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SPECIAL REPORT

Findings From a Pilot Project Highlight Lessons to Ensure Safe Cleaning Practices and Pesticide Use in At-Home Childcare Centers

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Abstract **Lead and pesticide exposure are leading environmental health concerns for children, and these exposures can result in long-term health consequences, including irreversible cognitive delay and endocrine dysfunction. A pilot program aimed to a) develop and disseminate educational materials and supplies and b) perform in-home childcare facility assessments to increase knowledge regarding lead and pesticide safety, provide education on the health impacts of elevated blood lead levels, and reduce exposure risks in these settings. The program was implemented in St. Louis, Missouri. From outreach and education efforts to interactive feedback, this article shares important lessons learned and highlights educational gaps that can and should be addressed by education and public health administrators alike.**

Keywords: health, childcare, cleaning practices, pesticides, education

Introduction

Many people are unaware that common household products such as pesticides, cleaning supplies, and living conditions (e.g., household paint that is chipping) can be harmful to children. Lead and pesticide exposure can result in long-term health consequences including irreversible cognitive delay and endocrine dysfunction (Breysse et al., 2004; Breysse & Gant, 2017; Landrigan et al., 2002, 2018). Several commonly used cleaning and disinfecting chemicals are known sensitizers and irritants. Children in early developmental stages are most likely to suffer long-term health consequences from exposure to chemical pesticides and lead (American Academy of Pediatrics, 2018).

The Mid-America Pediatric Environmental Health Specialty Unit (MAPEHSU) is located at Children's Mercy in Kansas City, Missouri. Children's Mercy provides comprehensive pediatric environmental health services through MAPEHSU, which is one of 10 pediatric environmental health specialty units located in the continental U.S. The mission of these specialty units is to improve reproductive and children's health by leading the integration of environmental health into clinical care and public health while supporting communities to address environmental concerns that harm health.

As part of a federal order to serve populations through environmental health education, MAPEHSU collaborated with their regional office of the U.S. Environmental Protection Agency (U.S. EPA) to engage with at-home childcare centers throughout St. Louis, Missouri. Centers that were located in older structures (i.e., homes built before 1978) were prioritized due to children being at greater risk of lead exposure from the breakdown of lead paint into dust. Additionally, the educational program included information about general cleaning and the use of pesticides and other chemicals. The program was delivered via online webinar trainings and in-person educational home assessments at the facilities, both of which were eligible for state continuing education clock hours through the Missouri Department of Elementary and Secondary Education.

Following participation in the education program, childcare center owners, directors, and participating staff were expected to have increased knowledge and capability in addressing risks related to childhood lead and pesticide exposures in their at-home childcare centers. This article describes the important lessons learned and findings from this environmental education pilot program.

Methods

The educational components and assessments for the in-home childcare program were planned and implemented from October 2023 to September 2024. Webinars were conducted in June and July 2024, and the on-site facility assessments were performed in August 2024. Participants were eligible for 1 continuing education unit (CEU) for the webinar and 2 CEUs for the facility assessment.

Recruitment

Recruitment started with a list of childcare facilities in St. Louis. An introductory letter was mailed to the facilities and was followed by phone calls and emails, with lit-

https://doi.org/10.70387/001c.147153

TABLE **1**

Characteristics and Background of Participants Attending Webinars About Harmful Chemical Exposures in the Early Learning Environment, Lead, and Pesticides in June and July 2024 (*N* = 41)

Characteristic	Participants	
	#	%
Gender		
Male	4	9.8
Female	37	90.2
Work in facilities built		
Before 1978	5	12.2
After 1978	13	31.7
Unknown or not applicable	23	56.1
Current cleaning practices		
3-step method	11	26.8
Vacuum, mop, dusting, a variety of products	25	61.0
Cleaning company or team	2	4.9
Unknown or not sure	3	7.3

tle response from most of the facilities. In addition, a social media digital promotional campaign was launched. After a sparsely attended initial webinar, we expanded recruitment efforts to include accessing relevant listservs, widely distributing a promotional flyer, and using other methods for communicating with facilities. Offering incentives to participants in the form of a gift card helped significantly with recruitment. These added supports resulted in a major increase in attendance for the second webinar, which was attended by 48 people.

Curriculum

Curriculum development for the training sessions involved gathering up-to-date information on lead and pesticides, plus using existing federal agency resources and basic knowledge from the environmental health team at Children's Mercy–Kansas City. The resulting training was a 45-min online webinar, which was attended by childcare workers in Missouri. The training content included:

- The connection between housing and health
- Principles of healthy homes
- Source, routes, and negative health effects of lead and chemical exposures
- Integrated pest management
- Importance of nutrition (e.g., reading food labels)
- Importance of safe cleaning practices (e.g., safer choices of disinfectants)

Webinar participants were asked to complete a 10-question pre-survey and a >10-question post-survey online, which formed each participant's knowledge score. The post-survey included additional questions about the facility (i.e., build date and cleaning practices) and questions based on a 5-point Likert scale (1 = not very to 5 = very much) asking about satisfaction with the webinar, relevance of the training content to their job, and overall satisfaction with the event. Participants who completed both surveys received a $100 gift card (made available with funding from a separate grant).

At-Home Assessments

The availability of in-person home assessments by an experienced environmental hygienist from Children's Mercy–Kansas City was promoted during the online training sessions. Approximately one tenth of participating at-home childcare facilities expressed interest in this service. The home assessments involved visual inspection of the facilities accompanied by education and recommendations. After the visit by the environmental hygienist, assessment participants completed a post-survey.

As an incentive, participants in the in-person home assessment received a Healthy Home Kit, which included a HEPA filtration-equipped vacuum cleaner and a carbon monoxide detector; two buckets, sponges, scrubbing pads, rags, and several healthier cleaning products (e.g., Mrs. Meyer's soap, Bon Ami cleanser, pumice stick); a trash can with a lid and trash can liners; pest monitoring traps, glue boards, and snap traps for rodents; and other items for maintaining a childcare facility (e.g., exterior doormat, cabinet locks, a thermohydrometer). The environmental hygienist ensured recipients were knowledgeable about how to use the items in the Healthy Home Kits. The kits were well received by childcare staff at the six participating facilities.

Statistical Analysis

Survey results were analyzed using IBM SPSS Statistics (Version 29.0.2.0). The difference between pre- and post-survey results for the webinar was tested for significance. The paired *t*-test was used to compare knowledge scores, and significance was set at $\alpha = .05$. Post-survey percentages for measures of satisfaction, relevance, and likelihood of making changes in practice were also calculated.

Results

Educational Sessions

A total of 60 people registered and completed the pre-survey. Of the 56 participants who attended an educational webinar, 41 (73.2%) completed both a pre- and post-survey for analysis. Of these 41 participants, most attendees identified as female (90.2%) and most attendees (56.1%) did not know when their respective in-home childcare facility was built (Table 1).

Based on the pre- and post-surveys, areas with substantial improvements in knowledge were: 1) how children who have been exposed to lead usually present (29.3% to 58.5%); 2) the best approach for reducing chemical exposure risks in a home-based childcare center when dealing with pests in the home (41.5% to 73.2%); and 3) the mandatory requirements for lead remediation in the home when it is also a childcare center in Missouri (41.5% to 65.9%). Overall, participants showed a significant increase in knowledge from the pre-

TABLE **2**

Knowledge Score Among Participants Attending Webinars About Harmful Chemical Exposures in the Early Learning Environment, Lead, and Pesticides in June and July 2024

Outcome	Overall						Paired *t*-Test				
	Pre-Survey			Post-Survey			Pre-Survey Mean (SD)	Post-Survey Mean (*SD*)	#	Difference and 95% CI	*p*-Value
	#	Mean Value (95% CI)	*SD*	#	Mean Value (95% CI)	*SD*					
Knowledge score	60	65.33	17.512	41	72.68	17.610	64.88 (17.482)	72.68 (17.610)	41	7.8 [2.6, 13.0]	.004

Note. CI = confidence interval.

to post-survey (64.9% to 72.7%, p = .004) (Table 2). The majority of participants were satisfied or very satisfied with the webinar (92.6%) and found the content to be relevant and helpful for their job (92.7%), giving the webinar content a 4- or 5-star rating. Most participants (90.3%) were satisfied overall with the logistics of the event, giving the event a 4- or 5-star rating. In addition, three out of four participants (75.6%) responded that they were likely to make changes in their in-home childcare cleaning and maintenance practices after viewing the webinar.

Facility Assessment

The facility assessment process provided many education opportunities for childcare staff at their respective facilities. In total, nine participants opted-in for an in-home childcare facility assessment at the six facilities, which included one district-owned, two home-based, and three center-based early childcare facilities. Two of the facilities were built before 1978. The six facilities combined provided care for >400 children.

All six of the facilities were clean and tidy in the areas where children played and resided. Some common hazards or potential hazards, however, were observed at each of the facilities (Table 3). Common issues identified on the outside of the facilities included paper wasp and mud dauber nests, ineffective water drainage within or near the building structures that could cause moisture damage and mold growth, and (possible lead-based) paint flaking on the exterior of the facility.

Several concerns were also identified within the interior of the facilities. A variety of exhaust issues were found, including a lack of, dysfunctional, or inappropriately placed exhaust systems in kitchens and restrooms. This problem can lead to the buildup of moisture, fine particulates, and disagreeable odors in these rooms. Additionally, only one of the facilities that was assessed had a required Class K fire extinguisher. In several instances, chemicals were observed in open spaces or within reach of children in an unlocked cabinet, both of which pose a major risk to young children.

All nine participants responded to the post-survey for the at-home assessment. Most of the participants correctly identified the primary source of lead exposure in U.S.-born children (89%), potential signs a child might have ingested a poison (100%), and the proper way to store pesticides and chemicals (100%). Most respondents also correctly answered why 1978 is an important date for potential lead exposure (89%) and simple steps that can be taken to minimize exposure (89%). Post-survey results from two questions—route of exposure to lead and integrated pest management—indicated that greater emphasis could have been useful, as only 55% and 33% of the participants responded correctly to these questions, respectively. When asked what was most valuable about the in-home assessment, participants reported that they valued learning about drains, supplies, cleaning products, lead sources, and making the environment safer overall for children.

Discussion

Although this project involved a small cohort, our findings provide insight into effectively recruiting and engaging childcare owners, managers, and staff, and ensuring an up-to-date knowledge base among caregivers for our youngest children. The in-person time spent with an environmental hygienist during the in-home facility assessments provides additional insight into potential hazards commonly found at childcare centers in Missouri and highlights a need for guidance on practice and/or intervention in at-home childcare facilities.

Recruitment for both the webinars and the at-home assessments, however, was a substantial challenge. With approval of the regional office of the U.S. EPA and the Missouri Department of Elementary and Secondary Education, MAPEHSU was able to create opportunities for monetary remuneration for participants by utilizing funding from a different grant to support community engagement. We partnered with the Missouri Department of Elementary and Secondary Education to provide CEUs through online training sessions for participants from the childcare centers. To recruit participants for the in-home assessments, we offered Healthy Home Kits (estimated monetary value of $250) to assist the centers in meeting the requirements to sustain a safe and clean environment.

The surveys from the online trainings indicated that although much of the content shared in the webinar is given to childcare directors during onboarding, repetition of baseline knowledge is warranted. Likewise, basic concepts in ensuring a safe growing and learning environment might warrant more in-depth training, including pathways of harmful exposures (e.g., ingestion and

TABLE **3**

Facility Environmental Assessment Outcomes in the Harmful Chemical Exposures in the Early Learning Environment, Lead, and Pesticides Program, August 2024

Assessment Component	Condition (Potential Risk)	# of Facilities With Condition (*n* = 6)
Lead hazards	Any lead hazard	2
	Exterior	2
	Interior	1
	Renovation in progress	1
Exterior	Pests: paper-wasp and mud dauber nests	3
	Impeded water drainage	3
	Covered weep holes or slots preventing water drainage	4
	Roof: flat (potential for moisture problems)	3
	Siding: brick	5
	Windows and doors: wood (potential for flaking paint)	2
	Foundation: stone	1
	Basement (potential for radon intrusion)	4
Interior		
HVAC systems	Filtration minimum efficiency reporting value ≤8	4
	Heating: radiators	1
	Dehumidification (air conditioning system): window	1
	Humidification system: risk for moisture and fungi	2
	Portable air cleaners: risk for ozone generation	3
Classrooms and play areas	Carpeted and upholstered items	6
	Pets (furry or feathered)	3
	No carbon monoxide detectors observed	1
	Not all plug outlet covers in place	6
	Slip, trip, and fall hazards	1
	Chemicals improperly stored	5
	Chemicals improperly applied	6
	Electrical hazards	3
	Moisture issues observed	2
Kitchen	Kitchen area not clean	2
	Gas appliances	3
	Exhaust hood not in proper place and on	3
	Fire extinguisher/suppression: no required Class K fire extinguisher	4
	Chemicals improperly stored	4
	Area not restricted to children	2
Restrooms	Exhaust not present or not operational	3
	Water temperature (i.e., not hot)	2
	Chemicals improperly stored	3
Nap area or bedrooms	Carpeted	1

inhalation of lead and harsh cleaning chemicals) and mitigation of risk (e.g., integrated pest management, selected cleaning chemicals). Furthermore, CEU training courses have proved an effective way to distribute education. Ensuring that the education leads to action, however, might involve more in-person contact and training.

The in-home childcare facility walk-through assessments highlight several commonalities among the participating centers (Table 1). Two items identified in the walk-through assessments as requiring further education were the use of air filtration systems and how to properly clean the spaces in addition to what chemicals to use for cleaning. Portable air cleaning devices were found in several facilities, and all had an ionization setting. Ionization from air purification systems is associated with the generation of ozone, a known irritant to respiratory and mucosal tissues. Children's Mercy staff recommended that a label be placed on units to discourage the use of the ionization setting.

The environmental hygienist reported that no participant knew the concept of dwell or residence time, which is the contact time required for a cleaning or disinfecting product to be effective as advertised. Cleaning chemicals, including disinfectants, are not likely to provide the intended benefits if they are not used properly—and improper use could expose children to risks associated with harsh cleaning chemicals (Holm et al., 2019).

This gap in practice knowledge likely is not unique to St. Louis, Missouri, nor to childcare center owners, thereby identifying a remediable risk affecting thousands, if not millions, of children. These two findings highlight the value of in-person and small group educational sessions, as well as one-on-one educational time with childcare providers. This educational time, in any format, is preferably provided by nonenforcement agencies, which was a necessary feature for our team to be invited into the in-home childcare centers.

Conclusion

Lead and pesticide exposure are leading environmental health concerns for children that can result in long-term health consequences, including irreversible cognitive delay and endocrine dysfunction. Highly personal, localized interventions, with additional professional incentives appear to be an effec-

tive means of improving baseline knowledge among at-home childcare providers. Further, one-on-one time with a subject matter expert (e.g., an environmental hygienist) allows for additional important education that otherwise can go unaddressed. Environmental health might not be commonplace knowledge among childcare providers, but our participants were willing to learn and make changes in their at-home childcare cleaning and maintenance practices to protect the children in their care.

Acknowledgments: This project was funded by U.S. EPA Region 7 cooperative agreement #96709701, the American Academy of Pediatrics, and a CDC/ATSDR cooperative agreement FAIN:NU61TS000296. Additionally, U.S. EPA supports pediatric environmental health specialty units by providing partial funding to CDC/ATSDR through Inter-Agency Agreement DW-75-95877701.

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