

PROFESSIONAL PRACTICE

Organization of Community-Based Respirator Fit Testing Programs for Agricultural Workers

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Abstract: *Background:* The agricultural industry exposes individuals to diverse respiratory hazards, yet historically, respirator use has been low. Ensuring proper protection remains challenging due to complex agricultural hazards (e.g., pesticides, dust, zoonotic diseases, wildfire smoke) and limited rural access to health care services. This professional practice publication outlines the development and initial impact of Community-Based Respirator Fit Testing Programs, highlighting the vital roles of nurses and community collaboration. *Methods:* This publication draws upon over 40 years of combined experience from a multidisciplinary team in conducting Community-Based Respirator Fit Testing workshops. It synthesizes insights from eight workshops over 5 years, engaging 175 participants across five states. These workshops trained diverse agricultural safety stakeholders on requirements for the Occupational Safety and Health Administration (OSHA), respiratory exposures, qualitative fit testing principles, and fit tester responsibilities, informed by two comprehensive Respirator Fit Test Guides developed in collaboration with National Institute for Occupational Safety and Health (NIOSH)-funded Agricultural Health and Safety Centers. *Findings:* Community-Based Respirator Fit Testing Programs require multiple steps, including on-farm hazard identification, appropriate respirator selection (considering cost challenges), medical evaluation, annual fit testing, training, and documentation. *Discussion:* Major challenges to fit test programs in rural agricultural areas include the cost of equipment and limited healthcare provider engagement. The most significant barriers identified during workshops were community awareness about respiratory protection and distance to services. These are compounded by agriculture's time-sensitive nature which favors task-based guidance. *Conclusion:* Respiratory protection is vital for agricultural

health. While self-reported use has increased in recent years, proper implementation through Community-Based Respirator Fit Testing Programs is crucial.

Keywords: agriculture, occupational health, pesticides, respirators, rural health

Background

Agricultural Industry and Respiratory Protection

The agricultural industry presents a variety of tasks that can expose workers to respiratory hazards. These hazards include pesticides, fertilizers, animal by-products, mold spores, organic dust, and exhaust emissions (Donham & Thelin, 2016; Grisso, 2020a; Peters et al., 2012). Numerous studies have linked agricultural work to respiratory health problems. Chronic exposure to dust, vapors, and gases has been associated with higher prevalence of respiratory symptoms like cough, wheezing, and shortness of breath (Faria et al., 2006; Nordgren & Bailey, 2016; Nordgren & Charavaryamath, 2018). Workers in the agricultural industry, especially livestock workers and veterinarians, are considered frontline workers for zoonotic diseases, which can be transmitted through airborne bioaerosols from animals and animal byproducts (Jeyaretnam & Jones, 2004; Lejeune & Kersting, 2010). Individuals working in agriculture are increasingly facing elevated respiratory risks due to poor air quality linked to wildfires and other outdoor pollution factors. Fine particulate matter and airborne pollutants generated during wildfire-associated combustion pose significant health hazards (Chen et al., 2016). As a result, several states have implemented regulations requiring outdoor workers to use respirators when the air quality index exceeds certain levels due to wildfire smoke (Oregon OSHA, n.d.; Yost et al., 2022).

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Applications to Professional Practice

The agricultural industry exposes workers to various respiratory hazards, including pesticides, dust, and air pollution. Respirators are suggested for numerous agricultural tasks and conditions, however proper use, including fit, remains challenging, especially in rural and agricultural areas. To address this, a Community-Based Respirator Fit Testing Program, informed by extensive experience and collaboration with two NIOSH Agricultural Health and Safety Centers, has been developed and promoted in eight respirator fit test workshops across five states. This Community-Based program integrates healthcare professionals, particularly nurses, with rural and agricultural stakeholders. Nurses may assist with core components including (a) selecting accurate respirator for diverse farm tasks; (b) facilitating the medical evaluation process to determine suitability for respirator use; (c) providing accessible qualitative fitting in rural agricultural areas; (d) delivering ongoing education on proper respirator use, maintenance, and relevant policies; and (e) documentation. By developing and implementing these comprehensive programs and leveraging tools like the Respirator Fit Test Guides, nurses may help rural communities significantly improve their capacity to reduce agricultural-related respiratory illnesses.

The specific contaminants encountered can vary significantly depending on the agricultural task, environment, and practices (Donham & Thelin, 2016; Grisso, 2020a, 2020b). Respirator use on farms may range from specialized respirators, like SCBA (Self-Contained-Breathing-Apparatus) for high-exposure tasks such as uncapping silos or rescue operations, to more basic filtering facepiece (e.g., N95) or cartridge air purifying respirators (full or half face coverage) used for tasks like cleaning grain bins or handling certain chemicals. Respirator use on farms may also be “conditional” for tasks such as working in dusty fields, during haying operations, or around livestock (Ag Health and Safety Alliance [AHSa], 2023b; Donham & Thelin, 2016). Some recommendations for specific farm tasks based on previous agricultural safety working groups have been provided in Supplemental Table 1.

Ensuring adequate respiratory protection for all individuals working within the agricultural industry is difficult due to the varied nature of work. As a form of personal protective equipment (PPE), respirators should be considered a last line of defense, following the National Institute for Occupational Safety and Health (NIOSH, n.d.) Hierarchy of Controls. Prioritizing engineering controls to eliminate hazards at the source and administrative controls like work practice changes is crucial. Historically, self-report surveys indicated low respirator use among agricultural workers (6%; Doney et al., 2005). Studies indicate that some individuals working in agriculture fail to consistently use respirators when handling pesticides (Calvert et al., 2008; Garrigou

et al., 2020; Greskevitch et al., 2008; Patel et al., 2008; Strong et al., 2008). Although very few studies have examined the acceptability of respirators, one found that the filtering facepiece (N95) respirator was often the most preferred by individuals working in agriculture due to its light weight and convenience (Popendorf et al., 1995). Recent studies have demonstrated an increase in respirator use (17%–48%), particularly among young adults (Cramer et al., 2017; Gibbs et al., 2023; Kearney et al., 2014, 2016; Mitchell & Schenker, 2008; Syamlal et al., 2013; Vogel, 2023). Researchers in these publications hypothesize increased generational familiarity with PPE overall and shifts in regulatory policies about respirator use requirements.

The complex and diverse nature of respiratory hazards in agricultural work necessitates a multifaceted approach to occupational safety. This approach, which the authors titled a *Community-Based Respirator Fit Testing Program*, contains critical roles played by occupational health nurses and others servicing agricultural communities. Healthcare professionals connect the agricultural workforce to the broader healthcare system and should leverage their expertise to ensure implementation of respiratory protection. This approach has been applied in agricultural settings, although not definitively described (Mpofu et al., 2002; Pate et al., 2016; Wierda et al., 2021). Occupational health nurses are instrumental in conducting fit testing, selecting appropriate respirators and delivering ongoing education and training tailored to the unique needs of agricultural workers. By fostering trust and collaboration within the rural and agricultural community, occupational health nurses help create a culture of safety that includes not only paid employees but also unpaid family members and volunteers working in this high-risk industry. The purpose of this paper is to describe the development of two respirator fit test training guides and 5 years of experience conducting respirator fit test trainings in rural, agricultural committees. This is provided to showcase how a community-based respirator fit testing program may benefit individuals working in agriculture.

Agricultural Exemptions and Impact on Respirator Use

Agricultural exemptions with regards to inspection and enforcement are likely to impact respirator use on farms. Many farms in the United States (U.S.) fall outside OSHA inspection authority (Occupational Safety and Health Administration [OSHA], 1998). However, the OSHA General Duty Clause still requires all employers to provide a safe workplace (United States Congress, 1970). Unless using temporary labor camps, farms with 10 or fewer employees are generally exempt from inspection. Some operations, especially family-owned farms, rely on unpaid family members, volunteers (such as neighbors), and youth workers, who may not be covered by formal employee definition and therefore by OSHA protections. These individuals may be working informally and often perform hazardous tasks without the benefit of mandated respirator programs (American Public Health Association, 2017).

NIOSH-certified respirators are recognized as safe for adult working populations (≥ 18 years old; OSHA 29 CFR 1910.134, 1998). Placing farm youth, particularly adolescents, in hazardous environments equipped with respirators may give a false sense of security to employers and could present health risks to the young workers. Some farm tasks, such as those that involve commercial or private agricultural pesticide application, require the individual to be at least 16 to 18 years old depending on requirements (WPS; 40 CFR 170.507(b)(10)). The lack of NIOSH-certified respirators specifically designed for adolescents means that 16- and 17-year-olds are likely relying on adult-tested models and highlights even more need for fit testing.

Agricultural Pesticides and Impact on Respirator Use

In the U.S., the pesticide label is a legal document, and any misuse (including misuse of recommended respiratory protection) is a violation of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; United States Environmental Protection Agency, 1972). The U.S. Environmental Protection Agency (EPA) revised the Worker Protection Standard (WPS) in 2015 to incorporate OSHA's Respiratory Protection Standard (OSHA RPP; WPS, 40 CFR 170.507(b)(10); (29 CFR 1910.134)). The WPS defines "agricultural workers" as those involved in plant production, while "pesticide handlers" are specifically those who mix, load, or apply pesticides. Compliance with the OSHA RPP standards for fit testing, training, and medical evaluation is mandatory if a pesticide has an "Agricultural Use Requirements" section on the product label and prescribes the use of a respirator. If the pesticide is used on the agricultural establishment for reasons outside of agricultural plant production, such as for livestock treatment, then the FIFRA requirements should be followed. Comprehensive training and educational resources about WPS exist for agricultural establishment employers, workers, and handlers (e.g., WPS Respiratory Protection Guide, Pesticide Educational Resources Collaborative, 2017). Agricultural operation owners and "immediate family members" are exempt from several WPS requirements, including specific PPE cleaning and maintenance requirements, but they are still required to comply with the pesticide label and OSHA RPP standards for fit testing, training, and medical evaluation (WPS, 40 CFR 170.507(b)(10); (29 CFR 1910.134)).

Community-Based Respirator Fit Testing

In agricultural communities, establishing a robust network of individuals and organizations is crucial to ensure access to respirator fit testing. The scarcity of local personnel equipped to assist with respirator selection and fit testing often presents a significant barrier to compliance with OSHA, WPS, and FIFRA requirements. A previous study, for instance, highlighted a deficit in qualified respirator fit testers in rural Iowa counties during the SARS-CoV-2 pandemic (Gibbs et al., 2021). This challenge is compounded by the high cost of quantitative respirator fit testing equipment, which uses a photometer to

measure aerosolized particle penetration. While a single unit could be beneficial for a rural clinic or extension office if fee-for-service charges offset the initial investment, a more affordable and portable option for many rural areas is qualitative fit testing. This method uses solution-based taste or odor tests to assess respirator fit at a fraction of the cost, with most kits providing enough solution for 100 to 150 participants and easy restocking. Qualitative fit test kits are particularly beneficial for nurses operating in travel clinic settings due to their portability. While not as precise as quantitative methods, qualitative testing provides valuable information and serves as a more accessible solution in rural agricultural communities (OSHA, 1998).

Beyond access to fit testing services, extensive education and outreach programs are essential to raise awareness about respirator requirements in the agricultural industry. Community-based respirator fit testing programs have a proven track record of increasing access to and proper use of respiratory protective equipment for vulnerable or rural populations, with the most effective programs seamlessly integrating education and training alongside the testing itself (Clayton & Vaughan, 2005; D'Alessandro et al., 2020). Despite this, there are very few published studies examining the specific impact of community-based respirator fit testing programs tailored for individuals working in the agricultural industry.

Methods

The Interdisciplinary Team and Focus

This publication draws upon the collective expertise of a multidisciplinary team of industrial hygienists, outreach professionals, and nurses, with a combined experience of more than 40 years in conducting Community-Based Respirator Fit Testing Program capacity-building workshops for agriculture. For this publication, the authors focused on experiences specifically over 5 years (2020–2024) from eight respirator fit Test community capacity building workshops. All workshops were 2 to 3 hours, and the curriculum covered essential topics including OSHA requirements and standards (1910.134), WPS requirements, an overview of common on-farm respiratory occupational exposures, the principles of qualitative fit testing, and the roles and responsibilities of a fit tester. Participants learned about medical evaluation questionnaires, confidentiality, various respirator types, and record-keeping. The most critical component of the workshops involved hands-on demonstration and extensive practice sessions using fit test kits.

Respirator Fit Test Guide Development

The Respirator Fit Test workshops were designed to train individuals who work with agricultural populations so they could conduct qualitative respirator fit testing confidently within their communities. In preparation for these workshops, the Ag Health and Safety Alliance™ collaborated with two NIOSH-funded Agricultural Health and Safety Centers to develop two

comprehensive Respirator Fit Test Guides (AHSA, 2021, 2023a). Initially, the Ag Health and Safety Alliance™ conducted a thorough review of existing fit testing training materials and relevant literature to compile a draft of the guides. The first guide focused on general respiratory protection within agriculture (AHSA, 2021) and the second guide focused more on pesticide-related requirements (AHSA, 2023a). Preliminary guide content was reviewed by three agriculture health and safety faculty from Central States Center for Agricultural Safety and Health (CS-CASH) at the University of Nebraska Medical Center and the Great Plains Center for Agricultural Health (GPCAH) at the University of Iowa. The pesticide-specific information within the guides received an additional review from a state-based pesticide safety education extension specialist. After review, the authors of the guide collaborated with a professional graphic designer to enhance the visual clarity and accessibility to required forms. The final versions were reviewed a second time.

These guides are a foundation training resource for rural, agricultural communities, developed following a thorough review of existing literature, U.S. industry standards and regulations, and currently known best practices in respiratory protection. The guides provide clear, concise, and actionable information specifically tailored to enhance respirator use in rural, agricultural settings and are regularly used to train various professionals to effectively implement respirator fit testing programs. Links to the guides have been provided in the references.

Organizing a Community-Based Respirator Fit Testing Program

Respirator fit test programs require multiple steps (Figure 1; OSHA, 1998) resulting in a successful respirator fit testing program and served as a foundation for the workshops. Figure 1 has been adapted from the OSHA Respirator Use Requirements Flowchart in the Small Entity Compliance Guide (OSHA, 2023) and presents the exact chronological order of steps defined in the Respirator Fit Test Guides developed by the Ag Health and Safety Alliance™. Community-based fit testing programs start with respirator selection and medical evaluation (OSHA, 1998). If an individual working in agriculture is approved to wear a respirator, they may be fit tested. Options for follow-up or alternative solutions are available if the respirator cannot be worn or the fit test fails. This includes several elements of education and outreach, as detailed in steps (a–e), below.

- (a) On-farm hazard identification and respirator selection. Accurate hazard identification is crucial to select the appropriate respirator (OSHA, 1998). While FFRs (also commonly called N95s) are suitable for many airborne hazards in agriculture (\$1–5), more complex exposures, such as pesticides or ammonia, may require half-face (\$35–80) or full-face respirators (\$100–400) with combined particulate and gas/vapor filtration (Donham &

Thelin, 2016). To facilitate informed decision-making, individuals working in agriculture should be empowered to select appropriate respirators. They should be informed regarding where to access resources, such as label interpretation assistance, or to receive guidance from local experts such as occupational health nurses. Given the diverse nature of agricultural work, it is likely that a single individual may need multiple respirators on their farm. The initial cost of such devices is generally affordable, but there are ongoing expenses for replacement respirators or cartridges. Rural agricultural communities can work to identify individuals or organizations (e.g., health care clinics, cooperative extension, retailers, educational institutions, nonprofits, and producer associations) who can provide guidance on respirator selection.

- (b) Medical evaluation. Following OSHA's guidelines, individuals wearing the respirator must complete a Respirator Medical Evaluation Questionnaire addressing health conditions like lung issues, heart disease, and claustrophobia that could be impacted or exacerbated by wearing a respirator (OSHA Respirator Medical Evaluation Questionnaire, (Appx. C to the standard) or equivalent; 29 CFR 1910.134). Individuals in the local community may oversee the dissemination and collection of the Medical Evaluation Questionnaire. This includes, but is not limited to: physicians, physician's assistants, chiropractors, nurse practitioners, registered nurses, licensed practical nurses, pharmacists, respiratory therapists, technicians, veterinarians, vet technicians, educators, cooperative extension personnel, safety officers/managers, and farmers. The questionnaire responses are confidential and only accessible to authorized healthcare professionals (Figure 1). There are strategies for electronic versions of the questionnaire to be directly shared and stored on file with the designated physician or licensed health care provider; alternatively, individuals completing the questionnaire may place it in secure envelope. Since many U.S. farms are family owned, it can be difficult to navigate confidentially with family members, such as spouses and children working on the farm.

Health care professionals in rural agricultural areas, such as pharmacists, LPNs, RNs and nurse practitioners, physician assistants, and chiropractors can review medical questionnaires to determine respirator fit testing eligibility. To address confidentiality issues on family farms, health care professionals may offer to administer the questionnaire and review responses in person. If the questionnaire raises concerns about an individual's ability to wear a respirator safely due to medical conditions, a physician, nurse practitioner, or chiropractor will conduct a further medical evaluation. This evaluation may involve a physical exam, additional medical tests, and recommendations for alternative respirators (e.g., a powered air-purifying respirator [PAPR]).

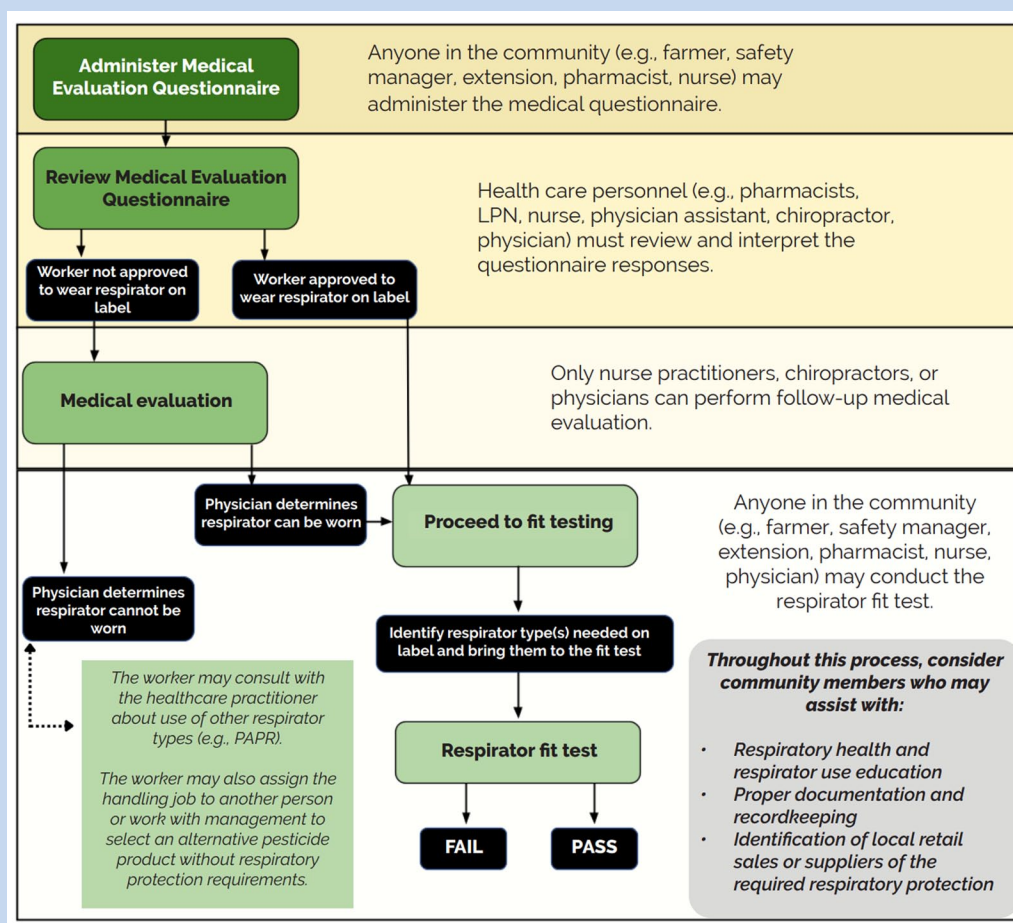


Figure 1. Flow chart for community-based medical evaluation and respirator fit testing. For specific details of this flow chart, see steps a to e in Results. Additional steps to facilitate community-based fit testing, such as education, record keeping, and local retail vendor involvement is also described. This flow chart is adapted from AHSA (2023a).

(c) Annual fit test for each respirator used. To ensure continued protection, fit testing must be performed annually for all respirator wearers, only after the Medical Evaluation has been completed (OSHA, 1998). Adherence to this requirement is essential for complying with agriculture-based policies such as the Worker Protection Standard (WPS). Respirator fit testing can be performed by trained members of the community. Respirator fit testing may take place in many locations in agricultural communities, such as medical offices, county health departments, cooperative extension offices, local pharmacies, schools, community colleges/vocational schools, or even directly on the agricultural establishment. Currently, there is no formal certification required to perform respirator fit testing.

Individuals working in agriculture (perhaps in coordination with local experts) should already have identified the type of respirator they want to use for a specific task and may bring

the respirator(s) to the fit test. A single fit test takes 20 to 30 minutes per individual, with additional time needed for those needing to try multiple sizes to obtain a fit. Fit testers should be able to recognize signs of discomfort (e.g., physical distress or claustrophobia), detect air leaks, and identify facial hair interference. It is crucial to have a variety of respirator sizes and models available to accommodate different face shapes and sizes. Sharing respirators should be discouraged. Fit testers should not provide fit testing for individuals with facial hair that contacts where the respirator touches the face; the NIOSH Facial Hair Guidance statement provides information on facial hair styles that may impede respirator use (NIOSH, 2017). Facial hair can compromise the respirator's ability to create a tight seal, reducing its effectiveness in protecting the wearer from airborne contaminants. If a participant refuses to shave (and therefore refuses participation), the fit tester should document the test refusal with facial hair impedance as the reason. This documentation is crucial for liability purposes.

Table 1. Services Offered by Community-Based Respirator Fit Testing Program.

Fee-for-service	Fee-for-service or free service	Free service
Medical questionnaire review	Respirator fit testing	Pesticide label interpretation
Medical evaluation/exams	Respirator use education (advanced*)	WPS consultation/training
Respiratory Protection Program (RPP) administration, industrial hygiene consultation	RPP administration, documentation	Respirators use education and general promotion or use
Retail sales of respirators		Guidance on respirator purchase
		Community-outreach programs

*Advanced respirator use education would focus on more skills required for using respirators in demanding environments, such as responding to natural disaster (e.g., floods) or biosecurity issues and zoonotic disease outbreaks on farms.

Respirator fit testing may also be viewed as an educational activity. During the test, a fit tester will demonstrate proper donning (including positive and negative respirator seal check checks) and doffing procedures for the wearer. It is important to encourage the wearer to practice these necessary steps before and after the fit test occurs.

(d) Annual training on respirator use. Agricultural workers wearing required respirators should undergo respirator training annually or when assigned a new respirator, if following regulations according to OSHA RPP (29 CFR 1910.134). This annual training should be documented. It is important to note that not all agricultural tasks or voluntarily worn respirators may require annual training under current regulations, but it should be highly recommended due to the evolving nature of respirator science and education (OSHA, 1998). Rural agricultural communities can provide annual respirator training events with documentation provided. Occupational health nurses are uniquely positioned to develop and deliver comprehensive respirator training programs, thereby ensuring workers thoroughly understand the importance of proper respirator use and maintenance. However, respirator education and training may not be limited to a single annual event; it can be effectively integrated at any stage of the respirator fit-testing process. This includes during respirator selection, medical evaluation, the actual fit test, and at separate yearly training events. Respirator training should cover the following topics:

- Respirator types, selection, and how to obtain (address accessibility and cost);
- Importance of proper respirator fit and seal;
- Donning and doffing procedures, including respirator fit checks;
- Respirator storage and care (e.g., washing, reuse, discarding policies, disinfection if necessary);
- Respirator replacement policies or suggested respirator replacement activities; and

- How to identify problems or issues with the respirator (incorrect fit, damage).

Annual respirator training should be viewed as a separate activity from fit testing, although, as mentioned, some education may be necessary during the fit test process.

- Documentation of all requirements. Documentation should include records of identified farm hazards and respirators selected, medical evaluations for wearers (confidentially maintained), annual fit test results, respirator cleaning and maintenance procedures, and training materials. Adherence to documentation practices during fit testing can potentially alleviate liability concerns. Respirator fit test records should include the date, names, job classification, agricultural establishment name, fit test method, and fit test results for each type of respirator. Problems encountered with specific respirator types (make/model) should be noted. This record should be maintained for 2 years (written or electronic).

Discussion

Other Recommendations for Community-Based Respirator Fit Testing Programs

Agricultural communities may need to rely on more than one individual or organization to fulfill all the roles and responsibilities of a *Community Based Respirator Fit Testing Program*. Community members should decide what items require a fee-for-service structure, and what items are provided free of charge (Table 1). Fee-for-service items may include medical questionnaire review and medical evaluations since they require clinical expertise. Some items may be provided, and sometimes at no cost, by government entities, educational institutions, or community-based organizations. These items include assisting with respirator selection (e.g., product label interpretation for pesticides, fertilizers, disinfectants, or cleaning

solutions), medical questionnaire promotion and dissemination, continued respirator use education, WPS compliance consultation, and local guidance on where to purchase respirators. Items like respirator fit testing and more advanced training (fit testing, respirator use education, and OSHA-compliant RPP administration) are offered as fee-for-service or be provided free of charge.

Community-Based Respirator Fit Testing Programs necessitate collaborative efforts, with roles and responsibilities directly linked to the scope of practice for licensed healthcare professionals, including occupational health nurses. Success extends beyond just respirator fit testing, encompassing many items that are often overlooked.

For example, retailers and vendors (such as safety supply stores and farm supply stores) play a crucial role and could be actively integrated into program planning. They can improve by providing guidance on how to select appropriate respirators for shoppers and should be involved in information agricultural workers about label interpretation. One caveat is that retailers fear liability for providing wrong advice on respirator selection. However, retailers may be a useful partner to distribute printed materials that help individuals working in agriculture recognize specific tasks worthy of respirator use.

Challenges

Some challenges to establishing and maintaining such programs in rural and agricultural communities include (but are not limited to):

- (a) substantial cost of respirator fit testing equipment,
- (b) limited rural healthcare provider engagement or recognition of fit testing as a clinical service,
- (c) inadequate health care provider knowledge about agricultural respirator requirements,
- (d) confusion about roles and responsibilities for fit testing,
- (e) limited community awareness about respiratory protection,
- (f) distance to existing services,
- (g) lack of culturally or linguistically appropriate respiratory health resources,
- (h) limited local access to retail respirators and filter cartridges, and lack of knowledge as to where to purchase these items; and
- (i) fit tester concerns about documentation and liability.

The largest challenges identified in workshops were (e) limited community awareness about respiratory protection and (f) distance to existing services, as these were both mentioned at every Respirator Fit Test Workshop in each of the five states visited.

It is highly likely that individuals working on farms have become somewhat familiar with working in hazardous environments due to generational involvement in production

and the overall lack of enforcement of respirator use in this sector. The authors hypothesize that the demanding and time sensitive nature of agricultural work often prioritizes getting tasks done quickly, and therefore “task-based guidance” (as offered in Supplemental Figure 1) is more likely to be positively received (Arora et al., 2020; Grocke-Dewey et al., 2023).

Distance to existing fit test services (e), often in combination with limited rural healthcare provider provision of fit testing (b) continues to be a concern. While some cooperative extension agencies provide referrals for fit testing services, these often refer to urban areas or out-of-state clinics (Mississippi State Cooperative Extension, 2023), where hospitals and occupational health clinics are more readily available. Individuals working with pesticides in rural areas face substantial challenges accessing these services, frequently encountering long travel distances or extended wait times (Davalos, 2024).

Implications for Occupational Health Nursing

Occupational health nurses (OHNs) can play a key role as advocates for respirator use in agricultural populations. Their involvement may extend beyond administering respirator fit testing—for example they may be involved in multiple facets of a community-based respirator fit testing program. For example, OHNs are suited to review medical evaluation questionnaires and lead appropriate training programs for their communities on respirator use and maintenance. If located in more urban areas, they may be able to collaborate with extension offices and more rural healthcare clinics to offer scheduled respirator fit testing services. They should consider how to integrate the services (steps a–e) into their existing practices and partnerships, and to evaluate whether they are currently serving the unique needs of the rural agricultural population.

Conclusions

This paper has reviewed the vital role of respiratory protection in safeguarding the health of individuals working in the agricultural sector. While self-reported use of respirators has increased in recent years, it is important to ensure proper use through *Community Based Respirator Fit Testing Programs* in rural areas with occupational health nurses playing an important role. In the U.S., many rural and agricultural communities still have limited access to resources for appropriate respirator fit testing. *Community Based Respirator Fit Testing Programs* require involvement from both healthcare providers and several overlooked collaborators such as educators, agricultural organizations, policymakers, and PPE vendors. It is important to continue raising awareness about the benefits of respiratory protection in agricultural communities while addressing concerns about regulatory compliance. Rural communities can explore more affordable fit respirator testing methods and engage a spectrum of community partners in the process. Further research is needed on the impact of voluntary respirator

use in agricultural communities and the effectiveness of community based fit testing programs.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Human Subjects

Not applicable. This Professional Practice manuscript is based on the authors' experience developing and implementing respirator fit test training programs in rural and agricultural communities, including observations of program effectiveness and application of two respirator fit test training guides. While feedback was gathered to improve training delivery, no formal research involving human subjects was conducted for this publication.

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Supplemental Material

Supplemental material for this article is available online.

References

- Ag Health and Safety Alliance. (2021). *Respirator fit test capacity building guide*. <https://aghealthandsafety.com/respiratory/>
- Ag Health and Safety Alliance. (2023a). *Respirator fit test guide: Agricultural pesticides handling*. <https://aghealthandsafety.com/respiratory/>
- Ag Health and Safety Alliance. (2023b). *Save your breath: Respiratory health in agriculture* (3rd ed.). <https://aghealthandsafety.com/category/respiratory/page/2/>
- American Public Health Association. (2017). *Improving working conditions for U.S. farmworkers and food production workers*. Policy brief. <https://www.apha.org/policy-and-advocacy/public-health-policy-briefs/policy-database/2018/01/18/improving-working-conditions>
- Arora, K., Cheyney, M., Gerr, F., Bhagianadh, D., Gibbs, J., & Anthony, T. R. (2020). Assessing health and safety concerns and psychological stressors among agricultural workers in the U.S. Midwest. *Journal of Agricultural Safety and Health*, 26(1), 45–58. <https://doi.org/10.13031/jash.13660>
- Calvert, G. M., Karnik, J., Mehler, L., Beckman, J., Morrissey, B., Sievert, J., Barrett, R., Lackovic, M., Mabey, L., Schwartz, A., Mitchell, Y., & Moraga-McHaley, S. (2008). Acute pesticide poisoning among agricultural workers in the United States, 1998–2005. *American Journal of Industrial Medicine*, 51(12), 883–898. <https://doi.org/10.1002/ajim.20623>
- Chen, R., Hu, B., Lie, Y., Xu, J., Yang, G., Xu, D., & Chen, C. (2016). Beyond PM2.5: The role of ultrafine particles on adverse health effects of air pollution. *Bioclimica et Biophysica Acta (BBA)-General Subjects*, 1860(12), 2844–2855.
- Clayton, M., & Vaughan, N. (2005). Fit for purpose? The role of fit testing in respiratory protection. *Annals of Occupational Hygiene*, 49(7), 545–548. <https://doi.org/10.1093/annhyg/mei046>
- Cramer, M. E., Wendl, M. J., Sayles, H., Duysen, E., & Achutan, C. (2017). Knowledge, attitudes, and practices for respiratory and hearing health among Midwestern farmers. *Public Health Nursing*, 34(4), 348–358. <https://doi.org/10.1111/phn.12306>
- D'Alessandro, M., Casey, M., & Cichowicz, J. H. (2020). The need for fit testing during emerging infectious disease outbreaks. *NIOSH Science Blog*. <https://blogs.cdc.gov/niosh-science-blog/2020/04/01/fit-testing-during-outbreaks/>
- Davalos, R. (2024, July). *Respiratory protection requirements in Florida* [Oral presentation]. WPS Stakeholder Meeting, EPA Region 4.
- Doney, B. C., Groce, D. W., Campbell, D. L., Greskevitch, M. F., Hoffman, W. A., Middendorf, P. J., Syamlal, G., & Bang, K. M. (2005). A survey of private sector respirator use in the United States: An overview of findings. *Journal of Occupational and Environmental Hygiene*, 2(5), 267–276. <https://doi.org/10.1080/15459620590949020>
- Donham, K., & Thelin, A. (2016). Agriculture respiratory diseases. In K. Donham & A. Thelin (Eds.), *Agricultural medicine: Rural occupational and environmental health, safety, and prevention* (2nd ed., pp. 95–143). Wiley and Sons.
- Faria, N. M. X., Facchini, L. A., Fassa, A. G., & Tomasi, E. (2006). Farm work, dust exposure and respiratory symptoms among farmers. *Revista de Saúde Pública*, 40(5), 827–836. <https://doi.org/10.1590/s0034-89102006005000006>
- Garrigou, A., Laurent, C., Berthet, A., Colosio, C., Jas, N., Daubas-Letourneux, V., Jackson Filho, J.-M., Jouzel, J.-N., Samuel, O., Baldi, I., Lebailly, P., Galey, L., Goutille, F., & Judon, N. (2020). Critical review of the role of PPE in the prevention of risks related to agricultural pesticide use. *Safety Science*, 123, Article 104527. <https://doi.org/10.1016/j.ssci.2019.104527>
- Gibbs, J., Sheridan, C., Anderson, M., & Janssen, B. (2021, June). *Lessons from a respiratory health and respirator fit test training workshop in Iowa* [Technical paper presentation]. International Society for Agricultural Safety and Health (ISASH) Technical Manuscript 21-002, ISASH Conference, Virtual.
- Gibbs, J. L., Sheridan, C., Sullivan, D., Rautiainen, R., Nonnenmann, M. W., & Wyatt, T. A. (2023). Self-reported respiratory health symptoms and respiratory protection behaviors of young adult hog producers in the United States. *American Journal of Industrial Medicine*, 66(9), 794–804. <https://doi.org/10.1002/ajim.23515>
- Greskevitch, M., Doney, B., Groce, D., Syamlal, G., & Bang, K. M. (2008). Respirator use and practices in agricultural crop production establishments. *Journal of Agromedicine*, 12(3), 25–31. <https://www.tandfonline.com/doi/full/10.1080/10599240801887801>
- Grisso, R. (2020a). *Respiratory protection in agriculture* (Publication No. 442-601, BSE-286P). Virginia Cooperative Extension.
- Grisso, R. (2020b). *Farmer's lung: Causes and symptoms of mold and dust induced respiratory illness* (Publication No. 442-602, BSE-287P). Virginia Cooperative Extension.
- Grocke-Dewey, M., Brennan, A., Freeman, B., Weas, H., Gutheil, J., Stallones, L., & McMoran, D. (2023). Perceived stress, stressors, and preferred stress management strategies among western agricultural

- producers. *Journal of Rural Mental Health*, 47(3), 152–162. <https://doi.org/10.1037/rmh0000233>
- Jeyaretnam, J., & Jones, H. (2000). Physical, chemical and biological hazards in veterinary practice. *Australian Veterinary Journal*, 78(11), 751–758.
- Kearney, G. D., Gallagher, B., & Shaw, R. (2016). Respiratory protection behavior and respiratory indices among poultry house workers on small, family-owned farms in North Carolina: A pilot project. *Journal of Agromedicine*, 21(2), 136–143. <https://doi.org/10.1080/1059924x.2016.1143429>
- Kearney, G. D., Shaw, R., Prentice, M., & Tutor-Marcom, R. (2014). Evaluation of respiratory symptoms and respiratory protection behavior among poultry workers in small farming operations. *Journal of Agromedicine*, 19(2), 162–170. <https://doi.org/10.1080/1059924x.2014.886536>
- LeJeune, J., & Kersting, A. (2010). Zoonoses: An occupational hazard for livestock workers and a public health concern for rural communities. *Journal of Agricultural Safety and Health*, 16(3), 161–179.
- Mississippi State Cooperative Extension. (2023). *Providers of medical clearance and respirator fit testing in Mississippi* (Publication No. P3023).
- Mitchell, D. C., & Schenker, M. B. (2008). Protection against breathing dust: Behavior over time in Californian farmers. *Journal of Agricultural Safety and Health*, 14(2), 189–203. <https://doi.org/10.13031/2013.24350>
- Mpofu, D., Lockinger, L., Bidwell, J., & McDuffie, H. H. (2002). Evaluation of a respiratory health program for farmers and their families. *Journal of Occupational and Environmental Medicine*, 44(11), 1064–1074.
- National Institute for Occupational Safety and Health. (2017). *Facial hairstyles and filtering facepiece respirators* (Infographic). Centers for Disease Control and Prevention. [Note: This infographic was removed from the NIOSH website in 2025].
- National Institute for Occupational Safety and Health. (n.d.). *Notice: Respirator approval program's updated position regarding facial hair and the selection and use of respiratory protective devices* (Revised – Supersedes the August 2018 version and the October 2, 2006 Letter to All Respirator Manufacturers). Centers for Disease Control and Prevention.
- Nordgren, T. M., & Bailey, K. L. (2016). Pulmonary health effects of agriculture. *Current Opinion in Pulmonary Medicine*, 22(2), 144–149. <https://doi.org/10.1097/MCP.0000000000000247>
- Nordgren, T. M., & Charavaryamath, C. (2018). Agriculture occupational exposures and factors affecting health effects. *Current Allergy and Asthma Reports*, 18(12), Article 65. <https://doi.org/10.1007/s11882-018-0820-8>
- Occupational Safety and Health Administration. (1998). *29 CFR 1910.134 Respiratory protection. Code of Federal Regulations*, Title 29, Labor, Part 1910, Subpart I - Personal Protective Equipment, Section 134 - Respiratory protection & Appendix A.
- Occupational Safety and Health Administration. (2023). *Small entity compliance guide for the respiratory protection standard*. U.S. Department of Labor. <https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf>
- Oregon OSHA. (n.d.). *OAR 437-002-1081 and OAR 437-004-9791*. Oregon Department of Consumer and Business Services.
- Pate, M. L., Beard, R., & Hall, K. (2016). Utah regional differences in respirator use and fit testing among pesticide applicators. *Journal of Agricultural Safety and Health*, 23(1), 55–66. <https://doi.org/10.13031/jash.11765>
- Patel, O., Syamlal, G., Henneberger, P. K., Alarcon, W. A., & Mazurek, J. M. (2018). Pesticide use, allergic rhinitis, and asthma among US farm operators. *Journal of Agromedicine*, 23(4), 327–335. <https://doi.org/10.1080/1059924x.2018.1501451>
- Pesticide Educational Resources Collaborative. (2017). *Worker Protection Standard (WPS) respiratory protection guide*. <https://www.pesticideresources.org/migrated/wps/hosted/PERC-WPS-Respirator-Guide.pdf>
- Peters, T. M., Anthony, T. R., Taylor, C., Altmaier, R., Anderson, K., & O'Shaughnessy, P. (2012). Distribution of particle and gas concentrations in swine gestation confined animal feeding operations. *Annals of Occupational Hygiene*, 56(9), 1080–1090. <https://doi.org/10.1093/annhyg/mes050>
- Popendorf, W., Merchant, J. A., Leonard, S., Burmeister, L. F., & Olenchok, S. A. (1995). Respirator protection and acceptability among agricultural workers. *Applied Occupational and Environmental Hygiene*, 10(7), 595–605. <https://doi.org/10.1080/1047322x.1995.10387652>
- Strong, L. L., Thompson, B., Koepsell, T. D., & Meischke, H. (2008). Factors associated with pesticide safety practices in farmworkers. *American Journal of Industrial Medicine*, 51(1), 69–81. <https://doi.org/10.1002/ajim.20519>
- Syamlal, G., Schleiff, P. L., Mazurek, J. M., Doney, B., & Greskevitch, M. (2013). Respirator use among US farm operators: Evidence from the 2006 Farm and Ranch Safety Survey. *Journal of Agromedicine*, 18(1), 27–38. <https://doi.org/10.1080/1059924x.2012.743379>
- United States Congress. (1970). *Occupational Safety and Health Act of 1970*. Pub. L. 91-596, § 5(a)(1), 84 Stat. 1590.
- United States Environmental Protection Agency. (1972). *Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)*. Pub. L. No. 92-80, 85 Stat. 504, codified at 7 U.S.C. §§ 136–136y.
- Vogel, C. (2023, November). *Surveillance: Rates of self-reported PPE amount in Midwest farmers* [Oral presentation]. Midwest Rural and Agricultural Safety Conference (MRASH), Dubuque, IA, United States.
- Wierda, M. R., Hygnstrom, J. R., Hoidal, N., Walker, T., Wilburn, J., Tutor Marcom, R., Herzfeld, D., Sargent, K., Richards, K., Maccini, R., & Bartholomew, C. (2021). Building capacities to conduct respirator fit testing for pesticide applicators. *The Journal of Extension*, 59(3), Article 14. <https://doi.org/10.34068/joe.59.03.14>
- Ye, M., Beach, J., Martin, J. W., & Senthilselvan, A. (2013). Occupational pesticide exposures and respiratory health. *International Journal of Environmental Research and Public Health*, 10(12), 6442–6471. <https://doi.org/10.3390/ijerph10126442>
- Yost, O. C., Downey, A., & Samet, J. (2022). The regulatory landscape regarding respiratory protection. In *Frameworks for protecting workers and the public from inhalation hazards*. National Academies Press (US).