

Mechanisms of Legal Effect: Perspectives from Public Health

A Methods Monograph

PHLR

Making the Case for Laws that Improve Health

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Mechanisms of Legal Effect: Perspectives from Public Health

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Summary

Public health approaches dating back to the late 18th century and earlier were primarily focused on economic, social and physical environmental conditions that increase risk of morbidity and mortality. As public health and medical breakthroughs of the early 20th century controlled infectious diseases and expanded life expectancy, public health shifted its attention from infectious to chronic disease. This era of public health primarily focused on individual-level risk factors and intervention approaches. Most recently there has been a movement to re-emphasize the importance of fundamental determinants of health and disease, including economic, social and physical conditions.

The public health perspective highlights many mechanisms through which laws affect economic, social and physical conditions that, in turn, affect population distributions of risky or protective exposures and risky or protective behaviors. Exposures and behaviors, in turn, affect population health outcomes. Smoke-free laws, anti-discrimination laws, and the Earned Income Tax Credit (EITC) illustrate causal pathways from law to population health outcomes. A wide variety of data are available for exploring mechanisms of legal effects on population distributions of exposures, the health-related behaviors of individuals and organizations, and health outcomes.

Introduction

The advent of public health can be traced back to the late 18th century when the first organized attempts were made to confront disease collectively. With the rise of industrialism and globalization, populations shifted to urban centers and seaports, producing dense populations living and working in unsanitary conditions ideal for spreading infectious diseases. As typhoid, smallpox, influenza, cholera, tuberculosis, and other diseases reached unacceptable levels, the first boards of health were formed in urban centers to respond to the epidemics (McNeill, 1977). The formation of boards of health illustrated the start of infrastructural public health law, and their actions in quarantining ill persons illustrate early use of police powers on behalf of public health. Right from the start, law was central to public health action.

Public health pioneer John Snow implemented corrective environmental actions long before science determined that microorganisms were the causes of widespread infectious diseases. In 1854, Snow traced a cholera outbreak in London to well water drawn from the Broad Street pump. By simply removing the pump handle, he prevented perhaps thousands of additional cases (Brody et al., 2000). Snow's action illustrates the practical orientation of the field — preventive action need not wait until all the detailed mechanisms and mediators are understood. More importantly, Snow's action illustrates the simplicity and effectiveness of changing the physical environment to improve the public's health, in contrast to attempts to change the behavior of thousands or millions of individuals, in the cholera case by boiling water thoroughly every time before drinking.

As public health and medical breakthroughs of the early 20th century (for example, clean water, improved sanitation, antibiotics and vaccines) controlled infectious disease epidemics and expanded life expectancy (Centers for Disease Control and Prevention, 1999), public health shifted its attention from infectious to chronic disease (Omran, 1971). Epidemiological studies of chronic disease showed that most cases in the population do not occur among those at high risk but rather

among those at moderate risk, because there are more people with moderate risk levels than there are with very high risk levels (Epstein, 1996; Rose, 1985). Recognition of the widespread distribution of risk might have led to a return to addressing the environmental and social conditions that elevated risks in so much of the population, but in the second half of the 20th century, chronic disease prevention efforts focused primarily on individual-level strategies designed to alter specific risk factors that are proximal causes of disease, such as blood pressure, cholesterol level, substance use, diet and exercise. A major weakness of this proximal risk factor approach is its de-emphasis of “fundamental” or antecedent determinants of population health (such as social class) that influence multiple proximal risks and maintain an association with disease even when specific proximal risks change (Link & Phelan, 1995). Although an intervention may temporarily reduce proximal risk factors for those individuals exposed to a particular intervention (for example, health education, screening), new people continue to enter the at-risk population at an unaffected rate if the intervention fails to intervene on forces in the community that cause the problems in the first place (Syme, 2004). The field of social epidemiology (Berkman & Kawachi, 2000) and the growing recognition of “social determinants of health” (Marmot, 2005) and “structural interventions” (Blackenship et al., 2006) signify that public health is increasingly returning to its classic (19th century) emphasis on environmental and social conditions. Because law is such an important influence on such environmental and social conditions, a return to classic public health action is also elevating empirical research on law’s public health effects as an increasingly recognizable field of study.

Causal Mechanisms: How Laws Affect Population Health

Figure 1 illustrates the central processes through which law can influence population health outcomes from a public health perspective. The diagram highlights the central public health focus on altering the economic, social and physical environments in ways that reduce toxic exposures and increase protective exposures, and ways that facilitate healthy behaviors and impede unhealthy behaviors. These many dimensions of the environment drive exposures and behaviors that, moderated by individual-level factors, ultimately affect aggregate levels of population health.

Law shapes environments through its effects on institutions, organizations and other implementation structures and processes. Obviously, law can also have direct effects on individual behavior, as illustrated in the many other monographs in this series. This monograph highlights the centrality of enhancing environments as a key role for law in improving population health. For simplicity, the many possible interactions across dimensions of the environments and the cybernetic nature of this causal system are not depicted. Our goal is much more modest than a complete depiction of how law affects health. Because history shows most public health gains have been achieved by altering social and physical environments, we highlight the central role of law in shaping those environments. Following a description of the conceptual framework, we present three detailed examples.

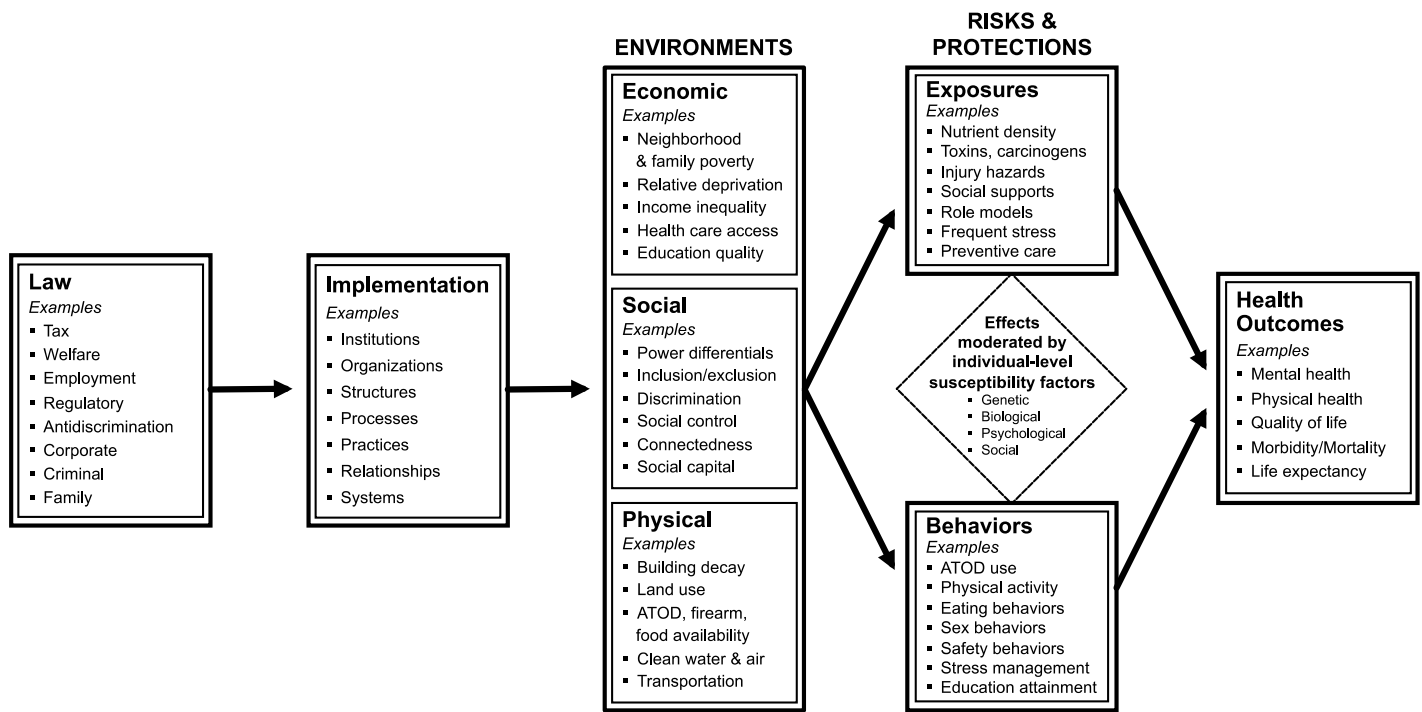


Figure 1 Causal Diagram Showing A Public Health Perspective On How Law Affects Population Health.

Law

Law affects the full range of institutions, organizations and other structures in society, and the resulting characteristics and actions of those organizations and structures affect the economic, social and physical environments that the population experience. Law shapes families, schools, churches, community organizations, businesses, and corporations. By affecting actions within such organizations and institutions, law influences the distribution of wealth, employment, health care, education, and other resources across a population. Economic factors, such as family income, relative income, degree of inequality, employment status, occupation, and education level have been independently linked with health outcomes (Adler & Newman, 2002). Tax law and welfare regulations have direct effects on family income and resources, and the distribution of wealth within a society. One example is the Earned Income Tax Credit (EITC), first enacted in 1975 with federal and state expansions since then. The goal of the EITC is to incentivize work and raise the effective

wages of low-income workers (Hotz, 2003). Several studies have indicated the EITC has positive effects on maternal and child health outcomes (Arno et al., 2009; Evans & Garthwaite, 2010; Strully, Rehkopf, & Xuan, 2010). An example of a policy influencing the distribution of wealth is Social Security. As a result of the Social Security Act (and its amendments), monthly cash benefits are provided to the majority of retired workers in the U.S., and constitute the major source of income for most of the elderly. Social Security dramatically lowered the rate of poverty and reduced health disparities among the elderly (Adler & Newman, 2002). Another example of law influencing the distribution of resources include food assistance programs (food stamps, school lunch requirements), which have been found to have a protective effect for low-income children's health (Jones et al., 2003).

Laws influence job creation, minimum wage, and collective bargaining rights. Enterprise Zone laws create special (typically blighted) geographic areas where normal tax and regulatory laws are lifted, in an attempt to increase employment and business in distressed areas (Greenbaum & Landers, 2009). Minimum wage and other labor laws reduce inequality at the lower end of the wage distribution (Autor, Manning, & Smith, 2010). Collective bargaining and trade union laws structure workplace relations in ways that influence wages, income inequality and worker participation, all of which appear to affect health (Hirsch, 2008; Kahn, 2000). Occupational health and safety regulations directly affect workplace dangerous exposures, and other workplace regulations can encourage (or conversely discourage) healthy practices such as breastfeeding.

Laws that affect social and institutional structures influence social conditions through the distribution of power, social inclusion/exclusion, social capital, and formal and informal social control. Federal securities laws and state corporate governance standards influence corporate conduct, and affect relations between corporate executives, investors and the public. Law attempts to curb undesirable effects of markets by reducing health, safety and environmental risks; market

power; and unfair discrimination. Laws that influence collective bargaining and the rights or limitations on unions influence power distributions between employers and employees. Anti-discrimination and diversity policies promote the rights and freedoms of disadvantaged groups (Kalev, Dobbin, & Kelly, 2006; Moreau, 2010). Criminal law sets standards of conduct necessary to protect individuals and the community and defines formal social control structures and practices to minimize violence and injury.

Family law in the U.S. includes a complex mixture of state and federal laws (Estin, 2010), defining what constitutes a family, family responsibilities and protections for children. Bogenschneider and Corbett (Bogenschneider & Corbett, 2010) argue for a much-expanded view of family policy, and advocate for a whole field of inquiry examining social policy effects on family functioning. They define four main functions of families including 1) family creation, 2) economic support, 3) childrearing, and 4) caregiving, all of which contribute to the health and well-being of its members.

The family is only one example. Laws define and shape a wide range of social and institutional structures and functions in society. Such laws affect population health by directly influencing social conditions within a society, including power dynamics, social stratification, inclusion or exclusion of specific subpopulations, and formal social controls. Such conditions influence connectedness and social capital, which in turn affect health outcomes (Sampson, Morenoff, & Gannon-Rowley, 2002).

Many laws and regulations provide guidelines and rules that directly alter physical conditions, thereby influencing exposures to risks or protections. Laws prohibit or regulate dangerous products. For example, many states and local governments prohibit or limit consumer fireworks due to the risk of injury and death. Laws are often successfully used to reduce the amount of hazard in products or the environment, such as regulations on the design and manufacture of products (for

example, car air bags, safety locks on firearms, alcohol concentration, number of pills per prescription).

Laws and regulations protect food supplies and provide safe housing. For example, the U.S. Food Safety Modernization Act of 2011 will build a new system of food safety oversight for the prevention of foodborne illnesses. Local and state governments define building codes and housing quality standards to protect the safety and health of residents.

Laws can be used to directly change the physical environment, such as road design, alcohol outlet density regulation, building codes, and pollution control. Legal interventions are also used to separate hazards from populations, such as smoke-free rules to limit exposure to environmental tobacco smoke (Brownson et al., 1997; Global Smokefree Partnership, 2009), minimum legal drinking age to reduce availability of alcohol to underage youth (Wagenaar et al., 1993), and pool fence requirements to provide barriers and protect children from drowning (Deal et al., 2000).

Urban design and land use rules are shaped by public health professionals to create safe and walkable communities. The 2005 U.S. transportation reauthorization bill provided federal funding to states for infrastructure to promote active travel to school, to include implementation of speed zones and traffic control measures. Laws altering the physical environment include those intended to improve health and safety outcomes--limiting exposures to risks and promoting exposures to protections--as well as those shaping the physical environments in which people live in ways that have unintended beneficial or deleterious effects.

This brief review illustrates with some examples the wide range of laws that affect the environments in which the population lives. We turn now to a brief summary of implementation considerations, followed by further description of environments, the most important intervening concept between law and population health when viewed from a public health perspective, because

most notable public health successes have used law to shape those environments, rather than focusing on using law to shape individual behavior directly.

Implementation

As with any public health intervention, the extent of effects of law on health outcomes depends on how well the law is implemented. Implementation fidelity is a key component to the effectiveness of any program, practice or policy and implementation science is an entire field of study in itself (Fixsen, 2005; Rabin et al., 2008). Laws shape environments through effects on institutions, organizations, personal and professional practices, relationships and systems. Implementation fidelity can be assessed through measures of receptivity, exposure, participation, compliance and enforcement. Implementation outcomes can include changes in formal and informal institutional and organizational structure and culture, behavior, relationships and systems.

Environments

We distinguish three broad types of environments relevant to health: economic, social, and physical. We have previously summarized the links between these three domains of environmental conditions and child health and developmental outcomes (Komro et al., 2011). Here, we expand upon our previous work on how environmental conditions affect health outcomes more broadly across the lifespan.

Economic Environment. Low income and lack of resources put individuals and families at increased risk of exposure to a multitude of health-compromising factors. Socioeconomic status is linked to a wide range of health outcomes and all-cause mortality (Adler & Rehkopf, 2008). Higher incomes promote exposure to health protections, such as better nutrition, housing, education, and

recreation (Adler & Newman, 2002). Lower-status jobs expose workers to both physical and psychosocial risks (Adler & Newman, 2002). Families face multiple challenges when they live in neighborhoods with a high poverty rate (Sampson, Morenoff, & Gannon-Rowley, 2002). Residents of high-poverty neighborhoods are more likely to be exposed to health risk factors, less likely to be exposed to health protection factors, and more likely to have poor health outcomes (Krieger et al., 2005; Sampson, Morenoff, & Gannon-Rowley, 2002).

In addition to absolute poverty, relative deprivation and income inequality affect exposures to risks and health outcomes. Wilkinson and Pickett (2009) provide an overview of the relationship between economic inequality and various measures of health and wellbeing. Countries and states in the United States with greater inequality in wealth have higher levels of health and social problems. They have lower life expectancy and higher rates of teenage births, obesity, mental illness, and homicides. In an analysis of all 50 of the United States, income inequality was associated with all indicators of child wellbeing (Wilkinson & Pickett, 2009).

Low-income families are much less likely to have health insurance and access to dental and medical care, which results in many consequences, including 1) being unlikely to have a regular source of health care; 2) unhealthy parents, which adds to financial distress; 3) less prenatal care, resulting in unhealthy infants and increased infant mortality; 4) less medical and dental care for children; and 5) poorer health outcomes among children (National Research Council & Institute of Medicine, 2002).

Household income is also linked with the quality of schools that children attend and, through earnings of offspring, contributes to the growth of income inequality in the U.S. (Chetty & Friedman, 2011). Numerous studies have found a link between educational attainment and health outcomes (Egarter et al., 2009). Educational attainment affects health outcomes through 1) health

knowledge, literacy and behaviors, 2) better employment opportunities and higher income, and 3) social and psychological factors (Egerter et al., 2009).

Social Environment. Social cohesion and social capital are defined as the extent of connectedness and solidarity within groups, enhancing the ability to reinforce social norms and provide help and support (McNeill, Kreuter, & Subramanian, 2006). Communities with greater social cohesion and social capital have lower overall population mortality (Sampson, 1997). Social support has been defined as a related, yet separate dimension of the social environment (associated with but distinct from social cohesion or social capital) (McNeill, Kreuter, & Subramanian, 2006). Social support enhances access to resources, material goods and coping responses (McNeill, Kreuter, & Subramanian, 2006). There is strong empirical support for the association between greater social integration and lower mortality risk (Seeman & Crimmins, 2001).

Social exclusion and discrimination break social cohesion. Discrimination creates psychological trauma, limits opportunities for advancement and increases exposures to risks (McNeill, Kreuter, & Subramanian, 2006). Perceived discrimination is linked to multiple deleterious health outcomes (Williams & Mohammed, 2009). Discriminatory policies and practices limit the power, status, and wealth of particular subgroups, which contributes to patterns of social isolation and concentrated poverty (Wilson, 2009). As a result, residents in high-poverty neighborhoods tend to experience lower levels of physical and mental health, educational attainment, and employment than residents of other neighborhoods (Lamberty, Pachter, & Crnic, 2000; Pachter & Coll, 2009).

Physical Environment. Many aspects of the physical environment affect exposures to risks and health outcomes. Neighborhoods with greater physical disorder and decay (i.e., abandoned buildings, trash, and crumbling structures) have higher levels of social and health problems,

including crime, higher levels of fear, lack of social cohesion, and more physical illness (Sampson, Morenoff, & Gannon-Rowley, 2002). Evidence suggests that improving neighborhood physical conditions can increase social cohesion and mental health outcomes (Williams et al., 2008).

Changing community- and street-scale urban design and land use laws such as zoning can achieve significant increases in physical activity and social interaction (Heath et al., 2006).

Availability of health-compromising products poses a significant risk for health outcomes. Tobacco availability and promotion is associated with all stages of smoking among children and adolescents, from experimentation through addiction (U.S. Department of Health and Human Services, 2004). Ease of access and low cost of alcohol influence patterns of alcohol use and alcohol-related problems (Popova et al., 2009; Wagenaar & Perry, 1994). Firearm availability, affected by numerous laws and regulations, similarly affects health. A 10-year time series analysis of data from the 50 states indicated a significant association between firearm availability and the rates of unintentional firearm deaths, suicides, and homicides among 5-14 year olds (Miller, Azrael, & Hemenway, 2002).

Residents of low income and minority neighborhoods have limited access to supermarkets and healthy foods, and greater access to fast food restaurants and energy-dense foods (Powell, Chaloupka, & Bao, 2007). Increasing fruit and vegetable availability in low-access neighborhoods appears to improve dietary choices (Glanz & Yarock, 2004). Research suggests that neighborhood residents with better access to supermarkets and limited access to convenience stores tend to have healthier diets and lower levels of obesity (Larson, Story, & Nelson, 2009). Residents of majority-minority and high-poverty neighborhoods face a greater risk of exposure to range of physical toxins and carcinogens (Crowder & Downey, 2010). Living near toxic exposures is related to an increased risk for adverse health outcomes (Braun et al., 2006; Brender, Maantay, & Chakraborty, 2011).

Risks/Protections and Health Outcomes

Economic, social and physical environmental conditions affect exposures to health risk and protection factors, as well as affect health behaviors. Income and resources affect multiple risks and protections including affordability of nutritious food; safe housing and neighborhood quality; stress; preventive health care, screening, treatment; and educational attainment. Social conditions affect exposure to social support, role models, norms, and stress. The physical environment affects exposure to high-fat and high-sugar (that is, low nutrient density) food, physical toxins and injury hazards. Environments not only have direct effects shaping health-relevant behaviors, but also have indirect effects operating through exposures to risks and protections; and those effects are moderated by other individual-level susceptibility factors (for example, genetic, biological, psychological, social). Finally, some physical and social toxic exposures have particularly large and long-lasting deleterious effects if the exposure occurs at particularly vulnerable times in the life-span, such as during pregnancy or early child development.

The leading causes of morbidity and mortality are heavily influenced by exposures to risks/protections and health behaviors. Major types of exposures include: physical and biological contaminants such as chemicals, gases, metals, radiation of various types, smoke, and infectious bacteria, protozoa, and viruses (related to cancers, other chronic disease, and infectious disease); access to specific foods and demands/opportunities for exercise (related to obesity and its consequences); access to alcohol, tobacco and other drugs for human consumption (related to many acute and chronic health problems); amounts and concentrations of kinetic, thermal, and other types of energy (concentrated energy is the fundamental cause of injuries of all types); and social supports and role models. Major categories of health behaviors include 1) alcohol, tobacco and other drug use, 2) physical activity, 3) eating behaviors, 4) sexual behaviors such as partner selection and use of

condoms and contraceptives, and 5) safety behaviors such as driving under the influence of alcohol or drugs and safety belt use.

Laws affect environments in many ways, and the resulting changes in environmental conditions and ultimate population health outcomes are complex and involve infinite causal paths. Understanding these complex mechanisms requires the same integrated approach employed by the interdisciplinary field of public health, which draws on knowledge and theory across many disciplines including biological sciences, medical and clinical sciences, environmental sciences, epidemiology, statistics, psychology, sociology, anthropology, economics, law and policy, politics, ethics, and more. Even engineering, urban planning, architecture, education, and social work are as critical to implementing public health laws and interventions as they are to understanding the mechanisms of how those interventions and policies affect population health. Nevertheless, all environmental influences on health outcomes operate broadly via two causal pathways — affecting exposures to risks/protections and affecting health behaviors.

The Study of Causal Mechanisms: Examples of How Law Affects the Environment and Population Health

To illustrate the possible causal mechanisms of how law affects environments, distribution of risky/protective exposures and behaviors, and health outcomes, we elaborate on the following examples: smoke-free laws, anti-discrimination laws, and the Earned Income Tax Credit. In each case we draw on the overall model in Figure 1 to hypothesize specific causal chains that could be investigated to better understand how law influences public health.

Smoke-Free Laws

Smoke-free laws provide a straightforward example of the mechanisms through which law promotes better public health outcomes by engineering the physical and social environment. Smoke-free policies restrict smoking in venues like workplaces, public transportation and restaurants. There is a growing movement in the U.S. and other countries to extend smoke-free restrictions to outdoor public spaces such as college campuses and hospital grounds (Global Smokefree Partnership, 2009), thus creating expansive areas of involuntary tobacco abstinence.

Smoke-free laws operate primarily by influencing social and physical environments. Laws that restrict smoking influence the physical environment via the simple expedient of making it harder to find places where smoking is allowed. They also promote and support a social norm against exposing others to smoke in public spaces. The force of social norms not to smoke, and to obey the rules, has been said to contribute to widespread compliance even without enforcement (Kagan & Skolnick, 1993). After implementing campus-wide smoke-free legislation, for example, hospital administrators reported more support, less difficulty, and lower costs than anticipated, as well as few negative effects and numerous positive effects on employee performance and retention (Sheffer, Stitzer, & Wheeler, 2009).

These laws reduce environmental tobacco smoke in public areas where smokers congregate and concentrate pollutants in secondhand smoke (Klepeis et al., 2007). Even brief exposure to smoke can have immediate physiological effects, such as constricting blood vessels and causing platelets to clump together to form clots, which can trigger a heart attack or stroke in particularly susceptible individuals (U.S. Department of Health and Human Services, 2006). These clinical findings are corroborated by a growing body of population-based studies documenting that hospital admission rates for cardiovascular events decline significantly in municipalities after public smoking bans are implemented (Pell et al., 2008), and these declines appear to be most pronounced among

younger individuals and nonsmokers (Meyers, Neuberger, & He, 2009). Reduced access to places where smoking is allowed may also lead to less smoking, which in turn may lead to better health outcomes for both smokers and non-smokers.

The general idea is simple, but research is needed to elucidate more precisely the means through which these effects are won by legal intervention. Implementation is a key mediating factor. Barriers to implementing smoke-free policies include lack of administrative and staff support to guide planners through the policy implementation process at their institution, lack of employee/student/patient support and involvement, and lack of resources and tools to instruct planners how to initiate a smoke-free movement (for example, a step-by-step guide, media templates, and model local ordinances) (Harbison & Whitman, 2008; Whitman & Harbison, 2010). Increasing compliance with an outdoor smoking ban may require multiple enforcement strategies such as moving cigarette receptacles away from building entranceways, adding signage about the smoking ban, and specifying the smoke-free zone with prominent ground markings (Harris et al., 2009).

The major goal of smoke-free policies is to reduce exposure to secondhand smoke and its deleterious consequences. Therefore, a logical hypothesized causal pathway for the effect of smoke-free laws on population health is:

Smoke-free policies → implementation fidelity → reduced tobacco smoking → reduced exposure to smoke in public places → decreased cardiovascular risk factors/events

In addition to reducing tobacco smoke in public spaces, outdoor smoke-free policies may have other beneficial effects on the physical environment, such as reduced unintentional fires, the vast majority of which are caused by cigarettes being abandoned or carelessly disposed (Hall, 2010). Aside from the fire hazard, cigarette butt waste — the single most common form of litter, constituting up to 40% by weight of all litter (Chapman, 2006) — has become a growing environmental concern

(Healton et al., 2011). Cigarette filters are made of non-biodegradable cellulose acetate designed to capture the toxic chemicals found in cigarettes (Novotny et al., 2009), and disposed cigarette filters may leach these toxins into the environment, including ground water supplies, causing harmful effects (Moerman & Potts, 2011; Slaughter et al., 2011). Outdoor smoking bans might reduce exposure to such environmental hazards. We are not aware of any studies to date that have examined the health effects of outdoor smoke-free policies mediated through water-borne exposures to toxins. A hypothesized causal pathway is:

Outdoor smoke-free policy → implementation fidelity → decreased cigarette butt waste → decreased exposure to toxins in water → reduced health risk/outcomes

Beyond modifying the physical environment, smoke-free policies may also affect positively the social and economic environments. For example, smoking bans at workplaces may increase employee attendance and productivity (Parrott, Godfrey, & Raw, 2000); bans at hospitals may improve patient outcomes and hospital profits (Whitman & Harbison, 2010); bans at restaurants or bars may have positive effects on sales and employment (Scollo et al., 2003); bans on beaches may increase tourism revenue (Ariza & Leatherman, 2012); and bans in any municipality may reduce cleanup and maintenance costs associated with litter abatement (Schneider et al., 2011). These economic effects could be examined on outcomes beyond smoke exposure, such as:

Outdoor smoke-free policies → implementation fidelity → increased community resources → increased health protection factors and decreased health risk factors → enhanced population health

Most importantly, smoking bans directly reduce prevalence and amount of tobacco use (Fichtenberg & Glantz, 2002), and indirectly affect public attitudes about smoking, making the practice less socially acceptable (Albers et al., 2004; Heloma & Jaakkola, 2003). In turn, lower tobacco use reduces health care costs and productivity losses attributed to smoking, currently estimates are at \$193 billion per year in the United States (Centers for Disease Control and Prevention, 2008).

Anti-Discrimination Laws

Discrimination — the differential treatment of groups by individuals and social institutions (Bonilla-Silva, 1997) — represents one of the most studied social determinants of health and health inequalities. Perceived racial discrimination has received substantial empirical attention as a psychological stressor that could have important consequences for health (Williams & Mohammed, 2009). The stress literature indicates that discrimination affects health through causing negative emotional states such as depression and anxiety, which create biological and behavioral stress responses that undermine health (Cohen, Kessler, & Underwood-Gordon, 1995). Consistent with this theorized stress mechanism, recent systematic reviews find robust associations between perceived racial discrimination and a broad array of adverse health consequences (Paradies, 2006; Pascoe & Richman, 2009; Williams & Mohammed, 2009; Williams, Neighbors, & Jackson, 2003). The most persistent findings from these reviews are strong associations between perceived discrimination and negative mental health outcomes including depression and anxiety, psychological distress, and general well-being (for example, self-esteem, life satisfaction, quality of life). Weaker but consistent associations exist for negative physical health outcomes including hypertension, cardiovascular disease, low birth weight and prematurity, numerous diseases, physical conditions, and general indicators of illness. Furthermore, evidence from longitudinal studies suggests that discrimination precedes poor health status (Gee & Walsemann, 2009).

Intuitively, anti-discrimination laws are expected to reduce social and institutional exposure to discrimination, and therefore lessen the resulting health consequences of this psychological stressor. However, despite the consistency of findings that link perceived discrimination with poor health, few published studies examine the effects of anti-discrimination laws on perceptions of discrimination and related health outcomes. And there are challenges in assessing implementation fidelity and compliance with anti-discrimination laws. Many lessons about implementing anti-

discrimination policies can be gleaned from experiences with the Americans with Disabilities Act of 1990 (ADA), a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on a physical or mental impairment. Some major obstacles to ADA implementation include accommodations that entail substantial cost (for example, wheelchair accessibility in a public transit system), lingering questions about who is covered, challenges and prejudices regarding mental disability, and insufficient capacity to monitor implementation and compliance (Percy, 2001). Assessing implementation fidelity of such a wide-ranging anti-discrimination law requires an examination of many processes along the implementation pipeline such as ensuring ADA language covers the full set of organizational and individual practices that can lead to discrimination based upon handicap, confirming administrative regulations are in place and enforced, measuring adherence to implementation guidelines, monitoring compliance by governing units and business enterprises, registering complaints, and tracking settlements that have been negotiated or imposed (Percy, 2001).

Several studies have examined the effects of anti-discrimination laws on health outcomes. In an analysis of women's health policies, Wisdom and colleagues (2008) found that state-level anti-discrimination laws were associated with population health status indicators for women. For example, state laws prohibiting insurance discrimination against domestic violence victims were associated with lower rates of hypertension and diabetes, while sexual orientation discrimination laws were associated with lower rates of smoking (Wisdom et al., 2008). The study authors conclude that state efforts to safeguard its female residents from discrimination may not only protect civil rights, but also protect public health by reducing stress for women. Similarly, King et al. (2012) found that diversity training policies at workplaces ameliorate minorities' experiences of discrimination as well as improve their job satisfaction, both of which could potentially reduce stress and improve health. Workplace anti-discrimination policies may also affect income and resources by

mitigating financial costs of litigation (Goldman et al., 2006), job turnover (Nunez-Smith et al., 2009), and social isolation of women and minority workers (Kalev, Dobbin, & Kelly, 2006).

Therefore, a testable mediation model is:

Anti-discrimination policies → implementation fidelity → reduced discrimination → reduced stress → improved health outcomes

In addition to reducing perceptions of discrimination and associated psychological stressors, anti-discrimination law may also alter economic and physical conditions, reducing subtle non-perceived institutional forms of discrimination that foster differential access to societal goods, services, and opportunities. For example, anti-discrimination law can target racial residential segregation — the physical separation of races by imposed residence in certain areas (Williams & Collins, 2001). Racial segregation, which remains exceedingly high for African Americans in the United States, is a well-established contributor to racial differences in socioeconomic status by limiting access to education and employment opportunities (Acevedo-Garcia et al., 2008; Williams & Collins, 2001). A recent housing experiment to address racial segregation showed that single-parent, minority women who took advantage of rent-subsidy vouchers (to help relocate their families to more affluent neighborhoods) were less likely to become obese or develop diabetes than women who remained in poor neighborhoods (Ludwig et al., 2011). A hypothesized mediation model is:

Anti-discrimination policies → implementation fidelity → enhanced living and working conditions → reduce exposure to risks, increased exposure to protections → improved health outcomes

Anti-discrimination laws go far beyond racial forms of discrimination, including unfair treatment attributed to gender, sexual orientation, religion, disability or other group identification. For example, the growing movement to enact anti-stigma and anti-discrimination legislation for people with mental disabilities may provide critical avenues for eliminating social barriers and promoting adequate and equitable access to mental health treatment (Cobigo & Stuart, 2010). But, we know

simply passing such laws is not enough (Burriss et al., 2006). Careful study of implementation structures and processes, and the subtle and complex prejudices of actors in the implementation systems are also warranted.

Earned Income Tax Credit

The federal Earned Income Tax Credit is the largest cash-transfer program for lower-income families. The EITC has been successful at promoting entry into the labor force of single parents, especially mothers, and increasing income among poor working families (Eissa & Hoynes, 2006; Neumark & Wascher, 2001), though the extent of its impact is debated (Alstott, 2010). Inasmuch as it has been credited with lifting more children out of poverty than any other government program (Eissa & Hoynes, 2006), it offers an example of how law in the form of the federal tax code can be used in a public health model to influence health outcomes.

The EITC works primarily through the economic environment. The EITC is designed and implemented to promote work and lift families out of poverty. As such, most of the literature is focused on evaluating the effectiveness on labor force involvement and poverty indicators. Evidence linking income support policies to health outcomes is scarce (Arno et al., 2009), highlighting the need for research that explores this possible relationship and its mechanisms. A primary focus of the EITC is income support to families with young children, hypothesized to provide material resources at a critical period of child development. Those increased resources are expected to improve many dimensions of the immediate environment experienced by such families (for example, more nutritious food, improved child care, lower stress) with long-term positive outcomes expected as a result (Arno et al., 2009). Following our conceptual framework, one hypothesized causal chain to examine the effects of the EITC on child health outcomes is:

EITC → implementation fidelity → decrease family poverty → increase material resources → improve child development and child health → adult/ lifelong health and quality of life

Alternatively, Arno and colleagues (2009) examined the effect of EITC on health insurance coverage for children, as a hypothesized mediator of an effect on child health outcomes. They found that single mothers with low or moderate incomes who were ineligible for the EITC program were 1.4 times more likely to lack health insurance for all of their children than single mothers who were eligible to receive the credit. They also examined EITC direct effects on infant mortality and found a statistically significant inverse association between EITC penetration and infant mortality. The causal interpretation from their results would be enhanced if they were to combine the two studies, directly examining the mediating influence of health insurance coverage on prenatal care and infant mortality, depicted as:

EITC penetration → implementation fidelity → increased health insurance coverage → increased prenatal care → decreased infant mortality

Strully et al. (2010) published an exemplary study examining the health effects of the EITC on birth weight mediated through maternal smoking during pregnancy. Low birth weight was chosen as an important outcome variable since it is predictive of various negative outcomes across the life course (for example, infant mortality, poor child health, and lifelong low educational attainment and earnings). Results of their analyses supported their mediational hypothesis. First, they found that those participants who received EITC experienced an increase in maternal employment and income, which was then associated with an increase in birth weight. They then performed a mediation analysis and found that the association between EITC and increased birth weight was partially explained by a reduction in maternal smoking during pregnancy. The mediation model tested was:

EITC → implementation fidelity → increase maternal employment/income → reduce smoking during pregnancy → increase birth weight

Evans and Garthwaite (2010) examined direct health effects of the EITC on mother's health outcomes. Using national data sets (that is, Behavioral Risk Factors Surveillance System and the National Health Examination and Nutrition Survey), they compared low-educated mothers of two or more children, who are eligible for the maximum EITC benefits, to mothers with only one child. They found evidence of positive health effects among those mothers eligible for maximum benefits, including fewer days with poor mental health, greater percent reporting excellent or very good health, and lower levels of biomarkers that indicate inflammation, which is associated with stress and is a risk for cardiovascular disease. However, they did not examine mediational hypotheses. Based on our framework and the work by Evans & Garthwaite (2010), we present two potential causal pathways, one examining effects on access to health care and one on social conditions:

EITC → implementation fidelity → increased social inclusion, connectedness → decreased stress → maternal health

and

EITC → implementation fidelity → increased access to health care → preventive services → maternal health

Potential health effects of the EITC may also operate via economic effects on high-poverty neighborhoods. It has been estimated that federal and state EITC refunds put \$9.3 million/square mile into New York City communities (Arno et al., 2009). And Spencer (Spencer, 2007) examined the effect of the EITC on the economies of poor neighborhoods in Los Angeles. Results indicate a positive effect on poor neighborhoods, with increased EITC income associated with retail job gains. He did not examine more distal effects on health indicators of the neighborhoods. A hypothesized causal chain for effects of the EITC on health outcomes within high-poverty neighborhoods is:

EITC → implementation fidelity → decreased neighborhood poverty → job and business generation → increased neighborhood protective exposures → improved neighborhood health

The earned income tax credit, anti-discrimination laws, and smoke-free laws each have many possible health effects deserving further study, and we depicted only a few possible causal paths. We illustrated just three examples from hundreds or thousands of laws that deserve careful theorizing and empirical testing of the many possible dimensions of economic, social and physical environments affected by a law, and how those environmental changes are reflected in aggregate levels of population health and well-being.

Measures to Study the Effects of Laws on the Environment, Exposures, Health Behaviors and Health Outcomes

To evaluate the broad scope of legal interventions that could affect population health, public health law researchers must determine relevant measures including primary health outcomes, proximal behaviors and exposures, and more distal indicators of environmental change. The relevant measures depend upon hypothesized causal mechanisms of legal effect. Consider the smoke-free policy example illustrated earlier. One hypothesized causal pathway for the effect of a smoke-free law on population health is that the smoking ban reduces tobacco smoking in a public area, which reduces non-smokers' exposure to secondhand smoke, which in turn, reduces the physiological effects that can trigger asthmatic or cardiovascular events in susceptible non-smokers who share the public space. Each of these links in the causal chain can be measured from the legal intervention to the ultimate health outcomes. For example, a comprehensive list of U.S. municipalities with local 100% smoke-free laws (by type of locale, that is, restaurants, bar, or non-hospitality workplaces) can be found at the Americans for Nonsmokers' Rights (ANR) website (<http://www.no-smoke.org/>). Similarly, the CDC's State Tobacco Activities Tracking and Evaluation (STATE) System allows

comparison of state smoke-free legislation ranging from public school campuses to private vehicles. Further in our causal pathway, tobacco smoking prevalence in states and municipalities can be assessed longitudinally (before and after implementation of the law) using a variety of CDC-sponsored tobacco surveillance systems for both youth and adults such as the Behavioral Risk Factor Surveillance System (BRFSS), National Health and Nutrition Examination Survey (NHANES), National Health Interview Survey (NHIS), National Youth Tobacco Survey (NYTS), and Youth Risk Behavior Surveillance System (YRBSS). Furthermore, some of these surveys have items that assess exposure to secondhand smoke. Lastly, numbers of asthmatic and cardiovascular events can be measured using claims data supplied by the Centers for Medicare & Medicaid Services (CMS) or using hospital and non-hospital patient medical record data supplied by the CDC-sponsored National Hospital Ambulatory Medical Care Survey (NHAMCS), National Ambulatory Medical Care Survey (NAMCS), and National Hospital Discharge Survey (NHDS). Measuring multiple links in the hypothesized causal pathway (as opposed to only examining the legal intervention and the ultimate health outcomes) maximizes understanding of the mechanisms of legal effect. If the observed pattern of effects matches the theoretically expected pattern, confidence is strengthened in causally attributing the observed effect to the law.

Before considering expensive and time-consuming primary data collection to address a research question, researchers should explore the gamut of secondary data sources. The availability of data (including its periodicity, time span, and geographic levels) limits research design options. Some data sources provide extensive longitudinal data, which can allow incorporation of multiple research design elements for strengthening causal inference such as the ability to use many repeated measures or comparison jurisdictions, groups or outcomes (see the monograph by [Gerber, Green and Sovey](#)). A wealth of high-quality data sources exists measuring a range of health-related indicators over varying time periods and geographic levels of analysis. For example, the U.S. Census

Bureau provides Small Area Income and Poverty Estimates (SAIPE) — combining data from administrative records, inter-census population estimates, and the decennial census with direct estimates from the American Community Survey — to provide consistent and reliable single-year estimates (since 1995) of income and poverty statistics for U.S. states, counties, and school districts. The U.S. Consumer Product Safety Commission (CPSC) oversees the National Electronic Injury Surveillance System (NEISS), which (since 1978) monitors hospital emergency department records for consumer product-related injuries including demographic data, cause/mechanism of injury, locale where injury occurred and product involved. These and other useful data sources are included in Table 1.

A useful list of data sources can be found at the Health Indicator Warehouse (HIW) website (<http://www.healthindicators.gov/Resources/DataSources>). The HIW — a collaboration of Agencies and Offices within the Department of Health and Human Services, and maintained by the CDC's National Center for Health Statistics — was primarily created to provide a single source for national, state, and community health indicators. Table 1 — adapted from the HIW's comprehensive list of data sources — describes 55 high quality data sources including supplier, years available and periodicity, mode of data collection, selected measures, population covered, and website for additional information.

Conclusion

The field of public health is fundamentally interdisciplinary, integrating knowledge and theory from many sciences and disciplines to develop effective ways to create the conditions that maximize the health and well-being of the entire population. Law is a critically important force in shaping the social, economic, and physical environments in which people live, and historically, many significant public health accomplishments were achieved by using laws and regulations to help shape the

conditions in which people live. Because law shapes so many dimensions of society, and because so many dimensions of the economic, social and physical environment affect one's odds of optimal health, opportunities for research on how law affects health abound. But research also needs to move beyond common "black box" studies that simply assess whether a given law is related to a given health outcome, as important as they are initially on new or understudied topics.

Understanding the many ways law affects population health would be enhanced by increased focus on more-complex mediation studies testing specific theory-based, and potentially widely generalizable, mechanisms of effect.

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