From Research to Policy: Targeting the Primary Prevention of Childhood Lead Poisoning

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SYNOPSIS

Public policy can be an effective method of promoting public health and preventing disease in a population. The proposing and passing of a municipal ordinance regulating power-sanding of leaded paint in New Orleans is a policy-level intervention that implements a primary prevention measure to address a community-wide risk. The process of achieving policy change involves defining the problem and the proposed intervention, integrating the resources of the individuals and groups with a stake in the situation, and disseminating information to the general public and to legislators. The implementation of the ordinance regulating power-sanding in New Orleans is a community-level lead poisoning prevention strategy.

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The ultimate goal of public health research is to improve the health of populations by identifying the determinants of disease as well as effective methods of intervention. A multi-factorial model for disease development views etiology as a complex concept and recognizes the contribution of both individual-level and environmental-level factors. The traditional epidemiologic approach to disease prevention emphasizes individual-level risk factors and subsequent modification.[1] However, for many health outcomes, prevention efforts are more appropriately addressed from a community standpoint. Making changes on a societal level often requires the development of public policy aimed at improving the collective health of the community.[2] Using the epidemiologic paradigm, the public policy is the intervention designed to improve health and prevent adverse health outcomes.[3]

The successful development and implementation of public policy to improve community health requires input and support from several, often disparate, stakeholders working toward a well defined goal. This article details a successful collaboration between child health activists, academics, the media, and government to implement legislation focused on the primary prevention of childhood lead poisoning in New Orleans.

BACKGROUND

Childhood lead poisoning has long been recognized as a persistent problem in inner city New Orleans. Currently, efforts to decrease childhood lead poisoning in the country and in New Orleans typically rely on secondary prevention; that is, actions taken in children who already have elevated blood lead levels.[4] However, the most effective way to prevent lead poisoning is to develop primary prevention measures to eliminate the sources of lead.[5] The effectiveness of primary prevention is evidenced by the dramatic decrease in the prevalence of elevated lead levels following the ban of lead in gasoline in the 1970s.[6]

In the 25 years since legislation mandated the removal of lead from gasoline,[7] the prevalence of elevated blood lead levels ($\geq$10 μ/dl) in children 1 to 6 years of age has declined from 88% to 2.2%.[6,8] In the four years following the removal of lead from gasoline (1976–80), blood lead levels declined in direct proportion to the amount of lead eliminated from gasoline.[9] While leaded paint was also banned in the 1970s and is no longer used, residual leaded paint is present in older homes. Children living in housing constructed after the removal of lead from paint continue to be at significantly lower risk for lead poisoning than those living in housing built prior to the ban on lead in paint.

The impressive declines in lead levels seen across populations of children are due primarily to these primary prevention efforts—the elimination of lead in gasoline and in paint, both of which necessitated significant public policy changes. However, further efforts to initiate primary prevention activities have had limited success, particularly in cities where the problem is concentrated among the poor and where municipal resources are limited.

Although lead was eliminated from paint by 1978, lead in paint remains a threat to children's health in homes where it has been applied in the past. Lead becomes mobilized when the paint becomes old and peels or is pulverized through friction, or when walls are scraped or sanded in preparation for a new coat of paint. In 2001, the New Orleans City Council passed an ordinance regulating the power-sanding of lead-based paint on the exterior of homes in the city.[10] Prevention research conducted by Tulane University's Environmental Diseases Prevention Research Center and other academic centers served as the scientific foundation for the city ordinance and is an example of the effective translation of prevention research into public health policy.

History of lead prevention in New Orleans

The New Orleans Health Department (NOHD) has conducted lead screening of children since the late 1970s. Although screening data results have been used for individual case management, they were not routinely used for public health purposes prior to 2000. The NOHD engages primarily in secondary prevention activities, including screening and health education. In the mid 1980s, Dr. Percy Rosenbaum, the consulting physician to the city's lead prevention program, called attention to the pervasiveness of lead poisoning in inner-city children. He intuited that secondary prevention would not alone significantly reduce the lead burden of children, and recognizing the link between substandard housing and lead levels, urged lawmakers to make funds available for environmental clean-up and to support a lead "safe house." However, despite his observations, quantitative data supporting his contention that lead was a significant public health threat was not available. Also, there was no public pressure to address lead hazards. Therefore, his recommendations were not enacted by public health officials and efforts to address the lead burden in New Orleans remained centered around secondary prevention activities.

The need for quantitative childhood lead poisoning data was addressed in the mid-1990s through the work of Tulane researchers in the development of a

database housing the results of lead screening for children in New Orleans between 1993 and 1995, and the subsequent development of the Childhood Blood Lead Surveillance System (CBLSS) by the state of Louisiana with funding from the Centers for Disease Control and Prevention (CDC).

APPROACH

Although secondary prevention measures like screening are important public health activities, primary prevention of lead exposure is needed to effectively reduce the lead burden in New Orleans. However, population-based primary prevention often requires a change in public policy, which in itself presents a challenge. In order to succeed, the work of academics, health care providers, and government agencies must be integrated into a coherent policy and presented to legislative policy makers. The traditional boundaries between research and policy need to be crossed. Some of the issues that may hinder the translation of research into policy include the relevance of the issue, the lack of channels through which academic research can be communicated to the public and to policy makers, and the acceptability and feasibility of the solution.[2,11] In this process, the relevance of the lead poisoning issue was demonstrated through a number of sources, including the existence of data that illustrated the severity of the problem in New Orleans, the presence of vocal child health activists who recognized the importance of the issue, and the increasing awareness of the affected community. The heightened awareness of the problem led to the fostering of relationships and the opening of channels through which scientific information could be disseminated.

The primary feasibility concern expressed during the crafting and passage of the ordinance involved the economic burden of more stringent paint removal methods. These concerns were quickly assuaged when the question was framed as contrasting the economic cost of action with the cost of inaction to children's health. In fact, subsequent to the passing of the ordinance, Jacobs et al. compared the economic cost of instituting lead-safe paint removal practices with the cost of environmental cleanup after removing lead-based paint with less safe practices, and found that the cost associated with cleanup ". . . greatly exceeds the incremental cost of incorporating lead-safe work practices into repainting."[12]

A multi-pronged approach was taken to coordinate efforts to develop and pass municipal legislation regulating power-sanding of homes. This approach limited the impact of boundaries that often impede the translation of research to policy. Steps in the process included: *(1)* defining the lead problem, *(2)* identifying a primary prevention intervention, *(3)* integrating existing resources, and *(4)* disseminating research findings.

Defining the lead problem

In order to persuade policy-makers that lead poisoning was a significant public health problem that warranted their attention, the lead burden had to be defined. This was done both quantitatively and qualitatively for maximum effectiveness.[13]

Defining the problem quantitatively involved data collection to describe the magnitude and distribution of elevated lead levels in New Orleans children. Tulane researchers conducted a systematic analysis of blood lead levels obtained from city health clinics to describe the magnitude of the lead problem and to determine the distribution of lead levels in New Orleans children. A cross-sectional study was conducted utilizing blood lead data from the New Orleans Lead Poisoning Prevention Program from January 1, 1993, to December 31, 1995. Prevalence rates stratified by age, race, sex, and geographic location were compared to national rates derived from the National Health and Nutrition Examination Survey (NHANES-III). The data were then geocoded and mapped using a geographic information system to provide a visual display of the neighborhoods in the city with the highest proportions of elevated blood lead levels. Overall, the prevalence of lead levels $\geq$10 μ/dl was in excess of 30% citywide for this high-risk group, and in some areas of the city, prevalence exceeded 50%.

Data from the 1993–1995 study served as the basis for the funding and development of the Louisiana Childhood Blood Lead Surveillance System (CBLSS), a statewide system that collects results of all blood lead tests on Louisiana children. At the initiative of the CBLSS, state reporting requirements for lead were amended to mandate reporting of all blood lead test results. Prior to this, only data from public health clinics and blood lead levels greater than 25 μ/dl were reported. In partnership with the Office of Public Health, Tulane researchers continued to analyze and map the data to determine annual rates and the distribution of lead poisoning in New Orleans. The results of these analyses are used to target resources and prevention efforts.

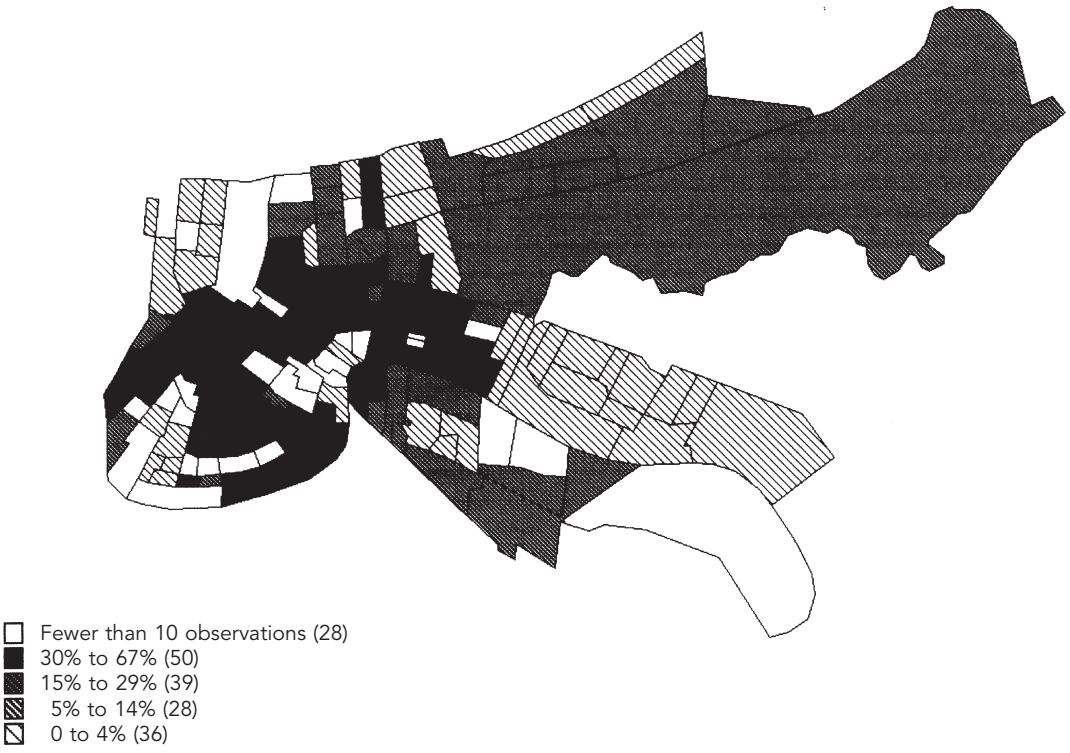
Analysis of 2000 CBLSS data indicated that, among New Orleans children screened at public health clinics, nearly 25% had lead levels of 10 μ/dl or greater.[14] Stratifying by age, 24.1% of children between the ages of 12 and 35 months who were screened for lead had elevated levels, and 27.9% of those between 36 and 72

months were elevated. Perhaps the most striking observation occurred when the data were stratified geographically, by census tract (Figure 1). Limiting the analysis to census tracts where at least 10 children had been screened (153 of 181 tracts), the prevalence of elevated lead levels was between 30% and 67% for 50 of the 153 tracts, with seven of those having prevalence of 50% or more. More than half (89 of 153) of the tracts had prevalence estimates of 15% or greater. Although these data represent the experience of a group of children who are at a greater risk for lead poisoning than the general population, comparing these results to national trends illustrates that there remain subgroups of children who are disproportionately affected by environmental lead.

In addition to quantifying the prevalence of lead poisoning, the lead burden was further defined qualitatively by members of the affected population. The Tulane University Prevention Research Center (PRC), also funded by CDC in 1998, has lead poisoning prevention research as its core activity. Lead was identified as a research focus area through a partnership with the residents' council of a public housing development located in an area of the city identified by the CBLSS as having high rates of lead poisoning. The resident's council identified lead as their major health concern and also expressed the need for jobs and job training for their residents. The outcome of this endeavor was the Community-Based Lead Intervention Study, a randomized trial investigating ways to lower lead levels in low-income minority children. Community workers, called "Lead Busters," were recruited from within the community and trained to implement the intervention project. The Lead Busters have become known and respected within the community and augment their research activities through community outreach and health education about lead poisoning prevention in numerous community forums.

In addition to the work conducted by Tulane and the CBLSS, other researchers in the city were addressing the lead problem. Mielke et al. conducted analysis to quantify the amount of lead and other metals released from power-sanding during renovation, and found that the potential release of lead by power-sanding in a typical home renovation project in New Orleans was approximately 82 kg of paint chips, with an estimated 7.4 kg of lead released as dust directly into the environment.[15] That is approximately 10 times

Figure 1. Percentage of lead levels 10 μ/dl or greater by Census tract among children screened in New Orleans public health clinics, 2000



more than the total daily tolerable intake for a child under six years.[9] This research underscores the hazard potential associated with power-sanding lead paint

Defining the lead problem, in quantitative and qualitative terms, was essential to gain the attention of the news media and to help persuade policy-makers to bring the sanding ordinance before the City Council for consideration.

Identifying a primary prevention intervention

Epidemiologic research has revealed that the primary source of children's exposure to lead is the home environment.[16–18] Environmental lead exposure may be classified in two components: indoor lead (paint and dust) and exterior lead (paint, dust, and soil). Factors that contribute to the character of New Orleans also contribute to the risk of lead exposure. Forty-three percent of homes in New Orleans were constructed prior to 1950,[19] and the majority of these are wood frame houses. The climate, with months of hot humid temperatures, necessitates frequent painting of their exteriors. Multiple layers of lead paint have accumulated from years of re-painting. The city also has a high poverty rate (42% of children under 6 living in poverty)[20] and the condition of the housing stock reflects the economic status. That is, the prevalence of poorly maintained homes is high in the inner city of New Orleans, where flaking paint in the interiors and exteriors of homes is common. Leaded paint and dust, both inside and outside the home, serve as sources of exposure. Further, a reservoir of lead is present in soils from years of deposition of air emissions from gasoline and from leaded paint that washes or is sanded from wood frame houses.[15]

Exterior maintenance in New Orleans generally entails power-sanding and repainting old weatherboards. Power-sanding releases and mobilizes lead dust directly into the air, where it may be inhaled or form a new layer in addition to the existing reservoir of contamination in the soil.[15]

Although the U.S. Environmental Protection Agency (EPA) mandates abatement procedures for industrial structures containing lead and the U.S. Department of Housing and Urban Development (HUD) regulates the abatement of leaded paint in HUD housing, these regulations do not extend to private dwellings. Additionally, no city laws addressed power-sanding of buildings containing lead in New Orleans. Paradoxically, an ordinance regulating power-sanding of historic homes in the French Quarter has been in effect for years. The French Quarter is a National Historic District and stringent laws have been enacted for historic preservation, but not for environmental health protection. After repeated reports of lead poisonings as a result of home renovation projects, community health advocates identified dry-sanding of leaded paint from the exterior of homes as a significant pathway of exposure and its banning as an important primary prevention activity.

Integrating existing resources

Although researchers generated data documenting lead as a serious health threat to young children, and lead was identified as a significant health concern among the affected community, this alone was not sufficient to prompt a change in policy. Similarly, research described the deleterious environmental and health effects of sanding leaded paint.[21–24] Pushing lead to the forefront of the policy agenda required a coordinated effort spearheaded by an organized unit. The benefit of such an effort would be the development of a broad constituency base and increased political clout.[13]

In late 1999, community health advocates became actively involved in lead poisoning prevention, specifically in the need to pass legislation regulating power-sanding. Awareness was raised following the poisoning of children after exposure to lead from dry-sanding leaded paint during home remodeling. Their efforts led to the development of the Lead Working Group, convened in February 2000 by the Mayor's Office of Environmental Affairs. The purpose of the Lead Working Group was to evaluate the exposure hazard from dry-sanding exterior leaded paint and to draft legislation regulating this activity. The Working Group was comprised of representatives from numerous interested groups, including parents, Tulane Prevention Research Center representatives and other academics, homebuilders, and community activists. The composition of the Working Group reflects the inclusive approach of the partnership. The Working Group worked with the city's attorney to research and subsequently draft an ordinance to regulate power-sanding of lead paint. When the ordinance was drafted, the group lobbied the City Council to adopt the ordinance.

Disseminating research findings

Enactment of a ban regulating sanding required action by the New Orleans City Council. To make the ban possible, relevant scientific data had to be disseminated from the researchers who gathered it to those working for change (the Working Group) and also to those in a position to effect change (the City Council). Without data sharing and dissemination of research findings, translating research into policy could not have been accomplished. Our dissemination ef-

forts utilized the following channels: *(1)* scientific presentations by researchers, *(2)* community outreach efforts, *(3)* partnerships with state and city health departments, *(4)* participation in the Lead Working Group, and *(5)* the news media. Figure 2 lists the entities involved and their relationship to each other and the overall process.

Findings from the analysis of lead in New Orleans were widely publicized. The Lead Busters disseminated findings back to the community in the form of health education materials and participation in health fairs and community health forums. Research data were shared with the local and state health departments and the Lead Working Group, via electronic and paper reports. In addition, regular meetings of the Working Group facilitated a coordinated effort to lead prevention. Finally, the news media served as an important channel for disseminating information on lead to the general public and elected officials.

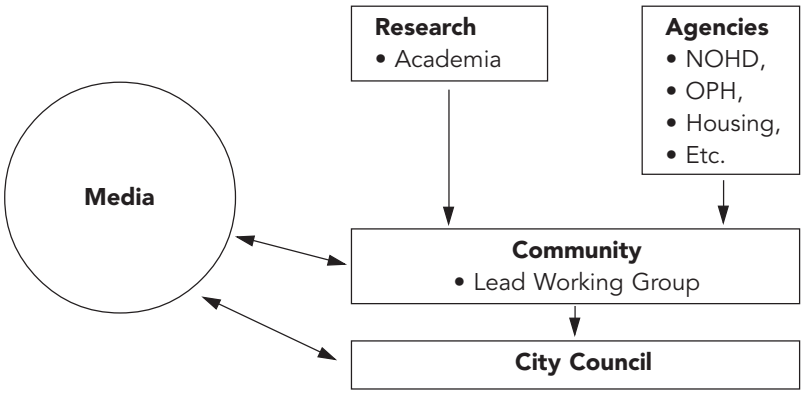
Dissemination to the media. Efforts by Tulane's Prevention Research Center to reduce lead poisoning in low-income children in New Orleans received considerable press coverage. The press became interested initially because of reports of the high prevalence of elevated blood levels in low-income children in New Orleans. Subsequent coverage focused on the human-interest aspect of the Lead Busters. The combination of quantitative data and a human-interest aspect provided the news media with an angle to keep the issue in the news over a sustained period of time. Media coverage included local newspapers, local radio and television, and national television. The Lead Working Group's efforts to pass the sanding ordinance were also prominently featured in the local and national press. This sustained coverage increased attention to the problem and exerted pressure on members of the City Council to address the issue of lead poisoning.

Dissemination to policy makers. While the Working Group's efforts to have the ordinance introduced to City Council continued, so did the research and media coverage. Repeated reports of the danger of lead and high rates of poisoning among children prompted City Council to act. In April 2001, epidemiologists from Tulane's Prevention Research Center were asked to address City Council on the issue of lead poisoning in New Orleans. Current data were presented showing that 25% of children tested in public health clinics had elevated blood lead levels,[14] that is, a level greater than 10 μ/dl. Risk factors were highlighted along with the issue of the disparity in the burden of this environmental exposure. Maps delineating neighborhoods with the greatest burden of lead were presented as a potential action plan. Media coverage of the study findings was extensive and City Council quickly agreed to consider measures to reduce the lead burden in the city. The stage was set for the proposed ordinance to go forward.

RESULTS

When City Council called for action to reduce the burden of lead on children, the Working Group responded with the proposed ordinance. The ordinance regulates power-sanding of leaded paint and imposes fines against those who fail to engage in lead-safe sanding practices. The ordinance specifies alternatives to

Figure 2. Entity interactions in the process of developing and passing the ordinance to ban power-sanding in New Orleans



NOHD = New Orleans Health Department

OPH = Office of Public Health

dry-sanding, including use of vacuum attachments with HEPA filters, use of containment barriers, and wet scraping.[25] After much hard work and dedication by the Lead Working Group, the ordinance was presented before the City Council in September 2001, and passed unanimously.

DISCUSSION

Several factors were responsible for the lack of widespread attention given to the issue of lead poisoning in New Orleans prior to the end of the last decade. First, with high poverty and an old housing stock, it seemed logical that lead would be a serious problem. However, no supporting data existed to demonstrate the distribution and magnitude of the problem. Second, there was limited advocacy for change outside of Dr. Rosenbaum's close circle of supporters. Third, there was no media interest in the issue to increase community awareness and support. Finally, lead poisoning in the U.S. is decreasing and those who remain at risk are low-income, minority populations, a group with limited political influence.

The development of the Lead Working Group was a major factor in the successful translation of research to policy; the energy and commitment of its members provided the catalyst for change. Prior to the formation of the Working Group, academics and health department employees worked in the scientific and programmatic arenas. Although their work is dedicated to change, direct activism is not within its scope. The Working Group is a coalition dedicated to making New Orleans a lead-safe city specifically by addressing primary prevention. Their first effort was to draft and pass an ordinance regulating power-sanding of leaded homes and their approach was inclusive. They recognized the need to use data as a foundation upon which to shape their position while addressing issues of feasibility and cost. This approach strengthened their credibility within the community and with policy makers.

Of note was the lack of opposition to the ordinance. Although initial concerns were raised regarding the potential economic burden, these concerns were quickly addressed. The primary reason efforts to prevent lead poisoning were stalled in New Orleans was due to apathy and the lack of an organized community group dedicated to making New Orleans a lead-safe city, and this was countered by the formulation of a concerted effort supported by scientific data.

The enactment of the lead-sanding ordinance, a primary prevention activity, represents the culmination of a coordinated synthesis of individual efforts and is a clear demonstration that the whole is greater than the sum of its parts. The contributions of each component—academia, activism, and the media—were pooled to achieve a goal that could not have been accomplished by any one group individually. Academic research, namely studies describing the distribution and determinants of health effects, is a necessary first step to public health prevention, but is not sufficient in itself to effect change. Translation of research into public policy involves partnering with the community to bring the data to lawmakers in such a way that problems are defined, facts are presented, and solutions are developed. In this way, preventive measures can be introduced on a community-wide basis to address the contribution of environmental risk factors.

CONCLUSION

Public policy can be an effective method of promoting public health and preventing disease in a population. Rather than targeting individual modifiable risk factors, the use of policy as intervention promotes a community-wide prevention approach to address community-level risk factors. The process of achieving policy change involves defining the problem and the proposed intervention, coordinating and integrating the resources of stakeholders, and disseminating information to the general public and to legislators. The enactment of the ordinance regulating power-sanding in New Orleans as a community-level lead poisoning prevention strategy demonstrates the power of this approach.

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