Strategic Planning for Chronic Disease Prevention in Rural America: Looking Through a PRISM Lens

Amanda A. Honeycutt, PhD; Kristina Wile, MS; Cassandra Dove, MPH; Jackie Hawkins, MS; Diane Orenstein, PhD

Context: Community-level strategic planning for chronic disease prevention. Objective: To share the outcomes of the strategic planning process used by Mississippi Delta stakeholders to prevent and reduce the negative impacts of chronic disease in their communities. A key component of strategic planning was participants’ use of the Prevention Impacts Simulation Model (PRISM) to project the reduction, compared with the status quo, in deaths and costs from implementing interventions in Mississippi Delta communities. Design: Participants in Mississippi Delta strategic planning meetings used PRISM, a user-friendly, evidence-based simulation tool that includes 22 categories of policy, systems, and environmental change interventions, to pose what-if questions that explore the likely short- and long-term effects of an intervention or any desired combination of the 22 categories of chronic disease intervention programs and policies captured in PRISM. These categories address smoking, air pollution, poor nutrition, and lack of physical activity. Strategic planning participants used PRISM outputs to inform their decisions and actions to implement interventions. Setting: Rural communities in the Mississippi Delta. Participants: A diverse group of 29 to 34 local chronic disease prevention stakeholders, known as the Mississippi Delta Strategic Alliance. Main Outcome Measure(s): Community plans and actions that were developed and implemented as a result of local strategic planning. Results: Existing strategic planning efforts were complemented by the use of PRISM. The Mississippi Delta Strategic Alliance decided to implement new interventions to improve air quality and transportation and to expand existing interventions to reduce tobacco use and increase access to healthy foods. They also collaborated with the Department of Transportation to raise awareness and use of the current transportation network. Conclusions: The Mississippi Delta Strategic Alliance strategic planning process was complemented by the use of PRISM as a tool for strategic planning, which led to the implementation of new and strengthened chronic disease prevention interventions and policies in the Mississippi Delta.

KEY WORDS: chronic disease, prevention, strategic planning, systems modeling

Mississippi has the highest heart disease death rate of any state in the nation.1 In 2007, 28.4% of all deaths in Mississippi were attributable to cardiovascular disease (CVD).2 Mississippi also has correspondingly high rates of risk factors and risk behaviors known to contribute to the development of CVD. In 2009, 35% of Mississippi adults were obese—the highest obesity rate in the nation. Approximately 32% reported not participating in physical activity for the past 30 days; 17% consumed 5 or more fruits or vegetables daily; 23% were smokers, 37% had high blood pressure, and 41% had high blood cholesterol.3 The Mississippi Delta (MSD)
region has even higher rates of these CVD risk factors and death rates than the state of Mississippi as a whole.

Federal, state, and regional public health advocates are working together to address heart disease and its risk factors in Mississippi. In 2008, in partnership with the Centers for Disease Control and Prevention’s Division for Heart Disease and Stroke Prevention, the Mississippi State Department of Health created the MSD Health Collaborative to build capacity within the Delta region’s communities to address risk factors for heart disease and stroke through policy, systems, and environmental changes that would increase access to physical activity, healthy foods, clinically based hypertension management/prevention programs, and quality health care and increase tobacco prevention efforts. The Mississippi Delta Strategic Alliance (MDSA) was formed in 2009 to implement community-based initiatives that integrate multiple evidence-based strategies to reduce CVD risk factors.

This article describes the MDSA strategic planning process and outcomes. We focus on MDSA’s use of the Prevention Impacts Simulation Model (PRISM) as an important tool to support strategic planning, although as with any strategic planning process, the MDSA synthesized information from a variety of sources, including PRISM outputs, community priorities, local resources, and needs assessments, to decide which interventions to implement.

Methods

PRISM is a user-friendly, interactive simulation tool that estimates the short- and long-term (up to year 2040) impacts of 22 categories of chronic disease interventions on health outcomes and costs. The PRISM intervention strategies (listed in the Table) range from individual-level intervention approaches, such as smoking quit services, to policy and regulatory changes with population-wide reach, such as local policies requiring daily physical activity in schools or statewide workplace smoking bans. The estimated impact of each PRISM intervention on behavior changes and costs is based on evidence from the peer-reviewed published literature or on expert opinion when published evidence was lacking or inconsistent. Figure 1 shows the PRISM framework; interventions modeled in PRISM affect CVD risk factors, such as hypertension, smoking, and obesity, which in turn affect mortality and costs from CVD and associated risk factors. PRISM allows users to visualize the relationship between CVD risk factors and outcomes and to explore the likely impact of various intervention scenarios on risk factor prevalence rates, CVD death rates, and medical and productivity costs. When using PRISM to support strategic planning, users first determine the current levels of each intervention approach relative to the maximum possible implementation. For example, if half of workers are already affected by workplace smoking bans, then the current level of that intervention is 0.50, or half of the full range between 0 and the maximum level of 1. Users may then explore alternative scenarios by adjusting the intervention levels between 0 and 1 to examine the potential impact, relative to the current baseline, on short- and long-term health outcomes and costs.

More details on PRISM and its assumptions are provided elsewhere, but as an example, we describe key fruit and vegetable access assumptions. Based on evidence in the literature, PRISM assumes that 41.3% of adults have low fruit and vegetable consumption. At baseline, 75% are assumed to have access to affordably priced supermarkets and produce stands. Providing access to affordable fruits and vegetables is assumed to reduce the likelihood of a diet low in fruits and vegetables consumption by 40% (based on Morland et al and expert opinion).

The MDSA held 3 strategic planning meetings in the MSD between July 2009 and April 2010 during which they used PRISM to inform their decisions. Meeting participants included representatives from a variety of state and local agencies (health, education, transportation, and environmental), local medical providers, academic leaders, community leaders, and legislators. These meetings had 34, 31, and 29 participants, respectively, and included interactive, facilitated discussions. The meeting facilitators contributed to this article. PRISM provided participants with quantitative information about the likely short- and long-term impacts of various intervention combinations compared with no intervention baseline forecasts. Strategic planning participants used PRISM as a tool to inform decisions regarding which chronic disease prevention activities to pursue.

During the first meeting in July 2009, participants discussed what a healthy Delta might look like. Using PRISM, participants examined several alternative intervention scenarios and identified interventions with the highest projected impact. At the second meeting in December 2009, participants again used PRISM to inform their strategic planning decisions. Participants identified existing partners and organizations in their communities and determined which interventions could feasibly be implemented or enhanced by these partners and organizations to have an impact in the Delta. At the third meeting in April 2010, a diverse group of participants (eg, Department of Transportation) was brought together for an additional round of strategic planning. Participants described their ongoing disease prevention activities, which were then entered into
PRISM using a facilitated process to reach consensus on what portion of the maximum possible intervention effort had been achieved. The facilitator led a discussion of what fraction of the population was being reached and the intensity of each intervention. For example, if 50% of the population was being reached, and the intervention was being implemented in 50% of all possible settings, then the intervention was represented as being at 25% (0.50 × 0.50) of its maximum level. PRISM outputs demonstrated the expected short- and long-term health and cost benefits relative to the no intervention baseline forecasts. Participants then used a similar process to identify possible incremental gains in health outcomes from additional preventive interventions. They committed to implementing a selection of additional preventive interventions, spending time in small groups to create action plans for each intervention. Because the locations varied, different groups of stakeholders participated in each of these meetings, yet a core group participated in all 3.

A national version of PRISM was developed that reflects the average prevalence of chronic disease risk factors for the US population. To increase buy-in from strategic planning participants, the version of the model used in the MSD was calibrated to match the population size and risk factor prevalence observed in the Delta. For this calibration, local health department partners in the MSD provided pooled census data for the years 2000 through 2007 from which we estimated population size by age, sex, and county for the 11 counties in the Delta. We also used National Health and Nutrition Examination Survey data for the years 1999 through 2006 to estimate national risk factor prevalence for hypertension, high blood cholesterol, diabetes, obesity, and smoking. We then used census data for the 11 Delta counties to reweight risk factor prevalence estimates accounting for differences between the United States as a whole and the Delta region in age, sex, race/ethnicity, poverty, and prior CVD events. Behavioral risk factors for the population, such as lack of vigorous physical activity and not having a regular health care provider, were obtained from the 2004 to 2007 Behavioral Risk Factor Surveillance System for the MSD counties.

Participants in the strategic planning effort were able to use PRISM to visualize the likely impact of current interventions on CVD and non-CVD outcomes and costs from 2010 through 2040 and then to compare the current interventions trajectory with a baseline reflecting the pre-2009 CVD prevention efforts in Mississippi that contributed to existing levels of risk factor and disease prevalence. They also compared outcomes and costs under several alternative scenarios of adding new or expanding existing interventions.
PRISM users can easily add from the menu of interventions or explore increases in the estimated population reach or intensity of existing interventions using the interactive model features. Users are provided with graphs for each scenario that show disease prevalence, deaths, costs, and other projected outcomes for the current year and for each successive year through 2040.

● Results

The MDSA’s use of PRISM complemented the strategic planning process already underway in the MSD. Using PRISM as a tool for strategic planning, participants identified specific actions to reduce the impacts of chronic disease in the Delta.

Integration of diverse chronic disease prevention efforts

The strategic planning meetings brought together participants from multiple sectors and allowed them to see how their own sector’s activities were contributing to improved interventions and outcomes. This shared experience and learning are important outcomes of strategic planning. The importance of creating a technical package of a limited number of high priority, evidence-based interventions and bringing a range of partners and coalitions together are 2 of 6 components that have been highlighted for effective public health program implementation. PRISM may help contribute to shared learning among a diverse group of planning participants, because it integrates multiple risk factors into a single model, enabling discussion about which organizations are working in each intervention area. PRISM was used to demonstrate the combined impact of stakeholders’ efforts on chronic disease prevalence and cost. Participants planned to align their goals and reduce program duplication and costs. For example, participants identified a shared need to catalog existing resources, such as preventive care services, farmers’ markets, and recreational facilities, for each geographical area. Partners would use this resource to identify where gaps and redundancies existed.

Evaluation of future impact of today’s policies

A goal for the strategic planning group was to analyze their past investment of resources to determine expected future trajectories of risk factors, chronic diseases, and costs if preventive efforts are sustained at existing levels. Strategic planning facilitators perceived that participants were encouraged by the simulated long-term impact of current efforts and motivated to implement new interventions (described later) to further reduce chronic disease. Participants also used the simulated estimates to communicate the potential benefits of policy change through presentations to their stakeholders.

Intervention implementation

By using PRISM in small groups, the participants were able to experiment with different combinations of interventions during their second meeting in December 2009. At the start of the third meeting in April 2010, the facilitator used PRISM to demonstrate how MDSA members’ recent efforts were affecting CVD outcomes and to illustrate the long-term potential impact of sustaining those efforts. Participants also committed to implementing new interventions and expanding several existing interventions by increasing the intensity of intervention efforts and/or the number of people reached. Their use of PRISM helped inform these decisions because PRISM allowed them to visualize which intervention options have the greatest impacts in terms of improving population health. The intervention approaches that MDSA participants committed to adopt during the April 2010 meeting are described in the subsections later.

Mississippi Delta strategic planning participants committed to adopt or expand the following evidence-based chronic disease prevention efforts: workplace smoking bans, air pollution restrictions, fruit and vegetable access, fruit and vegetable promotion, preventive care for residents who have experienced a previous CVD event (ie, post-CVD) and those who have not, and acute care and rehabilitation for post-CVD residents. Participants were already engaged in chronic disease prevention efforts that touched on 20 of the 22 CVD prevention interventions included in PRISM (all except air pollution and physical activity requirements in child care). The level of effort for each of these interventions is shown in the Table as MSD sustained efforts. After using PRISM in the April 2010 strategic planning session, participants agreed, at a minimum, to double existing efforts for 6 interventions and to begin working on a new intervention, air pollution restrictions (see the Table). The levels of increased intervention efforts are shown in the Table as MSD additional efforts for the following interventions: preventive care for both pre- and post-CVD events, acute care and rehabilitation for post-CVD events, fruit and vegetable access and promotion, and workplace smoking bans.

Figures 2 and 3 show the simulated impacts on death rates and medical and productivity costs of implementing what participants viewed as feasible levels of the 7 new or expanded interventions. We assumed that all interventions are implemented during a 2-year period and that they are sustained through 2040.
The figures also reflect the impacts of demographic changes, such as population aging as reflected in US Census bureau population forecasts for the Delta counties, and the combined effects of expected changes in all of the risk factors. Figure 2 illustrates that sustaining current efforts and expanding or implementing 7 interventions are expected to reduce Mississippi death rates from CVD risk factors by more than 15% in 2040 compared with the baseline. The expected future medical and productivity net costs of CVD and its risk factors are projected to decrease by more than 12% in 2040 compared with the baseline, assuming the MDSA fully sustains 14 existing CVD prevention interventions, expands 6 existing interventions, and adopts 1 new intervention (Figure 3).

**Tobacco and smoking**

Participants from Mississippi’s Office of Tobacco Control have been pursuing tobacco policy changes, and the cigarette tax rate increased from $0.18 to $0.68 per pack in spring 2009—the first increase in almost 30 years. Although these efforts were initiated prior to MDSA’s strategic planning meetings, the PRISM results provided strong verification for the increased tax by showing the future impact on CVD events, non-CVD events, deaths, and costs. These efforts are reflected in PRISM as sustained levels through 2040 for the tobacco tax intervention (Table).

In addition, the Office of Tobacco Control used the PRISM results to identify local county clean air acts as important interventions to reduce CVD events and deaths. This led to MDSA’s commitment to gather signatures for smoking bans at the county level, and they are now pursuing a state-level smoke-free policy. A 150% increase in the workplace smoking bans intervention in PRISM allowed strategic planning participants to visualize the likely impact of these efforts (see the Table).
Fruits and vegetables access and promotion

Limited access to fresh fruits and vegetables in rural areas has been identified as a potential barrier to residents’ consumption of a healthy diet, and strategic planning participants described that access is problematic in the MSD population. To address this issue, participants decided to implement interventions to increase access to fruits and vegetables. The initial action was to increase advertising and media efforts to make residents more aware of locations and times for existing farmers’ markets. They also formed a 3-organization collaboration to expand the number of farmers’ markets to further increase access to all residents within the MSD region. These efforts are expected to more than double levels for the PRISM interventions fruit and vegetable access and fruit and vegetable promotion (see the Table).

Transportation

Even before strategic planning meetings were held, MDSA identified low utilization of existing preventive care and community services as a problem that needed to be addressed. When MDSA presented the current conditions to strategic planning participants, the participants were interested in how they might improve access to preventive care, treatment services, and nutritious foods. An important contribution of using PRISM for strategic planning is that it enabled participants to think more broadly about the interconnections between risk behaviors, diseases, and their wider environment. As a result, discussions among strategic planning participants highlighted potential actions that might reduce the barriers and thus increase access to and utilization of care and services. The MDSA strategic planning participants identified the lack of transportation as a major barrier to obtaining preventive health care, treatment, and healthy foods. Thus, improving public transportation could have long-term impacts on disease prevalence and costs. To begin to address the transportation needs of MSD residents, MDSA members invited representatives from the Mississippi Department of Transportation to attend their April 2010 meeting. The MDSA members are now working with the Department of Transportation to raise awareness and use of the transportation network presently in place and have participated in transportation regional planning meetings. These improvements in transportation were assumed to double the levels of 3 PRISM interventions: preventive care for the post-CVD event population, preventive care for the non-CVD event population, and acute care and rehabilitation for CVD events.

Air quality

Using PRISM allowed strategic planning participants to identify potential contributors to chronic disease outcomes and costs that they were not already addressing through existing public health intervention efforts. For example, participants identified that interventions to improve local air quality could have a considerable impact on chronic disease outcomes and costs. Air quality is an important risk factor for heart and respiratory disease and deaths. Once MDSA participants identified poor air quality as an important contributor to chronic disease in the MSD that they could intervene to improve, a representative from the Mississippi Department of Environmental Quality was invited to attend the April 2010 MDSA meeting. Following discussion about specific intervention efforts that could improve local air quality, MDSA participants committed to work toward engine-idling restrictions for schools, government vehicles, and distribution centers. The
Department of Environmental Quality will also work with other partners to develop alternatives to agricultural burning in the Delta. These efforts are reflected in the Table as the adoption of a new local air pollution restriction intervention.

**Conclusions**

Strategic planning in the MSD was enhanced by the use of PRISM to examine the potential impact of alternative chronic disease interventions. PRISM is an evidence-based simulation tool for strategic planning that can help organizations examine the potential impacts of their current and additional intervention efforts over short and long time horizons. PRISM visually depicts the causal pathways of many different risk behaviors and clinical risk factors that lead to CVD and other chronic diseases.

The MDSA’s use of PRISM complemented the strategic planning process already underway in the MSD. Strategic planning participants committed to maintaining 14 interventions, expanding 6 interventions, and adopting 1 new intervention. The MDSA participants reported that PRISM was especially useful for picturing the likely impact of interventions that they might not have considered in the absence of PRISM simulation results (eg, air pollution interventions). PRISM also helped participants recognize that health and cost impacts can be greater when organizations that share overarching goals work together.

Even with its population-specific calibrations, PRISM, like any model, incorporates simplifications and does not capture the full complexity of chronic disease. PRISM should not be viewed as an oracle that provides answers about what to do. Rather, it is a decision support tool that provides diverse stakeholders with an evidence basis to work collectively and think clearly about chronic disease in the local context. Users should also consider community priorities external to PRISM, such as social justice and health equity, as well as local resources and context, when deciding which chronic disease interventions to implement, as the MDSA did during its strategic planning process. In addition, there are many assumptions about effect sizes in PRISM, where each effect has a range of uncertainty. Sensitivity testing has been done to better characterize ranges of results over the long term, and although not a part of the engagement with Mississippi, results support the MDSA conclusions about effective intervention options. Another limitation is that the MSD version of PRISM used national data on the prevalence of hypertension, high blood cholesterol, diabetes, obesity, and smoking, adjusted to reflect the demographic profile of the MSD population. Even if these adjusted numbers over- or undercount risk factor prevalence in the Delta, any bias should affect baseline and postintervention estimates in the same direction and therefore have little impact on the simulated differences from baseline. Finally, PRISM assumes that community interventions will have the effect sizes reported in the published literature and that the interventions will be implemented over 2 years and sustained at the same level over the time horizon of interest (eg, through 2020 or 2040). If the interventions that are implemented have a smaller impact or if they are not sustained over time, PRISM simulations will overstate the future impact of the community’s efforts.

PRISM may be a useful part of strategic planning efforts in other communities and settings that aim to improve population health status. Other communities have used PRISM for strategic planning and found it helpful for prioritizing local intervention strategies. The Centers for Disease Control and Prevention is currently working to make PRISM freely available online so that other communities will have access to it for use in strategic planning and policy decision making.

**REFERENCES**


