

The Boston Safe Shops Project—Preliminary Findings of a Case Study in Applying the 10 Essential Services of Public Health to Building Environmental Health Capacity

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Abstract

Boston's more than 500 automotive shops, located primarily in low-income communities of color, are a source both of well-paying jobs and of potential hazardous exposures to employees and residents. The Safe Shops Project works to reduce occupational and environmental health hazards without having to close these businesses. Combining inspections, in-shop trainings, outreach, and technical/financial assistance, it brings shops into compliance with laws and promotes use of safer practices and alternative products. After 18 months, 254 workers at 61 of 124 participating shops had received training. Surveys showed improved worker knowledge: Pre-training, 24.2 percent of the worker survey respondents stated that they knew what an MSDS was, and post-training, 75 percent stated that they knew. The surveys also found improvement in work practices: Pre-training, 48 percent of workers indicated that they used safety goggles in their work, while post-training, 70 percent indicated proper use of safety goggles. The results also showed shops investing in capital improvements such as replacement of PCE-based brake cleaners with aqueous cleaners. The Safe Shops Project has a successfully modeled application of the 10-essential-services framework to the building of public health capacity and community collaboration, and this model can be adapted to other locations and industries.

Introduction

The Boston Public Health Commission (BPHC) is charged with protecting, promoting, and preserving the health of the residents of Boston, particularly the most vulnerable. In carrying out this mission, BPHC is guided by the framework of the 10 essential public health services and an organizational focus on eliminating health disparities.

Small automotive repair and body shops are a common sight in communities of all sizes across the United States. In Boston, old neighborhoods and mixed zoning have resulted in these businesses frequently being in close proximity to houses, schools, and other sensitive sites. The majority of Boston's more than 500 auto shops are predominantly located in the city's lower-

income communities of color, making this situation not just an issue of public health and safety, but also an environmental justice concern. Table 1 summarizes some key statistics for these neighborhoods.

While providing a valuable source of skilled employment, auto shops can pose potential health risks to workers and nearby residents. Common hazards to workers and people living nearby include inhalation of solvents from parts cleaning and painting operations, airborne particulate matter from body work and brakes, dermal contact with solvents and corrosive materials, fire and explosion hazards from flammable materials, injury risks from stored automotive parts, heavy-metals exposure, and water and soil contamination from improper storage or disposal of hazardous wastes. Of particular concern to the project was reducing emissions and worker exposures to solvents and particulate matter from painting, parts cleaning, and brake jobs, as these exposures have been associated with serious health effects and can be easily addressed with product replacement, process changes, and personal protective equipment. According to a study conducted by the Toxics Use Reduction Institute at the University of Massachusetts Lowell, aerosol chlorinated solvents are frequently used in auto shops for brake cleaning, and other solvents, such as toluene, xylene, and acetone, are commonly used for cleaning of paint spray guns and for "off label" uses. These practices

TABLE 1**Demographics and Shop Distribution in Target Neighborhoods (Bolded) and Selected Other Neighborhoods**

Neighborhood	Pop. Nonwhite	Pop. Below Poverty Level	Asthma Hospitalizations per 1,000 Children Under 5 (1999–2003)	Elevated Blood Lead Levels (10 µg/dL or greater)	Number of Auto Shops
Roxbury	85%	29.2%	14.8	2.2%	36
Dorchester					
North	82%	22.9%	13.7	4.4%	163
South	67%	17.6%	11.4	3.8%	
Mattapan	97%	17.5%	9.9	2.8%	45
Allston/Brighton	31%	23%	3.4	2.5%	91
Charlestown	11%	17.5%	4.5	2.1%	2
West Roxbury	17%	6.8%	3.4	1.0%	14
Roslindale	40%	11.2%	7.5	2.1%	32
Jamaica Plain	49%	17.3%	9.7	2.5%	28
East Boston	50%	19.5%	4.3	2.6%	27

TABLE 2**Problems Commonly Found in Automotive Repair and Body Shops**

Mechanical Repair Shop Hazards	Body and Paint Shop Hazards
Required permits not present	Required permits not present
Record keeping (MSDSs, waste manifests, etc.) not sufficient	Record keeping (MSDS, waste manifests, etc.) not sufficient
Work done without use of proper personal protective equipment (dust masks for working with solvents/paint, etc.)	Work done without use of proper personal protective equipment (dust masks for working with solvents/paint, etc.)
Improper storage of flammable materials	Improper storage of flammable materials
Workers not adequately trained/informed—no knowledge of MSDS, safety plan, etc.	Workers not adequately trained/informed—no knowledge of MSDSs, safety plan, etc.
Parts cleaned in uncovered solvent systems	Cleaning of paint guns releasing large amounts of solvent into the air
Improper and off-label use of spray organic solvents	Spray painting outside of an enclosed spray booth
Improper storage of auto batteries, scrap metal, and spare parts	Heavy-metals and vapors exposures from body work and cutting/welding
Improper labeling, storage, and disposal of hazardous wastes	Sanding and body work being done without dust capture devices or respiratory protection

can result in high concentrations of these chemicals being volatilized into the air of the shop, where workers and the public can be exposed (Toxics Use Reduction Institute, 2006). Various studies have indicated a link between chronic overexposure to some common solvents and nervous system effects such as decreased learning and memory ability (Morrow, Steinhauer, Condray, & Hodgson, 1997), vision problems (Sharanjeet-Kaur, Mursyid, Kamaruddin, & Ariffin, 2004), peripheral neuropathy (Centers for Disease Control and Prevention [CDC], 2001), and hearing loss (El-Shazly, 2006).

Furthermore, exposure to such solvents and isocyanates from paint spraying has been linked to respiratory problems ranging from rhinitis to occupational asthma (Randolph, Lalloo, Gouws, & Colvin, 1997; Sari-Minodier, Charpin, Signouret, Poyen, & Vervloet, 1999). Exposure to isocyanates is widespread in the auto body industry because “the repair and refinishing of cars entails the sprayed on application of isocyanate-containing coatings on almost every vehicle” (Sparer et al., 2004, p. 570) and because exposure occurs through both skin contact and inhalation in those performing the painting work and those nearby in the shop (Pronk et al., 2006).

Sanding and body work also pose a health risk to workers and their families from exposure to solvents, lead, and other metals in the sanding dust, which can be inhaled or ingested by workers and may be taken home on work clothes to expose family members (Enander et al., 2002; Enander et al., 2004).

Small shops often fall through the cracks of federal, state, and local regulations or slip unnoticed into improper practices, and individuals often open such businesses without knowledge of what must be done to safely and legally run a shop. Problems commonly found in these shops are summarized in Table 2.

Several studies have highlighted the need for worker education and shop training in alternative practices (Enander, Gute, & Misaghian, 1998; Heitbrink, Wallace, Bryant, & Ruch, 1995). Historically, however, education and outreach efforts by health centers and community groups have had limited impact in changing shop behaviors because of a lack of authority to require change, while regulatory efforts by city enforcement agencies have also met with difficulties in delivering effective health education in the context of a stressful enforcement visit/inspection. The Safe Shops Project was formed to bring the stakeholders together. The project builds on the strengths of individual partners in an effort to reduce the occupational and environmental hazards posed by auto shops without resorting to closing down any but the most egregious polluters so that a valuable source of jobs and income for Boston residents can be preserved.

Methods

Monitor, Diagnose, and Investigate Health Hazards

Guided by the first two of the 10 essential public health services—to monitor health status and identify community health problems, and to diagnose and investigate these community health hazards—BPHC's Environmental Hazards Program (EHP) conducts inspections based on resident complaints. EHP also participates in the annual Health of Boston community meetings, at which BPHC shares city health statistics with the residents of each neighborhood and hears back from community members about issues that are of concern to them. Through these activities, it became evident that pollution and health hazards from small automotive shops were both a significant health hazard in the city and also a priority concern of the community.

Pulling together records from its own inspection files, inspection and permitting records from the Boston Inspectional Services Department (ISD), and Boston Fire Department records, EHP was able to compile a master list of almost 700 auto shops. The shop locations were then mapped with GIS software so that their distribution throughout the city could be viewed. Three neighborhoods were identified for intervention—Roxbury, Dorchester, and Mattapan (Table 1).

Building Community Partnerships

EHP next mobilized existing community partnerships and built new ones to address the issues. EHP met with ISD, the Bowdoin Street Health Center, and the Massachusetts Coalition for Occupational Safety and Health (MassCOSH) to form the nucleus of the partnership. In September 2004, BPHC received a three-year capacity-building grant from CDC funding the Safe Shops Project and allowing EHP to bring on staff resources and additional community partners. The current partnership comprises EHP, ISD, MassCOSH, Nuestra Comunidad Development Corporation, Doctor Richard Bird (an occupational health physician at Upham's Corner Community Health Center), the BPHC Public Health Van, the Mayor's Health Line, and several other supporting organizations.

Despite fluctuations over the course of the project, the components of the partnership have remained essentially the same. MassCOSH has been a dedicated commu-

FIGURE 1

Safe Shops Project Partnership Organization and Roles



nity partner providing worker education and outreach from the beginning while staffing problems at other partners resulted in Safe Shops seeking new health resource partners—Dr. Bird and the Health Van. The project also brought in Nuestra Comunidad Development Corporation to provide financial and business development assistance to participating shops. Nuestra Comunidad had already had success in this kind of work with a local “auto-mall,” which it set up to help a handful of struggling new auto shops comply with regulations and achieve business and financial stability. The contributions of the Safe Shops partners are summarized in Figure 1.

Safe Shops Activities

To assess the extent of hazards and needs in individual shops, inspectors with ISD conduct non-enforcement environmental-assessment visits at shops throughout the target neighborhoods using a standardized survey form as part of routine inspections. These visits collect general environmental information about each shop, such as status

of compliance with permits, practices with respect to waste storage and handling, degree to which proper personal protective equipment is used, housekeeping practices, chemical storage, and record-keeping status. Shops from the master list that are found to have moved or no longer exist are removed, and the list is updated.

Using the list of shops visited by ISD, outreach workers from EHP and the community partners visit shops to encourage shop owners/managers to have their shop participate in the Safe Shops Project. At shops that agree to participate, the outreach workers collect survey data on worker knowledge and practices related to occupational hazards. The worker survey and environmental assessment data are used to coordinate delivery of educational information and resources appropriate to each shop.

The owner of each surveyed shop is offered the opportunity to schedule a Safe Shops Tailgate Training for the shop. This 60- to 90-minute training takes place within the shop and is scheduled around the shop's schedule. It includes viewing of the *Auto-*

TABLE 3**Preliminary Results of Safe Shops Trainings—Changes in Shop Conditions**

Compliance Issue	Pre-training (N = 100)	Post-training (N = 100)	Percentage Change
Occupancy permit present	66	89	34.85%
Business certificate present	36	83	130.56%
If shop has a dumpster, ISD site cleanliness permit present	56	83	48.21%
If shop does welding, cutting, or other body work, BFD torch permit present	69	88	27.54%
Flammable liquids stored in DOT- or UL-approved containers or cabinets	45	72	60.00%
Flammable liquids containers or cabinets properly labeled	39	71	82.05%
Hazardous waste storage area labeled and limits marked	41	74	80.49%
Access to waste storage area clear and free of debris	69	83	20.29%
Containers in waste area properly labeled	50	81	62.00%
Drained waste oil, antifreeze, paints, and solvents stored in properly labeled containers	59	87	47.46%
Solvents and parts cleaner containers labeled and closed	47	88	87.23%
Used oil filters punctured, drained overnight, disposed of properly	59	74	25.42%
Batteries stored on pallets or shelving and disposed of properly	40	89	122.50%
Scrap tires stored outdoors covered and disposed of properly	59	85	44.07%
Shop and lot in clean and sanitary condition	78	94	20.51%
Exit signs posted over doors	65	86	32.31%

shop Pollution Prevention video created by EHP, trainer presentations on shop safety and best work practices, review of worker right-to-know information, and an extended question-and-answer session with the workers. Trainings may be for the workers of one shop or may draw an audience of workers from several shops in close proximity to one another. These trainings are highly interactive and rely heavily on trainers answering worker questions and concerns.

Linking People to Health Services and Innovative Solutions

At the conclusion of the training session, shops are offered a number of opportunities for additional follow-up. These include additional specialized training sessions, the opportunity for the shop owner to meet with project partners to plan shop improvements and work on the financial and bookkeeping aspects of making major changes to reduce pollution and come into compliance with regulations, and the chance to host the public health van at the shop for a Health Day at which workers and neighbors can receive free health screenings and health care referrals.

The Health Van visits (hosted once each month at a different shop) play a key role in linking individuals to needed personal health services and ensuring health care for the city's most at-risk individuals. The van provides

free health screenings for common health problems (HIV/AIDS, high blood pressure, cholesterol, elevated blood glucose, etc.) to the shop workers, their families, and the neighbors/customers of the shops. Because most of the shop employees are young men of color without insurance, this is often their first contact with the health care system. For this reason, the van also assists clients in enrolling in various free or reduced-cost health insurance plans and makes referrals to health centers and other resources.

Nuestra Comunidad and MassCOSH provide valuable technical assistance to businesses wishing to make capital improvements to eliminate hazardous chemicals or work practices. MassCOSH assists them in making a plan for alternative products, practices, or equipment, while Nuestra Comunidad provides assistance with business management and financial issues critical to making the business credit worthy and seeking financial resources to implement the capital improvements.

Evaluating Effectiveness

The Safe Shops Project is constantly evaluating the impact of the trainings and interventions in order to deliver better services to the shops and neighborhoods. Participating shops always receive a follow-up visit from an outreach worker and an inspection visit by ISD. During the outreach worker visit, work-

er survey data is collected to assess changes in knowledge, attitudes, and practices resulting from training and other interventions. These visits are also used as an opportunity to answer additional worker questions and frequently become a "refresher course" for the employees. The follow-up visit by ISD inspectors uses the same environmental assessment tool to assess any changes that have occurred as a result of the project and to remind the owners of any outstanding items that they need to address in order to be in compliance with all pertinent regulations.

In both the pre- and post-intervention visits, data are collected by means of an electronic form on a Palm PDA to reduce data entry time, ensure consistency of data by standardizing answers, and reduce data entry errors. This system speeds the progression of a shop through the project because data can be put into the project database immediately after a shop visit through "hot-syncing" of the Palm and is instantly available for analysis or use by other project staff.

Performance measures include changes in the findings of environmental inspections of shops and in responses on worker surveys, as well as reduced numbers of complaint calls from neighbors. A final measure of program success is an increase in the number of shop workers accessing health care workers, as reported by our health center partners.

Noted Post-training Changes in Shop Work Practices

- Three shops replaced perchloroethylene-containing brake cleaners with a water-based system.
- One shop replaced a solvent-based parts washer with a water-based cleaner.
- One shop went from use of a paper dust mask to use of a supplied-air respirator while painting cars.
- One shop replaced old spray guns with new high-volume-low-pressure (HVLP) spray guns with removable cups to reduce over-spray and eliminate paint waste.

Informing and Empowering the Community and Building the Public Health Workforce

In tandem with this process, Safe Shops promotes community awareness through its community partners and outreach staff. The community partners have held several public forums on the issues of auto shops and pollution in the target neighborhoods, and they attend community events and health fairs to distribute information about the project and auto shop issues in general. The goal of these efforts is to make residents aware of the health issues associated with auto shops and the resources available to them should they have concerns or complaints about shops in their area. Safe Shops also conducts mass mailings to auto shops in the city to advertise the availability of the project and raise awareness of the issues it addresses. This activity has resulted in several shops contacting project staff asking to participate—a significant accomplishment since the project is working with a population that has been very resistant to working with city agencies in the past.

Finally, Safe Shops incorporates an important element of public health workforce development and capacity building by holding frequent trainings for project staff and partners. The partners hold monthly meetings to share field observations and discuss concerns with one another. These meetings also incorporate trainings to teach outreach workers how to conduct the Tailgate Training sessions as well as overviews of specific topics and issues in shop practices, pollution prevention, occupational health, and the work of similar efforts around the country.

Results

After 18 months of operation, the project has conducted 124 initial and 100 follow-up shop

TABLE 4

Preliminary Results of Safe Shops Trainings—Changes in Worker Knowledge

Survey Question	Pre-training Percentage	Post-training Percentage
Trained in regulations / best practices in 2005–2006	10%	70%
Have and use ear plugs	18%	43%
Have and use safety goggles	48%	70%
Have and use dust mask	39%	64%
Have and use respirator with particle filter	24%	36%
Have and use respirator with VOC cartridge	20%	34%
Have and use rubber gloves	47%	72%
Answered yes to have been exposed to a health hazard	35%	40%
Identified self as having been exposed to solvents	19%	28%
Identified self as having been exposed to paint fumes	16%	21%

inspections. These numbers represent approximately 20 percent of the known auto shops in Boston because project work has cleaned outdated data from the master list of shops to reduce the number of known shops to just over 500. Of these, 119 shops have been visited by outreach workers to collect 217 initial and 53 follow-up worker surveys. The in-shop trainings have been attended by over 250 individuals from 61 shops. The project has also organized 13 monthly health days at shops, with the public health van screening over 142 people for issues ranging from blood pressure to HIV status. Of these, 31 people received referral to the Mayor's Health Line to be connected with health care resources. These activities have resulted in a marked improvement in shop conditions, worker knowledge, and practices in the shops at follow-up, as indicated in Table 3, Table 4, and the sidebar above. Pre-training, 24.2 percent of worker survey respondents stated that they knew what an MSDS was, and post-training, 75 percent stated that they knew. Pre-training, 48 percent of workers indicated that they used safety goggles in their work; post-training, 70 percent indicated proper use of safety goggles.

Since participating in Safe Shops trainings, three shops have switched from perchloroethylene (PCE)-containing brake cleaners to aqueous brake cleaners, and one has switched to aqueous parts cleaner. At one shop, the average ambient total VOC level in the garage fell from a range of 8–12 ppm (compared with an out-

side background level of 63 ppb) to a range of 280–310 ppb (compared with an outside background level of 86 ppb) after switching to an aqueous brake cleaner. The use of an aqueous brake cleaner has the added benefit of being a “wet cleaning method,” which is preferred by the Occupational Safety and Health Administration (OSHA) for infrequent brake work. This method keeps dust down and reduces worker exposure to fine particulates and asbestos, which is sometimes still found in brake and clutch linings and presents a substantial source of potential asbestos exposure and risk of mesothelioma, lung cancer, and asbestosis (OSHA, 2006). Infrequent brake work is categorized as no more than five brake jobs per week, which is characteristic for the size of shop with which the Safe Shops Project works.

In addition, auto body shops are implementing the use of nitrile gloves, vacuum sanders, and supplied-air respirators, and are purchasing new high-volume-low-pressure (HVLP) spray guns to reduce pollution, paint and sand waste, and worker exposure to hazards. These changes made by Safe Shops participants not only reduce pollution, but also may protect workers from occupational hazards that cause asthma or respiratory sensitivity.

Discussion and Conclusion

The Safe Shops Project built capacity by developing sustainable partnerships between local government, health care centers, and nonprofit organizations to deliver environ-

TABLE 5**Linking Activities of the Safe Shops Project to the 10 Essential Public Health Services**

Essential Environmental Health Service	Project Activities
1. Monitor health status to identify EH problems	Development of an auto shop map
	Track complaints of auto shops and maintain records of inspections
	Solicit feedback from project partners on areas in need of attention
2. Diagnose and investigate EH problems and hazards in the community	Conduct environmental assessments of shops for hazards
	Send outreach workers to auto shops on a weekly basis
3. Inform, educate, and empower people about EH	Outreach workers provide on-site trainings for auto shop workers and owners on right to know and best methods and resources for protecting themselves from occupational hazards
	Community outreach events, participation at health fairs, and flyers advertising health van visits
4. Mobilize community partnerships to identify and solve EH problems	Three health centers, one workers' rights organization, two economic development partners are actively involved in Safe Shops
	Attend health fairs, make presentations to community groups
5. Develop policies and plans that support EH efforts	Support development of a "licensure" ordinance
	Assist shops in implementing less toxic chemicals or preferable work practices to reduce pollution
6. Enforce laws and regulations that protect EH	Increase compliance with permit regulations and local, state, and federal environmental regulations through education and inspection
	Partnerships with Inspectional Services
7. Link people to needed EH services	New partnership with occupational health doctor
	Worker education on resources for occupational health
	Health Van partnership to provide free health screenings and health care/insurance referral assistance
8. Assure a competent EH workforce	Monthly partnership meetings to discuss progress
	In-service trainings for staff and partners
9. Evaluate the effectiveness, accessibility and quality of EH services	Pre- and post-intervention evaluation of worker knowledge and practices
	Pre- and post-intervention evaluation of shop environmental conditions
	Records of complaints to city agencies by neighbors
	Report-back from health center partners and Health Van/Mayor's Health Line
10. Research for new insights and innovative solutions to EH problems	Track change in materials/chemicals/equipment purchased
	Communicate and use tools created by other municipalities or programs

mental health services to a hard-to-reach population. The 10 essential public health services have been a critical guiding framework of the partners, and Table 5 summarizes how the project's activities and indicators of success link to each of these services.

Through consistent trainings and outreach, Safe Shops has developed trusting relationships within the auto shop community. These relationships have resulted in real changes in purchasing policies, implementation of pollution prevention strategies, and increases in regulatory compliance. The relationships are further strengthened by provision of additional public health resources

such as free Health Van screening events and health care and insurance referrals. The inclusion of a financial partner to assist small businesses with economic issues provides the final piece of the puzzle in promotion of change in shops.

The preliminary results showing substantial changes in a historically difficult-to-reach population demonstrate that Safe Shops is an effective model and an efficient use of limited public health resources. The nature of the changes being made in the shops and the health outcomes being addressed are such that a long-term health benefit cannot be measured at this time, but those benefits are ensured by

the fact that hazardous substances are being replaced in the workplace and that, where replacement is impossible, engineering controls (supplied air respirators for painting, vacuum capture sanders, etc.) and best work practices (proper use of personal protective equipment, etc.) are being institutionalized. This change is happening not only at individual shops, but throughout the community as a whole as word of the project spreads and shops request trainings, and as employees move from one shop to another and take what they have learned with them. The ability of the shops to network and share information is a strong contributor to the success of Safe Shops.

The development of a successful partnership with community organizations and the expansion of the public health infrastructure have been as important as the improvement in shops. Grant funding allowed for initial project development, hiring of staff, and solicitation of community partners. Now that Safe Shops has been established and proven effective, it is receiving support through the commitment of some city resources and additional grant funding. In addition, it has allowed our community partners to expand their resources and knowledge base. Although the project continues to work to reach the entire auto repair industry in Boston, plans are also being made to expand Safe Shops to address other businesses that involve similar environmental hazards, such as nail salons, floor finishing, and dry cleaning.

This approach can be replicated in other municipalities that have similar health hazards and resources. To encourage replication, the Safe Shops team is currently engaged in

providing an unwritten 11th essential public health service—"share successful models with others"—by publishing these findings and compiling a tool kit of all the project materials and process notes that may help others replicate what Boston has done. ❦

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