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Community Assessment of Chemical Exposures After a Train Derailment—East Palestine, Ohio, and Darlington Township, Pennsylvania, February–March 2023

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Objective: This study aimed to evaluate chemical exposures and health effects after a train derailment in Ohio, near the Pennsylvania border. **Methods:** Cross-sectional data (February–March 2023) on symptoms, exposures, medical care, and needs were collected using the Assessment of Chemical Exposures toolkit. Associations between exposures and symptoms were analyzed using logistic regression. **Results:** Participants reported chemical exposures (86%), mental health symptoms (70%), and physical symptoms (92%). Ears, nose, or throat symptoms (80%) and headache (76%) were the most common. Forty-one percent sought medical care, and 44% had unmet needs. Participants aged 18–64 years had higher odds of experiencing ophthalmic (odds ratio [OR], 1.51; 95% confidence interval [CI], 1.04–2.19), neurological (OR, 2.40; 95% CI, 1.51–3.83), and dermatological symptoms (OR, 1.50; 95% CI, 1.04–2.15), compared with participants aged ≥65 years. **Conclusions:** Most participants experienced chemical exposures, symptoms, and needs. Findings supported the establishment of a permanent health clinic.

Keywords: train derailment, emergency response, community health, environmental public health, assessment of chemical exposures (ACE)

CME Learning Objectives

After completing this enduring educational activity, the learner will be better able to:

- Analyze the relationships between age, gender, and survey administration method and the likelihood of reporting physical and mental health symptoms during the ACE investigation.
- Describe the ongoing needs, and physical and mental health symptoms reported by Ohio and Pennsylvania residents in an Assessment of Chemical Exposures conducted after a train derailment.
- Describe how lessons learned from this response after a train derailment in Ohio could improve future emergency response efforts in this community.

On February 3, 2023, a cargo train carrying hazardous chemicals derailed in East Palestine, Ohio, near the Pennsylvania border, resulting in a fire. Hazardous chemicals of concern included vinyl chloride, ethylene glycol, ethylhexyl acrylate, isobutylene, and butyl acrylates.[1] Local authorities issued a shelter-in-place order for residents of East Palestine, Ohio. Firefighters and hazardous materials teams were unable to contain the fire, resulting in evacuation orders and recommendations being sent to Ohio and Pennsylvania residents within a 1-mile radius of the incident site.

Information provided by the railroad company and its contractors prompted concern that a train car containing vinyl chloride was becoming unstable and might explode.[2] At the time, a decision was made to expand the evacuation zone and perform a controlled vent and burn (A controlled vent and burn relieve excessive internal vapor pressure from the tank car and drains the liquid product for disposal by controlled burning.)[3] of the derailed cars containing vinyl chloride, which was

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conducted on February 6, 2023.[2] The evacuation orders and recommendations for both states were lifted by February 8, 2023, allowing residents to return to their homes.

The Ohio Department of Health (ODH) and the Pennsylvania Department of Health (PADOH) requested assistance from the Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) to implement an Assessment of Chemical Exposures (ACE) investigation. An ACE investigation is a rapid, epidemiological assessment used to assess the health effects of an incident concerning persons and their communities.[4] It also provides response guidance to state and local health departments and identifies persons exposed to hazardous chemicals who might require follow-up to determine long-term effects of the incident.[4] The ACE toolkit includes modifiable health surveys to collect relevant information (eg, symptoms and hazardous chemical exposure data) to guide emergency and response efforts.[4]

This paper presents results from the community health survey conducted as part of the ACE investigation after the train derailment affecting East Palestine, Ohio, and Darlington Township, Pennsylvania. The survey was administered after evacuation orders were lifted, and while active environmental remediation was ongoing. Additionally, we explored the association between self-reported symptom categories stratified by three age groups to explore differences in symptom presentation by age.

METHODS

Investigation Setting

On February 16, 2023, a team from CDC and ATSDR, in collaboration with ODH, PADOH, and Columbiana County General Health District, initiated an ACE investigation in East Palestine, Ohio, and Darlington Township, Pennsylvania. East Palestine, Ohio, located in Columbiana County, had an estimated population of 4800 people and 2000 households.[5] Approximately 89% of the population was White, and 9% was Hispanic; 21% of the population was aged ≥65 years.[6] In East Palestine, 8% of the population lived below the federal poverty level (compared with 13% in Ohio).[5] Similarly, in Columbiana County, 95% of the population was White, and 2% was Hispanic; 23% of the population was aged ≥65 years.[7]

Darlington Township, located in Beaver County, Pennsylvania, had an estimated population of 1900 people and 780 households.[8] Approximately 97% of the population was White, and 19% was aged ≥65 years. Six percent of people lived below the federal poverty level, which is approximately half the poverty rate of Pennsylvania (12%).[8] In Beaver County, 90% of the population was White, and 3% was Hispanic; 23% of the population was aged ≥65 years.[9] Approximately 10% of the population from this county lived below the federal poverty level, which is lower than the US population (12%).[9] During 2018–2022, an estimated 91% and 86% of households had a computer and broadband Internet connection, respectively.[9] Darlington Township is demographically similar to Beaver County, Pennsylvania.

At the time of the train derailment, it was estimated that ~7000 people lived within the 2-mile radius surrounding the incident area.[10]

Survey Design

During February 21, 2023–March 31, 2023, cross-sectional data were collected using a community ACE survey tool. The ACE survey tool collected detailed information regarding demographics, sources of emergency and derailment-related information, evacuation status, perceived chemical exposures, symptoms experienced, health care received, needs resulting from the incident, and health effects on pets and livestock. For Pennsylvania residents, additional questions about agricultural concerns were included. Animal and agricultural data were not analyzed for this paper. The survey was developed and managed using REDCap software (Project REDCap for ODH and REDCap Cloud for PADOH).[11,12]

Participants

Survey participants were present in the investigation area defined as "East Palestine, Ohio, Darlington Township, Pennsylvania, or surrounding areas" on or after the train derailment until the end of the data collection (see Fig. 1 for investigation area). For persons aged <18 years, a parent or guardian completed the survey on their behalf. All participants consented to complete the survey. A separate ACE survey of first responders was completed, and the results are presented elsewhere.[13] The community ACE survey activity was reviewed by the CDC Institutional Review Board, subsequently deemed not research, and conducted consistent with applicable federal law and CDC policy (45 C.F.R. part 46.102(l) (2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq).

Data Collection

Surveys were conducted in person by health care and public health professionals or self-administered online. Survey completion was promoted through flyer distribution, news outlets, and social media posts, and by the poison centers of Ohio and Pennsylvania. Three methods of survey administration for data collection were implemented in overlapping stages.

1. Temporary health and resource centers (HRCs): One HRC was established in Ohio by ODH in collaboration with the Columbiana County General Health District, and another in Pennsylvania by PADOH. Health center staff administered the survey and offered immediate basic health assessments and referrals, on-site mental health support, emergency supplies, and informational pamphlets. Survey administration occurred during February 21–March 31, at the HRC in Ohio, and during February 28–March 31, at the HRC in Pennsylvania.

Conflict of Interest: W.V. declares that they received reimbursement for costs associated with the train derailment response from Norfolk Southern. This financial relationship did not influence the study design, data collection, interpretation, or conclusions. None were declared by the rest of the coauthors.

Disclaimer Statement (as required by CDC/ATSDR): The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry.

Ethics Approval and Consent to Participate (as included in the Methods section): All participants consented to complete the survey. The community ACE survey activity was reviewed by the CDC Institutional Review Board, subsequently deemed not research, and conducted consistent with applicable federal law and CDC policy (45 C.F.R. part 46.102(l) (2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq).

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Data Availability: The datasets generated and/or analyzed during the current study are not publicly available to protect participants' privacy but are available from the Ohio Department of Health and the Pennsylvania Department of Health on reasonable request.

AI Statement: No AI was utilized at any stage for this paper.

STROBE Checklist: We used the STROBE Guidelines for observational studies to report on our findings. The STROBE checklist is available as SDC.

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FIGURE 1. Community Assessment of Chemical Exposures investigation area defined as East Palestine, Ohio, Darlington Township, Pennsylvania, and surrounding areas. Ninety-nine percent of survey participants reported their home residence or being present in the geographic area depicted in blue on or after the train derailment during February 3, 2023–March 31, 2023.

2. Door-to-door surveys: ATSDR's Geospatial Research, Analysis, and Services Program mapped all households located within the 1- and 2-mile radius around the derailment site, and the proximate neighborhood downstream from Leslie Creek (resulting from the concerns of potential chemical runoff to waterways) for door-to-door canvassing. Additionally, neighborhood response rates were calculated using residential addresses to prioritize areas with <1% survey response rates for door-to-door canvassing. Residences were visited once by the field investigators administering and promoting the survey. Flyers containing HRC information, a survey link, and a QR code for self-administration were provided to residents when a door-to-door survey could not be completed at the time of canvassing. Additionally, flyers were left at unresponsive residences. On February 25, the field team conducted door-to-door canvassing in Ohio where only flyers were dropped. Subsequently, door-to-door survey administration was conducted on March 2 and March 6. In Pennsylvania, door-to-door survey administration was completed on February 26 and March 4.
3. Self-administered electronic surveys: Surveys were completed using a web link or QR code. This link/code was advertised to eligible people to self-administer the survey, in addition to the other options for survey completion. Participants received information about resources after survey completion. Surveys could be self-administered online during February 25–March 31.

Measures and Variables

Demographics

Age was categorized into <18, 18–64, and ≥65 years to represent the life stages of child, working aged, and retired or older adults, respectively. Participants were asked about their Hispanic or Latino ethnicity and could select multiple race options. Gender was categorized as male, female, declined, or missing.

Exposures

Participants reported contact with smoke, dust, debris, or other substances related to the train derailment and their exposure to hazardous chemical substances through air, water, or soil. Odors were described from a predefined list (eg, gasoline or chemical smell), with open text for unlisted odors. Participants could select multiple exposure answers.

Health Outcomes

Participants self-reported new onset or worsening of pre-existing symptoms after the train derailment in specific categories, including ears, nose or throat; ophthalmic; neurological; cardiopulmonary; dermatological; and mental health (see Supplemental Digital Content 1, http://links.lww.com/JOM/C286, which lists all symptoms). Participants could select multiple symptom categories. Using these categories, participants could select multiple symptoms from a total of 52 predefined individual symptoms (see Supplemental Digital Content 1, http://links.lww.com/JOM/C286). For analysis, participants were considered symptomatic if they reported any symptom within a category, with mental health symptoms analyzed separately.

Health Care Received

Participants indicated the highest level of health care received after the incident and the timing of medical care. The levels of health care included hospitalization, emergency department visits, urgent care, outpatient clinic visits, or telephone or video consultations. Self-treatment and no health care needed were classified as not receiving medical care. Participants had the option of reporting multiple visits at different times. The level and timing of health care were calculated for participants reporting any symptoms.

Unmet Needs

Participants indicated their unmet needs resulting from the train derailment from a predefined list (eg, water or medical care), with open text for additional unlisted needs. Participants could select multiple answers.

TABLE 1. Demographic Characteristics of Survey Participants (*N* = 701)—East Palestine, Ohio, and Darlington Township, Pennsylvania, February–March 2023

	Number (%)
Gender	
Female	444 (63.3)
Male	248 (35.4)
Declined	3 (0.4)
Missing	6 (0.9)
Race	
White	671 (95.7)
Other	5 (0.7)
Prefer not to answer	5 (0.7)
Missing	20 (2.9)
Ethnicity	
Not Hispanic or Latino	656 (93.6)
Hispanic or Latino	17 (2.4)
Prefer not to answer	10 (1.4)
Missing	16 (2.3)
Age (yr)	
<18	33 (4.7)
18–64	427 (60.9)
≥65	205 (29.2)
Missing	36 (5.1)

Data Analysis

Frequencies and percentages were calculated for demographic information, exposures, health outcomes, health care received, and unmet needs. Unadjusted logistic regression models were used to estimate crude odds ratios (ORs) and 95% confidence intervals (CIs) for the association between each symptom category, age group, gender, and method of survey administration The reference groups were age category ≥65 years, female, and survey administered at HRCs, respectively. Statistical significance was defined as 95% CIs not crossing the null of 1.0. Analyses were performed using SAS® software (version 14.1, SAS Institute Inc., Cary, NC).

We adhered to the STROBE Guidelines for observational studies to report our findings (for further information, see Supplemental Digital Content 2, http://links.lww.com/JOM/C287).

RESULTS

Demographics

A total of 701 surveys were completed; the majority was administered at HRCs (*n* = 458; 65%), followed by self-administration (*n* = 193, 28%) and door-to-door canvassing (*n* = 50, 7%). Participants were predominantly White (96%), not Hispanic or Latino (94%), and female (63%). Median age was 57 years (range, 1–90 years; Table 1).

Exposures

Most participants reported contact with smoke (*n* = 443, 63%), followed by dust (*n* = 328, 47%) and debris (*n* = 137, 20%; see Supplemental Digital Content 3 for detailed results, http://links.lww.com/JOM/C288). Moreover, 22% (*n* = 158) of participants were unsure of the type of substance they had contact with from the derailment. In total, 86% (*n* = 600) of participants reported they were exposed to hazardous chemical substances. Among those, 96% (*n* = 574) reported they were exposed to hazardous chemical substances through the air, 46% (*n* = 276) through water, and 46% (*n* = 274) through soil; 83% of survey participants reported smelling an odor. The most described odors were chemical (*n* = 370, 63%), sweet (*n* = 132, 23%), smoke (*n* = 102, 17%), and paint or paint thinner (*n* = 78, 13%).

Health Outcomes

In total, 92% (*n* = 642) of survey participants self-reported at least one new or worsening physical symptom after the train derailment, with 32% (*n* = 197) experiencing 11 or more physical symptoms. Of participants reporting physical symptoms, the most frequently reported individual symptoms included headache (*n* = 488; 76%), coughing (*n* = 328; 51%), and eye irritation, pain, or burning (*n* = 322; 50%; Fig. 2). Symptoms of the ears, nose, or throat were the most reported category (*n* = 560; 80%), followed by neurological (*n* = 530; 76%), cardiopulmonary (*n* = 444; 63%), ophthalmic (*n* = 422; 60%), and dermatological (*n* = 308; 44%; Fig. 3).

Logistic regression analysis showed that participants aged 18–64 years had higher odds of experiencing ophthalmic symptoms (OR, 1.51; 95% CI, 1.04–2.19), neurological symptoms (OR, 2.40; 95% CI, 1.51–3.83), and dermatological symptoms (OR, 1.50; 95%

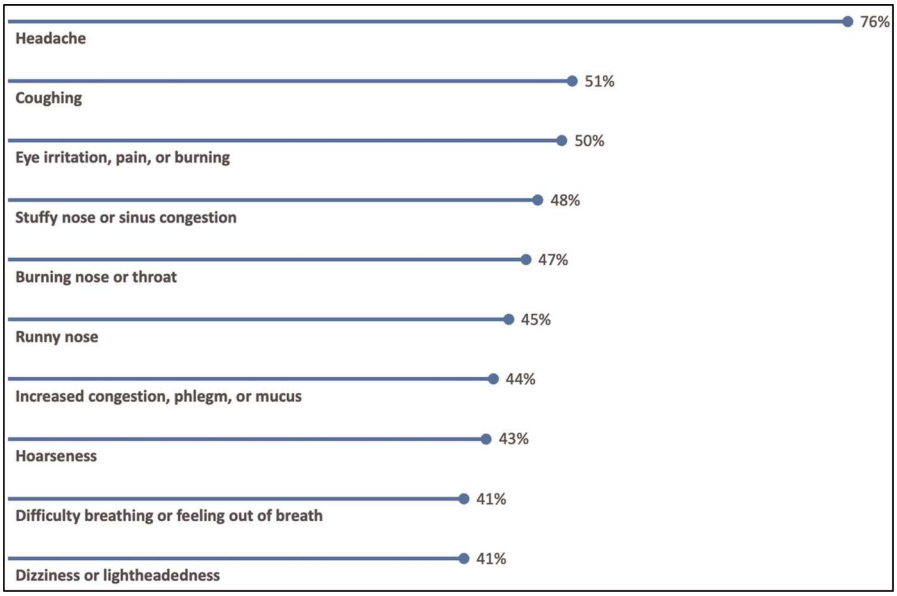

FIGURE 2. The top 10 physical symptoms among survey participants experiencing ≥1 new or worsening physical symptom after the train derailment affecting East Palestine, Ohio, and Darlington Township, Pennsylvania, February–March 2023. Symptoms are not mutually exclusive (*N* = 642).

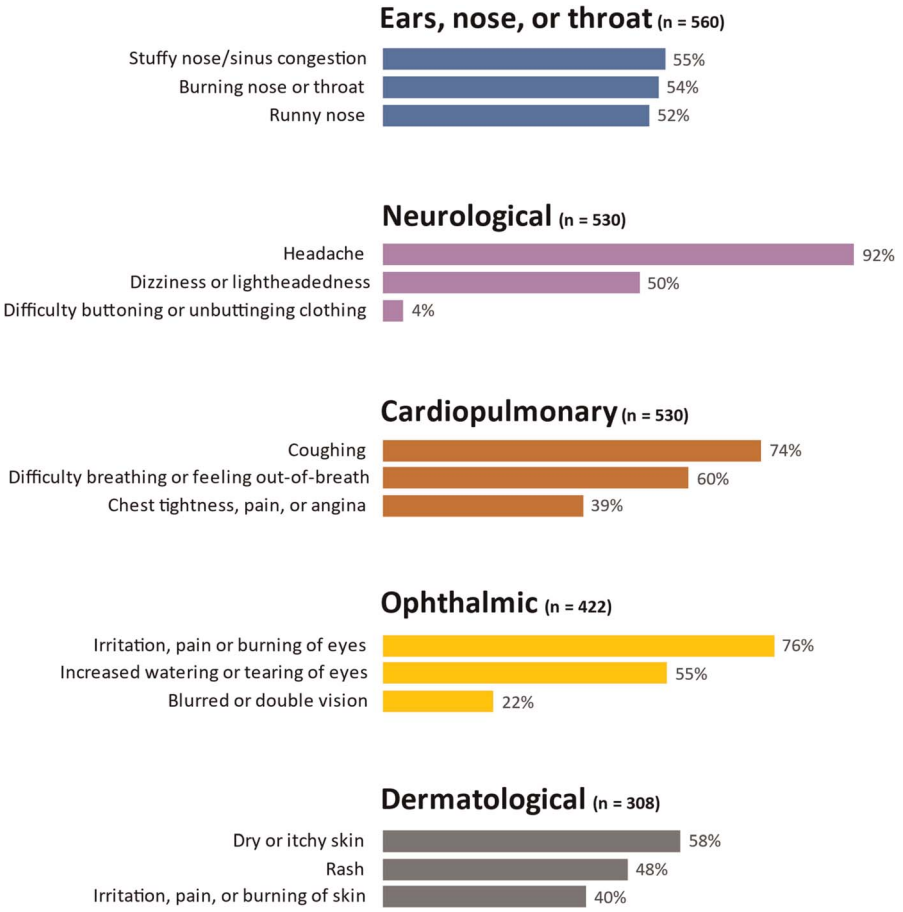

FIGURE 3. The top 3 most frequently reported individual symptoms by symptom category among survey participants experiencing ≥1 new or worsening physical symptom after the train derailment in East Palestine, Ohio, and Darlington Township, Pennsylvania, February–March 2023. Symptoms are not mutually exclusive, and symptom proportions are based on participants within that symptom category.

CI, 1.04–2.15), compared with participants aged ≥65 years. Additionally, the odds of experiencing dermatological symptoms were significantly higher among participants aged <18 years, compared with participants aged ≥65 years (OR, 2.53; 95% CI, 1.14–5.60; Table 2). Male participants had significantly lower odds of experiencing neurological symptoms (OR, 0.56; 95% CI, 0.36–0.88), compared with female participants. There were no statistically significant associations between gender and the other physical health symptoms categories. Participants completing the survey during the door-to-door activities (OR, 0.13; 95% CI, 0.06, 0.26) were significantly less likely to report at least one physical symptom than participants taking the survey at the HRCs.

Mental Health Outcome

In total, 70% (n = 493) of participants reported at least one new or worsening mental health symptom since the train derailment. Among these, the top 5 reported mental health symptoms included anxiety (n = 391; 79%), fatigue or tiredness (n = 313; 63%), difficulty sleeping, falling asleep, or staying asleep (n = 253; 51%), agitation or irritability (n = 209; 42%), and tension or nervousness (n = 230; 47%). Figure 4 shows the interrelatedness of mental health symptoms experienced by participants, with many participants experiencing ≥1 mental health symptom. A majority (n = 279; 56%) of participants reported experiencing ≥3 mental health symptoms, and 18% (n = 88) reported experiencing all 5.

Participants aged 18–64 years had the highest proportion experiencing ≥1 new or worsening mental health symptom (n = 318, 75%), followed by participants aged ≥65 years (n = 131, 64%) and <18 years (n = 19, 57.6%). Participants aged 18–64 years had significantly higher odds of experiencing ≥1 new or worsening mental health symptom compared with participants aged ≥65 years (OR, 1.88; 95% CI, 1.29–2.74; Table 2). There was no statistically significant difference between gender and reporting at least one mental health symptom. The likelihood of reporting mental health symptoms differed by method of survey administration. Participants completing a door-to-door survey (OR, 0.19; 95% CI, 0.10, 0.35) and those who self-administered the survey (OR, 0.55; 95% CI, 0.37, 0.81) had significantly lower odds of reporting at least one mental health symptom than those taking the survey at the HRCs.

Health Care Received

Among participants reporting any new or worsening physical or mental health symptoms (n = 654), fewer than half (41%) stated they received health care after the train derailment. Among 266 participants who reported receiving health care, 2% (n = 4) sought care <24 hours after the incident; 6% (n = 15), 1 or 2 days after the incident; 21% (n = 57), 3–5 days after the incident; and 73% (n = 193), ≥6 days after the incident. Most participants indicated they sought care at an emergency department, urgent care, or outpatient clinic (n = 177; 67%), followed by consulting a health care provider by telephone or video conference (n = 83; 31%). Six participants (2%) reported being hospitalized.

Unmet Needs

A total of 44% (n = 307) of survey participants reported having unmet needs after the train derailment. Among participants with unmet needs, the most frequently reported need was water (n = 181;

TABLE 2. Logistic Regression Model of the Estimated Association Between Reported Symptoms by Category and Age Group of Survey Participants After the Train Derailment—East Palestine, Ohio, and Darlington Township, Pennsylvania, February–March 2023

Category	No.	Crude OR (95% CI)	*P*
Ears, nose, or throat			
<18 yr	29	1.55 (0.43–5.45)	0.4966
18–64 yr	346	1.29 (0.76–2.19)	0.3451
≥65 yr	156	REF	REF
Ophthalmic			
<18 yr	18	0.87 (0.40–1.88)	0.7212
18–64 yr	274	1.51 (1.04–2.19)	0.0305*
≥65 yr	110	REF	REF
Neurological			
<18 yr	26	2.00 (0.66–6.08)	0.2177
18–64 yr	342	2.40 (1.51–3.83)	0.0002*
≥65 yr	136	REF	REF
Dermatological			
<18 yr	20	2.53 (1.14–5.60)	0.0225*
18–64 yr	195	1.50 (1.04–2.15)	0.0301*
≥65 yr	72	REF	REF
Cardiopulmonary			
<18 yr	20	0.66 (0.30–1.49)	0.3209
18–64 yr	272	0.98 (0.65–1.48)	0.9350
≥65 yr	126	REF	REF
Mental health			
<18 yr	19	0.91 (0.41–2.02)	0.8160
18–64 yr	318	1.88 (1.29–2.74)	0.0009*
≥65 yr	131	REF	REF

OR, odds ratio.
*Statistically significant ($P < 0.05$).

59%), followed by medical care (n = 63; 21%), mental health care (n = 61; 20%), medicine or medical supplies (n = 45; 15%), shelter (n = 47; 15%), food (n = 36; 12%), utilities (n = 30; 10%), and transportation (n = 15; 5%).

DISCUSSION

The most common self-reported physical symptoms were headache, irritation of the upper and lower respiratory system, and eye irritation. These symptoms are consistent with exposure to acute irritant gases produced by the combustion of materials and have been documented in other chemical fires.[14–16] Although symptoms reported by participants do not indicate exposure to a specific chemical, similar symptoms were reported in a previous vinyl chloride release after a train derailment in New Jersey.[17] Additionally, self-reported physical symptoms differed by age category and might be a result of differential exposures by age category. Time spent indoors or outdoors might be a function of greater exposure for persons who are younger, in the workforce, and more likely to be outside during the incident, compared with participants aged ≥65 years. Reporting of physical and mental health symptoms also varied by method of survey administration. People completing the ACE survey at HRCs were more likely to report symptoms and could be a result of persons experiencing symptoms wanting immediate in-person services and resources.

Most participants experienced multiple new or worsening mental health symptoms after the train derailment. The immediate and lasting effects of environmental and technological disasters on individual and community mental health have been documented.[18–20] Prior studies have identified mental health effects long after catastrophic events. For persons living in areas of known or perceived environmental exposures, like in this incident, the presence or concern of negative effects on health is a risk factor for psychological health outcomes.[21] Mental health services should be a main consideration during environmental emergency responses and ongoing recovery efforts. To increase the immediate and sustained mental health resources needed after a disaster, online mental health services, consultation, and supervision could be considered in resource-limited communities to improve the availability of services and provide specialty expertise to mental health practitioners.[22]

Although the long-term health effects of this incident are unknown, ongoing monitoring of other chemical fire exposures has shown the development of adverse health outcomes in exposed populations years after the incident.[23–26] Continued health assessment and

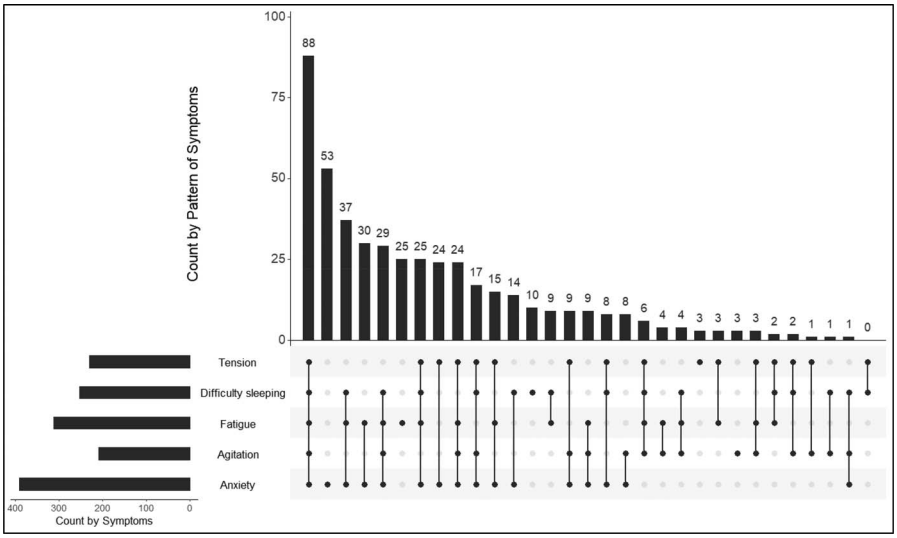

FIGURE 4. Upset plot showing combinations of the top 5 self-reported mental health symptoms experienced by participants reporting ≥1 new or worsening mental health symptoms after the train derailment in East Palestine, Ohio, and Darlington Township, Pennsylvania, February–March 2023 (N = 493). The horizontal bars (bottom-left) show the count of individual mental health symptoms reported by participants. The dots and lines (bottom-right) represent subset patterns (combinations) of mental health symptoms experienced by participants. The histogram (top) shows the count of participants who experienced each pattern of mental health symptoms.

health outcome monitoring can support early identification, mitigation, and understanding of adverse health outcomes associated with this exposure. ACE investigation findings were used to support the establishment of a permanent health clinic in East Palestine, Ohio, to address the health care needs of the population after the incident. Both state health departments conducted 1-year ACE follow-up surveys as advised to continue to monitor health outcomes.

The significant proportion of participants reporting unmet needs highlights the ongoing resources required in an emergency response. Although environmental disasters can result in substantial resource requirements for any public health system, small and rural public health departments might be more vulnerable and become more quickly overburdened with less capacity for resource mobilization.[27] The lessons learned from this response could improve the expediency and capacity of future emergency responses in this community and other communities that experience environmental disasters.[28] Maintaining the networks and investigation tools created for this response and establishing additional action plans can address resource gaps for future emergency responses in these public health jurisdictions.[27,28] Additionally, utilizing trainings and exercises, such as the Federal Emergency Management Agency's National Incident Management System Training Program and Disaster Related Exposure Assessment and Monitoring trainings with local, state, and federal partners, can help establish trained emergency management personnel before an incident.[29,30] Communities and public health partners can also increase their preparedness for similar events by participating in their local emergency planning committee (LEPC). Under the Emergency Planning Community Right to Know Act, a community can access chemical information and become more aware of their emergency preparedness plans through their LEPCs.[31] Engaging LEPCs will help to ensure emergency response plans are reviewed and revised annually, and the appropriate partners are included ahead of the next disaster.[32]

Limitations

Results of this investigation are subject to misclassification, because the interviews relied on participants remembering exposures and symptoms. However, the risk of recall bias was reduced by administering the survey shortly after the incident. Similarly, volunteer bias might have influenced our results; participants who self-reported symptoms or were more concerned about potential health outcomes could have been more likely to take the survey. In-person survey administration by health care and public health professionals could have mitigated potential volunteer bias resulting from the use of the online ACE survey among populations with decreased technological literacy or persons with limited access to computers. Despite these limitations, efforts were made to reduce the possibility of a skewed survey sample. For example, geospatial analyses were performed to identify areas underrepresented by survey participation to guide concentrated door-to-door recruitment efforts to improve response rates. Additionally, the use of HRCs increased the recognition and credibility of the ACE survey during the survey administration period. This facilitated a quick initial health and needs assessment of the community by reporting survey results daily with all public health partners involved in the ACE investigation.

Based on the age distribution of our sample, we cannot draw conclusions regarding the health effects experienced by participants aged <18 years, given the limited number of participants. Additionally, more multivariate analyses could not be performed because of the small sample sizes within some categories. Another limitation is not having baseline health data available to validate the onset of new or worsening health symptoms, limiting our ability to compare preincident health status with postincident health status. Neither jurisdiction opted to collect biological samples to ascertain chemical metabolites associated with exposures to volatile organic compounds. However, area syndromic emergency department data during the previous 28 weeks were used as a baseline comparison to identify significant changes in emergency room diagnoses and symptoms reported to poison centers after the derailment.[33] These data sources in conjunction with the ACE survey results would provide a more comprehensive health profile for the population affected by this emergency. Although open-text fields were not further categorized or mapped to existing categories for this paper, future qualitative analysis can be conducted to provide additional information about the community after the train derailment. Lastly, because convenience sampling was used to recruit participants, investigation results are not generalizable to the entire population of East Palestine, Ohio, and Darlington Township, Pennsylvania.

CONCLUSION

An ACE investigation was conducted to survey the affected communities in East Palestine, Ohio, and Darlington Township, Pennsylvania, after a train derailment with an environmental chemical release. We found that most participants reported new or worsening symptoms after the train derailment and reported potential hazardous chemical exposures related to the incident. Findings from this ACE investigation were used to support the establishment of a permanent health clinic in East Palestine, Ohio, to address health care needs of the population after the incident. The infrastructure established in this response has the potential to improve future emergency response planning and capacity building at the local level. Focusing on maintaining response networks and investigation tools identified in this emergency, addressing resource gaps including increased training and exercise opportunities, and unifying local, state, federal, and organizational partners such as poison centers can enhance preparedness for similar future disasters. The long-term health effects of this incident are unknown, and continued health monitoring may be needed to fully understand, identify, and mitigate any adverse health outcomes that might develop after this exposure. Both states have conducted a 1-year follow-up ACE survey to monitor health outcomes.

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