



A Survey of Environmental Health Interventions in the Maternal, Infant, and Early Childhood Home Visiting Program in the United States

Evelyn Shiang
*Johns Hopkins Center
 for Injury Research and Policy*
 Brendan Brown, MHS
Green & Healthy Homes Initiative
 Elise Omaki, MHS
*Johns Hopkins Center
 for Injury Research and Policy*
 Wendy C. Shields, MPH, PhD
*Johns Hopkins Center
 for Injury Research and Policy*

Abstract Home-based interventions in children ages 0–4 years have successfully reduced environmental health problems, yet the burden persists and disproportionately affects low-income families. Our study describes the extent to which home visiting models approved for federal funding included these home-based interventions and evaluated them. A survey was administered to key representatives at each of the 21 home visiting models eligible for Maternal, Infant, and Early Childhood Home Visiting Program funding that were being implemented in May 2023 in the U.S. The respondents were based across the U.S. and in other countries. All respondents returned completed surveys ($n = 21$, 100% response rate). Slightly more than one half ($n = 12$) of the respondents reported that their models included some environmental health content. Models on average covered 3 out of the 15 topics listed, with lead poisoning being the most covered ($n = 11$). The services used most often to address environmental health were risk assessment ($n = 10$) and referral to other organizations ($n = 8$). Only one respondent reported that their model evaluated the outcomes of their environmental health services. Home visiting programs represent a promising approach to mitigating harmful environmental exposures during early childhood but further incorporating comprehensive home assessments, safety device provision and installation, and linkages to healthy homes organizations would amplify their positive impact.

Keywords: home visiting programs, pediatrics, healthy homes, children's environmental health, lead poisoning, asthma

Introduction

Young children ages 0–4 years are uniquely vulnerable to harmful substances in the environment because they breathe more air, drink more water, and eat more food proportional to their body weight than adults do (University of California San Francisco, 2023). Environmental quality in households

has a significant impact on public health and the well-being of children because modern societies spend more than 90% of their time indoors (Leech et al., 2002). In the U.S., many harmful environmental exposures occur in or around the home.

For example, the primary source of lead exposure today is lead paint in old deteriorat-

ing housing, causing neurological dysfunction in children (Bellinger, 2008). Toxic air pollutants including particulate matter, nitrogen oxides, and volatile organic compounds (VOCs) from combustion appliances, inadequate ventilation, and construction materials found in the home lead to acute and chronic exposures during childhood (Pérez Velasco & Jarosińska, 2022).

These exposures are responsible for serious health problems not only in the short-term (e.g., health issues such as decreased lung function, respiratory infection, stroke, increased blood pressure) but also over the course of one's life (e.g., health issues such as premature mortality, bronchitis, asthma onset and exacerbation, low birth weight and pre-term birth, lung and breast cancer, heart failure, cardiovascular disease) (Pérez Velasco & Jarosińska, 2022). Additionally, gas stoves are a major source of indoor air pollutants, and many residential homes lack proper ventilation or range hoods or fail to use them while cooking (Zhu et al., 2020). An observational study concluded that 12.7% (95% confidence interval [CI] [6.3%, 19.3%]) of current childhood asthma is attributable to natural gas stove use in the U.S. (Gruenewald et al., 2023). Although natural gas-fired water and space heaters are regulated to be vented outside and therefore are primary sources of outdoor air pollution, in instances of malfunctioning ventilation, leakages, or backdraft, these systems can release pollutants into the home at levels that are hazardous for human health (Green & Healthy Homes Initiative, 2023).

The economic burden associated with environmental exposures during childhood is high. In 2008, the total medical cost of

childhood diseases with environmental origin—including lead poisoning, cancer, and asthma—was estimated at \$76.6 billion or 3.5% of total medical costs in the U.S. (Trasande & Liu, 2011). In 2013, the total healthcare cost of pediatric asthma alone was estimated at nearly \$6 billion, with asthma-related hospitalizations accounting for approximately \$1.5 billion (Perry et al., 2019). Moreover, using a comprehensive approach to estimate the economic burden including healthcare and societal costs, Nurmagambetov et al. (2018) concluded that in 2013, asthma resulted in a significant economic burden, with a total cost (including costs caused by absenteeism and mortality) of \$81.9 billion in the U.S.

Furthermore, low-income families are disproportionately impacted by childhood environmental exposures. According to the U.S. Environmental Protection Agency (U.S. EPA, 2024), asthma and developmental disabilities with environmental origin are more likely to affect children from low-income families. Because low-income children are more likely to live in old housing, they are at greater risk of lead poisoning (U.S. EPA, 2024).

One approach to addressing home environmental exposures, especially among low-income families, is through pediatric home visiting programs. Generally, home visiting programs are intended for low-income women who are pregnant, often working with families through the child's fourth year of life to provide or assist with the services necessary to raise physically, socially, and emotionally healthy children (U.S. Department of Health and Human Services [HHS], 2025). The Nurse-Family Partnership (NFP, 2023) Program is an example of an evidence-based model that “succeeds by having specially educated nurses regularly visit first-time moms, starting early in the pregnancy and continuing until the child's second birthday,” leading to a range of improved health and well-being outcomes for the child and mother and a return of \$5.70 on every \$1.00 invested (Olds et al., 1997).

In 2010, the Affordable Care Act established the Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program, providing \$1.5 billion over 5 years for states, territories, and tribal entities to implement home visiting models considered evidence-based by the U.S. Department of Health and

Human Services (HHS, 2025). In fiscal year 2022, the MIECHV Program served 138,000 households, the majority of which earned incomes at or below the federal poverty level guidelines (HHS, 2025).

HHS identifies evidence-based home visiting models through the Home Visiting Evidence of Effectiveness (HomVEE) Review, an annual literature search for programs that improve outcomes in at least one of eight domains: 1) child health, 2) child development and school readiness, 3) family economic self-sufficiency, 4) linkages and referrals, 5) maternal health, 6) positive parenting practices, 7) reductions in child maltreatment, and 8) reductions in juvenile delinquency. As of May 2023, 22 home visiting models met eligibility requirements for the MIECHV Program, 21 of which were being implemented (Home Visiting Evidence of Effectiveness [HomVEE], 2023).

Most of the home visiting models are based in U.S. states, but some models were founded internationally (e.g., Early Start from New Zealand). The objectives of the models vary widely. According to HomVEE (2023), only 7 of the 21 MIECHV-eligible models have demonstrated improved child health outcomes associated with environmental exposures, including low birth weight, preterm birth, obesity, shorter telomere length, and asthma. Yet it is unclear if these models mitigated environmental exposures to achieve these improvements, and it is unknown how many other models attempt to or successfully address childhood environmental health.

To date, multiple home-based interventions have been shown to improve childhood environmental health outcomes. In a recent systematic review, Balza et al. (2024) found that educational interventions to lower blood lead levels in children (e.g., hygiene or nutrition lessons) were more successful when they included home visits, used cultural tailoring, and provided cleaning supplies or assistance. However, Balza et al. (2024) identified no educational intervention that decreased childhood blood lead levels to ≤ 5 $\mu\text{g}/\text{dL}$, which is the current acceptable range set by the Centers for Disease Control and Prevention (CDC) (Balza et al., 2024). Because abatement or complete removal of lead paint from residences is expensive, remediation—which involves bringing one's home up to lead safety standards by mitigating hazards,

such as covering lead paint surfaces with rigid barriers (enclosure) or neutral paint (encapsulation)—is widely accepted as the most effective approach to eliminating lead exposure in children (Markowitz, 2021).

Like lead poisoning, childhood asthma can be effectively addressed through multicomponent, multifactorial interventions that target asthma triggers in the home environment. A systematic review by Leas et al. (2018) showed that evidence for single-component interventions (e.g., impermeable pillow and mattress covers) have not been associated with improved asthma outcomes, while multicomponent interventions (e.g., a combination of pest control, mold removal, and air purification) have shown success.

In our systematic review, multicomponent interventions that incorporated HEPA vacuums or pest control were more likely to reduce exacerbations and improve quality of life among asthma patients (Leas et al., 2018). Based on another systematic review, the National Asthma Education and Prevention Program Coordinating Committee (NAEPCC) Expert Panel Working Group also conditionally recommended impermeable pillow and mattress covers as part of a multicomponent allergen mitigation intervention (Matsui & Peng, 2020).

Additionally, integrated pest management is the only environmental control measure that the NAEPCC Expert Panel recognized as potentially effective as a standalone intervention, but the evidence is mixed (Cloutier et al., 2020; Matsui & Peng, 2020). Although multicomponent interventions are known to improve asthma outcomes, it is unclear whether specific combinations of mitigation approaches are more effective than other approaches.

Considering its nationwide enrollment of low-income families and longstanding bipartisan support, the MIECHV Program represents a unique opportunity to intervene with young children who are at increased risk of environmental health problems, such as lead poisoning and asthma. The extent to which MIECHV-eligible models include and evaluate evidence-based interventions to improve these outcomes, however, is unknown.

Addressing this gap in knowledge can highlight strategies for incorporating environmental health interventions into home visiting programs. Therefore, our objective in

this study was to describe the environmental health content included in the 21 home visiting models approved for MIECHV funding by HHS that were being implemented for children ages 0–4 years, including the types of evaluations being conducted.

Methods

For this cross-sectional, web-based survey study, we first identified all home visiting models on the HomVEE website that have been designated as evidence-based by HHS and eligible for MIECHV funding as of May 2023 (HomVEE, 2023). Contact information for one key respondent (e.g., researcher, training officer) at each model was also obtained through HomVEE, although when this information was unavailable, we retrieved it from the model's website.

We administered a questionnaire (hosted on REDCap data collection software) via email to all key respondents from September 2021 to May 2023. Most of the respondents and models were based in the U.S. (e.g., Michigan, Kentucky, Washington), with some models in other countries including Australia and New Zealand. Our study was deemed not human subjects research by the Johns Hopkins Institutional Review Board. Although informed consent forms were not collected, respondents were provided a detailed description of the study prior to accessing the survey. Each respondent was offered a \$25 gift card in appreciation for their participation. The data were compiled, and descriptive analytic techniques were employed to address our study aims. Due to the small number of respondents in this study, the exact number of any missing responses was reported.

Measures

The questionnaire was designed to collect comprehensive and standardized information about pediatric environmental health content in MIECHV-eligible models. Two experts in home-based childhood health interventions and environmental health, respectively, developed novel questions with items based on previous research. The survey was pretested by multiple professionals at Family Spirit, one of the MIECHV-eligible models included in our study, and feedback was incorporated in the final version. The questionnaire was formatted into four sections: 1) respondent and model characteristics, 2)

the environmental health topics, 3) environmental health services, and 4) environmental health evaluations included in each model.

Respondent and Model Characteristics

Three questions were included to generally characterize the respondents and models. The first question was open-ended, asking respondents to describe their professional title. The second question asked if their model used a standardized curriculum. Respondents then indicated if the model addressed environmental health, and only those who responded “yes” could answer questions in the following three sections.

Environmental Health Topics

One question asked respondents to indicate which environmental health topics were included in the model. Respondents selected among 15 listed items (e.g., asthma, lead poisoning, water quality) adapted from a literature review summarizing in-home environmental hazards (Green & Healthy Homes Initiative, n.d.). Respondents could also select “other,” which prompted an open-ended description.

Environmental Health Services

Next, one question asked about the services used by models to address environmental health and included five options (e.g., risk assessments, referrals, provision of safety devices) along with “other,” which prompted an open-ended description. If asthma was selected as an included topic in the previous section, respondents were also presented with a second question asking about the specific indoor allergen mitigation interventions provided (e.g., acaricide, pest control, HEPA vacuums). The nine items in this question were adapted from systematic reviews of interventions designed to reduce indoor allergens that showed promise in managing asthma (Cloutier et al., 2020; Leas et al., 2018; Matsui & Peng, 2020). If respondents selected “other,” an open-ended description was requested.

Environmental Health Evaluations

For the last section, respondents were asked if evaluations were conducted on the model's environmental health services. Individuals who responded “yes” were asked to report which of the CDC's five program evaluation

types were conducted on the model (e.g., outcome, cost-effectiveness, impact) or “other,” which prompted an open-ended description (Centers for Disease Control and Prevention, 2024). The third question in this section asked respondents to report which environmental health measures (e.g., disease severity, medication utilization, quality of life) were collected, listing 12 items and “other,” which prompted an open-ended description.

Options for this question were adapted from expert recommendations for evaluation measurements in asthma home visiting programs (Green & Healthy Homes Initiative, 2019). The final three questions in this section asked respondents to share a brief description of their evaluation findings, if there were citations to any reported results, and, if so, to provide these citations.

Results

Completed surveys were returned by all 21 of the respondents, representing each MIECHV-eligible home visiting model being implemented as of May 2023. Survey respondents most often described their professional title as researcher ($n = 8$) or program officer ($n = 8$), followed by training officer ($n = 2$), missing information ($n = 2$), and consultant ($n = 1$). Most models reported having a standardized curriculum ($n = 16$), although almost one quarter did not ($n = 5$). Just over one half of the models reported the inclusion of some environmental health content ($n = 12$). Table 1 provides a summary of the responses.

On average, models covered 3 out of the 15 topics listed (range 0–15). The topic most frequently covered was lead poisoning, reported by slightly more than one half of the models ($n = 11$), followed by environmental tobacco smoke ($n = 10$), and then biological and unsanitary conditions ($n = 8$). Asthma triggers and allergens were covered by one third of the models ($n = 7$). The least commonly covered topics were combustion gases and ventilation, radon, and weatherization (each reported by two models) and VOCs (reported by only one model).

The models reported using several different services to address environmental health. The most common services included assessing environmental risks in approximately one half of the models ($n = 10$), referring families to other organizations in slightly more than one third of the models ($n = 8$), and covering

TABLE 1

Environmental Health Topics, Services, and Evaluations in Surveyed Home Visiting Models (N = 21)

Survey Response	#
Models addressing environmental health	
Yes	12
No	9
Environmental health topics included	
Lead poisoning	11
Environmental tobacco smoke	10
Biological and unsanitary conditions	8
Indoor environmental asthma triggers and allergens	7
Pest management	6
Mold	5
Indoor air quality	4
Water access (i.e., availability of potable running water)	4
Energy security	3
Thermal comfort	3
Water quality	3
Combustion gases and ventilation	2
Radon	2
Weatherization	2
Volatile organic compounds (VOCs)	1
Other	1
Services to address environmental health	
Assessment of environmental risks in the home	10
Referral to other organizations	8
Content covered using a curriculum	6
Addressed when relevant without a curriculum	4
Provision of environmental control supplies	2
Other	3
Models evaluating environmental health services	
Yes	1
No	20
Evaluation types conducted on environmental health services	
Outcome	1

content using a curriculum in approximately one quarter of the models ($n = 6$). Of the seven models that reported covering asthma, only four identified the methods they used to mitigate indoor allergens: two reported using referrals, one reported using cleaning products, and another one reported using mold mitigation.

Only one model reported evaluating their services to address environmental health.

This model included outcome evaluations that collected the following measurements: quality improvement, tobacco use, primary care connection, and quality of life for the child and caregiver. This respondent for this model provided a citation to an evaluation report that showed improved linkage between intervention families and their desired community resources compared with

nonintervention families. No outcomes, however, for the other environmental health measurements were included in the report.

Discussion

Environmental exposures disproportionately harm children in low-income families, accounting for high medical and societal costs in the U.S. Incorporating evidence-based environmental health interventions in the MIECHV Program—given its longstanding federal support and national scope—represents a promising approach to targeting the most at-risk children. Our study is the first to examine the extent to which federally funded home visiting programs include and evaluate environmental health content for children ages 0–4 years. Although some environmental health content is already covered in approximately one half ($n = 12$) of the MIECHV-eligible models, our survey highlights opportunities to increase the positive effect of existing efforts and encourage further uptake.

In general, models were more likely to address environmental health issues that were commonly associated with greater perceived severity or behavioral change interventions. The most frequently covered topic was lead poisoning ($n = 11$), the elimination of which has been widely publicized as part of HHS's Healthy People Initiative objectives since 2000 (HHS, n.d.). Similarly, asthma became a major concern in the pediatrics field following surveillance showing its rising prevalence among children up to 2010 (Moorman et al., 2012).

Furthermore, mixed evidence on the relationship between asthma and COVID-19 has drawn more attention to asthma in children recently (Frey et al., 2023). Consistent with this urgency, one third of the surveyed models ($n = 7$) covered asthma triggers and allergens, making it the fourth-leading topic reported. The scientific literature, however, suggests that multicomponent interventions are the most successful at improving asthma outcomes, especially when they include the provision of HEPA vacuums; impermeable pillow and mattress covers; and pest control, especially integrated pest management (Green & Healthy Homes Initiative, 2020; Leas et al., 2018; Matsui & Peng, 2020). Yet fewer models covered these hazards (e.g., $n = 6$ for pest management and $n = 5$ for mold management), which have been considered

part of the evidence base for effective asthma control, indicating that home-visited families could benefit from a more comprehensive approach to addressing triggers in the home linked to childhood asthma.

Following lead poisoning, the topics most covered by models are often associated with behavioral change interventions: environmental tobacco smoke ($n = 10$) and biological and unsanitary conditions ($n = 8$). According to literature reviews of experimental studies, educational and motivational programs have demonstrated success at promoting parental smoking cessation and home hygiene practices (Bloomfield & Scott, 2003; Rosen et al., 2012). The high coverage of these topics suggests that models are able to naturally incorporate behavioral change into their services. Indeed, the Home Visiting Applied Research Collaborative acknowledged that the home visiting field has increasingly focused on behavioral change components to facilitate outcomes (Duggan et al., 2022).

In contrast, models were less likely to cover issues commonly associated with environmental modifications, which are services that necessitate technical expertise from the housing or energy sector. For example, addressing general indoor air quality ($n = 4$), including combustion gases ($n = 2$), radon ($n = 2$), and VOCs ($n = 1$), often requires the installation of energy-efficient appliances, air sealing, insulation, improved ventilation, or other home repairs (Green & Healthy Homes Initiative, n.d.). Improving water quality ($n = 3$) and access to clean water ($n = 4$) often require modifications to the home plumbing, filtration, or septic systems, which are difficult changes for home visitors to complete alone (Green & Healthy Homes Initiative, n.d.).

In our survey, weatherization ($n = 2$), energy security ($n = 3$), and thermal comfort ($n = 3$) were not frequently covered. These topics do not align with the usual scope of expertise of home visitors and account for fewer childhood deaths than other environmental health topics—but they have become increasingly salient public health issues as extreme weather events continue to increase (National Safety Council, 2025).

In recent years, emergency department visits and hospitalizations associated with extreme temperatures have substantially increased (Gronlund et al., 2018). These weather conditions disproportionately affect

households that cannot properly heat or cool their homes due to the cost of energy (energy rationing), utility disconnections for non-payment, and public safety power shutoffs. Weatherization practices, such as air sealing and insulation, are therefore essential for preventing temperature-related injuries and can support cost savings for low-income families experiencing energy insecurity.

Considering the usual strengths of home visiting programs, it is promising that the most popular services reported in our survey were assessing for hazards ($n = 10$) and referring to external organizations ($n = 8$). A referral pathway combining these approaches represents an inexpensive and feasible way for models to support families. With models reporting on average the coverage of only 3 out of the 15 environmental health topics listed in our survey, however, the assessments currently being used by home visitors need expanding to achieve the most benefits.

A potential solution is the development of a standardized assessment tool that can be employed across models. In 2018, the U.S. Department of Housing and Urban Development (HUD) published the Home Characteristics and Asthma Triggers Checklist for home visitors, which recommends action steps based on asthma risks in the home (HUD, n.d.-a). This tool relies largely on self-reported information from residents (e.g., “What type of stove do you have?”) and is accompanied by a training designed for non-environmental home visitors (HUD, n.d.-a).

For these reasons, the checklist provides an ideal template for guiding interventions that can be made more comprehensive through the addition of other environmental health topics (e.g., energy security) and clinical factors (e.g., blood lead level). Such a tool would even offer benefits to the few programs currently addressing a broad range of environmental health hazards. As an example, Minding the Baby was the only model in our survey that covered all 15 topics listed, but the respondent for the model reported using an informal assessment process to inform supply distribution and referrals. By offering a systematic method of assessment, a standardized tool with training would reduce the risk of error by home visitors, who often are not specialized in childhood environmental health.

Additionally, more models (i.e., leaders in charge of models) could be encouraged to

provide environmental supplies, as only two models reported implementing this service. Although the best practice for addressing environmental exposures is through comprehensive assessment and home modification, these protocols can be time intensive. Distributing environmental supplies to limit exposures often helps to immediately manage risks. Carbon monoxide detectors, for example, can prevent acute poisoning while a home with poor ventilation awaits repairs. Notably, only one model in our survey conducted evaluations of their environmental health services, and none conducted cost-effectiveness evaluations.

To advocate for the reimbursement of environmental health services and supplies in home visiting programs, researchers and practitioners in the field need cost-effectiveness data on existing efforts (Green & Healthy Homes Initiative, 2019). Therefore, we recommend that funding be made available for MIECHV-supported programs to pursue studies with a focus on efficacy and cost-effectiveness outcomes so that environmental health services can be widely incorporated in home visiting through strategies with a strong evidence base.

Because partnerships with external organizations have played an important role in the MIECHV-eligible models currently offering environmental health services, efforts to further facilitate cross-sector partnerships could increase uptake of comprehensive assessment and referral for home modifications in the models that have not yet included this content. One possible approach to supporting such partnerships is through the Healthy Homes Initiative by HUD.

Healthy Homes is a nationwide program that funds not-for-profit and for-profit firms, state and local governments, tribal entities, and universities to conduct research on home hazards and directly remediate the home hazards that contribute to environmental health problems (HUD, n.d.-b). In fiscal year 2022, more than \$40 million was authorized for the Healthy Homes Initiative (HUD, n.d.-c). HUD has prioritized this funding for projects that involve children and address “housing-related hazards in a coordinated fashion, rather than addressing a single hazard at a time” (HUD, n.d.-a).

These objectives make Healthy Homes-funded programs at the local and state lev-

els prime candidates for handling the environmental health services that home visiting programs currently lack the capacity to provide. Policymakers should consider expanding support for Healthy Homes grantees that demonstrate effective linkages to MIECHV-funded home visiting programs to incentivize greater inclusion of evidence-based environmental health interventions for young, low-income children.

Limitations and Future Directions

The results of our study must be interpreted in the context of the following limitations. Respondents held varying professional titles; thus, they likely differed in levels of familiarity with the survey content. Only one respondent was sought for each model, which may have affected the accuracy of responses. Historically, childhood environmental health has not been a primary focus of home visiting programs. Given that our survey was developed by experts, it likely required respondents to engage with topics outside of their usual expertise. And lastly, HomVEE's annual literature review uses methods and standards

that are regularly being updated; therefore, the list of home visiting models deemed eligible for MIECHV funding is subject to revision by HHS. These features limit the generalizability to programs in the future, as our study was a one-time, cross-sectional survey.

Future work should focus on developing and validating a comprehensive home assessment tool for childhood environmental health hazards that is low-cost and simple to use during home visits. Qualitative analyses should also be conducted with home visitors, model developers, and policymakers to understand the motivators and barriers of incorporating evidence-based environmental health interventions into home visiting.

Conclusion

Young, low-income children are uniquely vulnerable to harmful environmental exposures in the household. MIECHV-eligible home visiting models offer a promising approach to addressing home hazards for this at-risk population using evidence-based environmental health interventions—but to date, the inclusion of these types of efforts

has been unknown. Our survey findings show that MIECHV-eligible models have tended to cover environmental health topics commonly associated with high severity (e.g., lead poisoning, asthma) and solutions involving behavioral change (e.g., smoking cessation, home hygiene).

Furthermore, home visiting models have mostly used risk assessments and referrals to external organizations to address environmental health issues, but very few of the models has conducted evaluations of these services. Based on our study findings, to increase the positive impact of current environmental health efforts in these models and to advance the uptake of these efforts across these models, we suggest the implementation of policies that incentivize cost-effectiveness and efficacy evaluations, safety device provision and installation, and partnerships with healthy homes organizations. 🌸

Corresponding Author: Wendy C. Shields, MPH, PhD, Johns Hopkins Center for Injury Research and Policy, 624 North Broadway, Baltimore, MD 21205. Email: wshield1@jhu.edu

References

- Balza, J., Bikomeye, J.C., & Flynn, K.E. (2024). Effectiveness of educational interventions for the prevention of lead poisoning in children: A systematic review. *Reviews on Environmental Health*, 40(1), 115–132. <https://doi.org/10.1515/reveh-2023-0108>
- Bellinger, D.C. (2008). Very low lead exposures and children's neurodevelopment. *Current Opinion in Pediatrics*, 20(2), 172–177. <https://doi.org/10.1097/MOP.0b013e3282f4f97b>
- Bloomfield, S.F., & Scott, E.A. (2003). Developing an effective policy for home hygiene: A risk-based approach. *International Journal of Environmental Health Research*, 13(Suppl. 1), S57–S66. <https://doi.org/10.1080/0960312031000102804>
- Centers for Disease Control and Prevention. (2024). *CDC approach to program evaluation*. <https://www.cdc.gov/evaluation/php/about/index.html>
- Cloutier, M.M., Baptist, A.P., Blake, K.V., Brooks, E.G., Bryant-Stephens, T., DiMango, E., Dixon, A.E., Elward, K.S., Hartert, T., Krishnan, J.A., Lemanske, R.F., Jr., Ouellette, D.R., Pace, W.D., Schatz, M., Skolnik, N.S., Stout, J.W., Teach, S.J., Umscheid, C.A., & Walsh, C.G. (2020). 2020 focused updates to the asthma management guidelines: A report from the National Asthma Education and Prevention Program Coordinating Committee Expert Panel Working Group. *The Journal of Allergy and Clinical Immunology*, 146(6), 1217–1270. <https://doi.org/10.1016/j.jaci.2020.10.003>
- Duggan, A.K., Bower, K.M., Spinosa, C.Z., O'Neill, K., Daro, D., Harding, K., Ingalls, A., Kemner, A., Marchesseault, C., & Thorland, W. (2022). Changing the home visiting research paradigm: Models' perspectives on behavioral pathways and intervention techniques to promote good birth outcomes. *BMC Public Health*, 22, Article 1024. <https://doi.org/10.1186/s12889-022-13010-5>
- Frey, S.M., Rowe, R.K., & Halterman, J.S. (2023). The prevalence of childhood asthma: Interpreting falling rates in the context of shifting measurement and the COVID-19 pandemic. *Current Opinion in Pulmonary Medicine*, 29(3), 197–201. <https://doi.org/10.1097/MCP.0000000000000959>
- Green & Healthy Homes Initiative. (n.d.). *Achieving health and social equity through housing: Understanding the impact of non energy benefits in the United States*. <https://www.greenandhealthyhomes.org/publication/achieving-health-and-social-equity-through-housing/>
- Green & Healthy Homes Initiative. (2019). *Recommendations for evaluation metrics for asthma home visiting programs: Measuring environmental management & health outcomes*. https://www.greenandhealthyhomes.org/wp-content/uploads/GHHI_EMHOME_Publication_2019.pdf
- Green & Healthy Homes Initiative. (2020). *2020 expert panel updates—Indoor allergen mitigation: GHHI's comments on NHLBI asthma management guidelines*. https://www.greenandhealthyhomes.org/wp-content/uploads/GHHI_2020_Expert_Panel_Updates_Indoor_Allergen_Mitigation_GHHI's_comments_on_NHLBI_asthma_management_guidelines.pdf

continued on page 14

References continued from page 13

- homes.org/publication/2020-expert-panel-updates-ghhis-com
ments-on-nhlbi-asthma-management-guidelines/
- Green & Healthy Homes Initiative. (2023). *Integrating health-related
services into electrification upgrades: Feasibility study for BlocPower*.
[https://www.greenandhealthyhomes.org/wp-content/uploads/
GHHI_Feasibility_Study_BlocPower_June_2023.pdf](https://www.greenandhealthyhomes.org/wp-content/uploads/GHHI_Feasibility_Study_BlocPower_June_2023.pdf)
- Gronlund, C.J., Sullivan, K.P., Kefelegn, Y., Cameron, L., & O'Neill,
M.S. (2018). Climate change and temperature extremes: A review
of heat- and cold-related morbidity and mortality concerns of
municipalities. *Maturitas*, 114, 54–59. [https://doi.org/10.1016/j.
maturitas.2018.06.002](https://doi.org/10.1016/j.maturitas.2018.06.002)
- Gruenewald, T., Seals, B.A., Knibbs, L.D., & Hosgood, H.D., III.
(2023). Population attributable fraction of gas stoves and child-
hood asthma in the United States. *International Journal of Environ-
mental Research and Public Health*, 20(1), Article 75. [https://doi.
org/10.3390/ijerph20010075](https://doi.org/10.3390/ijerph20010075)
- Home Visiting Evidence of Effectiveness. (2023). *Early childhood
home visiting models: Reviewing evidence of effectiveness*. [https://
homvee.acf.hhs.gov/sites/default/files/2023-11/homvee-sum
mary-brief-nov2023.pdf](https://homvee.acf.hhs.gov/sites/default/files/2023-11/homvee-summary-brief-nov2023.pdf)
- Leas, B.F., D'Anci, K.E., Apter, A.J., Bryant-Stephens, T., Lynch,
M.P., Kaczmarek, J.L., & Umscheid, C.A. (2018). Effectiveness of
indoor allergen reduction in asthma management: A systematic
review. *Journal of Allergy and Clinical Immunology*, 141(5), 1854–
1869. <https://doi.org/10.1016/j.jaci.2018.02.001>
- Leech, J.A., Nelson, W.C., Burnett, R.T., Aaron, S., & Raizenne, M.E.
(2002). It's about time: A comparison of Canadian and Ameri-
can time-activity patterns. *Journal of Exposure Science & Envi-
ronmental Epidemiology*, 12, 427–432. [https://doi.org/10.1038/
sj.jea.7500244](https://doi.org/10.1038/sj.jea.7500244)
- Markowitz, M. (2021). Lead poisoning: An update. *Pediatrics in
Review*, 42(6), 302–315. <https://doi.org/10.1542/pir.2020-0026>
- Matsui, E.C., & Peng, R.D. (2020). 2020 updated asthma guide-
lines: Indoor allergen reduction. *Journal of Allergy and Clini-
cal Immunology*, 146(6), 1283–1285. [https://doi.org/10.1016/j.
jaci.2020.10.014](https://doi.org/10.1016/j.jaci.2020.10.014)
- Moorman, J.E., Akinbami, L.J., Bailey, C.M., Zahran, H.S., King,
M.E., Johnson, C.A., & Liu, X. (2012). National surveillance of
asthma: United States, 2001–2010. *Vital & Health Statistics, Series
3, Analytical and Epidemiological Studies*, 35, 1–58. National Center
for Health Statistics, Centers for Disease Control and Prevention.
https://www.cdc.gov/nchs/data/series/sr_03/sr03_035.pdf
- National Safety Council. (2025). *Deaths in the home by age
group, 2021*. [https://injuryfacts.nsc.org/home-and-community/
deaths-in-the-home/deaths-in-the-home-by-age-group/](https://injuryfacts.nsc.org/home-and-community/deaths-in-the-home/deaths-in-the-home-by-age-group/)
- Nurmagambetov, T., Kuwahara, R., & Garbe, P. (2018). The eco-
nomic burden of asthma in the United States, 2008–2013. *Annals
of the American Thoracic Society*, 15(3), 348–356. [https://doi.
org/10.1513/annalsats.201703-259oc](https://doi.org/10.1513/annalsats.201703-259oc)
- Nurse-Family Partnership. (2023). *Nurse-family partnership: Over-
view*. <https://www.house.mi.gov/HFA/PDF/HealthandHumanSer>
- vices/DHHS_Subcmte_Testimony_Nurse_Family_Partnership_
Overview_2-21-24.pdf
- Olds, D.L., Eckenrode, J., Henderson, C.R., Jr., Kitzman, H., Pow-
ers, J., Cole, R., Sidora, K., Morris, P., Pettitt, L.M., & Luckey,
D. (1997). Long-term effects of home visitation on maternal
life course and child abuse and neglect: Fifteen-year follow-
up of a randomized trial. *JAMA*, 278(8), 637–643. [https://doi.
org/10.1001/jama.1997.03550080047038](https://doi.org/10.1001/jama.1997.03550080047038)
- Pérez Velasco, R., & Jarosińska, D. (2022). Update of the WHO
global air quality guidelines: Systematic reviews—An introduc-
tion. *Environment International*, 170, Article 107556. [https://doi.
org/10.1016/j.envint.2022.107556](https://doi.org/10.1016/j.envint.2022.107556)
- Perry, R., Braileanu, G., Palmer, T., & Stevens, P. (2019). The eco-
nomic burden of pediatric asthma in the United States: Literature
review of current evidence. *Pharmacoeconomics*, 37, 155–167.
<https://doi.org/10.1007/s40273-018-0726-2>
- Rosen, L.J., Noach, M.B., Winickoff, J.P., & Hovell, M.F. (2012).
Parental smoking cessation to protect young children: A sys-
tematic review and meta-analysis. *Pediatrics*, 129(1), 141–152.
<https://doi.org/10.1542/peds.2010-3209>
- Trasande, L., & Liu, Y. (2011). Reducing the staggering costs of
environmental disease in children, estimated at \$76.6 billion in
2008. *Health Affairs*, 30(5), 863–870. [https://doi.org/10.1377/
hlthaff.2010.1239](https://doi.org/10.1377/hlthaff.2010.1239)
- University of California San Francisco. (2023). *Pediatric environ-
mental health: e-toolkit for prevention* (Version 3). [https://peht.ucsf.
edu/index.php](https://peht.ucsf.edu/index.php)
- U.S. Department of Health and Human Services. (n.d.). *Reduce blood
lead levels in children aged 1 to 5 years—EH-04*. Healthy People
2030. [https://health.gov/healthypeople/objectives-and-data/browse-
objectives/housing-and-homes/reduce-blood-lead-levels-
children-aged-1-5-years-eh-04](https://health.gov/healthypeople/objectives-and-data/browse-objectives/housing-and-homes/reduce-blood-lead-levels-children-aged-1-5-years-eh-04)
- U.S. Department of Health and Human Services. (2025). *The Mater-
nal, Infant, and Early Childhood Home Visiting Program*. Maternal
and Child Health Bureau. [https://mchb.hrsa.gov/sites/default/
files/mchb/about-us/program-brief.pdf](https://mchb.hrsa.gov/sites/default/files/mchb/about-us/program-brief.pdf)
- U.S. Department of Housing and Urban Development. (n.d.-a). *Pol-
icy and standards division*.
- U.S. Department of Housing and Urban Development. (n.d.-b). *The
Healthy Homes program*.
- U.S. Department of Housing and Urban Development. (n.d.-c). *FY
2022 Healthy Homes Production grant program*.
- U.S. Environmental Protection Agency. (2024). *Children's environ-
mental health*. [https://www.cdc.gov/environmental-health-track
ing/php/data-research/childrens-health.html](https://www.cdc.gov/environmental-health-tracking/php/data-research/childrens-health.html)
- Zhu, Y., Connolly, R., Lin, Y., Mathews, T., & Wang, Z. (2020).
*Effects of residential gas appliances on indoor and outdoor air qual-
ity and public health in California*. UCLA Fielding School of Public
Health. [https://coeh.ph.ucla.edu/wp-content/uploads/2023/01/
Effects-of-Residential-Gas-Appliances-on-Indoor-and-Outdoor-
Air-Quality-and-Public-Health-in-California.pdf](https://coeh.ph.ucla.edu/wp-content/uploads/2023/01/Effects-of-Residential-Gas-Appliances-on-Indoor-and-Outdoor-Air-Quality-and-Public-Health-in-California.pdf)