (NYS non-profit hospitals) and best aligns with both aspects of the research problem; identifying the presence or absence of non-profit hospital engagement of environmental pollutants as determinants of health as well as exploring the factors associated with such engagement.

I had considered quota sampling for this study. Although quota sampling would ensure the ability to evaluate factors varying with difference (in selecting cases by variables of interest so that there is variability and/or extremes for comparison of associated variables) this would also bias detection of these variables as contributors to difference (unless only selecting cases by degree of engagement with environmental pollution as a dependent variable). Also, if subjects/hospitals were selected for qualities that would otherwise be measured on an interval or ratio level, the process of selection by category would act to change that variable to a lower level of measurement (dichotomous high/low vs an interval/ratio) – thus reducing variability. Finally, quota sampling does not support generalization of findings as random sampling does. Future research pursuant to this study may draw further on case method or quota sampling in order to gain insights provided by these approaches

Variables

Descriptive and Dependent Variables: Community Benefit Process Stages and Environmental Pollution

Variable: Assessment of environmental pollutants in CHNA

Why this variable and level of measurement

This variable operationalizes the concept of assessment of environmental pollutants as an aspect of community health needs identification thus facilitating the pursuit of specific aims one, three and four and contributing to the overall goals of the study. The level of measurement is dichotomous, a (yes/no) variable.

Source and plan for extraction

Community health needs assessment (CHNA) description of assessment process, methods and data. Abstracted from CHNA for either 2015/2016 or 2017 (i.e. the most recent CHNA completed, excepting 2018 as will want to have a subsequent year for tax form 990 schedule H analysis related to aim two). The IRS final rule on Community Benefit CHNA (2014) states , “ (the) CHNA report will be considered to describe the process and methods used to conduct the CHNA if the CHNA report describes the data and other information used” (From p. 78967). The plan for extraction is based on a yes/no choice if consideration of environmental pollutants were included in the CHNA. Included (yes) will be chosen if description of process includes environmental pollutant assessment specifically or if a relevant data source and/or findings are noted.

About data.

This variable is measured directly from the researcher’s reading and extraction of relevant description from the institutional report of community benefit assessment

activities (as required by federal regulations). The direct self reported nature and the federal requirement for reporting are strengths in this variable measurement. Potential weaknesses include the possibility that some environmental assessment may be completed but not reported in the document. There is a potential for bias in that less well supported community benefit programs may have less consistent assessment and reporting processes. There is no known information on distribution of this variable in the population (state or national).

Variable: Identifies Environmental Pollutants as a Community Health Need

Why this variable and level of measurement

This variable captures the actual identification (positive finding) of environmental pollutants as a community health need (one that is held up or prioritized in the report). This variable also facilitates investigation of strategic planning or action for an environmental pollution community health need. Level of measurement is dichotomous (yes/no) variable

Source and plan for extraction.

Extract from: Direct examination of full text of 2015/16/2017 CHNA , also IRS Form 990 2016/2017/2018 (one year post CHNA included for study), schedule H, Part V, item 11, section C which states, “Describe in Section C how the hospital facility is addressing the significant needs identified in its most recently conducted CHNA *and* any such needs that are not being addressed”. IRS form 990 Sched H should, when completed by a hospital, describe needs addressed *and* not addressed in the last CHNA. The plan for

extraction will be based on a yes/no choice regarding whether environmental pollutants were identified as a health need/priority (regardless of if they were acted on or not).

About data

The initial report of this data is directly from the institution of interest. Potential weakness include the possibility of omitting identified needs, or failing to pull through to IRS reporting, needs that were not addressed or perhaps were not recognized as being within the notion of scope of hospital role in community benefit. However, this risk is overcome in reading and abstracting from the CHNA document. Strengths include the specific IRS direction to list identified community health needs that were *not* addressed as well as those that were. As with the previous variable, differences in institutional support for community benefit could potentially bias accurate reporting. There is no known information on distribution of this variable in the population (state or national).

Variable: Strategic Planning to Address Environmental Pollution as a Community Health Need

Why this variable and level of measurement

This variable operationalizes the concept of planning for actions to address environmental pollution as a community health need. This facilitates the pursuit of specific aims two, three and four and contributes to the overall goals of the study. The level of measurement is dichotomous (yes/no) variable.

Source and plan for extraction

Extracted from: either 2015,2016 or2017 IRS form 990 schedule H Part V: 8-10 and corresponding Implementation Plan: The researcher examined the narrative description in

form 990 schedule H to discern whether there is or is not an inclusion in strategic planning for a primary or secondary prevention action that addresses environmental pollution. Also, the researcher located and extracted relevant information from an existing Implementation Plan if this existed and was publicly accessible (see IRS form 990 schedule H Part V: 8-10 “is there an implementation policy is it submitted with schedule H and/or posted online with the CHNA?”). The plan for extraction is based on a yes/no finding regarding whether strategic planning for primary prevention action to address environmental pollution included in implementation policy.

About data.

This variable is extracted directly from the researcher’s review of the implementation policy and discernment of planning. A ‘yes’ value would result from evidence of a planned action to address pollution directly or to act to reduce exposure to pollution. The operationalization of this variable specifies a primary or secondary prevention action – this narrows the focus to actions that are aimed to either directly reduce pollution or pollution exposure or to screen or test for exposure to pollution. The number of subjects considered for this variable is limited to the pool of subjects having noted a pollution related community health need. This has potential to lead to concerns with sufficiency of data, power and variance in analyzing relationships with this variable (see chapter IV for disposition of analysis of predictors for this variable). The development of a strategic plan to be set forward in an implementation policy is nudged by federal guidelines however it is not set forth as requirement and this may contribute to a lack of data (lack of documented community benefit strategic planning) by some hospitals. Here as well there may be a bias towards reporting for those hospitals that have

greater support for community benefit processes. There is no known information on data distribution of this variable in the population (state or national).

Variable: Implementation of Action to Address Environmental Pollution as a Community Health Need

Why this variable and level of measurement

This variable operationalizes the concept of assessment of actions to address environmental pollutants as an aspect of community benefit. This facilitates the pursuit of specific aims two, three and four and contributes to the overall goals of the study. This variable also represents an end process outcome, one which this study has, in chapter one, claimed as a normative good. The level of Measurement is dichotomous (yes/no) variable

Source and plan for extraction

The source of data is either 2016, 2017, or 2018 IRS form 990 schedule H. Specifically, part VI, item 1 and the narrative description of part II “Community Building Activities”, item 4 “Environmental Improvements”. Instructions for IRS 990 schedule H (2018) part II, item 4, note Environmental Improvements as “protect from environmental hazards” and gives example of water or air pollution (p.4). Also relevant is Section C (narrative description of Part V item 11) of schedule h, the section states: “Describe ..how the hospital facility is addressing the significant needs identified in its most recently conducted CHNA and any such needs that are not being addressed together with the reasons why such needs are not being addressed.” (p.4). The data for this variable is extracted directly from the researcher’s review of IRS reporting.

About data.

This IRS report is the year subsequent to the year of the CHNA from which data for the ‘assessment’ and ‘identification’ (Aims One and Two) variables were obtained. This is to allow time for the initiation of action implementation. A ‘yes’ finding was marked if the source evidenced primary or secondary prevention actions initiated to reduce pollution or limit exposure to pollutants. The number of subjects considered for this variable is limited to the pool of subjects having noted a pollution related community health need. There is no known information on data distribution of this variable in the population (state or national).

Independent Variables: Community and Institutional Level Factors

Variable: County Level Population Percentage of Persons of Color (With Hispanic)

Why this variable and level of measurement

The Environmental Justice movement has been born out of the recognition that Persons of Color have been unjustly and disproportionately exposed to environmental pollution. Recent research reveals a continued disproportionality in exposure as well as a disproportionate vulnerability to harm from pollution exposure (Bullard, Mohai, Saha, Wright, 2008; Di et al., 2017; Mikati, Benson, Luben, Sacks & Richmond-Bryant, 2018; United Church of Christ, 1987). As this problematic phenomena exists, it is important to understand the potential association between racial identity distribution of the geographic population (in county of hospital location) and engagement of non-profit hospitals with assessment and response to environmental pollutants as part of efforts to identify and address community health needs. The level of measurement is interval (percentage)

Source and plan for extraction

The source of data for this variable is County Health Rankings, <https://www.countyhealthrankings.org/>, data compilation which draws on data from the US Census. Data pertains to the year 2017. This source gives population estimate percentages by race identity on a county level. The data is derived from the U.S. Census Bureau population estimates program.

About data.

The Categories for this variable are county percentage “Persons of Color including Hispanic” If, in future research, I wished to understand the significance of Hispanic identity related to Aim Three I could utilize the category “Hispanic all races”. I do not anticipate any missing data for this variable, although this variable carries with it all the limitations of the primary sources.

Variable: Local Air Pollution PM 2.5

Why this variable and level of measurement

From my exploration of the state of science regarding pollution and health, and as discussed in chapter I, I have found air pollution, specifically airborne particulate matter, to stand out as a type of pollutant about which there is a substantial amount of research showing associations between exposure and detriment to health (Bejot, Reis, Giroud & Feigin, 2018; Bowe, Xie, Li, Yan, Xian & Al-Aly, 2018; Peng et al., 2018; Zhang, Chen & Zhang, 2018). The association with particulate matter and harm to health has been found to be greater for those experiencing poverty and for persons of color (Di et al., 2017; Mikati, Benson, Luben, Sacks & Richmond-Bryant, 2018) and is particularly relevant to issues of social and racial environmental-justice. The level of measurement is ratio.

Source and plan for extraction

The source of data for this variable is a secondary source, County Health Rankings <http://www.countyhealthrankings.org/app/new-york/2018/measure/factors/125/data> . which represents the same data for PM 2.5 as given in the National Environmental Public Health Tracking Network <https://ephtracking.cdc.gov/DataExplorer/#/>. Although there are other sources of relevant data [e.g. <https://wonder.cdc.gov/nasa-pm.html>], County Health Rankings has particularly relevance as it is widely consulted for community health needs assessments. The measure utilized is average density of fine particulate matter in micrograms per cubic meter (PM2.5). The method of data collection/estimation is modeling based on limited monitoring.

About data

The County Health Ranking data is from 2014 and gives average daily density PM 2.5 at the county level. For reference the range across VT, NY and MA is range 5.4 - 11 PM2.5 ug/M³.

Variable: Accountable Care Organization Status (ACO)

Why this variable and level of measurement.

The logic of Centers for Medicare and Medicaid Services (CMS) accountable care organization design is to financially incentivize care that results in the improved health of the population of patients served. This stands in contrast to traditional fee for service models in which the financial incentive is reward for episodes of testing and treatment. It may be that hospitals that are involved in an accountable care organization will be

influenced by the value-based model to address health in the community on a root cause/upstream approach. One qualitative (Skinner, Franz & Kelleher, 2018) and two quantitative (Cramer, Singh, Flaherty, & Young, 2017; Singh, Cramer, & Young, 2018) articles indicate a positive relationship between ACO status and follow through, from assessment to implementation, of community health needs in community benefit processes. The Level of Measurement is nominal dichotomous (yes/no).

Source and plan for extraction

ACO membership was assessed as proximate to year of most recent CHNA (in study window of 2015-2017). Due to limitations in direct CMS listings (i.e. listed by ACO name rather than hospital institution), the primary source for this data became the 2018 survey of hospitals by the American Hospital Association AHA <https://www.aha.org/accountable-care-organizations-acos>. Data from this source was triangulated with data from the 2016 CMS Shared Savings ACO program membership list <https://data.cms.gov/Special-Programs-Initiatives-Medicare-Shared-Savin/2016-Shared-Savings-Program-SSP-Accountable-Care-O/3jk5-q6dr/data> and from current hospital websites. Hospital membership in ACO is in some case clearly discernable from the CMS list due to shared naming. At other times the current hospital website was utilized to match current ACO affiliation with 2016 CMS listed ACOs. Overall, if findings indicated ACO membership in the years assessed, 2016 or 2018, the variable was coded as 'yes' for ACO status.

About data.

ACO status is not specifically asked for in IRS non-profit reporting schedule H (form 990). CMS maintains list of Member ACOs. These lists are believed to be

dependable as CMS relies on iterations of these lists for data for ACO outcome analysis that is directly relevant to federal spending. At the time of data extraction the only relevant list year accessible was that of 2016.

The 2018 survey of hospitals by the American Hospital Association AHA results in a full book of published data (which was not utilized for this study due to price barrier). However, there are select elements of data that are made publicly accessible, this includes hospital reporting on ACO membership (current, previous, or never).

An important limitation in this data is that a 'yes' code indicates ACO participation in either 2016 or 2018. It is possible that a CHNA was completed for a hospital with a 'yes' code and that the hospital was not an ACO member in that specific year. However, it would be the case that hospitals code as 'yes' were either recently, soon to be, or at that point, an ACO participant. Therefore, these hospitals may have been more likely to have an institutional interest and engagement with value based care.

Variable: A Priori Categories for Assessment of Social and Environmental Determinants of Health in CHNA

Why this variable and level of measurement

With regards to the move of hospital systems to address population health, the literature speaks to the importance and need to assess and respond to the root causes, or upstream factors, which determine health (Pennel, McLeroy, Burdine, & Matarrita-Cascante, 2015; Pennel, McLeroy, Burdine, Matarrita-Cascante, & Wang, 2016). In a description of a community health assessment partnership deemed to have been successful in “reaching upstream” to identify social and environmental determinants of

health the authors credit the breadth and depth of assessment with the use of a priori assessment categories that include social determinants of health (Sampson, Gearin, & Boe, 2015). The literature supports the idea that establishing specific a priori strategy or roadmap that includes assessment of social and environmental determinants of health would support greater integration of these determinants of population health in the CHNA process and response. For this reason, the presence or absence of a priori categories for assessment of social and environmental determinants of health in the CHNA was identified as a variable of interest. As an independent variable this was hypothesized to be a potential predictor of assessment, strategic planning and actions to address pollution as a community health need. This measure is nominal dichotomous (yes/no).

Source and plan for extraction.

The source will be the 2015, 2016 or 2017 CHNA (most recent year excluding 2018) and in description of methods on the IRS 990 form Schedule H. A yes finding is determined if Schedule H or the CHNA description of methods note a process in which a category was created or a plan was denoted to specifically include assessment of social or environmental factors in the CHNA.

About data.

By design the measurement for this variable will assess whether an a priori category was created but this does not mean the assessment actually occurred. Intentionality to assess for social and environmental determinants of health that was not documented as plan or as an a priori categories may not be captured in this measure.

Variables: Hospital Mission

Why these variables and level of measurement

There is the potential for differences in actual commitment and orientation to community service (particularly beyond financial reward) amongst non-profit hospitals. In response to anticipation of such differences and with sensitivity to literature that points to the importance of broad and upstream conceptions of health, and the commitment to the health of all those living in the geographic service area, in order to achieve quality and success in hospital actions towards population health, I include Hospital Mission as a set of independent variables.

Source and plan for extraction

Hospital and mission statements were primarily drawn from institutions' websites. Mission statements were also found on form 990, in some instances these were abbreviated on the IRS reporting, so the web-based source was preferred. These variables draw from the mission and values statement of each subject/hospital but do not include vision statements as vision statements are not as consistently posted publicly and may not reflect fundamental commitments in the way that mission and values statements should. There is one variable each for the following mission characteristics: Community Commitment, Social Justice, Determinants of Health Approach, Natural World/Earth Commitment. There is an additional variable, Mission Total, that represents the total of any positive findings of the four other variables. Mission and values statements were evaluated for presence of characteristics based on the criteria below.

About data

The Mission Total variable is at an interval type level of measurement with a possible range of 0- 4 points. The other four variables are dichotomous.

- Community Commitment: service or commitment to community as value (unless such commitment is stated only as providing clinical direct care to the community)
- Social Justice: service of commitment to justice, the underserved, poor, or vulnerable
- Determinants of Health Approach: specific mention of concern with or commitment to addressing determinants of health, upstream health factors or population health.
- Natural World/Earth Commitment: description of commitment to, stewardship of or care of the environment, natural resources or natural world/earth. [exclusive of mention of nature of internal environment of hospital itself, e.g. a caring environment]

Variables: Collaboration with Community Organizations and/or Local Department of Health

Why these variables and level of measurement

A 2015 study by Pennel, McLeroy, Burdine, & Matarrita-Cascante, found that partnering with local public health departments was one of the factors most highly associated with public health quality score for community benefit community health needs assessments/implementation strategies. The community benefit literature broadly

advocates for community collaboration although actual presence may be low (Siegel, Erickson, Milstein & Pritchard, 2018)

There are three dichotomous variables: Collaborate in Assessment, Collaborate in Strategic Planning and Collaborate in Action. There is one interval type measurement, Collaborate Total.

Source and plan for extraction

The sources for this data will be Schedule H (form 990) Part V, section C (narrative) and the text of the CHNA and implementation plan. The IRS reporting is the only source for Collaborate in Action as the subject of interest here is action taken subsequent to the CHNA process. The 2015, 2016 or 2017 CHNA (most recent year excluding 2018) and subsequent year for Schedule H reporting. The data is read, coded and extracted by the researcher.

About data

The IRS final rules for CHNA completion (IRS, 2014) require “a hospital facility to take into account community input not only in identifying significant health needs but also in prioritizing them” (p.78964), the rules also require input from those “representing the broad interests of its community” (p. 78962) to include contributions to identifying resources to address identified health needs (p. 78964). Furthermore, the final rules “provide that a hospital facility must document its CHNA in a CHNA report ...(that includes) a description of how the hospital facility solicited and took into account input received from persons who represent the broad interests of the community it serves” (p. 78966). This information may be found in the narrative section of the CHNA, H (form

990) Part V, section C ,or in the description of methods in the CHNA (p. 78966). The final rules do not require collaboration in addressing the identified needs.

Variables: Collective Impact Criteria

Why these variables and level of measurement

The idea that meaningful improvements in community health would be best supported by collective impact (Kania & Kramer, 2011) or other types of synergistic community work has gained prominence in public health recommendations (Hester, Stange, Seeff, Davis & Craft; Pennel, McLeroy, Burdine, Matarrita-Cascante, & Wang, 2016; Pennel, Burdine, Prochaska & McLeroy, 2017) and is growing in practice (Perez, Szekendi, Taylor-Clark, Vaughn & Susman, 2016; Siegel, Erickson, Milstein & Pritchard, 2018).

This variable is at interval level and is the sum of each of the five Collective Impact Criteria found to be present.

Source and plan for extraction

The sources for this data will be Schedule H (form 990) Part V, section C (narrative) and the text of the CHNA and implementation plan. The 2015, 2016 or 2017 CHNA (most recent year excluding 2018) and subsequent year for Schedule H reporting. The data is read, coded and extracted by the researcher.

About data

The five Collective Impact Criteria/factors include: Common Agenda; Shared Measurement Systems, Reinforcing Activities, Continuous Communication and Backbone Organization Role. A positive finding for each was marked so if the factor was

found to be present in relationship of hospital community benefit work with a community organization or department of health as described in planned activity or in actual activity subsequent to the CHNA.

Data Cleaning and Missing Data Plan

Data frequency distributions were scanned for missing values (system missing), incongruent values and extreme outliers - then evaluated as potential errors. Extreme outliers were be evaluated via examination of frequency distributions with respect to distance from Interquartile Range (IQR).

Plan for Analysis

The objectives for specific aims one and two are addressed with descriptive statistical analysis and inferential parameter estimation. The result of the analysis describe the proportion of hospitals in the sample that includes assessment of environmental pollutants in the community health needs assessment (CHNA) and the proportion that identifies environmental pollutants as a Community Health Need in the CHNA. Additionally, from the non-profit hospitals in the sample that have identified environmental pollution as a need in the CHNA the result of the analysis describes the proportion of hospitals that have documented strategic planning to address these needs and the proportion which have taken actions at a primary or secondary level of prevention to address these needs. Confidence intervals (CI) are calculated where appropriate. Where statistically significant, the CI allow an inference to be made regarding these findings from the study sample to the population which is represented (NYS private non-profit hospitals).

The hypotheses relating to aims three and four seek to assess relationship between both community and institutional factors (the independent variables described in the previous section) *with* the dependent variables that operationalize the community benefit process and engagement of environmental pollution (as described in previous section). The dependent variables are the same as the variables explored in the descriptive aspect of this study.

Multiple logistic regression is utilized as the primary tool for multivariate analysis. There is a fit with this test and a combination of categorical and interval/ratio level independent variables and a dichotomous dependent variable. The test does not hold the assumption of normal distribution of the dependent variable which I do not expect in this study. This type of statistical test is suited to the interests of my analysis in that it helps to understand both if the variables come together to predict the dependent variable outcome and roughly discerns the magnitude of relationship of each independent variable to the outcomes.

As previously laid out, the goals of this study are to evaluate the extent to which non-profit hospitals, engaged in community benefit processes, incorporate assessment and response to environmental pollutants as part of efforts to identify and address community health needs and to evaluate community level and institutional level factors as predictors of such assessment and response. Meeting these research goals helps to address the larger research problem of a gap in knowledge regarding the presence or absence of non-profit hospital engagement of environmental pollutants as determinants of health and the factors associated with such engagement. This is significant because this knowledge may help to place environmental pollution on the systemic agenda of

community benefit policy. Nurses may take initiative in state and federal health policy, as well as in institutional policy and direct implementation of community benefit processes to instrumentalize the idea of acting on environment as a determinant of health and to further actualize the environmental domain of nursing. In doing so, nursing would help to more fully realize the social contract of community benefit by acting on upstream factors to broadly promote community health.

Chapter III References

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CHAPTER IV: RESULTS

Descriptive Findings

Sample Selection

Stratified geographical probability sampling was utilized to reach the desired sample size of 53 hospitals. This resulted in a total of 22 counties having been drawn consecutively from a randomized list of NYS counties (including one initial forced New York City county draw). Counties from each of the 10 NYS economic development zones are present in the sample. A map with the geographic distribution of included counties, color coded for metropolitan status and labeled with number of hospitals included in sample, is shown in figure 2. Using designations from the Rockefeller Institute for Government (Schultz, Oct.2019), 17 of the included counties, 30 hospitals from the sample, are designated as belonging to a NYS metropolitan statistical area region, i.e. near city of 50,000 or county population greater than 100,000 persons. Five of the included counties, 23 hospitals in sample, have been designated as rural or belonging to micropolitan regions. Fourteen of the hospitals are from New York City Counties.

Applying the criteria for exclusion of hospitals, as described in chapter III (lack of CHNA or IRS form 990), resulted in the exclusion of six hospitals (across six counties). Excluded hospitals represent 11.7% of hospitals considered for inclusion. Five of the six excluded hospitals were in metropolitan statistical area regions. When considering statistical inference and translation of findings, one may keep in mind that the sample included only voluntary (not public hospitals) community hospitals that have 501C3 status and was moderately evenly distributed across the state. New York City was well represented in counties drawn but was also the area that had the highest number of

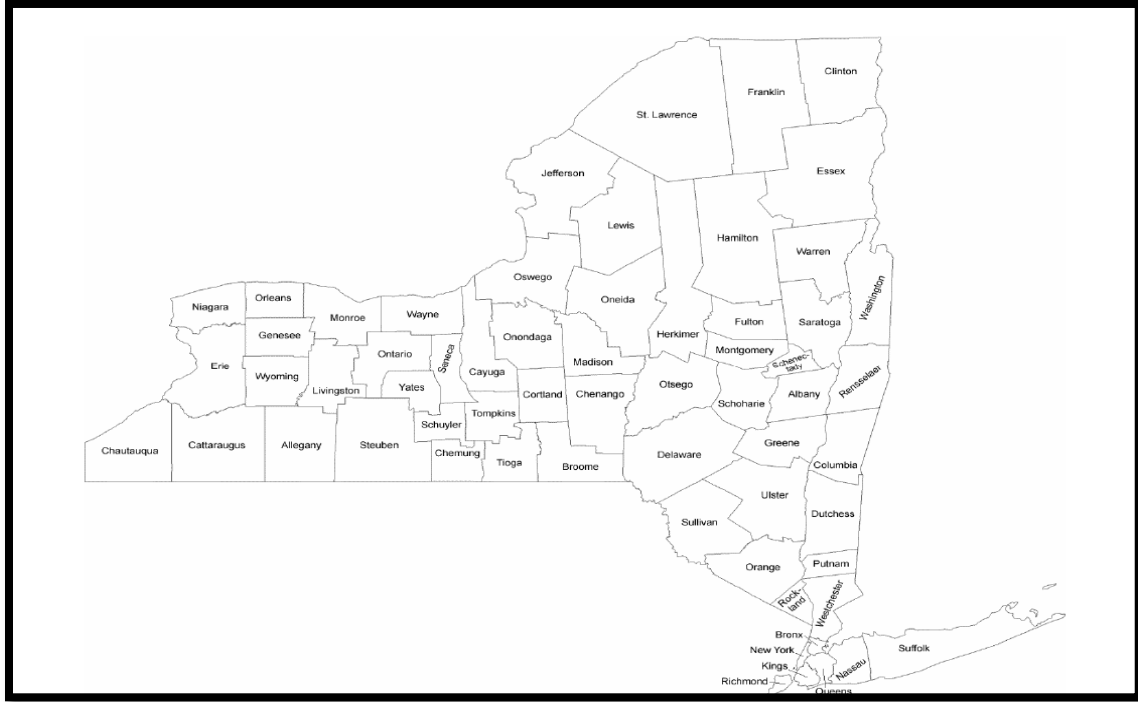
excluded hospitals (3). The NYC and Long Island area are also the site of all public hospitals (9) in drawn counties – such hospitals were not considered for inclusion.

Frequency tables and descriptive statistics were generated for all variables and were evaluated for potential erroneous data. The only missing data found (3 data points) was for ACO status; this was expected as there were three hospitals for which there was insufficient information to accurately discern the ACO status during the time frame of interest. For all variables, cumulative percent reached 100%, no outliers were found and there were no wild (impossible) codes.

Counties from Random Selection with Metro Status

Figure 3.

County Map of NYS



Distribution of Community Level Independent Variables

The variable Persons of Color with Hispanic had substantial variability, mean 31.2% (23.22), with a skew index 1.02 (0.33) and kurtosis index 0.56 (0.64). The variable PM 2.5 μm^3 had mean of 9.1 micrograms/ m^3 (1.1) with a skew index 0.17 (0.33) and kurtosis index - 0.23 (0.64). The variability, seen in standard deviation of 1.1 μm^3 , here, although not apparently high, *does have substantial clinical significance*. Air pollution as PM 2.5 increase of just 1 μm^3 has been associated with an increased mortality risk ratio of 1.08 (8 % increase in mortality from COVID 19) (Wu et al., Preprint, 2020)

Table 1.
Community Continuous Level Independent Variables Distribution

County Level Variable	M	SD	Skew Index	SE	Kurtosis Index	SE	Range
PM 2.5 Daily Avg	9.1ug/m ³	1.1	0.17	0.33	-0.23	0.64	6.6 – 11 (4.4)
Persons of Color (POC) with Hispanic	31.2%	23.22	1.02	0.33	0.56	0.64	4.2-93.3 (89.10)
African American	9.1%	6.22	1.27	0.33	2.49	0.64	.90 - 29.30 (28.40)
Non-Hispanic Hispanic	15.25%	12.41	1.24	0.33	2.51	0.64	2.10 -56.20 (54.10)
Asian	5.88%	7.16	2.08	0.33	3.7	0.64	.60 -27.10 (26.50)
American Indian & Alaskan Native	0.85%	0.65	2.51	0.33	7.27	0.64	.30 - 3.50 (3.20)
Native Hawaiian / Pacific Islander	0.10%	0.09	1.24	0.33	2.61	0.64	0.00 - .40 (.40)
White Non-Hispanic	67.73%	22.5	-0.98	0.33	0.437	0.64	9.20 -94.90 (85.70)

Distribution of Institutional Level Independent Variables

Hospitals showed a moderate amount of engagement with community partners, Collaboration Total, $\bar{x} = 1.74$ (0.86) (range 0-3) and demonstrated a moderate showing of the conditions for collective impact Collective Impact (CI) Total, $\bar{x} = 2.74$ (1.6) (range 0-5). Although the mean for the Collective Impact criteria is a moderate number, the skew index, 0.31 (0.33), and kurtosis index - 1.26 (6.4) reveal a distribution in which hospitals tended to have either a low or high number of Collective Impact conditions.

For the variable Mission Total, having four groups based on mission characteristics, the only positive findings were found for the first two characteristic groups: Commitment to Community (60.4% of hospitals) and Social Justice (17% of hospitals). Social Justice was nested within Commitment to Community; with all hospitals that had social justice as an element of mission also holding commitment to community as part of mission.

Table 2.
Institutional Continuous Level Independent Variables Distribution

	M	SD	Skew Index	SE	Kurtosis Index	SE	Range
Community Collab Total	1.74	.86	-.59	.33	-.08	.64	0-3 (3)
Collective Impact Total	2.74	1.6	.31	.327	-1.26	.64	0-5 (5)
Mission Total	.77	.72	.38	.33	-.99	.64	0-2 (2)*

Note. Potential range for Community Collaboration Total is 0-3, for Collective Impact Criteria Total is 0-5, and for Mission total is 0-4 (out of four possible categories, positive findings for Mission found only for none, one and two specified mission characteristics).

Table 3.
Institutional Dichotomous Level Independent Variables Percentage Positive

Independent Dichotomous Variable s	Percent with Positive Finding (raw #)
Collaborate in Assessment	83% (44)
Collaborate in Strategic Planning	49.1% (26)
Collaborate in Actions	41.5% (22)
CI Common Agenda	69.8 (37)
CI Shared Measurement Systems	30.2 (16)
CI Reinforcing Activities	94.3 (50)
CI Continuous Communication	43.4 (23)
CI Backbone Organization Designated	35.8 (19)
Mission Community	60.4% (32)
Mission Social Justice	17% (9)
Mission Population Health Upstream	0% (0)
Mission Earth Natural World	0% (0)
Proximate ACO Affiliation	52.8% (28) *
A priori Assessment Categories for Soc/Environ Determinants of Health	41.5% (22)

* 3 missing values

Correlation of Independent Variables

In an examination of correlation between independent variables it is striking that there is a significant positive relationship of moderate effect size between the percentage of population that is Persons of Color with Hispanic (POCcH) and higher levels of PM 2.5 ug/m³. This finding is in line with findings of racial environmental injustice reported in the literature and flags that in NYS counties, environmental racial inequity is present in regards to exposure to this pollutant PM 2.5, a known health hazard. Also of note, having a greater percentage of population that is Persons of Color with Hispanic negatively correlates with presence of Collective Impact Criteria in total (CIT).

Table 4.
Correlation Matrix of Independent Variables

	1 P M	2 PC	3 A A	4 Hi	5 As	6 AI	7 PI	8 Wt	9 CI	10 CT	11 Ca s	12 CP	13 Cac	14 MC	15 MI	16 MT	17 aP
1. PM 2.5	--																
2. POC \bar{c} Hispanic	.32*	--															
3. Afr.Amer. (\bar{s} Hispanic)	.35*	.90*	--														
4. Hispanic	.35*	.94*	.83*	--													
5. Asian	.08	.76*	.57*	.54*	--												
6. Am.Indn. AlaskanNat.	.38*	.55*	.52*	.55*	.26	--											
7. PacIsland	.28*	.92*	.86*	.93*	.56*	.55*	--										
8. White (\bar{s} Hispanic)	.32*	1.0*	.91*	.94*	.77*	.54*	.91*	--									
9. CoImpact Total	-	-	-	-	-	-	-	.42*	--								
	.25*	.43*	.26	.46*	.33*	.31*	.39*	*									
10. Collab Total	.27*	.3*	.17	.29*	.29*	.23	.29*	.3*	.52*	--							
11. Collab Asses	.28*	.13	.00 1	.16	.15	.04	.16	.13	.46*	.69	--						
12. Collab StPlan	.18	.55*	.34*	.58*	.46*	.22	.44*	.54*	.45*	.62	.24	--					
13. Collab Action	-	.14	.04	.19	.08	-	.07	-	.09	.58	.18	-.14	--				
	.07			.8		.11		.14		*							
14. Mission Community	.11	.17	.20	.15	.09	.28*	.15	-	-	.3*	-	-.05	-	--			
						*		.17	.26	.3*	.16		.34*				
15. Mission Justice	.19	.23	.21	.24	.12	.14	.16	-	-	-	.21	-.24	.03	.37*	--		
								.23	.27*	.04							
16. Mission Total	.17	.24	.25	.23	.12	.26	.18	-	-	-	-.16	-	.87*	.77*	--		
								.24	.32*	.22	.00	.21					
17. a priori Sedoh Cat	.3*	.07	.04	.09	.02	.31*	.06	.07	.21	.31*	.38*	-.14	.38*	-	.03	-.11	--
						*			*	*				.18			
18. ACO Status	.25	.25	.28*	.29*	.07	.04	.32*	-	.12	-	.00	-.28	.1	.05	.31*	.2	.28*
			*	*			*	.25		.1	.4						

Note: significant positive correlations (Pearson's r value) in green, significant negative correlations in blue. * statistically significant $p \leq .05$. Highlights for interest.

Analysis

Aims One and Two

The first specific aim of this study is to identify the extent to which non-profit hospitals, within the context of community benefit processes, include assessment of environmental pollutants as an aspect of community health needs identification. *Of hospitals sampled, 60.4%, 95% CI [.46,.74] included environmental pollution in community health needs assessment.*

The second specific aim is to examine the proportion of hospitals that have identified environmental pollutants as specific community health needs in community benefit processes and to identify the extent to which those hospitals go on to plan to address and/or implement actions to address these environmental health needs. *Of hospitals sampled, 18.9%, 95% CI [.09,.32] identified a type of environmental pollution as a stated community health need.*

No hospital in the sample planned to address or addressed pollution from industrial, automobile, or powerplant sources (the major sources of PM 2.5) or other point source pollution. There were, however, two urban hospitals, both run by the same non-profit organization, that each specifically identified out of home (including outdoor) cigarette smoke as an air quality concern and went on to plan for and act on this concern. Each placed this concern under the priority/focus area of ‘promote a healthy and safe environment: ‘*outdoor air quality/built environment*’ and each highlighted survey data indicating percent of people reporting daily secondhand *smoke exposure outside of the home*. Although I did not anticipate including cigarette smoke as an outdoor environmental pollutant, and these two hospitals are not alone in addressing smoking, the understanding and framing of secondhand smoke as an air quality (including outdoor air

quality) by these hospital, led me to include these two hospitals as positive findings for Plan and Act on an identified environmental pollution health need. *Given this, 3.8%, 95% CI [.01,.13] of hospitals in the sample planned and initiated action on a pollution-related need*

In considering the nested nature of the findings, (i.e. Identify was nested in Assess and Strategic Plan and Action were nested in Identify) and in line with the phrasing of the specific aims; of those hospitals that had assessed environmental pollution, 31.25% went on to identify environmental pollution as a community health need. Having identified environmental pollution as a community health need, 20% went on to plan and take action.

Table 5.
Descriptive Prevalence of Outcome Variables

Independent Dichotomous Variables	Percent with Positive/Present Finding (raw #)
Assess Environmental Pollution	60.4 (32)
Identify Pollution as Comm Health Need	18.9 (10)
Plan to Address Environmental Pollution	3.8 (2)
Action Taken on Environmental Pollution	3.8 (2)

Aims Three and Four

The third specific aim for this study is to discern *potential relationships between community level factors* associated with non-profit hospital system, community benefit related, assessment and engagement of environmental pollutant health determinants. The fourth specific aim for this study is to *discern potential relationships between*

institutional level factors associated with non-profit hospital system, community benefit related, assessment and engagement of environmental pollutant health determinants.

As stated, there were only two hospitals to have engaged Strategic Planning or Initiated Action to Address Environmental Pollution as a Community Health Need. Therefore, having less than a 5% yes response with subsequent low variability, these two variables are omitted from analysis for aims three and four.

The process of building logistic regression models to respond to aims three and four was initially based on theoretically related groups. Subsequently, presence of statistical significance and effect size was considered to create models that combined both community level and institutional level factors. Variables were entered with simultaneous entry. Tables 6 and 7 show five models each for Assess Environmental Pollution, and for Identify Environmental Pollution as a Need.

The percentage of Persons of Color with Hispanic, when controlling for level of airborne fine particulate matter PM 2.5 μm^3 , was a small but significant predictor of Assessment of Environmental pollution [$W(1) = 4.07$, $p = .04$, OR: 1.04]. In a model including both Persons of Color with Hispanic and PM 2.5, each variable was a significant predictor of Identifies Environmental Pollution as a Community Health Need [POCcH; $W(1) = 10.85$, $p = .001$, OR: 1.12], [PM 2.5; $W(1) = 4.5$, $p = .03$, OR: 3.1]. In a larger model integrating both community and institutional variable (see Table 7, model five), Persons of Color with Hispanic [POCcH; $W(1) = 4.96$, $p = .03$, OR: 1.17, remains a significant predictor of Identifies Environmental Pollution, even when controlled for by four other variables (Soc Justice Mission, ACO, CIT total, PM 2.5).

Social Justice Mission [$W(1) = 4.21, p = .04, OR: 10.4$] emerged as a very strong predictor of Assessment of Environmental Pollution when in the small model of two mission variables, *Hospitals had over ten times greater odds of having assessed for environmental pollution if social justice/commitment to the poor or underserved was part of the hospital mission*. Social Justice Mission was not significant in the same model for Identification of Environmental Pollution, however, although non-significant, Social Justice Mission showed an extremely high effect size for Identification when in a model with five variables (see table 7).

In a model of four independent variables, ACO status was both a strong predictor of Assessment of Environmental Pollution [$W(1) = 6.97, p = .008, OR: 8.95$] and, in a model of five variables, a strong predictor of Identification of Environmental Pollution as a Community Health Need [$W(1) = 3.52, p = .06, OR: 9.6$].

Collective Impact Criteria Total (CIT) was a *negative*, predictor of both Assessment of Environmental Pollution ($W(1) = 7.81, p = .005, OR: .43$) and Identification of Environmental Pollution [$W(1) = 3.99, p = .05, OR: .25$] – both models with four independent variables (see Table 6 and Table 7 Models Two). In a small model of only community collaboration variables, Collaborate on Strategic Planning emerged as a *negative* predictor of Assessment of Environmental Pollution ($W(1) = 5.44, p = .02, OR: 0.22$).

Table 6.
Logistic Regression Models for **Assess** Environmental Pollution

	Model One $p = .07$ $NR^2 = .13$		Model Two $p = .004$ $NR^2 = .36$		Model Three $p = .03$ $NR^2 = .21$		Model Four $p = .04$ $NR^2 = .16$		Model Five $p = .01$ $NR^2 = .36$	
Variable	p	OR	p	OR	p	OR	p	OR	p	OR
PM2.5	.64	.87								
POC \bar{c} H	.04	1.04							.6	1.01
ACO			.03	5.94					.12	3.64
aPrioriCat			.34	2.1						
CITotal			.01	.46					.19	.69
CollabTot			.46	1.44						
CollabAsses					.979	1.02				
CollabPlan					.02	.22			.44	.53
CollabAct					.21	2.24				
MissionCommun							.13	.39		
MissionJustice							.04	10.4	.46	2.49

Note: Highlights for interest

Table 7.
Logistic Regression Models for **Identify** Environmental Pollution

	Model One $p = <.001$ $NR^2 = .69$		Model Two $p = .002$ $NR^2 = .47$		Model Three $p = .001$ $NR^2 = .42$		Model Four $p = .10$ $NR^2 = .13$		Model Five $p = <.001$ $NR^2 = .80$	
Variable	p	OR	p	OR	p	OR	p	OR	p	OR
PM2.5	.03	3.1							.19	6.58
POC \bar{c} H	.001	1.12							.03	1.17
ACO			.03	11.76					.77	.44
aPrioriCat			.70	1.52						
CITotal			.03	.25					.16	.23
CollabTot			.80	.85						
CollabAsses					.91	.89				
CollabPlan					.99	.00				
CollabAct					.58	.62				
MissionCommun							.45	2		
MissionJustice							.12	3.8	.12	47.8

Note: Highlights for interest

Close Chapter IV

Pollution related assessment was present for more than half of hospitals and nearly one fifth of hospitals identified pollution as a health need. Few hospitals planned or took actions regarding such needs and no hospital addressed environmental industrial or transportation related pollution. Social Justice Mission, PM 2.5, Percent County Population Persons of Color with Hispanic and ACO status were positive predictors of engagement of environmental pollution in community benefit. Collective Impact Criteria Total and Collaborate in Strategic Planning were negative predictors.

Translation of these findings are limited by the cross-sectional design. The population represented by the study is NYS private non-profit community hospitals. Bias may have been introduced in a disproportionate exclusion of hospitals from the downstate region. The outcome data in this study relies on the process of reporting by those completing the community benefit documents as well as the abstraction process by this researcher, both aspects are vulnerable to omission or error, in reporting or interpretation.

Even given these real and potential limitations, the findings of this study establish contextual knowledge which nurses may consider when advancing upstream environmental health research, development of policy agendas related to hospital practices and development of pathways for action in environmental health.

References Chapter IV

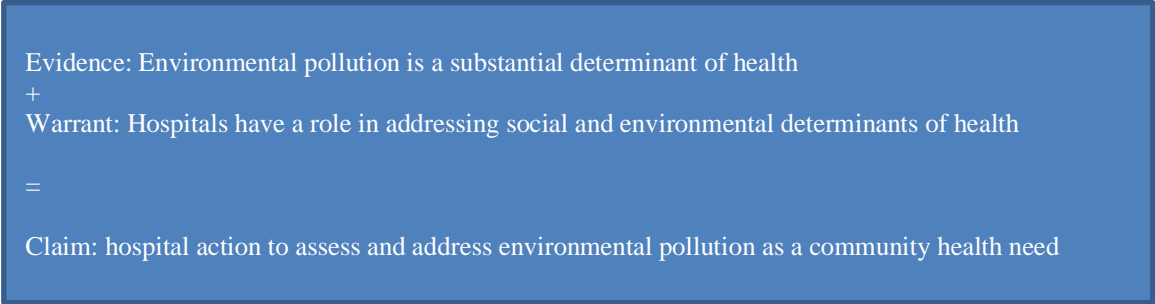
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CHAPTER V: DISCUSSION

Introduction

This project is premised on the warranted claim that hospitals *should* take part in assessment and action to address environmental pollution (see fig 1). The research problem that this study addresses is that there is a need to know, and a gap in current knowledge, regarding non-profit hospital assessment of and actions towards environmental pollutants as determinants of health (Also unknown, are the factors associated with such engagement). Filling this gap in knowledge is important.

Figure 4.
Claim for Hospital Action on Environmental Pollution



Evidence: Environmental pollution is a substantial determinant of health
+
Warrant: Hospitals have a role in addressing social and environmental determinants of health
=
Claim: hospital action to assess and address environmental pollution as a community health need

Fit of Methods and Study Limitations

The non-experimental design is appropriate for the assessment of a naturally occurring phenomena. Due to constraints of time in observing phenomena over years, this study was retrospective in nature. The cross-sectional nature of the design allows for reference to a particular round of triennial community benefit reporting requirements, the time frame allows for inclusion of IRS reporting in the year subsequent to the CHNA

assessed. These aspects of the design prevent conclusions of causality. The random sampling of subjects (hospitals) and the fact that the sample comprises approximately 1/3 of the population (of NYS private non-profit hospitals) supports generalization to the population of NYS private non-profit hospitals.

Coding of documents and consequent conversion to numerical measures, when integrated with other quantitative data, allowed for quantitative analysis with inclusion of phenomena that was discernable only from publicly available documents in narrative form. The use of multivariate logistic regression as a statistical technique was appropriate for discerning potential predictors (at both dichotomous and scale level of measurement) on the dichotomous outcomes of interest. The simple use of relative frequencies is at the heart of this study in discerning prevalence of practices of hospital engagement of environmental pollution which had not yet been described.

Limitations in this study include the specificity of the sampling frame: the population of reference should not be thought to include public/government administered hospitals, specialty hospitals or for-profit hospitals but, rather, solely NYS non-profit private hospitals. Public hospitals were not included as they do not have the same requirements for IRS schedule H submission, and this form was a key document in the plan for data abstraction. It is important to consider that in some areas, particularly in downstate metropolitan NYS, public hospitals may play a key role in service provision for communities; so that without the inclusion of public hospitals in the study there may be phenomena related to sharing or shunting of community services that would not be captured in this study. There are no private hospitals in NYS. As noted in chapter IV, six

hospitals were excluded from the study, 5 of which were in a metropolitan areas - potentially introducing geographical, or other, selection bias.

Considerations of Aims and Findings

Aims One and Two: Considerations and Fit with Literature

The First Specific Aim for this study is to identify the extent to which non-profit hospitals, within the context of community benefit processes, include assessment of environmental pollutants as an aspect of community health needs identification. The second specific aim is to examine the proportion of hospitals that have identified environmental pollutants as specific community health needs in community benefit processes and to identify the extent to which those hospitals that do identify environmental pollutants as a community health need go on to plan to address and/or implement actions to address these environmental health needs.

The results of this study show that *60.4% of hospitals in the sample assessed for environmental pollution as a potential community health need*. Of the sample, *18.9% of hospitals identified pollution as a community health need/priority* (31.25%, of those hospitals that had assessed for environmental pollution).

This engagement represents an important advance – extending a paradigmatic boundary to include pollution in the appreciation of social and environmental determinants of health. Although important, this advance has not reached actualization. *No hospital took action on industrial, fossil fuel, or any point source pollution*. Two hospitals (3.8% of total and 20% of those having identified environmental pollution as a

community health need), planned and took action on cigarette smoking which the hospitals presented as, partially, a potential outdoor air pollutant.

This is the first study to assess hospital engagement of environmental pollution in community benefit processes. However, Pennel et al., in a 2016 study of 95 non-profit hospitals in Texas, made a comparable type of analysis for the category of broad social determinants of health. When assessing CHNA and implementation documents for evidence of a determinants of health approach in assessment Pennel et al. (2016) found that for community assessment including ‘underlying etiologies of health problems/ root causes’ 7% of CHNAs scored high and 43% fell in the midrange (compare this to the 60.4% of NYS hospitals in my study that included environmental pollution in assessment of community health needs). Pennel et al.(2016) found that “community conditions (including environment) made up approximately 5% of the of the identified/prioritized needs in the CHNAs. It should be noted here that the Pennel et al. (2016) study drew from Texas CHNA and implementation documents from 2011- 13 while my study draws from New York State 2015-17. Regarding evidence of a determinants of health approach in implementation plans and actions, Pennel et al. (2016) found that for ‘identification of influences and strategies that reflected broader determinants using a social ecological framework’, 2% had a high score and 25% fell in the midrange (here one is able to compare only to two hospitals in my study that planned and took action and this action, although targeting a concern that had been framed as a pollutant, the hospital action was focused on supporting individual behavioral change).

It is possible that an inclination for hospitals to focus on supporting individual behavior change rather than socio-environmental structural changes to support health

may be a factor in blocking progression from identification of environmental pollution as a community health need to action on that need. The most effective action here would in most cases mean moving beyond individual behavioral issues, for example air pollution effects may be lessened by precautions in spending time exercising outdoors on high pollution days, but ultimately pale in comparison to a direct reduction of air pollution.

In taking stock of current community benefit practices of non-profit hospitals in NYS, what is revealed is that there is a gap in hospital action. A moderate level of engagement with assessment and identification of environmental pollution is present but, there is a lack of action, on the part of hospitals, to address pollution. Both of these major findings are important.

The finding that most hospitals in the sample include environmental assessment in pollution may serve to raise awareness of possibility and opportunity, for actors both within hospital institutions, local communities and elsewhere, to recognize hospitals as potential partners in investigating and, ultimately addressing, the health impacts of pollution. I recently presented the findings of aims one and two at a research conference and a researcher; in the area of PM 2.5 exposure, HPA axis suppression and maternal depression; corresponded with me to relay her changed awareness of what hospitals are doing in regards to assessment of pollution and shared her interest in the continued work of hospitals in this direction.

This point, where hospitals do not advance to action on pollution, where the idea of a determinants of health approach to healthcare stalls before becoming realized in praxis, this may now be understood as an important juncture to focus policy and continued inquiry.

A qualitative study on substance abuse in relationship to community benefit processes illuminates other potential phenomena that may block a hospital's progression from positive finding in assessment to prioritization and action. Franz, Skinner & Kelleher (2019) found that community benefit administrators reported perceptions of lack of resources, stigma, concern regarding ability of hospital to address this issue and concern of potential risks of involvement as connected to lack of action on substance abuse concerns in the community. My study did not have enough hospitals with planning and action on environmental pollution to evaluate my hypothesized predictors on these outcome variables. Use of qualitative case methods to further investigate the factors associated with hospital progression (or block) in action to address environmental pollution is warranted.

Even as it is important to further investigate factors influencing a block to, or facilitation of, action on environmental pollution, it is also important to consider the factors that were found here to predict assessment and/or identification of environmental pollution as a community health need and to consider the implications for research and translation to policy and actions.

Aim Three: Considerations and Fit with Literature

The Third Specific Aim for this study is to discern relationships between community level factors associated with non-profit hospital system, community benefit related, assessment and response to environmental pollution health determinants. Here, in a small model combining the variable percentage of Persons of Color with Hispanic (POCcH) and airborne fine particulate matter PM 2.5 μm^3 ; the former was a significant

predictor of Assess for Environmental Pollution and both were significant predictors of Identify Environmental Pollution as a community health need.

Airborne Particulate Matter PM 2.5

That PM 2.5 predicts Identify Environmental Pollution is a reassuring finding; as this is an important form of pollution, amongst others. This study found that with each 1 ug/ m³ increase of PM 2.5 air pollution there are three times greater adjusted odds a pollutant will be identified as a community health need. There is a compelling body of literature showing the substantial impact of PM 2.5 on health and the substantial racial inequity in both amount of exposure and risk with exposure (Di et al., 2017, Mikati et al., 2018).

If hospitals assess for environmental pollution as a threat to health of the communities they serve, then this is a step towards environmental justice (particularly if in communities with higher percentages of Persons of Color, as is the finding in this study). However, if this assessment is not brought forward to identification (where appropriate) and action, then the benefit is unrealized.

County Percentage Persons of Color with Hispanic

County level percentage Persons of Color with Hispanic (POCCH) also predicts, albeit at small magnitude, assessment and identification of environmental pollution even with PM 2.5 controlled for in the model. A finding that is incidental to the study aims but that is of great importance is that Percentage Persons of Color with Hispanic correlates in significant positive relationship with airborne fine particulate matter PM 2.5 u/m³. This finding adds further to the substantial body of evidence of racial inequity

in exposure to environmental pollution and points to the need for actions to advance environmental justice.

Regarding Percentage Persons of Color with Hispanic as predictor of both Assess and Identify Environmental Pollution (adjusted for level of PM 2.5): this seems to indicate that POCcH has an independent relationship with Assess and Identify Environmental Pollution beyond what might be mediated by actual presence of pollution. However, the only pollution accounted for here is small particulate matter air pollution (PM 2.5); the possibility remains that inequitably distributed presence of other types of pollution may be mediating percentage population POCcH and hospital assessment and identification of pollution as a health need.

What else might be involved in this small but consistent predictive relationship of POCcH and hospital assessment and identification of pollution. POCcH does not correlate significantly with Social Justice in hospital mission and remains a predictor of Identify when adjusted for Social Justice Mission so, for these reasons, Social Justice Mission is less likely to be a mediating variable.

It is possible that there is an awareness of environmental injustice in Communities of Color that reaches the hospital and those completing the community health needs assessment; and that this awareness facilitates assessment and identification of environmental pollution. This is an important question for future qualitative research for, if this were to be the case, there may be important strengths here to learn from. A qualitative research question for future inquiry might be: how do values and understandings around racial environmental injustice interact with the practices of hospitals in community benefit.

Aim Four: Considerations and Fit with Literature

The Fourth Specific Aim for this study is to discern relationships between institutional level factors associated with non-profit hospital system, community benefit related, assessment and engagement of environmental pollutant health determinants.

Hospital Mission: Community, Social Justice

A model consisting of each of the two variables (Community Mission and Social Justice Mission) showed that neither significantly predicted Identification of Environmental Pollution. However, commitment to Social Justice, including service to the poor or vulnerable, (variable Social Justice Mission) did, in this model, significantly predict Assessment of Environmental Pollution. If Social Justice was part of hospital mission the odds were over 10 times greater that Assessment of Environmental Pollution occurred. Also, although Social Justice did not significantly predict identification the effect size here was remarkable (OR: 47.8, $p = .12$). It may be that an explicit orientation, and commitment, to justice translates to assessment and identification of environmental pollutants; that something about consideration of justice leads to a fuller, and more critical, appreciation of the social, built and natural environment - so that environment pollution is included. Additionally, as previous qualitative research in community benefit has shown, for some administrators responsible for community benefit process, an uncertainty to move forward on new directions of population health was related to lack of guidance on this new direction (Skinner et al. 2018 a.). It may be that a social justice mission signals and guides those involved to move forward on a critical and broad determinants of health approach.

In pursuing a population health improvement goal, it may be important for hospitals to contemplate the institutional relationship to social justice, and, where this is desired, to build this commitment into core institutional commitments. For hospitals to fully assess the scope of realities affecting human lives it may be necessary to develop critical insights that accompany a commitment to social justice and service.

It is notable that Social Justice Mission was nested in Community Mission, there were no Social Justice Mission findings that did not also have Community Mission present. The other two variables pertaining to hospital mission, Population Health/Upstream and Earth/Natural World Commitment, are not included in models as there were no positive findings for these variables.

Accountable Care Organization

Accountable Care Organization membership was a significant predictor of both Assessment and Identification of Environmental Pollution as a Community Health Need. With odds of Assessment of Pollution being 8.95 times greater for those hospitals with a positive ACO finding, and odds of Identification of Environmental Pollution as a community health need being 9.6 times greater. Hospitals that join or form an ACO have begun a shift towards a value based approach to health care, which rewards health outcomes rather than episodes of care, as in a strictly fee for service model. The shift to value based care has centered on quality of care parameters, evidence based screening and promotion of behavioral health. However, the logic of this approach, particularly in capitated payment models, may lead to involvement with upstream improvements (Hester et al., 2015) to built and natural environment (including environmental pollution) as a means of improving the health of populations served by the institution.

It is possible that the associated internal institutional orientation towards a determinants of health approach to health care is important in the relationship to environmental pollution. It is also possible that ACO membership may align with greater use of assessment guidelines and information resources that include or nudge towards consideration of environmental pollution as a health determinant.

Skinner et al. (2018 a.) found that community benefit administrators, with hospitals that were part of larger systems (such as Accountable Care Organizations) expressed satisfaction with funding for community benefit activities and reflected a positive report of the newly holistic roles that the community benefit processes facilitated. Other research has noted a positive relationship between progress in elements of community benefit processes and membership in an accountable care organization (Cramer et al., 2017; Singh et al., 2018a)

Further exploration of the relationship of ACO, and other value based mechanisms, to engagement of environmental pollution as a community health concern is important as this is a potential pathway that has been at the core of health care reform for population health and is an area rich with reach and resources to affect policy change.

A Priori Assessment Categories for Social-Environmental Determinants of Health

Establishment of A priori social-environmental determinants of health categories for community health needs assessments was not found to be a significant predictor of Assessment or Identification of Environmental Pollution as a community health need. This finding does not align with literature that shows descriptive support for a link between A priori establishment of categories for assessment of social- environmental

determinants of health and later engagement with such determinants (Sampson et al., 2015).

Collective Impact and Community Collaboration

Paradoxically, Collective Impact Criteria Total (CIT) and Collaborate on Strategic Planning (CollabStPlan) both showed negative relationships with Assessment and/or Identification of Environmental Pollution as a Community Health Need. CIT was a negative predictor of both. Collaborate on Strategic planning was a negative predictor of Assessment. Although this study utilizes a non-directional hypotheses, the findings are seemingly paradoxical because they conflict with prior theory based and analytic findings in the literature that indicate a positive relationship between community collaboration and engagement of social determinants of health (Carlton & Singh, 2018; Pennel et al., 2015; Pennel et al., 2016; Pennel et al., 2017; Sampson et al., 2015)

What might be happening here? Noting the moderately strong negative correlation between both Collaborate on Strategic Planning and CIT with the variable Persons of Color with Hispanic leads to the question of whether it is that CIT and CollabStPlan negative relationships with Assess and/or Identify Pollution partially reflect a lack of collective impact factors and collaborative planning in Communities of Color.

I queried the data and found that although CIT significantly negatively predicts both Assess and Identifies Environmental Pollution in bivariate analysis, and Collaborate on Strategic Planning negatively predicts Identifies in bivariate analysis; these relationships become non-significant when Persons of Color with Hispanic is included in the model. The negative relationships of Collaborate Strategic Planning with assessment and Collective Impact total with both assessment and identification of environmental

pollution in my study may point to social injustice related problems in what is not happening within communities in order to work jointly for common good. Given the historical inequities in economic opportunities and outcomes for Persons of Color, the findings of Singh et al, (2018a) are notable here: that hospital participation in community wide planning was less in communities of greatest need.

There are other potential explanations for the negative relationships described, including the possibility that there are ongoing collaborative, collective efforts with community partners preceding the community health needs assessment and that these activities may predispose those conducting the community health needs assessment to place greater relative focus on these particular issues that are established ongoing collaborative efforts (Pennel et al., 2016). This possibility should not point us towards a rejection of community collaboration (there of course may be other benefits occurring here outside of natural environment) but may give reason for reflection. That is; that community collaboration, while an important goal, may not be the complete answer. Community organizations, in doing important work, may not be doing *all* the important work there is and it still should fall to non-profit hospitals to look broadly and critically at the broad scope of community determinants of health – to engage upstream thinking, to look distally, to, push outside of current focus. Ultimately this will give a fuller opportunity to assess needs, assess resources, to use creative envisioning to move beyond paradigmatic limitations and, ultimately, to more accurately engage community benefit with greatest utility for population health.

Implications of Findings/Significance

Contribution and Implications for State of Science

This study is the first to focus on engagement of environmental pollution in community benefit processes. There is notable engagement at the level of assessment and identification of environmental pollution as a community health need. This important new knowledge may open up connections and opportunities for others (stakeholders, scientists, advocates) to connect to the process; to bring environmental health concerns to the attention of hospitals and to reach out in collaboration to address these concerns.

This study offers theory based insight regarding *instrumentalization of ideas*, which may be appropriate for adoption in future related research. In this study, this theoretical lens helped to reveal the importance of a block in the movement of an element of the idea of population health (environment as determinant of health) to full praxis in action.

In addition to the novel focus on environmental pollution in community benefit, this study adds to the understanding of concepts that are currently the subject of investigation in the larger body of research on community benefit, such as the progression of processes in community benefit; concerns of equity in community benefit; characteristics and qualities that predict quality; and scope of engagement with determinants of health.

This study does not measure health outcomes. There is one recent study that is on the vanguard of measuring community benefit impact on health outcomes. Chaiyachati et al. (2020), in a retrospective study of close to half of the private non-profit hospitals in the US, found a substantial decrease in hospital

readmissions with increase in community-directed community benefit spending. This study has some limitations in making causal conclusions; still, the results are substantial and the implications of the findings are impressive. The rate of readmission was 1.21 percentage points lower in the higher spending quartile of hospitals compared to the lower quartile (and this shows linear increase across spending level groups). The authors offer the comparison of the extensive CMS Hospital Readmissions Reduction Program which showed a 1.5 percentage point difference between readmission types targeted by the program and types that were not. The issue of potential utility is at hand here. The authors note the relative small amount of resources represented in spending of community-directed community benefit spending (a mean of 0.59 (1.67) percent of hospital spending or \$1 mill (\$3mill) for hospitals in the sample). Where hospitals do engage in addressing environmental pollution, innovative ways to measure health outcomes are needed.

Continued research to discern outcomes and pathways to engagement of environmental pollution in community benefit is important. Nursing should look to collaboration in research on these points with other disciplines in which there may be a mutual sharing of disciplinary perspectives and strengths (public policy, public health, medicine, social work, management, geography, economics , law...and more).

Implications for Theory

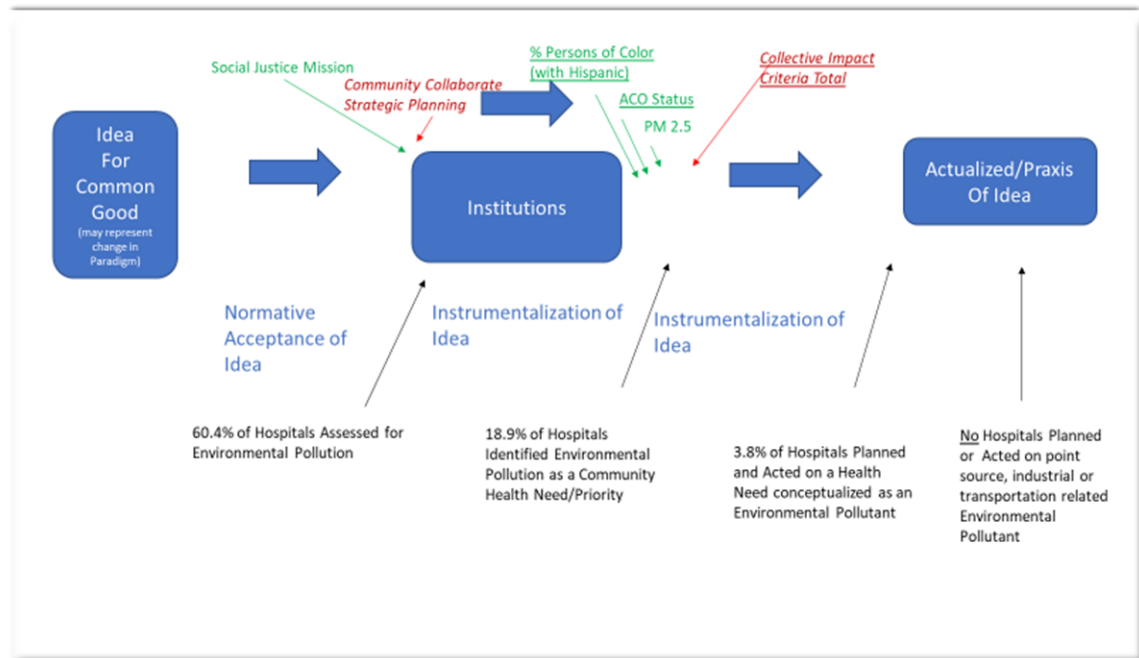
The subject of this study, non-profit hospital engagement of environmental pollution as determinant of health is related to the instrumentalization of an idea

(Dewey,1922) - the idea being that of population health (health outcomes of a group of people as influenced by health determinants). Environmental pollution is an important determinant of health and therefore an element of population health. I propose that population health is an idea for common good, an idea that has led to a paradigmatic shift in the normative role of hospitals. This idea of population health has been accepted as a normative good and as important for hospital engagement and commitment.

The diagram in figure 5 shows, in heavy blue line, the progression of a concept for common good (in this case addressing environmental pollution as a community health need) from normative acceptance, which brings the idea into the realm of influence upon institutions (main focus here: non-profit hospitals); to extent of instrumentalization; to completion in actualization of praxis (here would be hospital action taken to address environmental pollution). The diagram shows (in thin black arrows) where percentages of hospitals fall in progress towards instrumentalization of this idea (acknowledging that full progression to action may or may not be an appropriate priority in each case). Green print and arrows are used to indicate where the independent variable predictors in this study may come into play in affecting instrumentalization of the idea of hospital role in addressing environmental pollution. Red print and arrows are used to indicate where the independent variable predictors in this study may have a negative relationship with such progress.

Figure 5

Instrumentalization of Idea of Population Health (with study findings)



In public life there is an alignment of institutions and other entities for common good (e.g. hospitals, government, community organizations, nursing), bound by shared accountability for population health. Nonprofit hospitals hold a social contract for community benefit (benefit to the community beyond billed services). It is this social contract for community benefit, in the current socio-political context, that holds potential for improvement of population health through addressing determinants of health, including environmental pollution. Through community benefit as a social contract, hospitals have this opportunity to manifest a broad care taking role for the common good: to move beyond fee for service and engage a shift to supporting the development and iterative social reproduction of healthy human society in balance with nature.

The use of the concept of instrumentalization is deductive here and does not in itself directly contribute to new theory (although the findings related to predictive factors may contribute to new theory). However, the concept shows usefulness in structuring an understanding of progress of a health policy idea to praxis. The idea of paradigmatic shift (Kuhn, 1970) is important here in understanding that there has been a change in what hospitals may do for the populations they serve, but it is Dewey's older idea of instrumentalization that allows for a tracking of progression from idea in concept to idea in impact. The findings of this study show that hospital responsibility to environmental pollution as a health determinant is substantially progressed in assessment and is evident in identification as a health need but has largely stalled before action is taken by hospitals to address identified environmental pollution health needs.

Dorothy Kleffel (2006) in explicating the 'Environmental Metaparadigm of Nursing' claims that, even as environment has historically remained an important element of nursing, the level of environment with which nurses engage (Merchant's categories of individual/*egocentric*, societal/ *homocentric*, to planetary/*ecocentric* p.97) has fluctuated and recessed. Kleffel called for

“evolving and expanding our environmental metaparadigm...to practice, educate and do research in the global arena in order to affect the widespread major health problems of our present day...(to) join forces with those..addressing the social, economic , and political conditions of the world, just as did Florence Nightingale and Lillian Wald in their day” (p. 107).

Nursing leadership in advancement of ideas and actions to address pollution as a health need in community benefit process would represent a manifestation of the nursing environmental domain at the societal/*homocentric* level and may at times reach to the *ecocentric* level.

Implications for Policy and Actions

I want to close here with a reflection from my time in teaching experienced nurses in a graduate population health course in NJ. I guided nurses in a local population health assessment: the nurses consulted epidemiological sources which included data on environmental contamination and superfund sites as well as local cancer and other disease occurrence. The nurses considered relative incidence and prevalence and, at times, developed hypotheses regarding potential causal relationships with pollution/contamination. There was a pain of experience (of ill patients, friends, family, self) and painful disconnect between illness they hypothesized might be partially related to environmental contamination, and any sense of empowerment to change this circumstance. I was concerned that this academic work brought moral distress. Although the relationship of nursing to population health was being taught and was welcomed by most students as related to their identity and work as nurses, here was a frustration to fulfillment of that aspect of nursing. Although improvement of environment and work on health policy was the stuff of this course, and fits with the ethos of nursing, there was the painful frustration of not having a nursing pathway to action on a potential environmental harm in their communities (while at the same time, having direct experience and care responsibilities with the hypothesized consequences). It is partially from this experience, witnessing the expressed frustration of nurses in the implementation of their full values in practice, and from an awareness of the suffering brought by environmentally caused illness, that I am greatly interested in discerning pathways for nursing to address environmental pollution.

Hospitals are one of the central places of the work of nursing and, as institutions, have a place of great importance in facilitating, or blocking, the full expression of nursing values. Nursing has a social contract to service that is carried out through the expression of professional values and commitments. Non-profit hospitals have a social contract to provide quality accessible direct care and have a formalized, legislated, social contract to community benefit.

The social contracts of nursing and non-profit hospitals should be synergistic. Patricia Butterfield's (2017) Upstream Model for Population Health calls for upstream nursing actions targeting system change in health promoting systems (p. 7). Suggested points of nursing action include 'operations', defined as "standard operating procedures and processes at the program or system level" (p.7). The standard procedures and processes of community benefit are an important place for upstream nursing action and a place where the social contracts of both nursing and non-profit hospitals may be synergistic in moving forward ideas of population health that include environmental health determinants.

In order to prioritize community health needs for action some hospitals employ a formal mechanism in which potential community impact of a given community health need is weighed with the feasibility of addressing that need. Hospitals that do not lay out a formalized decision making tool may yet engage a similar type of logic. The decision making calculation that considers feasibility is an important point at which hospitals may decide whether to prioritize and move forward to action (or not) on an environmental pollution health concern. This is a point at which nurses should take a role in bringing environmental health information and implications to light.

Feasibility is a concept that is occupied by resource limitation realities as well as substantial social construction, bound by historical paradigms and subject to reinterpretation with vision and creativity. Here is great opportunity for nurses, and others, to re-envision what is feasible in hospital promotion of community well-being, and to incorporate collective actions and alliances to address pollution as real possibilities for nursing and hospital actions in community benefit. Nursing influence in hospital community benefit may come in the form of administrative roles, board membership, or requests for input in process. Individuals or groups may engage the process by participation in community engagement opportunities and by submitting feedback to reports when made available. Nursing representative bodies such as state and national professional organizations, unions, and even Magnet councils could further extend involvement in community benefit to influence these processes. Models for wholistic community that include natural environment could be employed in these efforts, e.g. Rippel Foundation's Rethink Health (2018). Influence could be exerted through involvement at the institutional level, and through advocacy for policy at the state and federal level that would support pathways to engagement of environmental pollution in hospital community benefit.

Concluding Statement

The newly appointed director of the NIH National Institute for Nursing Research, Dr. Shannon Zenk, has encouraged nursing researchers to identify what they most care about, then pursue research to discern the evidence that will help to move change forward on that issue (Zenk, 2020). My concern is Gaia, and the beings who are part of this ecology; my concern is community and the integrity of social arrangements – contracts

and covenants that support liberty while working for universal access to possibilities of human wellbeing; my concern is the nurse struggling against constraints to deeply manifest the environmental ethos of their profession. This research generates knowledge to guide nurses, and others, in developing pathways to reach greater scope and impact in hospital community benefit practices, specifically to assess and act on environmental pollution – improving the health of humans via healing of the natural environment, and bringing about a greater realization of the environmental domain of nursing.

Chapter V References

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