In addition to measuring chronic disease burden, chronic disease epidemiologists have the opportunity to look upstream and work with program partners to implement prevention and control strategies with potential to impact the greatest number of residents. Therefore, this chapter reminds you as the lead chronic disease epidemiologist that different levels of society can impact individual behavior and that several frameworks describe these levels or interventions at these levels. This chapter will foster your thinking about how social context and community factors can drive behaviors affecting chronic diseases. Part of your role as the lead chronic disease epidemiologist is to measure these contextual factors to better understand the relationships among the environment, individual behaviors, and population health outcomes. Additionally, this chapter describes the potential role of these relationships in informing the development of policy, systems, and environmental changes targeted at the different societal levels to help promote improved population health. While individuals are responsible for initiating and maintaining the behaviors necessary to reduce risk and improve health, their behavior is influenced to a large
extent by the context in which they live (i.e., social determinants of health). The social forces are life threatening. Researchers from Columbia University estimated deaths attributable to social factors in the United States in 2000: 245,000 deaths attributed to low education; 176,000 to racial segregation; 162,000 to low social support; 133,000 to individual-level poverty, 119,000 to income inequity, and 39,000 deaths to area-level poverty.¹ As stated in a 2000 Institute of Medicine report on health promotion, "It is unreasonable to expect that people will change their behavior easily when so many forces in the social, cultural, and physical environment conspire against such change."² By identifying determinants of health, you as the lead chronic disease epidemiologist can guide interventions that help communities overcome these barriers and allow for the healthy choice to become the easy and life-extending choice.

For the senior epidemiologist or professional who supervises or mentors the lead epidemiologist, you can use this chapter to identify and share previous analyses that informed environmental, system, or policy changes and their success or failure in preventing chronic diseases or reducing the impact of diseases on activities of daily living. If your department has its own model for systems thinking and/or for social determinants of health, provide it to the lead chronic disease epidemiologist. For the entry-level epidemiologist assess whether or not the surveillance system that you use or know best includes measures of social or environmental context.

Understand the Levels of Public Health Intervention and Their Influence
Public health interventions to prevent and control chronic illness can be implemented at any (or all) societal level(s), from the individual to the institutional to the entire community or state. More recently state public health departments have shifted from providing or funding individual direct services (intervening directly at the individual level) to improving a system of services (intervening at the organizational and community level).

Social Ecological Model
A useful framework describing a systems approach at various societal levels is the Social Ecological Model (Figure 4-1).³ This model recognizes and articulates the relationship between the individual and their environment. The Social Ecological Model can have four or five levels. At the center or base is the individual level of internal determinants of behavior, such as knowledge, attitudes, beliefs, and skills. The interpersonal level comprises the external influences of family and friends, social norms, social identity and role definition form and operate at this level and can influence lifestyle and health care choices. The

institutional or organizational level considers the rules and policies that guide and support behavior, including healthy behavior, in the assemblies that aggregate interpersonal associations, such as the workplace, schools and social organizations. The fourth level, the community, is the collective network of individuals, businesses, institutions and organizations. These larger social constructs, which include the media and advocacy groups, can be defined by geography, membership, heritage or affiliation. The last level, the policy level, describes the authoritative decisions made by a local, state, or federal governing body that can influence all the other levels. For example, federal, state, local or tribal government officials can support chronic disease prevention and control through laws, ordinances, regulations or proclamations.

Figure 4-1. Social Ecological Model
The Health Impact Pyramid

Dr. Thomas Frieden's five-tier, Health Impact Pyramid, Figure 4-2, can be described as an adaptation of the Social Ecological Model. In place of the five levels of possible public health intervention, the pyramid depicts five types of interventions and their relative population reach. The five tiers of the pyramid are, from bottom to top, socioeconomic factors (e.g., decreasing the negative impacts of poverty), changing the context to make individuals' default decisions healthy (e.g., eliminating trans fat), long-lasting protective interventions (e.g., colonoscopy, treatment of tobacco addiction), clinical interventions (treatment of hypertension and hyperlipidemia), and counseling and education (e.g., dietary counseling). Like the Social Ecological Model, the Health Impact Pyramid suggests that interventions with greater population reach—and which require least individual effort—will have the greatest overall public health impact. Moreover, these population-level interventions are potentially more sustainable as, unlike individual-level focused activities, they typically do not require considerable ongoing financial support and are not impacted by limits in scalability.

Figure 4-2. The Health Impact Pyramid
Figure used with permission from AJPH. Frieden TR. A Framework for Public Health Action: The Health Impact Pyramid. Amer J Pub Health. 2010; 100(4): 590–595.

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The Maternal and Child Health Pyramid

The “MCH pyramid” is a conceptual framework for four tiers of services funded by the Title V Maternal and Child Health Block Grant (http://www.amchp.org/AboutTitleV/Documents/MCH_Pyramid_Purple.pdf). Older than the Health Impact Pyramid, this framework used a pyramid to show the same impact, that the lowest tier had the largest reach in terms of population impact and the top tier the smallest. Its four tiers from top to bottom are:

- Direct health care services (for gap filling)
- Enabling services (transportation, translation, outreach, respite care, health education, family support services, case management coordination with Medicaid)
- Population-based services (newborn screening, lead screening, immunizations, oral health, injury prevention, nutrition, outreach, public education)
- Infrastructure-building services (needs assessment, evaluation, planning, policy development, quality assurance, standards development, monitoring, applied research, systems of care, information systems, training)

Changing the Context in Communities

Additional emphasis on implementing population-level, upstream efforts—and especially on changing the context to make individuals’ default decisions healthy—may be the most promising strategy to maximize the impact of limited resources. One example is the highly successful campaign to reduce the number of public spaces where smoking is permitted; this effort has changed the environment for many smokers and also helped to shift social norms. However, such interventions can be controversial, especially when there are vested interests opposed to changing existing societal norms.

As with public smoking, changing the context can mean changing policies, systems, the environment or some combination thereof. Policy changes occur at the governmental or organizational level and include laws, ordinances, resolutions, mandates, regulations, or rules supporting healthy lifestyle choices; for example, a corporate policy to provide paid time off during work hours for staff to receive health screenings. Systems changes impact the modus operandi in institutional or community settings, such as schools, hospitals, transportation systems and recreational systems; for example, introducing electronic health records within a health care

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system to facilitate information-sharing, care coordination and patient empowerment. Finally, **environmental changes** involve substantive changes to the economic, social, or physical environment; for example, incorporating sidewalks, and recreation areas into community design.

Some prominent "context-changing" interventions include:

- Fluoridation of drinking water, a cost-effective measure that is helping to prevent tooth decay among the estimated 210.7 million U.S. residents serviced by fluoridated public water systems.\(^8\),\(^9\)
- Iodization of salt to prevent iodine deficiency and associated disorders, including goiter, hypothyroidism, and congenital hypothyroidism.\(^10\)
- Eliminating artificial trans fat from foods and moving from use of saturated to unsaturated cooking oils in restaurants to improve cardiovascular health.\(^11\)
- Introducing healthy vending machine foods in schools and worksites to reduce obesity and improve nutrition.\(^12\),\(^13\)
- Mandating, at the school system- or state-level, that elementary school students receive at least the recommended 30 minutes of daily physical activity during each school day to reduce obesity and enhance cardiovascular health and fitness.\(^14\)
- Instituting Complete Streets—roadways designed to safely and comfortably provide for the needs of all users, including, but not limited to, motorists, cyclists, pedestrians, transit and school bus riders, people with disabilities, and emergency users—to promote physically active transportation.\(^15\),\(^16\)

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Develop a Coordinated Response

As noted in Chapter 2, as the lead chronic disease epidemiologist, build relationships with a broad range of partners within and outside the state public health department to achieve population-level improvements in health. In addition to established professional and voluntary associations interested in chronic disease issues, virtually all states have several statewide coalitions working to reduce the burden of specific diseases or risk factors. Other potential chronic disease stakeholders include hospitals, health insurance groups, health care quality improvement organizations, schools, faith-based institutions, employers, community members and others (Figure 4-3).

Although these stakeholders have traditionally worked independently (or in limited partnerships) to address specific interests, there is increasing awareness of the value of coordinating activities to achieve common goals and attempts to collaborate to do so.

Figure 4-3. Stakeholders involved in the implementation of chronic disease prevention and control interventions.

One strategy that has been implemented to increase coordination across sectors is the development of comprehensive state chronic disease control plans. Some state chronic disease programs have used Coordinated Chronic Disease Grant and other funding from the CDC to create these with input from various partners. While programmatic initiatives should comprise a key component of a state plan, a major focus for many plans will be interventions to "change the community context" via policy, systems and environmental changes. The state plan should:

- Identify well-defined, measurable goals and, perhaps, an overall vision statement.
- Identify key process and health outcome indicators that can be tracked over time at the state level and, when possible, at the local level to evaluate and refine interventions to achieve goals.
- Document each stakeholder’s role in carrying out portions of the plan.
- Identify mechanisms to report progress and other feedback to plan stakeholders.
If the plan includes all of the above, it mirrors the five principles of collective impact: a shared agenda, mutually reinforcing activities, measurable performance objectives, regular communication, and a backbone organization.

Ultimately, these state plans should be adaptable to individual communities’ unique contexts and concerns. Chronic disease epidemiologists should encourage communities to conduct or update their own community assessments, using primary and secondary data to assess current social conditions. Such assessments are vital to illuminate the “conditions on the ground,” including readiness for change, so that appropriate interventions that support the overall state plan, but are specific to the local community, can be selected, implemented, and evaluated. The CDC Healthy Communities Program’s Community Health Assessment and Group Evaluation (CHANGE) tool is designed to facilitate this assessment process: "It can be used annually to assess current policy, systems, and environmental change strategies and offer new priorities for future efforts." The tool is available at www.cdc.gov/healthycommunitiesprogram/tools/change.htm. Overall, the promise of a coordinated, statewide effort is a synergistic effect, with the total impact being greater than the sum of each stakeholder's individual efforts.

Other assessments can inform these plans. Every five years the federal Maternal and Child Health Bureau as part of the Title V block grant require states to conduct a state needs assessment that includes state and local input and to use this assessment to select priorities for the next five years. Many states as either part of the public health accreditation process or as part of their public health improvement process require a needs assessment that can include a public health capacity assessment and priority setting.

However, no matter what community assessment tool is used or what interventions are prioritized and implemented, the following are needed to support positive changes at both the state and local levels:

- Effective public-private partnerships.
- Targeted policy and environmental changes embedded in broader community initiatives.
- Continued engagement and interaction with the broader community.
- A meaningful, long-term commitment from partners work towards desired outcomes.

State and local groups need to place greater emphasis on population-level, upstream efforts to successfully decrease the growing burden of chronic disease and associated risk factors. Many of these efforts should attempt to change the community context through policy, systems, and environmental changes. State health departments’ chronic disease programs and their partners should consider working toward consolidating each of the targeted chronic disease state plans into one overarching plan, highlighting the important role each disease-specific group can play to achieve desired health outcomes. With this collaborative framework in place, stakeholders

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throughout the state can move upstream and impact population health in the most effective and efficient way possible.

Resources and implementation examples
The list of articles and web sites below provide examples of system approaches, such as the social ecological model, and evaluating community change related to various chronic disease risk factors and outcomes. Included are articles and web sites related to social determinants of health which take a system approach to address specific risk factors or outcomes. These resources are provided as a reference for you as the lead chronic disease epidemiologist. Select which ones to read in detail, based on the current need and priorities in your state.

Articles

Implementing SEM concepts in an analysis: example
Singh, Siahpush, and Kogan (2010) examined the relationship of neighborhood socioeconomic conditions and obesity and overweight prevalence among U.S. children and adolescents using the 2007 National Survey of Children's Health. The odds of a child's being obese or overweight were 20-60 percent higher among children in neighborhoods with the most unfavorable conditions such as unsafe surroundings; poor housing; and no access to sidewalks, parks, and recreation centers, compared to children living in better conditions.

http://www.publichealthreports.org/
Implementing SEM concepts in public health action: example

The work on Schaff et al. (2013) applied the social ecological model to engage, foster, and train partners across community organizations and across government institutions, including staff in the local health department. Collaboratively, these partners addressed public health issues such as lack of running water through specific policy changes, such as a moratorium on water shutoff to inhabited but foreclosed rental properties. Specific to chronic diseases, they worked with the district attorney’s office to create a case management component of the truancy court where the judge can refer children

Web sites

CDC Colorectal Cancer Control Program — http://www.cdc.gov/cancer/crccp/sem.htm
CDC Social Determinants of Health — http://www.cdc.gov/socialdeterminants/

Summary

The information in this chapter can inform your competency in the domain of community dimensions of practice in a way that also increases the potential impact of the interventions. It can enhance your competency in systems thinking, which in turn might give you opportunities to demonstrate leadership as you think across the community levels and partnerships. The main points related to the three public health essential services that epidemiologists provide are:

- Surveillance: Your role is to coordinate and conduct chronic disease surveillance, including helping to establish new standard indicators related to risk and protective factors at the individual and system level. You can influence what contextual factors and social determinants of health are measured and analyzed. Only then can you bring this vital information to the policy discussion and to program planning. You can assess the impact of the new policies or interventions.
- Communication: Your role is to communicate scientific and technical information in a way that decision makers can use it. Select one of the frameworks as a way to communicate varying impact of possible interventions on population health. Building a collaborative, integrated state chronic disease plan demands good listening skills and the ability to translate information using language and concepts from multiple disciplines and clinical fields.

Consultation: Through your consultation, you connect the science and data to the policy options and policy makers in your state. You have the opportunity to work with family leaders, advocates, stakeholders, organizations and communities representing different social ecological levels and understandings of public health need and impact. You can connect state activities with state health assessments and advocate for evaluating the interventions that are not evidence based or monitor the fidelity to the evidence-based program. Read the next chapter for more about evidence-based public health and your role in it.