Community Health Workers' Perspectives and Needs for Early Childhood Environmental Health Promotion

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Abstract

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Community Health Workers (CHWs) play an important role in reducing health disparities, especially in low resourced communities. CHWs have been part of health promotion services of pregnant individuals and young children in the United States for decades, but data on their attitudes, perceptions, and practices regarding environmental health (EH) relating to maternal and child populations are lacking. We designed and disseminated a 26-question survey for CHWs, supervisors of CHWs, and CHW trainers located in Washington, Oregon, Idaho, and Alaska that work with pregnant individuals and families with young children. Convenience and snowball sampling was utilized to reach CHWs from a wide variety of agencies and organizations. Questions aimed to understand their experience with EH topics, the training they have had related to EH, and their attitudes and perceptions of EH in the communities they serve. A total of 40 surveys were included in the final analysis: 24 from Washington, 11 from Oregon, and 5 from Idaho. The survey responses suggest CHWs in our region endorsed the impact of environmental factors on the health of the communities they serve (95% "strongly agreed" with an EH belief statement). EH training was not common among participants (55% reported no

training in EH) and most reported moderate confidence in discussing EH with clients. A desire for more EH training was a strong theme among responses to open-ended questions. Additionally, time and accessible resources were commonly stated barriers to discussing EH concerns with clients in open-ended responses. These findings suggest that CHWs serving young children and pregnant individuals are well poised to provide EH promotion on topics relevant to child health. Enhanced opportunities for training and availability of relevant resources specific to EH topics and EH communication for these CHWs would facilitate their inclusion of these topics in their roles.

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INTRODUCTION

In fetal life and early childhood, children are uniquely vulnerable to adverse health consequences of environmental exposures. This reflects their rapid growth and development which may be perturbed by developmental toxicants as well as behaviors such as hand-to-mouth and typical oral exploratory behavior in early childhood [1]. They are more metabolically active which means on a per kilogram basis, they take in more air, water and food compared to adults, so if contaminants occur in these media, they receive a higher dose. Adverse health outcomes associated with early life exposure to environmental factors include spontaneous abortion, low birth weight, and birth defects [2]. Exposures to toxicants in early life are also linked to outcomes later in childhood including asthma, learning disabilities, and behavioral and cognitive health effects such as ADHD and autism [3]. Many toxicants cross the placenta and disrupt fetal growth and prenatal programming of later health effects directly or through placental effects [4]. Among the most well-established toxicants of concern for early life exposure are lead, air quality (indoor and outdoor), drinking water contaminants, molds/pests in homes, and pesticides.

A child's risk of exposure to toxicants is often closely tied to their degree of social vulnerability. Children who are more socially vulnerable are also at higher risks of adverse health consequences from environmental exposures. Socioeconomic status is one of the vulnerabilities that may co-occur with environmental exposures. For example, children in low-income households are more likely to suffer from lead exposure because paint in poor conditions (peeling, chipping) is more common in low-income households [5]. Additionally, children of low-income households more often live in communities that are proximal to industries that produce toxic emissions, live closer to hazardous waste sites or live near pesticide applications for agriculture. Established hazardous waste sites of concern, such as Superfund sites, are

commonly linked to contaminated drinking water resulting in infant mortality, water-borne illnesses, and pediatric cancers [6]. Children in low-income households are more likely to live near interstates or highways, resulting in higher levels of exposure to traffic related air pollution [7]. In parallel, children in low-socioeconomic neighborhoods are also more likely to experience respiratory diseases including asthma [8]. Other vulnerabilities that may co-occur with environmental exposures may include neighborhoods of racially and ethnically minoritized people, poor built environments, fewer educational resources, and less access to quality health care. Barriers like language and cultural differences can complicate interventions to improve health conditions in these communities.

The cumulative impacts of social vulnerabilities combined with children's biological susceptibility in early life stages and environmental disparities result in high-risk communities. Community Health Workers (CHWs) are a potentially important resource to address environmental health (EH) disparities in high-risk and low-resourced communities. Within the United States, CHWs have played an important role in health education and promotion for decades with an expanded workforce in the last several year [9,10]. CHWs have been impactful in addressing health concerns in many sectors of health, including maternal and child health (MCH) concerns such as antenatal care, infant health, and childhood asthma [11–13]. CHWs' services to address MCH are typically delivered through home visits (both in-person or virtually), offering health education and outreach, and/or working in clinical settings [14]. CHWs typically serve high-risk communities including low-income households and individuals with cultural and language barriers. Since CHWs are trusted members from within these communities, they share experiences, cultural practices, and usually the same language, which provides a foundation of trust. As noted by the Center for Disease Control and Prevention (CDC), CHWs

can consequently empathize and communicate with clients through experience and culture in ways that medical practitioners may not be able to with their patients [14].

CHWs could be highly effective at addressing children's environmental health (CEH); the CHW model is already proven to be effective in addressing childhood asthma through home visiting programs. CHW-facilitated home visits to address asthma may include educating clients on the environmental triggers of asthma as well as recognizing symptoms of asthma, the correct administration of medications, the potential side effects of asthma medications and when to seek help [13]. In as little as four home visits with a CHW, pediatric clients and their families have shown behavior modifications that lead to improvements of the home environment, improvement in symptoms, fewer asthmatic episodes, fewer days of school missed, and fewer visits to hospital emergency departments [13]. Clients who receive home visits from CHWs have shown greater improvement in asthma symptoms than those who have clinic visits with certified asthma educators (AE-Cs) one year after interventions have ceased [15]. Additionally, CHWs may help families of pediatric clients with asthma navigate housing resources to reduce the burden of disease such as pest management and public housing applications [16]. Pediatric asthma is significantly tied to a child's environment, and CHWs effectively educate their clients how to manage symptoms and lower the risk of asthmatic episodes. With similar training and implementation, CHWs may be able to address other CEH concerns as effectively.

The Pediatric Environmental Health Specialty Unit (PEHSU) Program is a national network of centers that provide training and consultation on pediatric and reproductive environmental health to healthcare and public health professionals and the public. PEHSU is supported by the CDC and the U.S. Environmental Protection Agency (EPA) with a center in each of the 10 federal regions. This project was conducted with the Region 10 Northwest

PEHSU (NWPEHSU) which serves Alaska, Idaho, Oregon, and Washington State. This study intended to inform the NWPEHSU on the needs and interests regarding regional CHWs in the promotion of CEH with a focus on the common children's environmental health topics of concern such as lead, air quality, drinking water quality, mold/pests in homes and pesticides. Through administration of a survey, the NWPEHSU sought to understand CHWs' training, beliefs, attitudes, activities and perceptions regarding CEH, and any barriers they experience in addressing CEH issues with their clients.

MANUSCRIPT: "COMMUNITY HEALTH WORKERS' PERSPECTIVES AND NEEDS FOR EARLY CHILDHOOD ENVIRONMENTAL HEALTH PROMOTION"

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This project was conducted with the Region 10 Northwest PEHSU (NWPEHSU) which serves Alaska, Idaho, Oregon, and Washington state. This study sought to inform the NWPEHSU on needs and interests regarding regional CHWs in the promotion of children's environmental health (CEH) with a focus on with a focus on the common children's environmental health topics of concern such as lead, air quality, drinking water quality, mold/pests in homes and pesticides. NWPEHSU is part of a US national program to provide pediatric and reproductive environmental health education and outreach to health professionals and the public for the ten federal regions. Prior data on CHW involvement in CEH are lacking. Through administration of a survey, the NWPEHSU sought to understand CHWs' training, beliefs, attitudes, activities and perceptions regarding CEH, and any barriers they experience in addressing CEH issues with their clients.

Methods

We collected surveys from CHWs, supervisors of CHWs, and CHW trainers that serve pregnant individuals and families with young children in Washington, Oregon, Idaho and Alaska between February and April 2023. Participants had the option of completing the survey online or participating in a phone or Zoom interview covering the same questions. The online survey was available in English, but interviews were offered in English and Spanish. The University of Washington International Review Board reviewed the study procedures and deemed it exempt.

Recruitment

We targeted recruitment of CHWs, CHW trainers, and CHW supervisors that regularly work with pregnant individuals and families with young children through emails and phone calls, obtained from maternal and child health-oriented websites. We sought to receive survey responses from at least 5 respondents in each of the four states in our region. We utilized convenience and snowball sampling by reaching out to regional CHW networks and public health agencies that include CHWs in their programming for maternal and child populations, such as federal and nationwide programs under Maternal, Infant, and Early Childhood Home Visiting (MIECHV) in Oregon, Alaska, Idaho or Washington. These networks and agencies were encouraged to forward our survey to other CHWs and CHW mailing lists. A $25 virtual gift card and free children's books that discuss CEH topics to share with their clients were offered as incentives for participants.

Instrument

Both the online survey and phone interview involved a consent agreement at the beginning of the session. The survey consisted of 26 items divided into two sections and was estimated to take 20-30 minutes to complete (Appendix A – Survey). Item formatting included check boxes, multiple choice, and open-ended responses. Our questions were designed to gather basic information about CHWs' practices and education regarding CEH topics and the services their organizations offer in order to understand their interests and needs for future educational outreach and involvement in CEH promotion in their programs.

The first domain of 13 items focused on the individual as a CHW, a CHW supervisor, or CHW trainer. Questions ascertained information about the participants' employment, experience in CEH training, and beliefs and attitudes towards the relationship between MCH and

environmental factors. Additionally, this section surveyed the frequency at which participants discuss EH with their clients, how they prefer to receive information, and the top environmental concern they perceive for their community.

The second domain of 13 questions focused on the organization where the participant worked. Questions gathered information on the types of services provided to clients, client demographics, and educational opportunities the organizations may offer. The survey concluded by asking participants what barriers they experience in addressing EH with their clients, what EH topics are most important to them, and how they prefer to distribute information to their clients.

Analysis

Surveys were completed in REDCap a web-based application designed to support data capture for research studies. Descriptive statistics including proportions and means were calculated within REDCap and Microsoft Excel. Responses from open-ended questions were uploaded into a Microsoft Word document for qualitative analysis. A code book was developed using deductive coding. By applying the code book to responses, themes were observed and developed.

Results

A total of 43 surveys were submitted by participants. Two represented duplicate surveys from one individual and one survey that did not meet our requirement of working with pregnant individuals and families with children. For the duplicates, data from the most recently completed survey was included in our analysis. Data from two partially completed surveys was included. The final total of surveys included in analysis was 40 (n=40): 24 from Washington, 11 from Oregon, and 5 from Idaho. Of the 40 participants, the majority (80.0%, n=32) identified their position as a CHW. One identified as a CHW trainer, and 17.5% (n=7) identified as a supervisor

of CHWs. One participant selected "Other" as their job title and specified their position as a registered nurse.

Table 1 summarizes participants' experience in their position and the training they've received related to EH. A large majority of participants have been in their position 5 years or less (82.5%, n=33), while only 10.0% participants (n=4) have been in their position 10 or more years. Less than half of participants have received training on EH topics including lead, air quality, drinking water quality, mold and pests in homes, or pesticides (45%, n=18). Of these, the majority reported they had obtained the training through their organization (55.6%, n=10) and/or as a webinar or seminar lecture (50.0%, n=9). Of these reporting training, fewer reported training specific to exposures in pregnancy (17.5%, n=7), compared to those who reported having training that related to early childhood environmental health (27.5%, n=11).

Reports of participants' agencies/organizations are shown in Table 1. Nearly 70% of participants said their agency is a community organization. Most participants reported their organization offers a combination of both home visits and office visits to clients and that their organization offers training or conferences to employees. Less than half reported that their organization provides clients with EH services (n=15, 38.5%). The majority of participants reported 10 or fewer CHWs in their organization (81.6%, n=31). Most respondents specified their organization serves a regional area which may include multiple cities or counties (54.3%, n=19), and 40.0% (n=14) serve a single county.

The results of all client demographics and organization settings are displayed in Table 1. The most prominent race/ethnicity of clients are Hispanic/Latino/Spanish origin and White, with 95% (n=38) of organizations including both categories in their client demographics. Notably, 55.0% (n=22) of participants responded that their clients include people that identify as

American Indian/Alaska Native, and 57.5% (n=23) of participants said their clients include people who identify as African American or Black. About 80% of participants reported their organization serves clients beginning at pregnancy through 2 years of age.

Table 1. Community Health Worker Survey Participants' Work Experience, Organizational Characteristics, and Client Demographics		
	No.	**Percent**
Experience in Role (n=40)		
1 year or less	16	40.0%
1-5 years	17	42.5%
6-10 years	3	7.5%
10+ years	4	10.0%
Training in EH (n=40)		
Yes, Specific to pregnancy	7	17.5%
Yes, Specific to early childhood	11	27.5%
No	22	55.0%
General Frequency of Discussing EH (n=39)*		
Never	0	0.0%
Rarely	6	15.4%
Sometimes	15	38.5%
Often	12	30.8%
Always	6	15.4%
Frequency of Discussing EH/week (n=30)*		
0	6	15.4%
1-2	17	43.6%
3-4	9	23.1%
5+	7	17.9%
Organization Type (n=39)*		
Community Org.	27	69.2%
Clinic or hospital	10	25.6%
Other	2	5.1%
Organization Services (n=38)*		
Home visits (virtual or in person)	5	13.1%
Office Visits	5	13.1%
Combination	27	71.1%
Other	1	2.6%
Clients' Races & Ethnicities (n=39)*		
Hispanic or Latino or Spanish origin	37	94.9%
American Indian/Alaskan Native	21	53.9%
African	13	33.3%
African American/Black	22	56.4%
Asian	14	35.9%
East Asian	4	10.3%
South Asian	6	15.4%
Southeast Asian	5	12.8%

Asian-American	8	20.5%
Native Hawaiian/Other Pacific Islander	11	28.2%
Middle Eastern	10	25.6%
White	36	92.3%
Other	2	5.1%
Client Age Ranges (n=36)*		
Preconception	20	55.6%
Pregnancy	31	86.1%
0-12 mo.	31	86.1%
1-2 years	29	80.6%
2-3 years	23	63.9%
3-4 years	23	63.9%
4-5 years	24	66.7%

**Participation for each question was optionable; some questions did not receive responses from all 40 participants.*

Beliefs, Perceptions, and Attitudes About EH

The first Likert scale question assessed participants' beliefs on whether the environment influences the health of pregnant people and children. Participants rated the following statement: "I believe that the environment (ex. housing, food, water) plays a role in the health of pregnant people and children." 95% (n=38) "strongly agree" with this statement; the remaining 5% (n=2) marked "somewhat agree."

Thirty-eight respondents elaborated on why they believe the environment may have an impact on the health of pregnant people and children. Their responses largely reflected on the importance of one's environment as the cornerstone of general physical health ("Someone's environment, affects everything about their health") and that a healthy environment is crucial for one's mental health ("I believe that lack of access to [safe food, water, housing] adds additional stress that can affect overall mental health"). Several responses discussed how the environment can influence pregnancy and birth outcomes ("The living environment can influence the development of pregnancy complications and increase childhood illness").

Participants' prioritization of discussing various EH topics with their clients are shown in Figure 1. Participants ranked discussing these EH topics with their clients as low (1), medium

(2), or high (3). No topic was clearly prioritized above the others. The EH topic that yielded the highest prioritization was mold and pests in home (mean=2.25). However, the difference between the highest and lowest means of EH topic prioritization was a small margin of 0.35 (lead being the lowest scored, mean=1.90).

When queried about which EH topics are most important to the CHW personally, mold or pests in homes was the most common response (n=28, 77.8%). Drinking water and air quality were closely tied as the second most important EH concern for participants (n=21, 58.3%; n=22, 61.1%, respectively). Similarly, when participants were asked what they believe to be the most important EH concern for the community they serve, mold was the most common answer (n=17, 43.6%) within their open-ended responses. Housing and air quality were the second and third most common responses (n=12, 30.8%; n=10, 25.6%).

Participants were asked to share their level of confidence in discussing EH topics with their clients. The results are shown in Figure 2. Every EH topic surveyed received a ranking of "somewhat confident" by more than half of the participants. Drinking water and pesticides both yielded the highest confidence means of 2.03. No topic received a majority ranking of high or low confidence.

No participants reported "never" discussing EH with their clients. 40.0% (n=16) reported discussing EH topics with their clients "sometimes", while about a third reported "often" (30.0%, n=12). Furthermore, 85.0% (n=34) reported discussing EH with clients at least once per week.

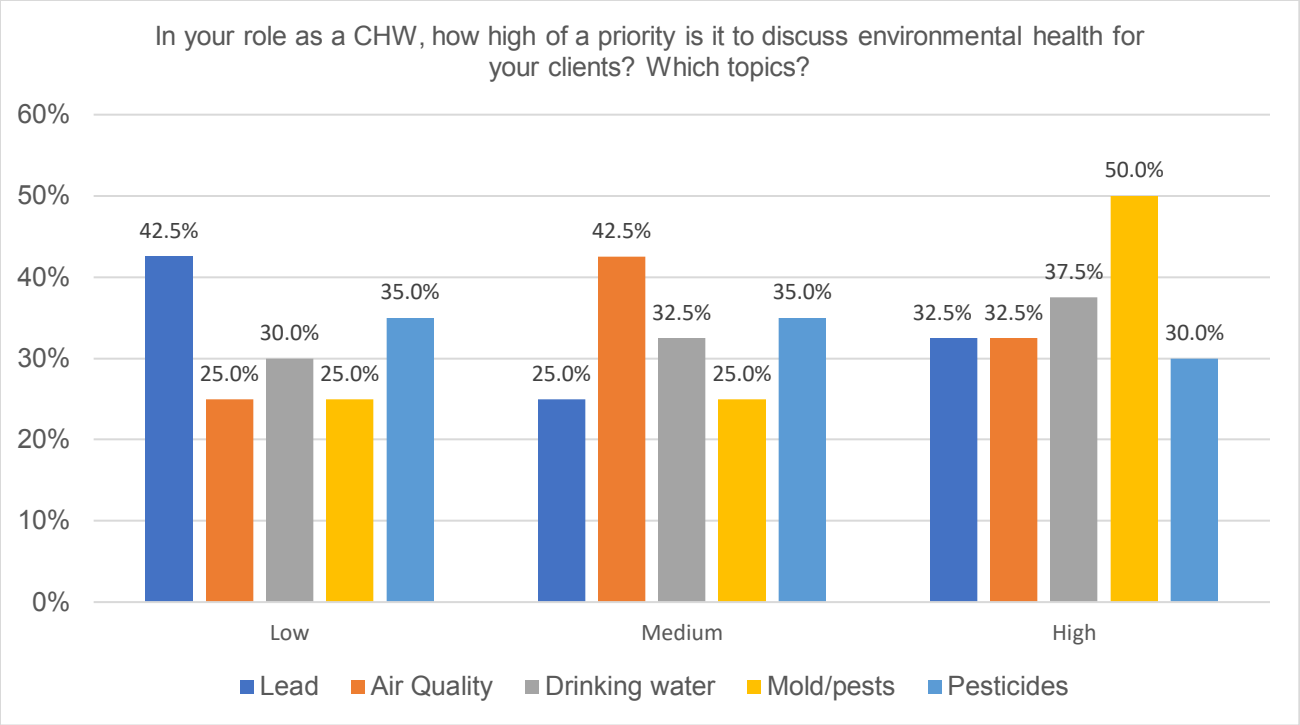

Figure 1 Survey results of Community Health Worker Prioritization of discussing EH topics with clients.

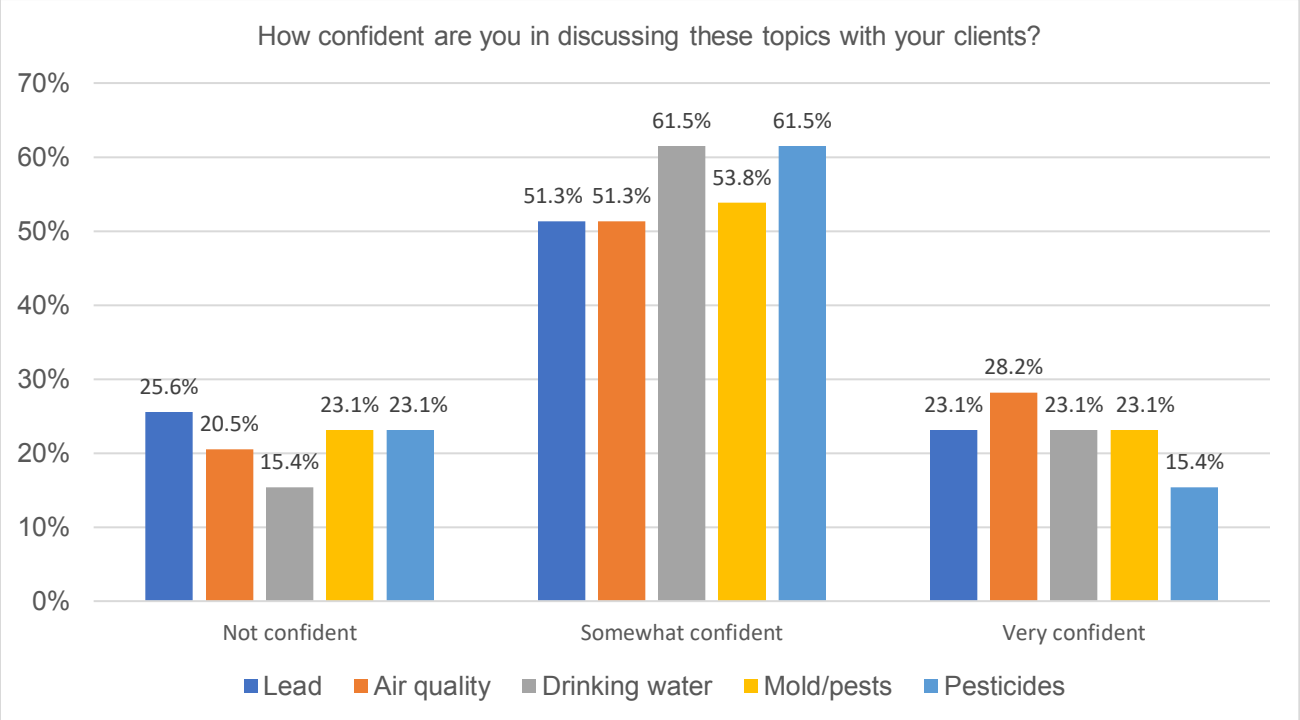

Figure 2. Survey results of Community Health Worker Confidence in discussing EH topics with clients.

Further Training & Barriers

Most participants responded that they subscribe to newsletters, attend webinars, or in-person events for training. When learning about opportunities for training or new emerging issues, the majority prefer to receive it through email (82.1%). Webinars were the second most preferred mode of receiving new information (53.8%). With regards to providing information to their clients, 84.2% prefer to share new information with their clients in person. Notably, 21.1% of participants selected "other," and several of these respondents specified they text or call their clients when sharing new information.

Several barriers to discussing EH with clients were identified (see Table 2). The most common obstacle to educating their clients included in responses was a need for more training ("I definitely need more training"). Additionally, CHWs expressed a need for resources for their clients. Resources mentioned included both physical resources that can be handed to clients and actionable resources, or the knowledge of who or what can help their clients that are in need EH consultation or intervention ("more handouts and resources" and "resources available that can actively change the environment"). Time constraints were also a common barrier which seemed connected to competing topics to cover ("home visits are only 1 hour" and "other priorities [that] seem more urgent").

Table 2. Qualitative Themes on Barriers and Needs of Community Health Workers regarding addressing Environmental Health content with their clients	
Themes	Summary
Desire for training	**EH General Training:** CHWs expressed a need for additional training in EH topics including exposure to mold, pesticides, and lead; drinking water, air quality, and safe cleaning products. **EH Communication Training:** CHWs expressed a desire to learn more about how to effectively communicate EH to clients while maintaining respect for various cultural practices such as burning incense.
Desire for resources	**Tangible resources:** CHWs expressed a need for physical resources such as flyers, handouts, graphics, etc. That can be shared with their clients. **Actionable resources:** CHWs expressed a need for actionable resources, or the knowledge of who may be able offer support to clients facing EH concerns.
Time Constraints	**Visit lengths:** CHWs expressed limited amounts of time during home visits to address EH concerns. **Competing Topics:** CHWs expressed that with short appointments discussing other topics may be a higher priority above EH.
Prioritization	**Higher prioritization of other health topics:** CHWs expressed EH education is often put aside in order to first address more urgent health needs.
Accessibility	**Language barriers:** CHWs expressed language barriers regarding 1) basic health communication and 2) resources such as handouts available for clients.
Client Perception	**Client buy-in:** CHWs expressed clients may not understand the impacts their environment has on their health and therefore do not prioritize it themselves.

Discussion

This novel survey sought to assess the EH practices, perceptions and beliefs of CHWs providing maternal and early childhood health promotion in the NWPEHSU region states. We found that while less than half reported having formal EH training, all survey participants reported discussing EH with clients in their role, though at varying frequencies with almost half endorsing “often” or “always” and nearly 85% having these discussions at least once a week. While more than half have not had training in EH, nearly every participant expressed interest in

learning more about EH and having access to more resources to effectively communicate with clients about EH topics; although, no topic was notably of higher interest among the core topics queried (lead, air pollution, drinking water, mold/pests, pesticides). Respondents widely reported "somewhat confident" to "very confident" in discussing the EH topics we surveyed, but no topic had a distinctly strong prioritization.

To our knowledge, this is the first study to evaluate the perceptions, attitudes, and beliefs of CHWs regarding EH promotion in pregnancy and early childhood. There is a robust body of literature studying the impact of CHWs in specific roles related to chronic disease management. In addition, CHWs' favorable impact on MCH outcomes including birth outcomes, antenatal care, and pediatric asthma have been described [12,20,21]. This study found that CHWs who serve pregnant individuals and families with young children believe EH is important to discuss with their clients and routinely do so, although the effects of this have yet to be evaluated.

Despite less than half of our CHWs reporting training in EH (45%), most participants endorsed feeling "somewhat" to "very" confident discussing EH topics (75-85%) and reported regularly having EH conversations with their pregnant clients and clients with young children. Similar studies have analyzed pediatricians' perceptions, attitudes, and beliefs regarding EH and concluded that most medical practitioners highly valued CEH but only 12%-20% reported having training in taking patient environmental histories [17–19]. Similarly to our findings, a study in Georgia found pediatricians reported feeling "somewhat confident" to "confident" when discussing environmental exposures with patients and that pediatricians held a high level of belief that environmental exposures impact their patients [19]. Drinking water sources and lead exposure were reported to be commonly included in routine interviews, but mold and air quality were not [19]. Conversely in our findings, lead was ranked as a low priority to discuss with

clients by 42.5% of CHWs and mold as a high priority by 50.0%. In both New York and Wisconsin, pediatricians reported high confidence discussing lead but low confidence discussing all other EH topics included in the surveys (e.g., mold and pesticides) [17,18]. Though prior studies focused on pediatricians, CHWs in our study reported moderate confidence in discussing all EH topics with no topic standing out as a clear lead. The EH training necessary for clinicians and CHWs is differently suited to the scope of their roles, so it may not be applicable to directly compare our assessment of CHWs' general EH training and these studies' assessments of clinicians' training in taking an environmental history. It should also be noted that the studies focused on clinicians were published 15-20 years ago, so modern training for pediatricians may include a heavier focus on EH. Despite these differences, participants in in prior health worker surveys expressed a high level of interest in learning more about EH and a high level of belief that the environment impacts the health of children [17–19].

Our study suggests CHWs recognize the intersectionality of EH and other dimensions of health. In reviewing qualitative data, we discerned that our participants acknowledged the impacts EH has on mental health, physical health, and general wellbeing. This likely reflects their multimodal service approach in their communities. A study conducted in Arizona assessed how CHWs rate the general health of their Latino clients with chronic diseases, and CHWs expanded on their reasoning for giving their clients such ratings. While CHWs cited their clients' physical health and self-management of their disease as influences of their ratings, they also emphasized how their clients' emotional well-being and social determinants of health including interpersonal relationships and finances ultimately impacted how they viewed their clients' health [22], reaffirming the holistic lens that CHWs view their clients' health. Similarly, our participants vocalized how clients' wellbeing and mental health are connected to EH. Due to the

trusted messenger model, CHWs are empowered to build strong relationships with their clients that allow for this comprehensive lens of health. It is a natural outcome of these close relationships that CHWs would observe how their clients' environment or home health is interconnected with other areas of health.

CHWs experience several barriers preventing conversations with clients about EH, all of which are rooted in limited capacity. Participants mainly focused on a lack of training and a lack of resources. Desire for general training or more in-depth training on specific health topics frequently addressed in their role is a common want among CHWs [23–25]. CHWs working with Latino communities in Nebraska expressed a desire for specialization training and training in cultural competency [24], comparable to how our participants expressed a desire for EH training to effectively communicate with clients about environmental exposures and potential health outcomes. Our participants also expressed a need for additional resources, both tangible resources such as educational handouts that can be shared with clients in multiple languages and actionable resources such as knowing what agencies they can refer clients to for EH intervention or consultation. CHWs in Detroit stated their lack of resources acted as a barrier in engaging with their community and emphasized that having current information about available resources acted as a facilitator to engaging their community [26]. These CHWs detailed feelings of frustration when they were unable to provide the resources their clients need and that their clients also may have developed feelings of hopelessness when resources are unknown or unavailable [26]. Our participants did not directly communicate frustration in their lack of EH resources, but they did express a desire to have more EH resources at their disposal to share with clients. By equipping CHWs with EH training and resources, their capacity to address EH with clients of

pregnant individuals and families with young children will expand, ultimately lessening CEH disparities.

Some limitations to our study include our responses reflecting the pool of CHWs who elected to respond, and therefore may have had a higher interest in the topic and made time to complete the survey. In addition, despite multiple efforts and avenues to elicit perspectives from CHWs in Alaska, we were unsuccessful in receiving any surveys from Alaska. Lastly, since our results are based on self-reporting, social desirability may have influenced participants to select what they believed to be the "right" answer.

The perceptions shared by CHWs in this study may not be representative of CHWs in different regions. Additional research is needed to further explore the EH beliefs, perceptions and attitudes of CHWs serving communities with varied environmental health concerns and conditions, such as those living in remote areas including Alaska. Although our survey was offered in Spanish via Zoom or telephone, additional research is needed to explore how language barriers may impact CHWs' EH training and communication in non-English speaking communities. Regardless, our study demonstrates that CHWs are discussing EH with their clients of pregnant individuals and young families, ultimately showing the potential for opportunities to address CEH disparities by utilizing the CHW model.

Conclusion

This study suggests CHWs in Idaho, Oregon and Washington recognize the relationship between the environmental factors and MCH. However, many lack formal training in EH which would contribute to confidence in discussing EH with clients. Despite a lack of EH training, CHWs have conversations with their clients about EH concerns on a regular basis. Barriers to these conversations, in addition to training, include a lack of resources and time. CHWs in our

region want to learn more about EH in order to better serve their clients. Our findings suggest that with effective and accessible EH training and resources to use with clients, CHWs are well-poised and ready to improve EH conditions in high-risk communities which may alleviate longstanding CEH disparities.

CONCLUSION

Recommendations developed from this study apply to two sectors. Here I have detailed suggestions for future directions of each sector: the pediatric environmental health organization that supported this work and future research of CHWs in both Region 10 states and nationally.

Northwest Pediatric Environmental Health Specialty Unit

The Northwest Pediatric Environmental Health Specialty Unit (PEHSU) at the University of Washington provided financial, outreach and technical support for this study. The NWPEHSU develops partnerships with local organizations to extend outreach education and offers consultations for clinical cases, environmental justice projects, and concerned members of the public. The NWPEHSU actively seeks information of emerging CEH topics to engage with multiple audiences of stakeholders in need of consultation or guidance. Considering PEHSU's mission and approach, we make the following recommendations:

- **Establish trusted partnerships with agencies that utilize CHWs in their MCH programming.** Collaboration between public health agencies and organizations advances public health goals [27]. Our study reached CHWs from over 20 different organizations or agencies within our region that offer services to hundreds of pregnant individuals and families with young children. If the NWPEHSU were able to establish working relationships with even a few of these organizations, it could significantly extend the NWPEHSU's outreach capabilities. Additionally, trusted partnerships between these agencies could lay a foundation to facilitate CHWs confidence in discussing CEH concerns of their clients with the NWPEHSU team. These partnerships would be a "foot in the door" to implementing future sustainable EH trainings for CHWs, who may be more inclined to attend trainings if they are familiar with the presenting organization.

Partnerships could be beneficial for both organizations by building capacity for CHWs and increasing PEHSU's educational outreach.

- **Develop comprehensive EH training resources tailored to CHWs.** Participants in this study expressed a clear need for additional training in EH topics, and the NWPEHSU is equipped to create training curriculum that is uniquely adapted to the needs of CHWs. The NWPEHSU has previously developed educational programs for many audiences with various EH educational backgrounds. Considering responses from this study, the NWPEHSU should develop training materials that focus on the five topics covered in this study since no single subject was clearly regarded as a lower priority than the others. By creating EH trainings, PEHSU will alleviate the barrier to discussing EH with clients that CHWs communicated in their survey responses.
- **Develop educational CEH resources for CHWs to share with clients.** An overall need for resources was expressed by participants. The NWPEHSU is well poised to develop educational materials that CHWs can learn from and share with their clients. Participants reported in this study a preference for sharing new information with clients in person or via email, and CHWs reported their own preference to learn about emerging health information via email as well. PEHSU has educational materials readily available on their website and open to the public. Additional resources could be developed with the results of this survey in mind: resources that can be printed and shared face to face, virtual resources that can be shared via email, and resources available in multiple languages. By creating easily accessible EH educational resources, PEHSU could alleviate some of the limited capacity and time that CHWs have to discuss EH with their clients.

Future Directions of Research

- **Conduct research and outreach to remote CHWs and CHWs of various settings.** We were unable to recruit any CHWs from areas of Alaska. A potential explanation for this lack of response is that participation in our survey required the use of technology, either through the internet, email, or phones. Research should target CHWs that work with rural populations, whose access to technology may be more limited. Traditional mailing methods may be employed to reach these CHWs, or in-person recruitment and participation once partnerships have been established with their agencies of employment. Due to their lifestyle and unique living conditions, the EH education CHWs have or the topics they perceive as most important to discuss with their clients could be entirely different than the participants included in our survey who all had access to the internet.
- **Prioritize research in how language barriers may impact CEH promotion and training of CHWs.** Language barriers in healthcare settings lead to a decrease in quality of care, patient safety and patient satisfaction [28]. Similarly, CHW participants in other studies have reported language barriers as a frustration in their role and a lack of confidence in their ability to advocate for their communities since they cannot fully express their clients' needs to their English-speaking counterparts and supervisors [29]. Further research is needed to investigate what additional burden language barriers place on EH outreach and education in the realm of CHWs. Since our participants only responded in English, our results are not necessarily applicable to CHWs who do not speak English.
- **Investigate potential for EH to be included or covered in more depth in CHW training curriculum.** While training requirements vary by state, many states have

certifications or CHW basic training available. For example, Idaho State University offers a 9-10 credit Community Health Worker Academic Certificate, and environmental health is not explicitly included in the program's curriculum [30]. Future research should assess the potential for EH and CEH to be included in CHW curricula so that CHWs are trained in EH topics before working in the field.

This study suggests CHWs in Region 10 states recognize the relationship between the environment and maternal child health. However, many lack formal training in EH which would contribute to confidence in discussing EH with clients. Despite a lack of EH training, CHWs have conversations with their clients about EH concerns on a regular basis. Barriers to these conversations, in addition to training, include a lack of resources and time. CHWs in our region want to learn more about EH in order to better serve their clients. Our findings suggest that with effective and accessible EH training and resources to use with clients, CHWs are well-poised and ready to improve EH conditions in high-risk communities which may alleviate longstanding EH disparities.

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APPENDICES

Appendix A – Survey

Community Health Workers Survey: Maternal & Child Environmental Health

Thank you for being part of this survey. The purpose of this survey is to better understand the interest and need of community health workers to promote maternal, infant, and children's environmental health in Alaska, Idaho, Oregon, and Washington state. This survey is coordinated by a program at the University of Washington called the NW Pediatric Environmental Health Specialty Unit (PEHSU). We are part of a national network of centers funded by the US Environmental Protection Agency (EPA) and Center of Disease Control and Prevention (CDC) to help communities and health workers address concerns about children's environmental health.

In the context of this survey, pediatric and reproductive environmental health refers to interactions between pregnant person or children and the environment. Common issues include lead exposure from deteriorating paint in older homes, drinking water contaminants, mold or pests in the home that cause breathing problems in children, or use of toxic pesticides.

The information collected in this survey will be compiled in a written report that will not include identifying information or responses. We intend to publish this report in order to advocate for how best PEHSU and similar organizations can work with and support community health workers.

All responses will be kept anonymous and no personal/identifiable information will be shared.

Your preferred email to receive the $25 gift card will be collected at the end of the survey.

_____

If you exit out of the survey before submitting, your progress will be lost. For this reason, we recommend completing the survey in one session (around 15-20 minutes).

By typing your name and continuing, you are consenting to participating in this survey.

This section asks questions about your role as a community health worker.

1) Name

_____

2) Name of your organization

_____

3) What is your current role as it relates to community health workers/aides/educators? (Select all that apply.)

- ☐ Community health worker/aide/educator
- ☐ Trainer of CHWs
- ☐ Supervisor of CHWs
- ☐ Other

If you checked "Other" for your role, please briefly describe your role here.

_____

4) How long have you been in your current position?

- ◯ 1 year or less
- ◯ 1 - 5 years
- ◯ 6 - 10 years
- ◯ 10+ years

5) Have you had any training on environmental health topics such as lead, air quality, drinking water quality, mold or pests in homes, or pesticide?

- ◯ Yes
- ◯ No

If yes, please clarify your experience (select all that apply):

- ☐ Within the organization or outside
- ☐ Attended college courses that incorporated this topic
- ☐ Continuing education on these topics
- ☐ Attended a webinar/seminar or lecture that incorporated this topic
- ☐ Conducted self-study related to these topics/read a book or examined web based educational materials on this took
- ☐ As part of onboarding as a CHW in your organization

Were these trainings specific to pregnancy?

- ◯ Yes
- ◯ No

Were these trainings specific to early childhood?

- ◯ Yes
- ◯ No

6) Please rate your view on the following statement.

I believe that the environment (ex. housing, food, water) plays a role in the health of pregnant people and children.

- ◯ do not agree.
- ◯ somewhat agree.
- ◯ strongly agree.

7) Could you expand on your answer or share your reasoning for question 6?

_____

8) How often would you say you discuss environmental health topics with your patients?

- ◯ never
- ◯ rarely
- ◯ sometimes
- ◯ often
- ◯ always

9) How many times per week do you discuss environmental health with your patients?

- ◯ 0
- ◯ 1-2
- ◯ 3-4
- ◯ 5+

10) In your role as a CHW, how high of a priority is it to discuss environmental health for your patients? Which topics?

	Low	Medium	High
Lead	◯	◯	◯
Indoor or outdoor air quality	◯	◯	◯
Drinking water quality	◯	◯	◯
Mold or pests in homes	◯	◯	◯
Pesticides	◯	◯	◯

11) In your role as a CHW, what are the top environmental concerns you have for the population/community you serve? _____

12) How confident are you in discussing these topics with your patients?

	very confident	somewhat confident	not confident
Lead	◯	◯	◯
Indoor or outdoor air quality	◯	◯	◯
Drinking water quality	◯	◯	◯
Mold or pests in homes	◯	◯	◯
Pesticide	◯	◯	◯

13) What is your preferred way to receive information about trainings or new emerging issues? (Check all that apply.)

- ☐ emails
- ☐ newsletters
- ☐ social media
- ☐ seminars in person
- ☐ webinars
- ☐ other

How do you get new information as a CHW?

_____

Is there a designated trainer within your organization or a different/partner organization?

_____

Do you subscribe to newsletters, or attend webinar or in-person events for training?

_____

The next set of questions focuses on your organization.

14) How is your organization based?
- ◯ Clinic or hospital
- ◯ Community organization
- ◯ Other

If you selected "Other," please clarify.

_____

15) How many CHWs are in your organization? (estimated number or range)

_____

16) How many towns or counties do you see patients in? Would you describe the area you see patients in as urban, suburban, or rural?

_____

17) Please select which races/ethnicities your patients identify as (select all that apply).
- ☐ Hispanic or Latino or Spanish origin
- ☐ American Indian/Alaskan Native
- ☐ African
- ☐ African-American/Black
- ☐ Asian
- ☐ East Asian
- ☐ South Asian
- ☐ Southeast Asian
- ☐ Asian-American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ Middle Eastern
- ☐ White
- ☐ Other

If you checked "Other" for question 15, please clarify.

_____

18) How long has your organization been serving pregnant people and children?
- ◯ < 1 year
- ◯ 5 years
- ◯ 10 years
- ◯ unsure

19) What types of services are provided by your organization for pregnant people and children?
- ☐ Home visiting (virtual or in person)
- ☐ Visits in an office (clinic or organization)
- ☐ A combination of the above
- ☐ Other

If you selected "Other," please clarify.

_____

20) Select which types of patients you see (select all that apply):
- ☐ Pre conception
- ☐ Pregnancy
- ☐ 0-12 mo.
- ☐ 1-2 years
- ☐ 2-3 years
- ☐ 3-4 years
- ☐ 4-5 years

21) Does your organization currently provide patients with activities/services to address environmental health in pregnancy or early childhood? Such as classes, educational materials, group workshops, etc.
- ◯ Yes
- ◯ No

If yes, please expand on the services/activities your organization provides patients to address environmental health in pregnancy or early childhood.	_____
22) What are most important environmental health issues to you?	☐ Lead ☐ Air quality ☐ Drinking water quality ☐ Mold or pests in homes ☐ Pesticides ☐ Other
If you selected "Other", please clarify.	_____
23) What are any barriers or obstacles in trying to address environmental health in pregnancy or early childhood, if any? (ex: not enough time during visits, need more training resources)	_____
24) Does your organization offer conferences or other training opportunities for continuing education?	_____
25) What environmental health topics are you interested in learning more or receiving more information/training?	_____
26) What are the preferred ways to distribute information to patients?	☐ In-person visits ☐ Newsletters ☐ Community events ☐ Social media ☐ Other
If you selected "Other", please clarify.	_____

Thank you for your responses.

Would you like to receive a copy of our report once it is published?
◯ Yes
◯ No

Please provide an email you would like to receive a copy of our report once it is published.
_____

To receive a $25 Amazon gift card, please list your preferred email for delivery.
_____

As a thank you, we are offering to mail out kits/books for children/families. We can share the following:

- "Happy Healthy Lead-free Me" board book in English and Spanish
- "Why is Coco Orange?" in English
- Comic strips/packets for safer disinfection in multiple languages

Would you like any of these?
◯ Yes
◯ No

How many of each?

"Why is Coco Orange?" - Max 10 (English only)

"Happy, Healthy, Lead Free Me" - Max 10 each of language (English/Spanish)

Safer Disinfection Comic Books - Max 15 of English and Spanish; Somali/Russian/Korean/Tagalog/Chinese (simplified)/Vietnamese/Amharic available on request in limited quantities.
_____

What is the best shipping address, and who should the attention be addressed to?
_____

Would you be interested in a CHW specific listserv/newsletter via email?
◯ Yes
◯ No

What email would you like to be added to our newsletter mailing list?
_____

How do you think the PEHSU can best support your work at this time?
☐ sharing factsheets and resources
☐ providing continuing education
☐ other

If you have other ideas in how the PEHSU can support your organization, please share.
_____

Do you have any coworkers or other CHW organizations in mind that you think would want to participate in this survey?
_____