Mulch Madness: A Community-Academic Partnership for Lead Poisoning Prevention

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ABSTRACT

Background. Soil constitutes a major source of childhood lead exposure, disproportionately affecting communities of color. Mulching offers a low-cost interim control.

Objectives. A community-academic partnership was established for lead poisoning prevention, with a three-fold aim: (1) control soil lead hazards by applying mulch, (2) identify home lead hazards with screening kits, and (3) connect residents to resources to address lead hazards.

Methods. Student volunteers canvassed neighborhoods one month prior to the annual event. They requested consent for mulching, distributed lead screening kits, and screened residents for grant eligibility. Soil samples were collected from each home before mulching. According to principles of community-based participatory research, materials and plans were iterative, guided and adjusted by neighborhood association feedback, and detailed reports about home lead results were shared with each participating resident. Composite neighborhood data and survey results were shared with volunteers and community partners.

Results. The project was evaluated in the third (41 homes) and fourth (48 homes) years of implementation. Before mulching, the median soil lead level was over 400 ppm, and after mulching, it was below 20 ppm. Lead screening kits identified widespread lead hazards in paint, soil, and dust, but not water. Challenges remain in (a) increasing child blood lead testing and (b) increasing submissions for City grant funding for lead abatement. Evaluation surveys indicate a sense of ownership in the project among community partners and high levels of engagement among students.

Conclusions. Community-academic partnerships are an effective tool for lead poisoning prevention, generating evidence for public health action.

KEYWORDS: Environmental Health, Community-Based Participatory Research, Community health partnerships, Health disparities, Poisoning, Health, Health equity, Public Health, Lead exposure, Lead screening, Midwestern United States

Introduction

Childhood lead poisoning remains a pressing public health challenge in the U.S. due to historic use of leaded gasoline and paint.[1,2] Notably, the neurodevelopmental deficits of childhood lead poisoning–and the accompanying social consequences–fall disproportionately on communities of color as a result of the enduring effects of structural racism.[3] Historically, communities of color were deemed "hazardous" investments and were denied mortgage loans by the Federal Housing Authority, codifying racial residential segregation into practice.[4] Redlining maps, developed by the Home Owners' Loan Corporation in the 1930s, reflect discriminatory lending practices that contributed to the institutionalization of residential segregation. Residential segregation has limited Black Americans' access to employment, education, quality housing, nutrition, and transportation, leading to inequities in population health outcomes and neighborhood-level economic conditions.[5–7] Existing literature shows that neighborhood racial composition is linked with both poverty and poor housing conditions,[3,8] giving way to a racialized patterning of environmental exposures, including lead,[9,10] thereby producing significant racial inequities in childhood lead poisoning rates.[3,11–16]

The persistence of environmental lead (Pb) is of particular concern in South Bend, Indiana, where roughly 80% of homes were built before 1978, when lead-based paint was banned by the U.S. government.[17] As exterior lead-based paint deteriorates, paint chips deposit in the soil, where lead is retained, constituting a major source of exposure, especially among young children who play in the soil and engage in hand-to-mouth behaviors.[1,2,18,19] Consequently, lead remediation initiatives focus on controlling lead-based paint hazards, a cost-effective method known to produce significant (a) returns on investment and (b) reductions in children's BLLs.[20,21] Initiatives addressing soil as the principal source of lead exposure,

however, have produced indeterminate results.[22] In the 1980s, the Environmental Protection Agency (EPA) funded studies on soil lead abatement in three cities: Boston, Baltimore, and Cincinnati. In Boston, researchers found that soil lead abatement, or removal, was associated with statistically significant reductions in children's BLLs,[23] while researchers concluded that, in Baltimore, soil lead abatement had no effect on children's BLLs.[24] Even though soil lead concentration is a strong predictor of children's BLLs,[25,26] the indeterminate results of abatement projects have caused soil lead *abatement* to be deemed prohibitively expensive for the associated benefit,[27] shifting focus to soil lead *remediation.*[28,29]

Effective remediation projects must go beyond interim controls, however, and consider upstream causes. For example, mulch can encase lead in the soil, but its effects are limited if exterior paint remains unaddressed, continuing to deteriorate and deposit leaded paint chips in the newly applied mulch. To that effect, we present an evaluation of "Mulch Madness," a community intervention that aims to (1) address soil lead hazards by applying 4-6 inches of mulch, as advised by the EPA for soil lead remediation,[30] (2) identify home lead hazards using lead screening kits,[31,32] and (3) link residents with city resources to address lead hazards, including on-site blood lead testing and grant funding for lead abatement.

Mulch Madness depends on methods of community-based participatory research (CBPR) to instill health equity by intentionally partnering with those personally affected by an issue. Co-developed interventions rely on community members' expertise to effectively reach and provide services in the community, generating knowledge for action and social change.[33–35] This evaluation offers lessons learned from implementation and provides a project framework that can be scaled and implemented in diverse contexts, generating evidence for public health action and accountability.

Methods

About the Partnership: Setting, Historical Context, and Partnership Formation

This project began in spring 2021 in the Monroe Park neighborhood, which was selected after a pilot study raised concerns about environmental hazards throughout the neighborhood.[36] In spring 2022, this project expanded to include the Near Northwest Neighborhood (NNN), a longstanding collaborator with Notre Dame on lead remediation, and River Park Neighborhood, which was selected in consultation with employees from the City of South Bend's Department of Community Investment because of its (a) older housing stock, increasing risk of lead exposure, and (b) robust neighborhood association, offering capacity to facilitate a community-academic partnership. Sociodemographic characteristics of participating neighborhoods are summarized in **Table 1**.[37] Compared to the city of South Bend, two of the three neighborhoods (Monroe Park and NNN) are more racially diverse and have higher rates of economic disadvantage, which can be traced to historical discriminatory lending policies that reinforced residential segregation.[3,4,16] These policies, rooted in structural racism, are reflected in redlining maps of the 1930s, where Monroe Park, like other communities of color, was classified by the HOLC as a "hazardous" investment for banks (**Figure 1**), and NNN and River Park were both classified as neighborhoods with "definitely declining" conditions, restricting access to credit in all three neighborhoods.[38]

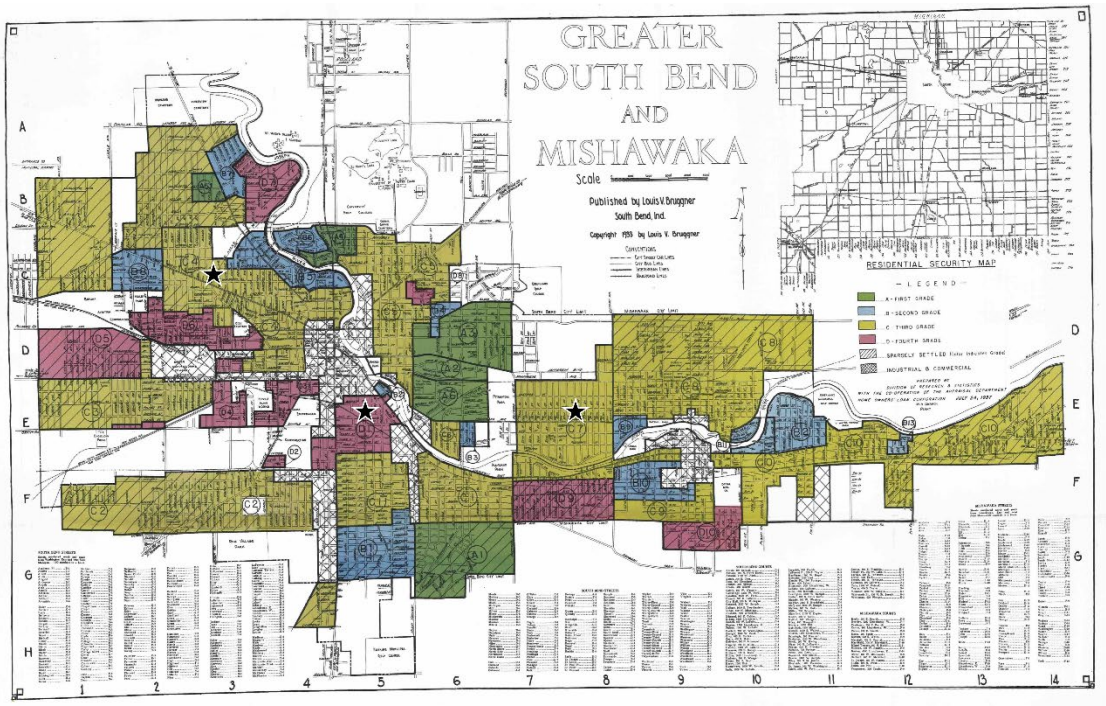

Figure 1. Redlining map of South Bend, Indiana (1938). Monroe Park (D1) is color-coded red, which corresponds to a neighborhood that poses "hazardous" risk to banks and other mortgage lenders, while NNN (C4) and River Park (C7) are color-coded yellow, denoting "definitely declining" conditions, typically due to the "infiltration" of other racial or ethnic groups.[39] Stars on the map denote participating neighborhoods.

To initiate the community-academic partnerships, researchers from Notre Dame contacted the presidents of the three neighborhood associations to discuss forming a partnership centered around environmental health and lead poisoning prevention. All three leaders were interested and invited the research team to share the idea–and previous work undertaken in the community–at the subsequent neighborhood association meeting, where neighborhood residents could listen, ask questions, and determine if they would like to forge a partnership with Notre Dame. Partnerships were ultimately formed with all three neighborhoods (Monroe Park, NNN, and River Park), with members from the Notre Dame research team attending monthly meetings and communicating regularly–by email, phone, and Zoom–with neighborhood association presidents and community organizers to co-develop plans for Mulch Madness. As plans

developed for spring 2022, an additional partnership was established with the St. Joseph County Department of Health to expand services, namely, blood lead testing for children. The expertise and lived experience of community members who serve as neighborhood association leaders and community organizers informed all stages of the project, from planning (selecting neighborhood priority areas, setting dates and times, and co-developing recruitment materials) to implementation (canvassing, on-site presence on the day of mulching) to evaluation (providing feedback on project fidelity and opportunities for improvement). Event plans were informed and adjusted, when possible, with feedback from community partners and incorporated into planning documents for subsequent years.

Project Model

"Mulch Madness" has been used as a name for other neighborhood beautification projects across the U.S., but these programs are unrelated to the project described herein. Mulch Madness is an annual initiative bringing together researchers, students, and community members for lead poisoning prevention and action. Operating as a community-academic partnership, Mulch Madness has a three-fold aim: (1) remediate elevated soil lead levels with mulch application to reduce surface availability, mitigating risk of childhood exposure; (2) distribute lead screening kits, allowing residents to test paint, dust, water, and soil from their home to identify environmental lead hazards;[31,32] and (3) connect residents with City resources, including on-site blood lead testing and grant applications to fund lead-related repairs and abatement for income-eligible households. [17] While the primary aim addresses soil lead via interim control, the latter two aims address upstream causes.

Roughly three weeks before the event, a team of a dozen student volunteers ("captains") canvassed each neighborhood. Prior to canvassing, captains received training (**Supplemental Materials**) on environmental lead exposure, canvassing best practices, completing a lead screening kit,[31,32] and data collection with REDCap (Research Electronic Data Capture).[39] Training materials were co-developed by partners, with researchers and community organizers facilitating the session together. Community partners guided the recruitment strategy by setting the canvassing date and time, selecting areas of the neighborhood to prioritize, and assisting with the development of flyers and consent forms. Captains canvassed neighborhoods in pairs, presenting educational information on childhood lead exposure and asking if residents would like to (a) have their home mulched free of charge, (b) complete a lead screening kit, and (c) check eligibility for the City grant program (**Figure 2**). If the resident agreed to have their home mulched or to complete a lead screening kit, informed consent was obtained in accordance with protocols approved by the Institutional Review Board (IRB) at the University of Notre Dame (IRB # 20-09-6244, approved 19 October 2020, exempt review status). Those who accepted a kit could (a) complete the kit with the assistance of captains or (b) complete the kit independently and leave it on their doorstep the morning of mulching. Eligibility screens for grant funding was designed in consultation with the City's grant program manager. Residents who met at least one of the two eligibility criteria (income ≤ 80% area median income *or* if a child ≤ 6 years old is frequently in the home) received applications and were asked if their contact information could be shared with the City's Department of Community Investment who could provide technical assistance. Homes that did not answer the door during canvassing received flyers about the event, lead poisoning prevention resources, and a paper consent form. Additional canvassing was

executed by community organizers in the final week leading up to the event. Canvassing data were collected with REDCap.

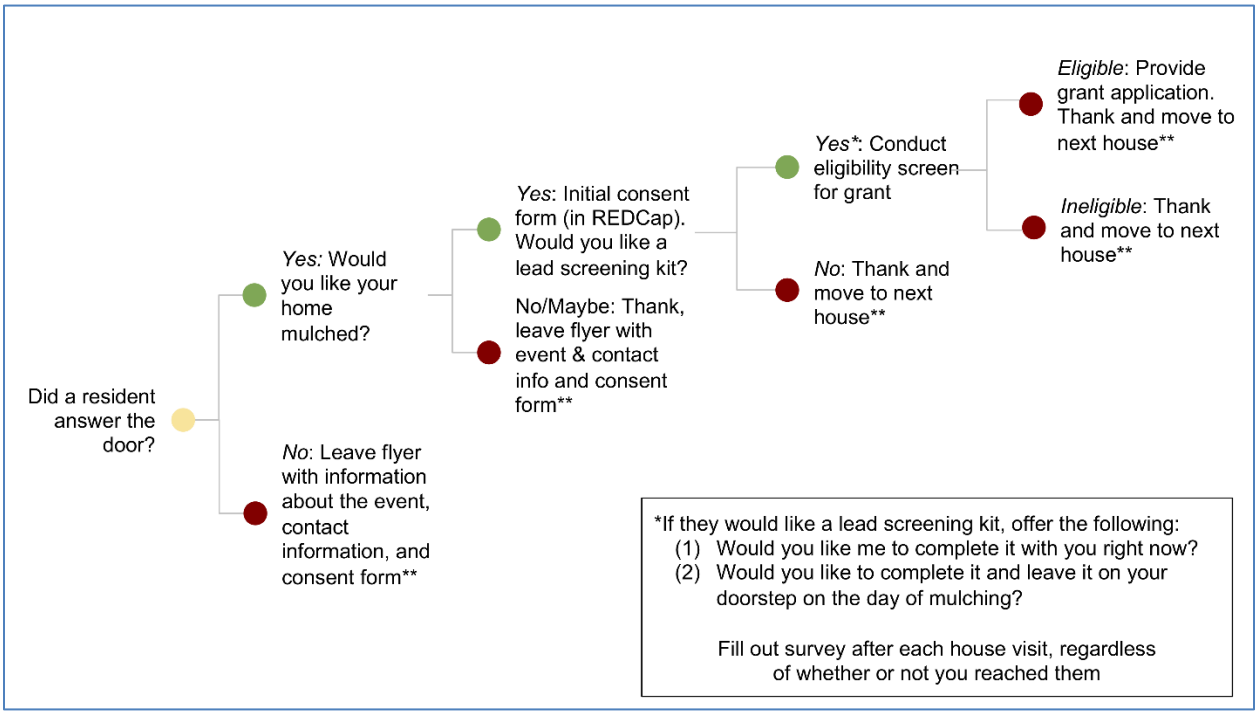

Figure 2. Canvassing model. Core volunteers went door-to-door in pairs, asking residents if they would like (a) to have their home mulched, (b) to complete a lead screening kit, and (c) to see if they might be eligible for City grant funding for lead-related repairs and/or abatement. Green dots indicate to proceed to the next step, and red dots indicate termination points.

The mulching event was executed in early April and coordinated with a neighborhood clean-up event, facilitated by Neighborhood Services and Enforcement (formerly "Code Enforcement"), bringing together neighborhood residents, student volunteers, and City officials. Captains recruited additional student volunteers via snowball sampling,[40] and event information was sent to all students by Notre Dame Student Government as part of the University's annual day of service, netting about 300 student volunteers. Volunteers were divided into five teams in

each neighborhood, with each team led by two captains, who communicated details to team members in the days leading up to the event. Each team was assigned to a block of the neighborhood where participating homes were clustered; territories aligned with captains' prior canvassing assignments to ensure familiarity with the neighborhood. Neighborhood association leaders identified open lots within each team's territory that would serve as hubs, complete with mulch piles, shovels, wheelbarrows, five-gallon buckets, and gloves. The week leading up to the event, tarps were laid down at the hubs, and roughly ten cubic yards of mulch–obtained at no cost from the City's Department of Organic Resources–were delivered by the University of Notre Dame Landscaping Services to each site. A neighborhood hub was also established, where the research team had a portable x-ray fluorometer (pXRF) on-site for analysis.

During the event, captains distributed additional grant applications, collected lead screening kits, and distributed new kits to those who had not received a kit during canvassing, while student volunteers mulched and collected soil samples. Residents were encouraged to complete their screening kit with captains; otherwise, arrangements were made to return the kit for analysis. Student volunteers, neighborhood association leaders, community organizers, and researchers engaged with residents to provide educational information about lead exposure and keeping their home and neighborhood safer from lead.

Evaluation

At all participating homes, student volunteers collected 3 soil samples, *prior* to mulching, from the dripline (area within 3 feet from exterior wall) and any other location where residents requested mulch. Soil samples were analyzed with the pXRF to measure lead concentration. Samples were collected to (a) survey soil lead hazards across neighborhoods and (b) assess

effectiveness of mulching by comparing samples pre- and post-mulching. Two months after mulching in Monroe Park, participating homes were solicited for consent to obtain three follow-up samples. Soil or mulch available at the surface was collected from three sites, spaced at least five feet apart, around the dripline and any other specified mulching locations to assess the lead concentration in any accessible soil to which children could be exposed. The average soil lead concentration was calculated for each home before and after mulching. Because the data were not normally distributed (confirmed with the Shapiro-Wilk test), the Wilcoxon signed-rank test was used to assess differences in lead concentration after mulching between matched pairs in Monroe Park.[41] McNemar's test was employed to determine if the hazard category, according to EPA standards,[42] changed after mulching, complementing the results of the Wilcoxon signed-rank test by verifying that any differences in Pb concentration produced changes in hazard thresholds and could be considered meaningful reductions in practice.[43] All analyses were performed using R Statistical Software, version 4.0.3 (R Foundation for Statistical Computing).

Lead screening kits were completed as previously described.[31,32] Lead hazard thresholds were based on EPA guidance: 400 parts per million (ppm) for soil; 1,000 ppm for paint; 10µg/ft^2 for dust (**Figure S1**); and 15 ppb for water.[42,44]

After the event, surveys were sent to key informants: neighborhood association leaders and Department of Health employees. These surveys assessed partnership effectiveness with quantitative and qualitative measures related to satisfaction, effectiveness, impact, trust, decision-making, and adherence to CBPR principles.[45–47] Measures were drawn from Israel and colleagues,[45–47] with quantitative responses measured on a 5-point Likert scale ranging from strongly disagree to strongly agree. Additionally, surveys were sent to student volunteers to

assess their engagement, including their sense of inclusion in the project, desire to participate again, understanding of the community, and knowledge about lead poisoning.

Results

Students canvassed 298 homes, leaving educational flyers and paper consent forms at homes that did not answer. Of the 133 homes reached, 89 homes (66.9%) provided consent for mulching, and 50 (56.2%) received a lead screening kit, 33 (66.0%) of which were returned for analysis. Outcomes are summarized in **Figure 3**, illustrating the biggest bottlenecks: (1) contacting households (55.4% attrition) and (2) eligibility for city grant funding (52.2% attrition). Although not depicted in Figure 3 (due to the lack of a denominator [i.e., number of children aged 1-6 years residing in participating neighborhoods]), two children received a blood lead test at the event.

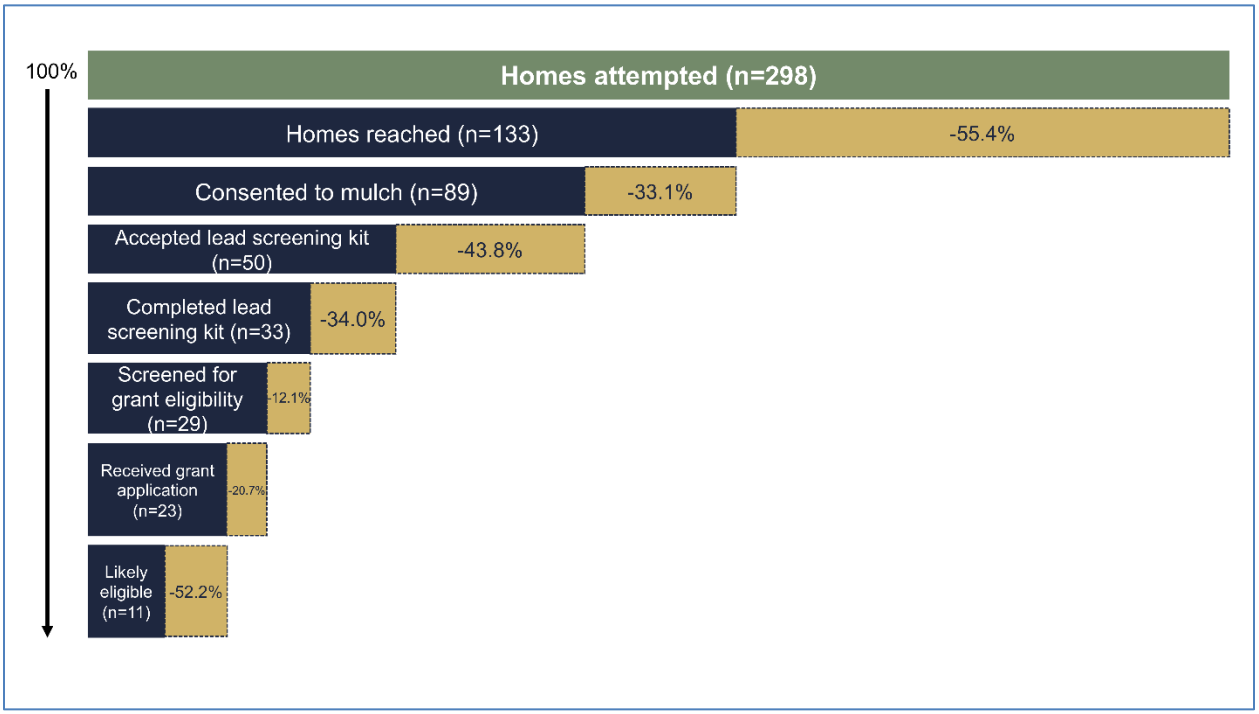

Figure 3. Cascade model of project outcomes. Student volunteers canvassed 298 unique homes, reaching 133 and enrolling 89 (33.1% attrition rate). 50 of the 89 participating homes accepted a lead screening kit, 33 of whom completed and returned the kit for analysis (34.0% attrition rate). 29 homes were screened for grant eligibility, of whom 12 (41.4%) met one eligibility criterion and 11 (37.9%) met both eligibility criteria.

At all participating homes, except two enrolled on the day of the event, students collected three soil samples *prior* to mulching, from the dripline and locations where residents requested mulch (n=87). Of the 87 homes, 60 homes (69.0%) had ≥1 soil sample with a lead concentration above the EPA's hazard threshold for children's play areas (≥ 400 ppm Pb). Although many of these samples were dripline samples, this level of lead still indicates a concerning lead burden in the soil around the home. Lead screening kit results (**Figure 4)** indicated widespread hazards: 62.1% of homes (n=18) had ≥1 paint sample with a hazardous Pb concentration (≥ 1,000 ppm), and 51.6% of homes (n=16) had ≥1 dust sample with a hazardous Pb concentration (≥ 10 µg). Although the threshold for lead-based paint is 5,000 ppm, the EPA encourages intervention for paint with a lead concentration ≥ 1,000 ppm.

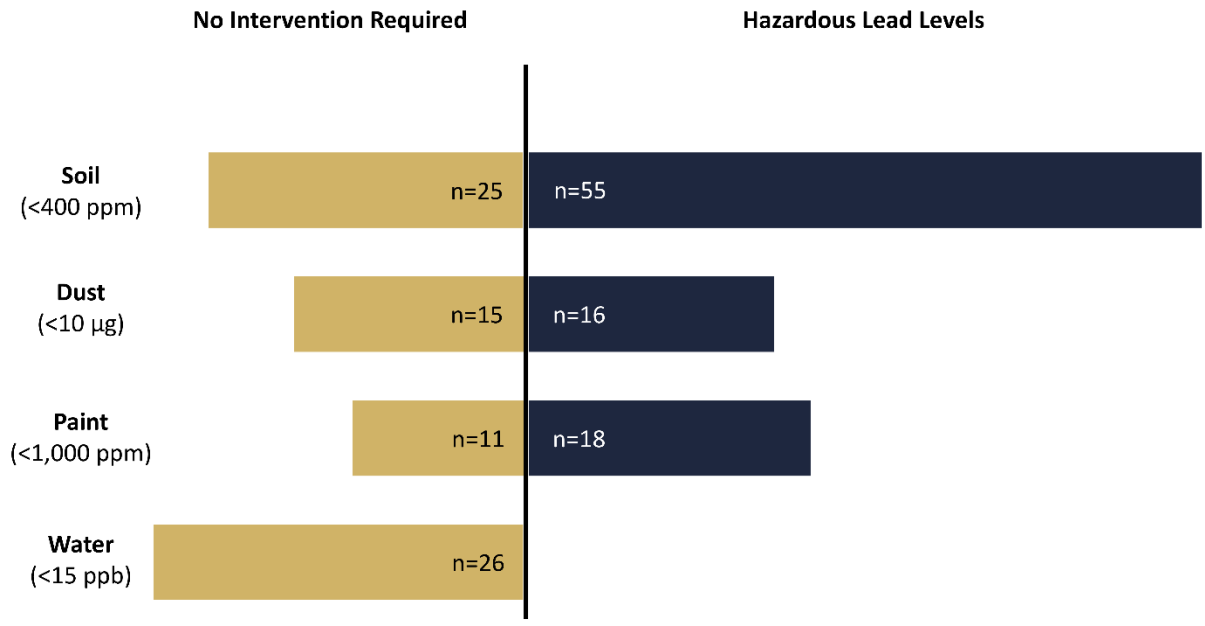

Figure 4. Lead screening kit results. Roughly 7 in 10 homes had elevated soil Pb levels, 2 in 3 had elevated paint Pb levels, and 1 in 2 had elevated dust Pb levels. Lead was not detected in any water samples.

To assess the effectiveness of mulching for lead remediation, follow-up samples were collected in Monroe Park two months after mulching. Two-thirds of participating homes (n=27) consented to follow-up samples to assess the lead concentration in any accessible soil to which children could be exposed. Comparing soil available at the surface pre- and post-mulching, the intervention significantly reduced lead concentration from an average of 1,294 (95% CI: 581.4 - 2,006.6) ppm to 160.5 (95% CI: 18.1 - 302.9) ppm ($P<0.001$) (**Figure 5**). This reduction corresponds to a significant change in hazard, bringing 82% (n=18) of homes with previously elevated soil lead levels below the hazard threshold, requiring no further intervention.

A post-event survey was sent to all neighborhood association leaders, community organizers, and Department of Health employees to assess the project's fidelity to CBPR principles (**Figure 6**). A different survey was sent to all student volunteers (n=284), which was completed by roughly one-fifth of recipients (n=53). The vast majority of respondents (88.7%) would participate in the event again, reporting high levels of (a) inclusion (90.6%) and (b) understanding of the event's objective beyond direct service or application of mulch (84.9%). Over three-fourths (75.5%) reported that by participating in Mulch Madness, they learned more about the community and lead poisoning.

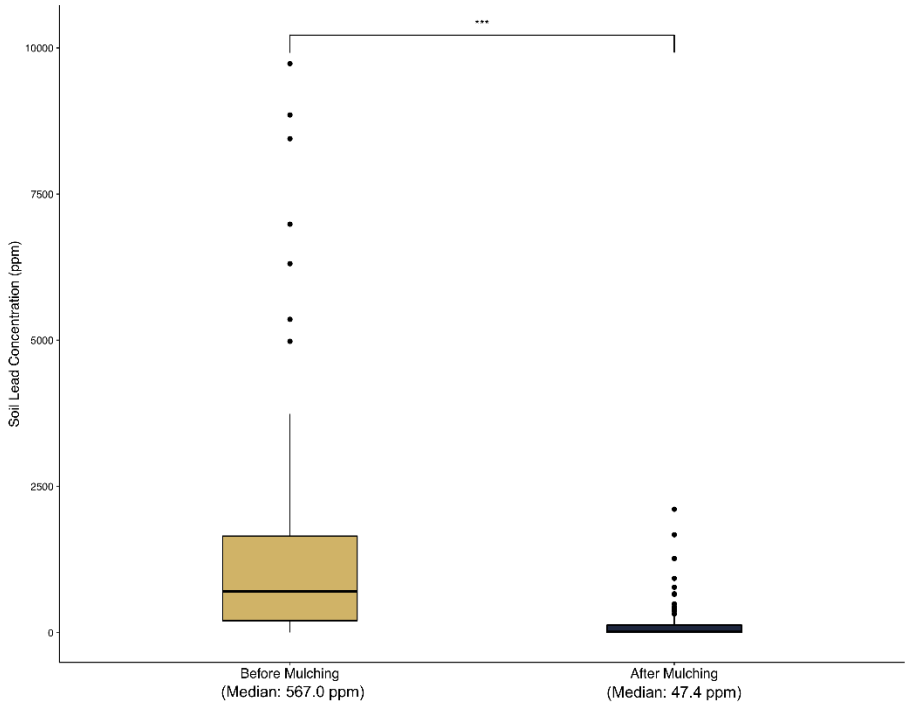

Figure 5. Soil Pb concentration (in ppm) before and two months after mulching in Monroe Park. Mulching significantly reduced the soil lead concentration ($P<0.001$, assessed with Wilcoxon signed-rank test). The median soil lead level before mulching was 567.0 ppm, and 2 months after mulching, it was 47.4 ppm. The dashed line denotes the EPA hazard threshold (400 ppm) for which intervention is advised. These results informed expansion to NNN and River Park neighborhoods, so no follow-up samples were collected during the 2022 event.

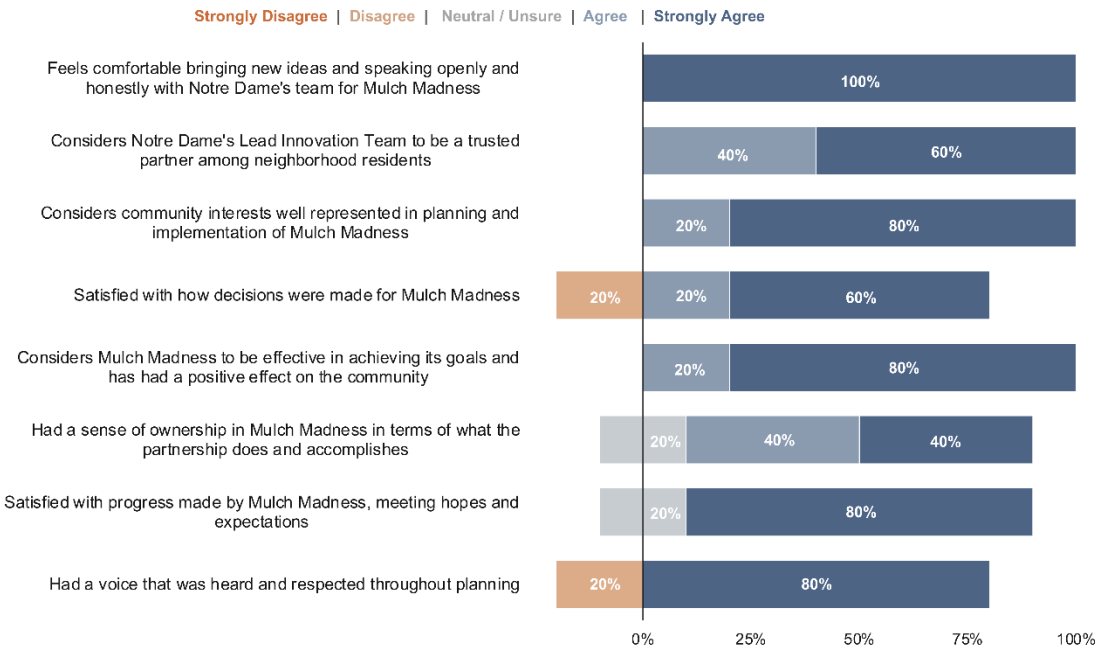

Figure 6. Measures of partnership effectiveness and fidelity to CBPR principles. Key informants (n=5) completed a post-event survey, all of whom considered Mulch Madness to be effective in achieving its goals, with community members comfortable speaking openly with academic partners, ensuring community interests were well represented throughout planning and implementation. The majority of respondents had a sense of ownership in Mulch Madness, but one partner reported dissatisfaction with how decisions were made.

Discussion

Mulching significantly lowered the soil lead concentration at the surface, where children could be exposed, but mulching only goes so far when additional sources of exposure remain unaddressed. When exterior paint is poorly maintained, leaded paint chips can continue to deposit in the dripline,[2,18] limiting the effects of mulching in mitigating exposure. Analyses of soil samples and lead screening kits highlight widespread environmental lead hazards throughout South Bend, Indiana, with lead hazards in (a) soil at over two-thirds of participating homes, (b) paint at over three-fifths of participating homes, and (c) dust at over one-half of participating homes. The state of California enforces a significantly lower hazard threshold (80 ppm) for

children's play areas than the EPA hazard threshold used in this analysis (400 ppm), and this standard may be an indicator of future federal guidance. Using this safety threshold, 96.3% (77/80) of participating homes for which soil samples were collected prior to mulching had at least one soil sample with a hazardous concentration of lead. This is notably higher than many other geographic regions where soil lead concentrations have been surveyed,[48] underscoring the persistence of lead hazards in South Bend, Indiana.

Project findings, alongside remediation guidance and recommendations for safer living, were shared in a project report that was distributed to all community partners to share with neighborhood residents. While Mulch Madness aims to *identify* lead hazards in the home, there remains a need to develop interventions to *address* and *remediate* hazards. Initiatives, like Mulch Madness, that provide community education and guidance on best practices for do-it-yourself (DIY) remediation techniques are a step in the right direction, but considering childhood lead poisoning disproportionately affects structurally vulnerable populations,[11,12,49] effective interventions must address economic barriers to implementation. Increasing community capacity of lead-certified painters and contractors is critical, but the cost of lead-certification presents a barrier to contractors–and to residents who then pay a premium for hiring a certified contractor. Further research should explore novel incentive mechanisms to increase the capacity of lead-certified contractors and minimize financial barriers in hiring certified contractors. Additionally, future projects should make a concerted effort to collect demographic data of neighborhood associations and participating households to ensure all neighborhood voices are represented and evaluate if projects are meeting their intended reach.

Previous studies have identified mulching as a cost-effective strategy for remediating environmental lead hazards,[50] and Mulch Madness brought tangible benefits to neighborhood

residents by (a) lowering soil lead concentrations, limiting the amount of lead accessible at the surface to which children could be exposed, (b) identifying hazards around the home before a child is poisoned, and (c) connecting them to City resources, including funding and blood lead testing.

While this study is limited to one midwestern city, there are thousands of communities across the United States with notable environmental lead hazards,[51] where Mulch Madness could be implemented. Mulch Madness was a no budget operation, accomplished by the coordination of community and academic partners. Participating students also benefited, reporting new learnings and high levels of engagement, drawing attention to how projects like Mulch Madness could be readily incorporated into courses with community-based learning experiences and work to understand best practices for student engagement. Cities, too, can institutionalize Mulch Madness by trucking mulch from organic waste to neighborhood sites for community mulching projects.

Several challenges were encountered throughout implementation and evaluation, offering lessons learned for future iterations. For one, Mulch Madness, functioning as a community-academic partnership, depends on power sharing between community and academic partners for effective implementation.[33–35,52] Results from the key informant survey highlights that not all partners were entirely satisfied with planning or decision-making. This was a critical lesson learned, as the survey was only administered at the conclusion of the project. In future years, assessments on project fidelity to CBPR principles should be administered routinely to identify any power imbalances and quickly correct course, ensuring community voices are heard and respected. Evidence suggests that partner involvement is the most critical determinant of partnership satisfaction,[53] and thus, Mulch Madness can improve by fostering opportunities for

broad partner involvement. This starts by adopting a mindset of continuous flexibility, compromise, and feedback,[54] providing assurance that all issues are open for negotiation and decisions are not made unilaterally.[53,54] Similarly, this approach of continuous flexibility might require certain plans or structures to change. For example, one partner (the health department) joined Mulch Madness later in the planning process than others, at a point when the timing and cadence of meetings had already been established. As partnerships grow, the timing and cadence of meetings should be re-visited, giving priority to the schedules of all partners to ensure all partners are in regular attendance to discuss issues and provide input.[54] Additionally, at the time of decision-making, partners should discuss parties responsible for each task, prioritizing both the division of responsibilities and ownership in the project.[54]

Beyond efforts to improve partner satisfaction, Mulch Madness could be improved by including participating households in the evaluation, asking questions about the canvassing approach, why they elected to participate, what worked well, and what could be improved. These conversations could likely be integrated into neighborhood association meetings, yielding key insights for project improvement and could provide an avenue for community members (beyond neighborhood association leadership) to become involved in an advisory role for planning and implementation of next year's event. While partnerships with neighborhood associations can be replicated in other settings, further research is needed to assess how formal and organized associations must be to provide enough structure for a successful partnership.

Project outcomes were constrained by (a) canvassing approach, (b) legal challenges of lead screening, and (c) funding eligibility. Several days of canvassing should be pursued, visiting the neighborhood on different days of the week and different times of the day, to increase contact rate. Increasing the number of canvassing days provides repeated exposure for captains to

familiarize themselves with the neighborhood, which may streamline processes on the day of mulching but will likely not affect the attrition rate for home lead screening. Homeowners who know that their home has lead-based paint are required to disclose this information when selling or renting.[55] Because the disclosure of lead-based paint may negatively impact home value, individuals may be disincentivized from completing lead screening kits that serve as prevention tools in identifying hazards before a child receives an elevated blood lead test. Neighborhood residents demonstrated interest in City funding for lead-related repairs, but eligibility was a notable bottleneck, which suggests that relaxing eligibility requirements may expand remediation activities if excess funds remain at the end of the fiscal year. Eleven households received grant applications, and while we lack follow-up data (e.g., application submission and award rates), future research efforts should consider (a) barriers and facilitators to application submission and (b) effective avenues for technical assistance.

Previous research has identified exceedingly low rates of childhood blood lead testing in South Bend,[56] but blood lead testing numbers during Mulch Madness were notably low. It remains unclear if this was due to neighborhood residents (a) not being aware of the service or (b) not being interested in the service. Advertisements may increase participation in blood lead testing services, which should be pursued in partnership with churches, temples, and schools in the neighborhood, all of which are trusted messengers and sites already frequented by community members.[57] Effective advertisements must grip residents' attention because lead is seldom perceived as an immediate threat or priority.[57] Additionally, registration for blood lead testing can be incorporated into the canvassing process. Future interventions aiming to improve child lead screening rates, which have declined significantly over the course of the COVID-19 pandemic,[59] should consider integrating community health workers (CHWs), whose shared lived

experience will inform strategies to meet people where they are with point-of-care testing and accessible messaging.[60]

In summary, this study generates evidence for public health action and accountability, providing an example of a community-academic partnership that can (1) address soil lead hazards, (2) identify sources of lead exposure around the home before a child is poisoned, and (3) link residents with city resources for home repairs and blood lead testing. Mulch Madness offers a framework that can be scaled and implemented by other academic institutions, health departments, and/or city government entities in partnership with local communities, working towards environmental justice and health equity.

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Table 1. Descriptive statistics of sociodemographic parameters of neighborhoods participating in Mulch Madness – Northwest Indiana, 2021-22. [a,b]

Indicator	Indiana	South Bend	Monroe Park Neighborhood	Near Northwest Neighborhood	River Park Neighborhood
Race/Ethnicity					
White	80.2%	53.5%	50.4%	27.7%	70.9%
Black	9.2%	26.8%	45.7%	48.2%	15.7%
Hispanic/Latinx	6.4%	14.2%	0.9%	19.0%	6.7%
Socioeconomic Characteristics					
Median Household Income	$50,400	$35,800	$34,400	$30,221	$37,440
Employed	59.5%	58.1%	35.6%	55.1%	65.0%
Households Receiving SNAP [c]	12.2%	21.6%	31.9%	41.7%	12.5%
Households with Children (aged 0-17 years)	24.0%	27.8%	16.0%	35.4%	20.6%
Educational Attainment					
No High School Diploma	11.9%	17.0%	16.2%	26.0%	9.9%
High School Diploma	55.1%	52.1%	62.7%	55.4%	57.8%
Higher Education	33.0%	31.0%	21.2%	18.6%	32.2%

[a] Indiana and South Bend are presented for reference, enabling comparison.
[b] Demographic characteristics were compiled from U.S. Census Bureau.[38]
[c] SNAP = Supplemental Nutrition Assistance Program (formerly "food stamps").

Table 1. Descriptive statistics of sociodemographic parameters of participating neighborhoods.[a,b]
[a] Indiana and South Bend are presented for reference, enabling comparison
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