

Article

Pollution Prevention through Peer Education: A Community Health Worker and Small and Home-Based Business Initiative on the Arizona-Sonora Border

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Abstract: Government-led pollution prevention programs tend to focus on large businesses due to their potential to pollute larger quantities, therefore leaving a gap in programs targeting small and home-based businesses. In light of this gap, we set out to determine if a voluntary, peer education approach led by female, Hispanic community health workers (promotoras) can influence small and home-based businesses to implement pollution prevention strategies on-site. This paper describes a partnership between promotoras from a non-profit organization and researchers from a university working together to reach these businesses in a predominately Hispanic area of Tucson, Arizona. From 2008 to 2011, the promotora-led pollution prevention program reached a total of 640

small and home-based businesses. Program activities include technical trainings for promotoras and businesses, generation of culturally and language appropriate educational materials, and face-to-face peer education via multiple on-site visits. To determine the overall effectiveness of the program, surveys were used to measure best practices implemented on-site, perceptions towards pollution prevention, and overall satisfaction with the industry-specific trainings. This paper demonstrates that promotoras can promote the implementation of pollution prevention best practices by Hispanic small and home-based businesses considered “hard-to-reach” by government-led programs.

Keywords: pollution prevention; promotoras; small businesses; minority; home-based businesses; peer education

1. Introduction

The United States Environmental Protection Agency (US EPA) defines pollution prevention (P2) as, “reducing or eliminating waste at the source, promoting the use of non-toxic or less-toxic substances, implementing conservation techniques, and re-using materials rather than putting them into the waste stream” [1]. Formal P2 intervention programs employed by government agencies traditionally focus on large businesses due to their potential for sizeable pollution events as demonstrated by highly publicized chemical spills [2]. Pollution generated by small businesses is more significant than one would think primarily because small businesses are not aware of their potential to pollute and often they do not implement even minimal P2 practices [3,4]. Additionally, home-based businesses are an understudied small business sector. They function at an even smaller scale than the average small business, and many times exhibit inadequate chemical management and P2 infrastructures. Therefore, there is a gap in government-led P2 programs that target small and home-based businesses.

The unique features of small and home-based businesses need to be considered when crafting P2 interventions to better target these businesses. Small businesses account for 99% of the total employer firms in the USA [5]. Small businesses differ from large businesses in that they are defined as having fewer than 500 employees and report less than \$7,000,000 in average annual earnings [6]. Home-based businesses are a subsection of small businesses that are classified as have fewer than 20 employees and less than \$ 500,000 in gross receipts [7].

Low-wage workers typical of small and home-based businesses are disproportionately foreign-born, Hispanic, and women [8]. Furthermore, unique exposures can be encountered in such workplaces [9]. According to Sorensen [10] chemical substances in small work environments can be many times more hazardous than those in large businesses. This is due to inadequate best practices when handling hazardous chemicals because of a lack of occupational health interventions and industrial hygiene personnel [11]. Additionally small and home-based businesses do not have the capital and time to fully implement costly P2 practices on-site. It is difficult for many small businesses to financially justify the recommendations provided by P2 assessments [12].

Given the challenges stated, P2 strategies need to be developed and customized for these types of businesses. We set out to determine whether a voluntary, peer education approach led by female, Hispanic community health workers (promotoras) can influence small and home-based businesses to change behaviors and apply P2 strategies on-site. In the literature, P2 outreach programs that target businesses are typically government agencies (e.g., US EPA) or university groups that communicate P2 information unilaterally [13]. Some P2 programs are motivated by a research question or business need. Typical outcomes of these P2 programs are the development of networks and the establishment of feedback channels. Successful examples of such P2 outreach programs are usually collaborations between two or more stakeholders (e.g., government, academic, non-profit, *etc.*) [2,14–16]. Granek and Hassanali [17] suggest that the primary business drivers to implement P2 are risk reduction, business image, and economics. Zarker and Kerr [18] determined that a “comprehensive approach” (incorporating social, economic, and environmental consideration) has the potential to eliminate barriers that arise in US-based P2 programs. Such an approach is important as it connects P2 programs that already exist. According to Miller [13], comprehensive programs are imperative in P2 so as not to have businesses incorporate actions solely as a “fad”, but more as a core value.

Barriers in the implementation of best practices for long-term sustainability of P2 programs are important to study. These barriers highlight the potential pitfalls that can be considered when implementing a new P2 program. Identified barriers include declining public support, competing business priorities, and difficulty in documenting P2 progress [13]. The last barrier (P2 documentation) is reoccurring and echoed by various authors within the P2 literature [19–21]. Youngblood [15] tried to tackle this barrier by advocating for better evaluation techniques, for example, suggesting that the best time to quantify P2 program benefits is within one year, and for more complex businesses, within two to three years from the date of the initial intervention. In the cleaner production literature, barriers have also been determined and include financial factors, human capacity, business compatibility, and communication of information [22,23].

What is missing from traditional P2 approaches is a clear understanding of the social constructs in which small and home-based businesses reside. The eco-social context needs to be considered to implement effective P2 measures with long-term effects. A community’s ecology (*i.e.*, politics, ethnicity, language, culture, and economics) partly determines how health disparities develop and how solutions can be applied [24,25]. P2 actions outside of formal, enforceable regulations are frequently linked to values inherent to the community and the business owner. When considering P2 outreach, the community’s ecology, which influences business practices, must be understood and addressed to develop effective capacity building. For example, employee cultural and linguistic characteristics should be considered when implementing P2 education programs since these facets facilitate knowledge acquirement [9].

A strategy that is sensitive to a community’s ecology is popular education, originally proposed by Paulo Freire [26]. Popular education is the empowerment of citizens through direct dialogue, knowledge acquirement, and engaged participation to resolve a problem. This strategy has been traditionally employed in disadvantaged communities that face oppression because of a public health issue [27]. A vehicle for popular education applied in Hispanic communities is the community health worker. The community health worker model goes by various titles in the literature such as promotor (a)

de salud, community health representative, peer-health promoter, and community outreach worker [28]. In this article we will use the term promotora.

A promotora is a female, Hispanic community member who has leadership qualities that allow her to effectively promote a particular issue in her own community [27]. She is viewed as a community leader because she has been trained to address public health issues, she partners with organizations to assist them in achieving common goals, and she is indigenous to the community where she works. The promotora model has been implemented for decades to address public health disparities in Hispanic communities [29–31] and can be leveraged to address P2 issues [32]. For example, the “Boston Safe Shop Model” [14], which targets automotive repair and nail salons in minority areas of Boston, has bilingual and bicultural community leaders (similar to promotoras) who coordinate P2 trainings and provide technical assistance. Program results suggest that the key to enticing businesses to join the program is the participant’s ability to “relate” and connect with language, culture, and life experiences. These promotora-led efforts are not perceived as enforcement programs because promotoras are part of the community and tend to interact with the businesses on a daily basis. The latter is an important point that affects the recruitment of businesses into voluntary P2 programs [2]. Promotoras are ideal liaisons because they already understand a community’s ecology.

A promotora-led P2 program was implemented in an area that is considered environmentally compromised in Tucson, Arizona. In this article, we outline how consideration of the community’s ecology in tandem with popular education practices can be used to reach Hispanic small and home-based businesses. The purpose of this project is to determine whether a voluntary, peer education approach led by promotoras can promote P2 education efforts and if so, can they influence small and home-based businesses to change behavior and apply P2 strategies on-site. The program activities include technical trainings for promotoras and businesses, generation of culturally and language appropriate educational materials, and face-to-face peer education via multiple on-site visits. The program’s primary evaluation tools were surveys that measured the frequency of P2 practices implemented by businesses on-site and their perceptions of P2 as well as their satisfaction with industry-specific trainings and potential implementation of the information distributed to them.

1.1. Program Background

In 2005, under a US EPA Community Action for a Renewed Environment (CARE) grant, promotoras working for the Sonora Environmental Research Institute, Inc. (SERI, Tucson, AZ, USA) received complaints from community members about unusual chemical odors in their neighborhoods during promotora routine home visits. As part of this CARE grant, SERI developed a community-mapping project to identify high-risk areas based on environmental hazards by having promotoras walk neighborhoods and georeference tag areas of concern using global positioning system units. The maps developed showed the large number of small and home-based businesses in and around the neighborhoods and overlapped this information with the potential hazards based on the chemicals used at the businesses. Subsequent business interviews conducted by promotoras indicated a shortage of language and culturally appropriate information, lack of trust in governmental enforcement agencies, and perceived high cost of “becoming green” as barriers to implement P2 activities [32].

Based on the types of businesses in the area and their use of hazardous chemicals, SERI began targeted outreach to automotive maintenance and repair, automotive paint and body shops, and nail salons.

This initial work pinpointed a community need, but for the program to become more formalized, promotoras needed technical trainings. To address this educational need, new collaborations were formed with academic and government organizations to move the program forward. The resulting multidisciplinary collaboration of academic, industry, and government environmental programs became an essential component of the promotora-led P2 program. Each collaborator's contribution is reported in detail in the Experimental Section (Section 2). This promotora-led P2 program was implemented during the three-year period between 2008 and 2011.

1.2. Site Description

In Tucson there are an estimated 37,000 registered businesses of which 85%–90% are considered to be small businesses and many of which are Hispanic owned [33]. The promotora-led P2 program targeted small and home-based businesses in six zip code areas (85,701, 85,705, 85,706, 85,713, 85,714, and 85,719) previously identified as hotspots (containing major industrial and waste management facilities) and where residents had originally complained of neighborhoods' industrial odors [34]. Approximately 60% of the residents in these zip codes are Hispanic, low-income, and vulnerable populations (either having children under 18 years old or adults over 65 years old) [34]. The most common industry sectors in the targeted area are automotive maintenance and repair, automotive paint and body, printing and lithography, metal plating, surface coating, woodworking, and plastics and resins. The most frequently used volatile organic compounds (VOCs) are toluene, methyl ethyl ketone, xylene, and methyl isobutyl ketone. Acute exposure to VOCs can result in acute cardiovascular effects, mild irritation to lungs and respiratory tract, liver toxicity, and skin and eye irritation. Chronic exposures can result in such as neurological, dermatitis, and potential carcinogenicity [35].

2. Experimental Section

The promotora-led P2 program consisted of diverse activities that specifically included promotora-focused P2 technical trainings, P2 industry-specific workshops, P2 educational materials tailored to business and language, and face-to-face, peer education visits to small and home-based business. In addition, P2 outcomes and perceptions that were derived from the activities were captured via survey instruments (industry-specific workshop survey and initial and follow-up business visit surveys). The University of Arizona (UA) Human Subjects Protection Program determined that this program is exempt due to the use of the data for evaluation and improvement purposes.

2.1. Promotora-Focused P2 Technical Trainings

The P2 technical trainings were developed to be accessible by promotoras and provided real-world applications (connecting basic science with action-oriented examples that could be easily translated to the targeted businesses). They consisted of a formal classroom-style lecture (one to two hours), hands-on activities, question and answer period (15 min), and business tour. Content experts carried out the trainings and all trainings were provided in Spanish (simultaneous translation into Spanish was

provided if needed). SERI collaborated with UA's Department of Atmospheric Sciences, Superfund Research Program (SRP), Dean Carter Binational Center for Environmental Health Sciences (Binational Center), and Arizona Water Institute to strengthen technical P2 trainings for promotoras. Government-based environmental and conservation collaborators housed in Pima County (Department of Environmental Quality, Small Business Waste Assistance Program, and Trees for Tucson) and the City of Tucson (Tucson Water and Tucson Fire Department) provided additional technical trainings to promotoras as well as literature on existing small business assistance programs. This multidisciplinary component of the program worked to leverage P2 resources, expand the expert pool, and increase the knowledge base of promotoras. No evaluation tools were implemented to assess promotora knowledge gained or readiness.

2.2. P2 Industry-Specific Workshops and Educational Materials

SERI promotoras worked closely with UA SRP and Binational Center to coordinate industry specific workshops for small and home-based businesses. Meetings were coordinated with industry-specific P2 experts to discuss the informational needs and accepted best practices of specific industries. Partnerships were developed with the Automotive Services Association, Printing Industry Association of Arizona, Arizona Lithographers, The Source Beauty Salon and Spa, The Green Edge Group, and Pure Aesthetics Natural Skincare School.

At each industry-specific workshop, P2 technical advice, environmentally preferable product samples, and P2 informational packets were distributed. In general, an industry representative involved in either implementing P2 at his/her business or promoting P2 through a professional association delivered the majority of the technical advice. Bilingual (English and Spanish) P2 packets provided suggestions for reducing business waste, factsheets on industry-specific hazardous chemicals, and information on local P2 assistance services. Much of the outreach information was readily available from the US EPA Design for the Environment program, Arizona Department of Environmental Quality's P2 for Automotive Maintenance and Repair Shops manuals, Occupational Safety and Health Administration safety information, and California Department of Toxic Substances Control P2 materials. This information was not always available in Spanish and lacked cultural nuances. The program translator not only worked with promotoras to develop culturally appropriate linguistic translations, but also had technical expertise that allowed for appropriate science translation. In addition, simultaneous translation into Spanish was provided at each industry-specific workshop.

2.3. Industry-Specific Workshop Survey

UA SRP and Binational Center partners developed a brief survey to apply at the industry-specific workshops. It was comprised of eight questions consisting of four-point Likert scale, three-point Likert scale, and open-ended. The purpose of this survey was to understand the workshop benefits, potential connections, practical application, and content satisfaction. Surveys that were not completed were not included in the analysis.

2.4. Face-to-Face, P2 Peer Education to Small and Home-Based Business Visits

SERI promotoras partnered with UA SRP and Binational Center to implement small and home-based businesses visits. Technically trained promotoras were the leads during these P2 peer education visits. Promotoras began each business visit by introducing themselves, providing the project goal, and discussing general concepts of P2. They used a survey to collect business information and observations (details discussed in Section 2.5). During the visit, informational material was provided on reducing exposure to chemical pollution and P2 related support resources. Environmentally preferable product samples were at times supplied to provide businesses with an opportunity to test alternatives. Examples of these products include pipe build-up removers, grease and petroleum solvents, drain odor reducers, acetone-free nail polish removers, and water-based cleaners and degreasers. Some of these samples were tested with partnering P2 business leaders to assure they provided equivalent quality to traditionally used products.

2.5. Initial and Follow-Up Business Visit Surveys

SERI developed the survey instrument used to collect information during business visits. The initial and follow-up business surveys targeted owners or managers of the small and home-based businesses because of their knowledge of the business and ability to implement business-wide changes. All survey information obtained was entered into an Excel spreadsheet and quantified.

The initial business visit survey was designed as a script and checklist to assist promotoras in covering important themes during their face-to-face interaction. This checklist design was selected to ensure consistency in the information delivered to and obtained from the business owners and managers during the business visits. The information captured in the survey instrument encompassed a business's willingness to participate in P2 activities, current P2 practices being implemented on-site, and perception of P2 and associated practices. In addition, the survey also captured preferred incentives to entice the business to implement P2 best practices on-site and its willingness to participate in voluntary or training opportunities (e.g., City of Tucson Green Business Program or industry-specific workshops). The survey also allowed promotoras to document their observations of the businesses as well as highlights from their conversations.

The follow-up visit survey was structured to gauge the business's progress towards implementing P2 practices, plans, and policies, obtaining measurable emission reductions, and utilizing the industry-specific packets and/or samples distributed during the initial visit. This follow-up survey was designed similar to the initial business visit survey, containing questions in the form of a script and checklist (yes or no). When an in-person follow-up visit was not feasible, the promotoras called the business and conducted the survey over the telephone.

2.6. Calculations of Small Business Emission Reductions

During follow-up business visits, behavior changes were self-reported and used to determine emission reductions. The emission reduction calculations for nail salons were based on average use of acetone per station. The calculations for solvent degreasers at auto repair shops were based on estimates for uncontrolled organic emissions from cold cleaner units.

Control devices (methods and procedures used to reduce or prevent emission of pollutant) can reduce emissions 13%–38%, while operational procedures, *i.e.*, an established procedure for a given operation, can reduce emissions by 15%–45% [36]. Reductions were calculated using a 15% reduction factor [36]. A conservative estimate was applied, as most businesses agreed to implement both control devices and operational procedures. Businesses that implemented emission reduction strategies for solvent degreasers agreed to cover solvent containers regularly, drain parts for at least 15 s, and store waste solvent in covered containers. Although solvent consumption data would provide much more accurate emission estimates, this information was not available.

3. Results and Discussion

We set out to determine whether the promotora-led P2 program, a voluntary peer education approach, would influence Hispanic small and home-based businesses to change behaviors and apply P2 strategies on-site. Survey instruments applied to both the small and home-based business visits and industry specific workshops allowed for analysis of outcomes. The results have been divided into the P2 activities mentioned Section 2.

3.1. Promotora-Focused P2 Technical Trainings

A total of 17 SERI promotoras participated in basic P2 trainings for the auto repair, printing, and nail salon industries. Fifteen additional technical trainings were designed for these promotoras that included environmental exposure, contaminant transport of industrial solvents, air quality, water conservation, and business-specific P2 best practices (e.g., green printing, woodworking, dry cleaning, and auto repair and maintenance).

3.2. Industry-Specific P2 Workshops and Educational Materials

The promotora-led P2 program completed a total of 11 industry-specific workshops for auto repair, hair and nail salons, and printing and lithography. A total of 313 business representatives participated in these workshops of which 74 requested on-site visits. Eight industry-specific packets were developed that targeted auto repair, hair salons, woodworking, business offices, nail salons, dry cleaning, print shops, and auto body and paint shops.

3.3. Industry-Specific P2 Workshops Survey

Industry-specific P2 workshop surveys were provided at both the printing and lithography (28 participants) and hair and nail salon (17 participants) workshops. Survey responses highlighted that participants were satisfied with the workshops and that the P2 best practice information provided was relevant to their business. Of the 17 attendees of the hair and nail salon workshop, 11 stated that they were going to switch to ammonia-based hair dye and all printing and lithography workshop attendees reported that they would implement P2 suggestions. Information on whether these businesses actually implemented P2 strategy was not collected.

3.4. Face-to-Face Peer Education Small and Home-Based Business Visits

Of the 17 technically trained promotoras, 10 of them conducted business visits and became actively involved in the P2 program. These participating promotoras engaged a total of 640 different small and home-based businesses in face-to-face peer education through initial visits. Of the 640 businesses, 105 were initially contacted under the CARE grant. After promotoras received technical training under this P2 program, they revisited these 105 businesses to share their newly acquired P2 technical knowledge.

In addition to the initial business visits, 72 businesses received follow-up visits and 493 received follow-up telephone calls. As already mentioned, eight industry-specific packets were developed for the targeted businesses. A total of 662 of these packets were distributed at either initial or follow-up visits. All businesses received an industry-specific packet during the initial visit, and 22 businesses requested an additional packet during the follow-up visit. Of the total businesses, fewer than 20 were determined to be home-based businesses. Although the number is low, interacting with home-based businesses is noteworthy and was not originally anticipated as a business type. Table 1 provides information on business visits and how many of these businesses reported implementing P2 practices. During the initial business visit phase, only two small businesses (auto repair and auto body and paint shops) refused to participate in the program and therefore are not included in the total sample size. Six businesses (three auto repair, one auto body and paint shop, and two nail salons) that were engaged in the initial business visit phase were not interested in continued participation at the time of the follow-up interactions.

Table 1. Participating businesses in the promotora-led P2 program activity.

Business Type	Initial Visit *	Industry-Specific Workshops **	Reported Implementing P2 Practice
Nail Salons	124	***	84
Auto Repair	178	2	110
Autobody and Paint	146	86	94
Hair Salon	144	***	-
Printing—All Types	19	28	-
Woodworking	21		-
Dry Cleaning	4		-
Tire Repair	2		-
Other	2		-
Grand Total	640	171	288

* A total of 105 businesses were previously contacted by promotoras involved in the CARE grant;

** Number of people participating in industry-specific workshops; *** Hair and nail salon specialized workshop was combined for a total of 55 participants.

3.5. Initial and Follow-up Business Visit Survey

The businesses that participated in the survey identified themselves as managers (52%), owners (32%), or employee/receptionist/worker (14%). Two percent did not identify themselves at all. All businesses that received an initial visit completed the survey. The initial business visit survey revealed that 90% of the businesses were willing to take part in the voluntary promotora-led P2

program. Also, the initial business visit survey identified preferred incentives that would entice them to implement P2 best practices (Figure 1).

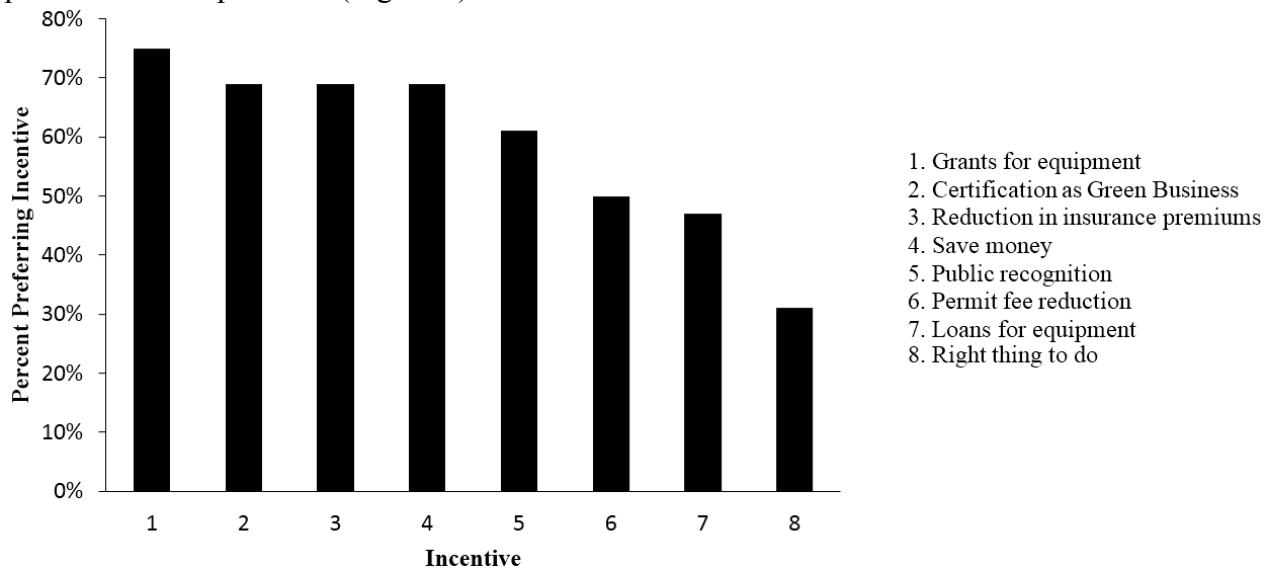


Figure 1. Preferred incentives selected by small and home-based businesses that would help foster P2 practices on-site.

Qualitative observations were also made during initial business visits. Promotoras detected that businesses did not want to participate in workshops because of the perceived lack of time and value. To encourage participation, promotoras personally visited businesses and invited them to events. Events were scheduled at different times throughout the day, and when possible, events coincided with new air quality requirements. Most small businesses believed that it took money to implement P2 measures and requested grants to purchase equipment. We emphasized low-cost methods that any business could implement and distributed information that demonstrated the cost savings over time; however, we found it difficult to convince many small businesses to purchase new equipment based solely on P2. Promotoras observed that many business owners and managers did not see the value in taking time to develop new plans or policies, as they were busy completing day-to-day operations and in general did not have business policies. As part of the program, examples of business plans were provided that could be easily modify for their facilities.

During follow-up business visits, promotoras documented using the survey (face-to-face or via telephone call) any reported or observed P2 changes. When it came to actually actively implementing any P2 practices suggested, 288 (45%) of the total businesses accomplished this goal. These practices ranged from recycling to substitution of products and were variable from business to business. Table 2 provides five P2 leader examples that were part of the promotora-led P2 program. These examples demonstrate the various levels of practices implemented by these businesses such as providing customers with environmentally preferable products (low-cost, practical changes) or investing in P2 equipment (site-wide, large changes). Finally the follow-up business visit survey uncovered that 13 of the 640 businesses adopted P2 policies or business-wide protocols into their corporate doctrine. This is important to highlight because these policies are permanent and guaranteed to affect P2 practices throughout the entire lifetime of the business.

Table 2. Examples of P2 business leadership identified as a result of the promotora-led P2 program.

Business Name	Best Practices Implemented	P2 Leadership Qualities
Jorge’s Auto Repair	<ul style="list-style-type: none"> • Sold reusable car oil filters • Implemented metal and automotive oil recycling program • Used saw dust to clean up on-site oil spills 	<ul style="list-style-type: none"> • Tested “green” degreasing agents for program • Attended P2 program workshops • Received recognition by US EPA and SERI
Extreme Hair Salon	<ul style="list-style-type: none"> • Designed and installed on-site ventilation system • Sold environmentally preferable or less toxic hair care products • Eliminated acrylic nail services 	<ul style="list-style-type: none"> • Attended P2 program workshops • Provided program feedback • Hosted US EPA site visit
McElroy’s Automotive	<ul style="list-style-type: none"> • Purchased aqueous parts washer 	<ul style="list-style-type: none"> • Provided P2 training to other auto repair businesses • Received recognition by US EPA and SERI
Karina’s Home Hair Salon	<ul style="list-style-type: none"> • Replaced salon hair care products with those that are environmentally preferable or less toxic • Sold environmentally preferable or less toxic hair care products 	<ul style="list-style-type: none"> • Participated in P2 programs workshops • Requested on-site technical information
C & H Paint and Body	<ul style="list-style-type: none"> • Implemented on-site paint room • Purchased paint cabinet • Created a paint mixing room • Switched to water-based auto paint 	<ul style="list-style-type: none"> • Provided program feedback • Hosted US EPA site visit

3.6. Calculation of Small Business Emission Reductions

The follow-up business visit survey was used to determine reported emission reductions using recommended best practices provided to the business via the program (Table 3). A total of 84 of the 124 nail salons reported they would try acetone-free nail polish remover. The average nail salon in Tucson has four stations and each of these stations use eight fluid ounces of acetone nail polish remover per day. Assuming that these salons are currently not using any other P2 measures, each shop is thought to use 0.73 kilograms of acetone per day or 194 kg per year when operating the business five days per week. This is equivalent to 16,308 kilograms of VOC emissions reduced per year when acetone is replaced with non-acetone nail polish remover.

For automotive repair and paint and body shops, 203 businesses reported they began covering solvent degreaser containers when not in use. Covering a cold solvent degreaser and associated drainage facility reduces emissions between 13% and 38% [36]. Using the conservative estimate of 13%, we calculated that emissions were reduced by 45 kg/year. This gives a reduction in VOC emissions of 763 kg/year. One of the 17 shops reported that they switched entirely to an aqueous degreaser. Using conservative estimates, it was calculated that a total of 10,886 kg of VOC emissions were reduced per year at this business.

Table 3. Emissions reduced by the adoption of best practices at nail salon, auto repair, and hair salon businesses.

Business Type	Best Practice Implemented	Number of Businesses	Emissions Reduced (kg/year)
Nail Salon	Switched to acetone-free nail polish remover	84	16,308
Auto Repair/Paint and Body	Covered solvent degreaser containers	203	763
Auto Repair	Switched to aqueous degreasers	1	10,886

3.7. Discussion

The promotora-led P2 program reached 640 small and home-based businesses in Tucson and 288 of these businesses reported implementing some kind of P2 practice that they had learned about through the program. Table 4 compares the promotora-led P2 program with other programs described in the literature, demonstrating that the promotora-led P2 program reached a significant number of businesses. There is no standardized process to compare impacts among these P2 outreach programs. We can, however, highlight the businesses that participated in each program to underscore the reach of these programs. The goal of our program was to fill the gap left by formal government programs (that typically overlook small and home-based businesses) by applying a peer education and community ecology approach to P2 outreach. This type of effort is important since many minority, low-wage workers who normally are employed by small and home-based businesses more often live in communities that have higher soil, water, and air pollution [37]. Programs that contain the appropriate culture and language are needed in these communities to provide information and encourage practices that can address such pollution. Effective P2 outreach through peer education can promote positive public health outcomes through direct dialogue, engaged participation, and business empowerment. This type of P2 engagement can provide a platform for environmentally conscious citizens that can ultimately address other issues in their community.

Table 4. Comparison of selected P2 technical assistance programs in the literature and the promotora-led P2 program in Tucson, AZ, USA.

Program Name	Location	Period	Partners	Objective	Businesses Reached
Promotora-led P2	Tucson, AZ, USA	2008–2011	Government, non-profit organization, academia	Influence Hispanic businesses to change behaviors and apply P2 strategies on-site via voluntary, peer education model led by promotoras	640
Safe Shop	Boston, MA, USA	Auto 2005–2008 Nail 2008–2009	Government, community organizations	Improve safety and environmental practices in small-immigrant-owned businesses using a community partnership model	408
Enviroclub	Quebec, QC, Canada	2000–2003	Federal government	Assist improving profitability and competitiveness via enhanced environmental performance projects	130

Table 4. Cont.

Program Name	Location	Period	Partners	Objective	Businesses Reached
Toronto Region Sustainability	Toronto, ON, Canada	2000–2005	Government, non-profit organizations	Technical assistance and financial incentives to encourage P2 practices	42
Partners in Pollution Prevention	Nebraska	1997–2004 Summers	Academia: student interns	Conducted assessments of waste stream and provided suggestions to minimize waste generation	305

Promotoras who are technically trained can influence small and home-based businesses' environmental operation decisions. In this program, using the right culture and language, small and home-based businesses were encouraged to participate in the program and as a result became aware of the opportunities that P2 could offer. Through the promotora-led P2 program, businesses trusted both the messenger and the information, making them more amenable to suggested P2 practices. Since the information was “translated” with the community's ecology in mind, the businesses could both better understand the information and engage in P2 practices more readily. P2 programs in other settings can benefit by applying similar community ecology principles. If promotora groups have not been established, community leaders also known as “sparkplugs” or “champions” can provide the structure needed to develop such a program. The benefits of incorporating a community's ecology, demonstrated in the Tucson promotora-led P2 program and in the Boston Safe Shops model, are apparent—trusted community members could work successfully with small businesses to promote P2.

Program findings reinforce and echo previous P2 findings, specifically the importance of cost avoidance and profitability [2,38,39]. It was determined in the promotora-led P2 program that many businesses believe that a barrier to “going green” is expense and that an incentive for them to join the P2 program is primarily cost savings. Values of emission reductions explained in terms of cost savings, has been determined by various P2 technical assistance programs as a key to better communicate and translate benefits to business owners [12,15,17]. It is important that future iterations of the program translate P2 best practices into monetary benefits, for example, focusing on emission reductions that can be achieved by low-cost best practices such covering chemical containers. Such practices allow small and home-based businesses with little revenue to enter the P2 continuum. As our program predicts, implementing low-cost best practices can result in emission reductions which can decrease pollution and improve workers' occupational health.

Surveys were the primary method of gathering program information and evaluating outcomes. As mentioned previously, these surveys helped gather the perception of participants in the initial and follow-up business visits and the industry-specific workshops. The usefulness of these surveys was limited since only prescribed information was obtained. The program evaluation could be improved by applying a mixed methods approach (*i.e.*, follow-up in-depth interviews and content analysis) to obtain information not previously anticipated or code interviews to derive additional conclusions. In addition, more detailed information could have been gathered pertaining to how the promotoras reduced specific barriers and what were the motives for adopting practices after taking part in the P2 program (long-term perspective).

The promotora-led P2 program implemented technical trainings and follow-up interactions to document changes undertaken in the short-term, but long-term practices are not monitored. Miller [13] suggests that there is a cause and effect relationship between technical assistance and the implementation of best practices. Since this specific program was limited to three years, follow-up beyond this time did not occur, and therefore we cannot document that this voluntary promotora-led P2 program was sustainable past this period. Another added layer of complication is that there are no governmental follow-up mechanisms to monitor voluntary P2 actions in the long-term or reinforce P2 best practices learned through volunteer trainings. An additional limitation of this promotora-led P2 program is the lack of *in-situ*, real time environmental monitoring data. The calculations used to determine the level of emission reductions achieved due to the promotora-led P2 program interventions are based on self-reporting, which can add uncertainty to the calculations. To strengthen the assessment and evaluation of emission reductions, real-time monitoring and long-term follow-up, should be applied.

We did not initially anticipate interacting with home-based businesses and this interaction is a noteworthy outcome. Literature regarding P2 efforts targeting home-based businesses is almost nonexistent and to the best of our knowledge has not yet been reported in the P2 literature. This promotora-led P2 program provides a concrete case study and evidence about how to reach this subsector of small businesses. Even though the numbers reached were low, this finding does highlight that home-based businesses need to be incorporated in P2 programs. This program provides a model that can be applied to expand the number of home-based businesses engaged in P2 activities.

4. Conclusions

The promotora-led P2 program resulted in the engagement of many minority owned and managed small and home-based businesses. It impacted more than 600 businesses which are usually unnoticed. As described in this article, the right culture and language derived from the community's ecology is essential to implement P2 program with minority businesses. With the participating Hispanic businesses in Tucson, we observed that combining on-site and follow-up visits led by technically trained promotoras (peer education) can result in improved P2 outreach. Specifically, technically trained female, community health workers can be effective at convincing small and home-based businesses in applying P2 practices on-site and demonstrate that emission reductions can be achieved by low-cost interventions. This type of voluntary approach is complimentary to government-based programs, since it extends the reach of existing resources and infrastructure.

We recommend that similar programs should be implemented to fill the gap left by large-scale government programs. This process described here to achieve P2 can assist in decreasing community-wide pollution emissions that are greatly amplified in minority neighborhoods. It is important to keep in mind that this type of intervention is only one piece of the diverse partnerships needed to implement a sustainable P2 culture.

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Author Contributions

Ann Marie Wolf, Aminata Kilungo, and Eric A. Betterton conceived and designed the project; Lourdes Veá, Aminata Kilungo, Denise Moreno Ramírez, Monica Ramírez-Andreotta, and Rocio Estrella-Sánchez performed the outreach/fieldwork; Ann Marie Wolf and Aminata Kilungo analyzed the data; Ann Marie Wolf, Aminata Kilungo, Denise Moreno Ramírez, Monica Ramírez-Andreotta, and Anna H. Spitz contributed training support; Rocio Estrella-Sánchez and Lourdes Veá translated program materials; Denise Moreno Ramírez wrote the paper, and all authors read, contributed, and commented on the manuscript content.

Conflicts of Interest

The authors declare no conflict of interest.

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