

REPORT 3 OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH (I-14)
Tornado Safety and Manufactured Homes
Resolution 401-A-13
(Reference Committee K)

EXECUTIVE SUMMARY

Objective. To review available standards and guidelines for the construction and installation of manufactured homes and assess the vulnerability of these homes in tornadoes and other severe wind storms. Recommendations are provided to enhance the health and safety of residents of these homes.

Methods. English-language articles were selected from searches of the PubMed and Google Scholar databases from 2010 to July 31, 2014 using the search terms “manufactured homes,” “mobile homes,” and “tornadoes” in the article title and/or abstract. Internet sites managed by federal agencies also were reviewed for relevant information. Additional articles were culled from manual review of reference lists contained in pertinent articles and other publications.

Results. The Department of Housing and Urban Development regulates the construction of all manufactured homes in the United States. Federal standards preempt other state and local building standards. An estimated 20 million people live in manufactured housing nationwide. In a tornado, the most preferred life-safety protection is a safe room or storm shelter, specifically designed and tested to criteria established by the International Code Council or Federal Emergency Management Agency. Residents of manufactured homes are particularly vulnerable in tornadoes since most of these homes lack permanent foundations, are tied down with metal straps, and lack interior rooms or basements for shelter. Construction of safe rooms or storm shelters in manufactured homes poses significant challenges.

Conclusion. Although manufactured homes may meet applicable construction and installation standards, federal authorities recommend against taking shelter in a manufactured home during a tornado. During severe weather, federal authorities recommend that manufactured home occupants move to a safer location that is better protected from potential wind-borne debris and least susceptible to collapse. Options exist for owners of manufactured homes and owners of manufactured home parks that can provide a high degree of occupant protection from extreme winds. Pre-event planning and mitigation are particularly relevant to individuals and communities located in regions at increased risk of tornadoes and other extreme wind events. As part of disaster preparedness planning efforts, local jurisdictions should review their local zoning and code requirements to ensure manufactured housing and storm refuge options can be accommodated safely and effectively. Citizens also should develop emergency plans for where they will go and what they will do when a severe weather alert is issued.

REPORT OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH

CSAPH Report 3-I-14

Subject: Tornado Safety and Manufactured Homes
(Resolution 401-A-13)

Presented by: Stuart Gitlow, MD, Chair

Referred to: Reference Committee K
(Hugh Taylor, MD, Chair)

1 INTRODUCTION

2
3 Resolution 401-A-13, “Tornado and Storm Safety,” introduced by the Indiana Delegation and
4 referred by the House of Delegates (HOD), asked:

5
6 That our American Medical Association (AMA) adopt policy that: 1) manufacturing standards
7 be improved to require every new manufactured home produced in the United States to contain
8 a “safe room” with clear labeling indicating its location; 2) local ordinances across the United
9 States require that manufactured homes be properly anchored; 3) incentives be offered to
10 owners of existing homes to promote the installation of a “safe room” or other storm shelter for
11 those homes; and 4) programs providing discounted weather alert radios be developed and
12 promoted.

13
14 The reference committee recommended that the resolution be referred for more in-depth study and
15 analysis to inform a comprehensive approach to personal and community preparedness for
16 tornadoes affecting occupants of manufactured homes. The HOD agreed.

17
18 BACKGROUND

19
20 In the United States, federal agencies such as the National Oceanic and Atmospheric
21 Administration (NOAA) constantly monitor for tornadoes and other extreme weather events.
22 Despite their best efforts, the circumstances, severity, and exact strike point of some of these events
23 are hard to predict reliably. For tornadoes, it is possible to forecast potential storm formation, but it
24 is not possible to forecast the actual occurrence of the storm, where it will strike, or how it will
25 move. Modern technology allows for live tracking of a storm’s path. Coupled with emergency
26 communication systems and local media, such technology can provide people with useful and very
27 timely information about the estimated time of arrival of a storm at a given location so that
28 appropriate actions can be taken to avoid or mitigate harm. Typically, building structures of light
29 construction, such as residential homes (and particularly manufactured homes), suffer the greatest
30 damage from tornado impact. In buildings hit by tornadoes, the threat to human life results from a
31 combination of effects resulting from very strong winds and the impact of wind-borne debris,
32 which occur almost simultaneously. Pre-event planning and mitigation are particularly relevant to
33 communities located in regions prone to tornadoes and other extreme wind events.

34

1 The United States experiences the highest number of tornadoes in the world. In the continental
 2 United States, tornadoes typically occur between the months of April and June; nearly a third of
 3 these occur in the midsection of the country, an area known as “Tornado Alley.” Even states that
 4 are at lower risk for tornadoes and hurricanes can experience dangerous wind conditions that
 5 threaten human health and safety. During an average year, more than 1,000 tornadoes occur across
 6 the continental United States, resulting in 60 deaths, more than 1,500 injuries, and millions of
 7 dollars in personal and property losses.¹ Tornado-related fatality rates have decreased substantially
 8 over the last century with better storm prediction and warning systems, improvements in building
 9 construction technologies and codes, and better disaster mitigation planning, among other factors.²

10
 11 During a tornado, strong winds and fast moving wind-borne debris present a risk to people who are
 12 unable to find safe shelter, as well as to those in homes that are not able to withstand these violent
 13 forces. In the United States, residential housing options include manufactured, modular, panelized,
 14 and site-built housing. Most residential homes are not designed to withstand the extreme forces
 15 caused by the high wind speeds of severe tornadoes (up to 200 mph). The majority of tornadoes
 16 recorded in the United States are considered weak (Enhanced Fujita scale [EF]-1 or below^a), with
 17 maximum wind speeds of 110 mph or less (intensities that properly designed and constructed
 18 homes can withstand).

19
 20 Manufactured homes (sometimes called “mobile homes”^b) provide affordable housing options for
 21 many families. They are not the same as modular or prefabricated homes, which are factory-built
 22 and then towed in sections to be installed at a permanent location. Manufactured homes have a
 23 permanent chassis to assure the initial and continued transportability of the home to a residential
 24 site. The requirement to have a wheeled chassis permanently attached differentiates manufactured
 25 homes from prefabricated/modular homes. Some manufactured homes also may have second
 26 stories, dormers, and other amenities more typically found in conventional “site-built” homes.

27
 28 An estimated 20 million people (mostly between the ages of 18 to 59) live in manufactured housing
 29 nationwide, accounting for approximately 9% of new single family home sales.³ In 2013, more
 30 than half of these homes were shipped to eight mostly southeastern coastal states, Kentucky, and
 31 California. About 70% of manufactured homes are located on private properties and 30% are
 32 located in communities (on public or leased land). Residents of manufactured homes are
 33 particularly vulnerable in tornadoes since most of these homes lack permanent foundations, are tied
 34 down with metal straps, and lack interior rooms or basements for shelter.

35
 36 According to the NOAA, the fraction of tornado-related deaths that occurred in manufactured
 37 homes has increased since 1975. From 1976 to 1980, 24% of tornado-related deaths were in
 38 manufactured homes. That fraction increased to 34% from 1986 to 1990 and 50% from 1996 to
 39 2000.² The mean annual tornado fatality rate from 1975 to 2000 in manufactured homes was 1.23
 40 per million population per year; the mean annual fatality rate from 1985 to 2000 in site-built
 41 housing was 0.06 per million population per year.^{2,4}

42
 43 **METHODS**
 44

^a EF tornado intensities are classified on the Enhanced Fujita Scale with ratings between EF-0 (weakest: 65 to 85 mph) to EF-5 (strongest: greater than 200 mph).

^b This is the term used for manufactured homes produced prior to 1976 when federal standards went into effect. Despite the more preferred terminology of *manufactured home*, *mobile home* and *trailer* are still commonly used in the United States to describe this type of housing.

1 English-language articles were selected from searches of the PubMed and Google Scholar
2 databases from 2010 to July 31, 2014 using the search terms “manufactured homes,” “mobile
3 homes,” and “tornadoes” in the article title and/or abstract. Internet sites managed by federal
4 agencies also were reviewed for relevant information. Additional articles were culled from
5 reference lists contained in pertinent articles and other publications.

6 7 REGULATIONS AND STANDARDS APPLICABLE TO MANUFACTURED HOMES

8
9 The U.S. Department of Housing and Urban Development (HUD) Office of Manufactured Housing
10 Programs regulates the construction of all manufactured homes built in the United States.⁵ This
11 office is responsive to the Manufactured Housing Consensus Committee, a federal advisory group
12 charged with providing HUD with recommendations on the revision and interpretation of HUD’s
13 manufactured home construction and safety standards and related procedural and enforcement
14 regulations. The HUD federal building code for manufactured homes was originally established in
15 1976; prior to this, manufactured homes were built to voluntary industry standards. Following
16 Hurricane Andrew (in which 97% of all manufactured homes in Dade County, Florida, were
17 destroyed, compared with 11% of conventional homes), HUD revised its construction standards in
18 1994 to improve the wind resistance of manufactured homes. The federal standards are preemptive
19 of state or political subdivision standards to ensure that disparate state and local requirements do
20 not affect the uniformity and comprehensiveness of the federal standards.

21
22 The HUD regulations, commonly referred to as the HUD code, are codified mostly under 24 CFR
23 3280 and 24 CFR 3285.^{6,7} The HUD code regulates manufactured housing design, construction,
24 and installation, and is the only federally-regulated national building code. On-site additions, such
25 as garages, decks and porches must be built to local, state, or regional building codes. The HUD
26 code does not address local standards governing the placement of individual units on site. Local
27 zoning, subdivision ordinances, architectural design standards, and other requirements often limit
28 both the number of locations in which manufactured housing can be placed, impose additional
29 onsite installation standards and other design requirements (which do not pertain to site-built units),
30 and in some cases, prohibit the use of manufactured housing units altogether. No manufactured
31 home can be shipped from the factory unless it complies with the HUD code and receives a
32 certification label from an independent, third-party inspection agency.

33
34 All manufactured homes are required, at a minimum, to be tethered with metal straps attached to
35 steel anchors screwed into the ground. The home manufacturer must provide installation
36 instructions and certification by a professional engineer or registered architect confirming that the
37 foundation support and anchoring meets HUD’s installation standards.⁷ Third-party monitoring and
38 inspection of the installation are typically provided by a representative from a state or local
39 government. The Federal Emergency Management Agency (FEMA) has guidance for
40 manufactured home foundation system design and installation.⁸ Disconnects can develop between
41 design standards or agency polices and installation practices in the field. Jurisdictions vary in their
42 ability to provide competent inspectors who can discern all deviations from established standards
43 (E. Kiesling, PE, PhD, written communication, August 6, 2014).

44 45 SAFE ROOMS AND STORM SHELTERS

46
47 Historically, building codes for storm shelters were aimed at reducing the level of damage to
48 structures during extreme wind events but did not address life-safety protection for building
49 occupants during such events. In 2008, the International Code Council (ICC), with support of the
50 National Storm Shelter Association, released a consensus *Standard for the Design and*
51 *Construction of Storm Shelters*, also known as the ICC-500, which introduced specific criteria into

1 U.S. building standards for providing protection from extreme wind events and wind-borne debris
2 associated with these events.^{9,10}

3 *Storm Shelters vs Safe Rooms*

4
5 “Storm shelters” are structures, buildings, or portions of buildings that have been designed and
6 constructed to meet ICC 500 criteria and provide life safety protection from extreme wind events.
7 By contrast, a “safe room” is a hardened structure or area of a building that has been designed and
8 constructed to provide near-absolute protection^c against both wind forces and the impacts from
9 wind-borne debris. To be considered a FEMA safe room, the structure must be designed and
10 constructed to the criteria specified in FEMA P-320, *Taking Shelter from the Storm: Building a*
11 *Safe Room for Your Home or Small Business*¹¹ or FEMA P-361, *Design and Construction*
12 *Guidance for Community Safe Rooms*.¹² Additionally, all applicable federal, state and local codes
13 must be followed. Structures built to the FEMA safe room criteria meet and exceed all of the
14 design criteria in the ICC 500 standard, and also consider additional emergency management-
15 related performance criteria.

16
17 The level of occupant protection provided by a space specifically designed as a safe room is
18 intended to be much greater than the protection provided by buildings that comply with the
19 minimum requirements of building codes. The construction of a safe room typically requires a
20 permit from the local building department. Further, to verify compliance with the FEMA 320/361
21 or ICC-500 criteria, additional quality control inspections for community safe rooms, and often for
22 residential safe rooms, may be needed. FEMA recommends that a professional engineer or
23 architect be consulted for site specific guidance on the appropriate location and type of safe room
24 to be constructed. In an investigation of two tornado outbreaks in 2011, all observed residential
25 safe rooms and storm shelters were used successfully to prevent injuries and fatalities.¹³

26
27 *Location and Labeling of Safe Rooms*

28
29 Safe rooms should be constructed in a basement, on top of a concrete slab-on-grade foundation or
30 garage floor, or an interior room on the first floor. Both above-ground (which may be more
31 accessible to young, old, and disabled individuals) and below-ground safe rooms can be stand-
32 alone structures away from the home or building, or they can be rooms or areas in the home, such
33 as a bedroom, a bathroom, or a closet. As long as a safe room is designed to meet or exceed
34 specific FEMA criteria, it will offer the same near-absolute protection whether it is above or below
35 ground. A design often used in the past is a residential safe room installed below the ground
36 surface outside a house or building to accommodate the occupants of one house, a few houses, or a
37 small apartment building. Today many manufactured products are available utilizing a variety of
38 materials that can be installed above or below ground level, indoors or outdoors. Many are
39 anchored to garage slabs or installed underneath the slab with sliding door access. Underground
40 shelters present special challenges in compliance for access by individuals with disabilities.

41
42 Below-ground safe rooms must be designed to avoid accumulating water during heavy rains that
43 often accompany severe windstorms. Optimal attributes of above ground, hardened structures are
44 having minimal access times and locations away from flood prone areas, collapsible structures, and
45 electrical power lines.

46

^c *Near-absolute protection* means that, based on FEMA’s current knowledge of tornadoes and hurricanes, the occupants of a safe room built according to FEMA 320 and 361 will have a very high probability of being protected from injury or death.

1 Safe rooms should be labeled accurately and also identified on posted floor plans. This is especially
2 important for visitors who may not know where the safe room is located or the extent of the
3 protected space within a larger building. Safe rooms should be registered with local emergency
4 management agencies (sometimes it might be police or fire departments), with the exact Global
5 Positioning System (GPS) coordinates of the main entrance of the room, so that occupants of the
6 safe room can be located readily by first responders in the wake of a severe weather event. This is a
7 concern because safe rooms can be hidden beneath debris and difficult to locate after a storm, and
8 occupants may have no means of communication with first responders.

9 10 *Construction Costs*

11
12 Local jurisdictions generally do not require safe rooms or shelters. Costs for construction vary from
13 \$6,600 to \$8,700 for a safe room (~64 ft²) built inside a new house as a master closet, bathroom, or
14 utility room; larger designs for greater comfort have higher costs, with 14 foot by 14-foot safe
15 rooms ranging in cost from approximately \$12,000 to \$14,300. States have developed incentives
16 and initiatives for the construction of residential, public, and private safe rooms, including safe
17 rooms in hospitals, emergency operations centers, first-responder facilities, schools, day care
18 centers, manufactured home parks, private residences, community centers, senior centers, and
19 campgrounds. Some state and local governments have engaged in grant programs with the federal
20 government to partially subsidize the construction of safe rooms, both residential and community.

21 22 **SAFE ROOMS AND MANUFACTURED HOMES**

23
24 Construction of a safe room similar to what is described in FEMA P-320 in manufactured homes
25 poses significant challenges because most of these homes are installed on piers or posts, and not
26 permanent foundations. If a safe room cannot be easily constructed within a structure, several
27 possible approaches can be considered: (1) a stand-alone safe room placed on a permanent
28 foundation as a completely separate structure; (2) concrete steps with shelter space underneath,
29 which can be partially underground or be sufficiently anchored outside the home to provide
30 protection; (3) below ground shelters not within the home; (4) storm shelters (manufactured or site-
31 built) anchored to a concrete slab adjacent to the manufactured home and that can serve other
32 purposes in addition to storm protection; or (5) a single larger community shelter built to withstand
33 both the uplift and debris impact that accompany a tornado event shared by a group of
34 homeowners.

35
36 Most manufactured home parks do not have community storm shelters or safe room locations for
37 tornado protection. Owners of manufactured home parks may be reluctant to provide such shelters
38 largely because of cost and liability issues, as well as challenging operational policies. In some
39 cities, ordinances require that community storm shelters be provided in new manufactured home
40 parks. Currently, Minnesota is the only state that has requirements for certain owners of
41 manufactured home parks to provide community storm shelters. An additional deterrent to more
42 widespread use of safe rooms in manufactured home parks is that, in most cases, the occupant is
43 not the landowner.

44 45 **TORNADO SAFETY FOR MANUFACTURED HOME RESIDENTS**

46
47 Absent a properly constructed and installed safe room, there is no place in a manufactured home
48 that can provide adequate life safety protection during a tornado; the best advice is to plan in
49 advance for an alternate location to take cover (such as the lowest floor of a sturdy, nearby building
50 or a storm shelter). Manufactured homes, even if tied down, offer little protection from tornadoes.
51 A recent FEMA report stated that, although the design and construction of manufactured housing

1 has improved after HUD requirements were changed in 1994, manufactured housing is not
2 constructed to survive a tornado event.¹⁴ The long, narrow dimension of these units and the
3 different means and methods of securing them have contributed to overturning and other failures.
4 Anchoring systems provide some protection from uplift during both wind and flooding events but
5 do not eliminate the risk of debris impact damage to the structure or perforation of the building
6 envelope. Like the decision to construct a safe room, it is best to seek a design professional to make
7 specific recommendations on the appropriate anchoring system for a specific manufactured home.
8 FEMA provides general guidance on tie down/anchoring components and systems and has
9 evaluated these following various storms.^{7,15}

10
11 During severe weather, federal agencies recommend that manufactured home occupants move to a
12 safer location that is best protected from potential wind-borne debris and least susceptible to
13 collapse. While these areas may not provide near-absolute protection (unless designed as safe
14 rooms), they may reduce the number of occupants injured or killed. Appropriate tornado refuge
15 areas should be identified by architects, engineers, or design professionals familiar with FEMA 361
16 and FEMA P-431, *Tornado Protection: Selecting Refuge Areas in Buildings* and should be clearly
17 marked with a permanent sign (e.g., tornado refuge, shelter, safe room) depending on its ability to
18 meet existing criteria for those designations.¹⁶ In the absence of access to a safe room or storm
19 shelter constructed to FEMA 320/361 or ICC 500 specifications, tornado refuge areas are typically
20 a “last choice” or “only option” for those seeking protection. These areas are usually interior
21 locations with short-span roof systems, reinforced masonry or concrete walls, and no glazed (glass)
22 openings (e.g., corridors, small interior rooms, and restrooms). It is important to note that tornado
23 refuge areas do not guarantee safety and offer only limited protection from wind and windborne
24 debris; however, if they are identified correctly, they offer the most protection for occupants
25 seeking refuge during tornadoes and are better than no protection at all.

26
27 All safe rooms, storm shelters, and best available refuge areas should be equipped with the tools
28 necessary for occupants to open or dismantle the door from the inside in the event that egress is
29 blocked or the door is damaged. Safe room and storm shelter owners and operators should plan for
30 potential disruptions to both wired and wireless communications systems. Community safe rooms
31 and storm shelters in particular may require backup power to operate alternate communication
32 systems.

33 34 PREPARATION AND PLANNING FOR TORNADOES AND OTHER DISASTERS

35
36 To protect health and safety, it is important that residents learn about tornadoes and other disasters
37 that may affect the community, actions that can be taken to minimize the impact of these events,
38 and about community plans for warning residents, sheltering displaced persons, and evacuating
39 affected populations. The best way to make homes and communities safer for such events is to be
40 prepared before disaster strikes.

41 42 *Personal Preparedness*

43
44 The key to surviving a tornado and reducing the risk of injury lies in planning, preparing, and
45 practicing “what to do” in such an emergency. Knowing what to do can make a difference when
46 seconds count. Advance planning is especially important if an individual requires assistance to
47 reach shelter from an approaching storm or has other special medical needs. In a disaster,
48 individuals and communities may have to deal with an increased demand for medical resources,
49 especially in rural areas and when local emergency medical services and hospitals are
50 overwhelmed. Personal preparedness involves being able to recognize and protect against potential
51 dangers and hazards, knowing how and when to call for help, and knowing how to provide basic

1 first aid and critical life support.¹⁷ Most personal preparedness efforts are germane to any disaster,
2 such as putting together an emergency kit, developing a family communications plan, ensuring
3 access to medications and medical equipment, monitoring local community and broadcast warning
4 systems, identifying evacuation routes and places to take shelter, and establishing procedures to
5 account for family and friends.

6
7 The American Red Cross, Centers for Disease Control and Prevention, Department of Homeland
8 Security, NOAA, and FEMA, as well as state and local emergency management agencies, provide
9 detailed information on their respective websites to help individuals and families prepare for,
10 respond to, and recover from tornadoes and other disasters. The American Academy of Pediatrics
11 “Children & Disasters” Web site (<http://www.aap.org/disasters>) provides information and resources
12 for physicians, families, child care centers, schools, and policymakers on disaster preparedness and
13 response issues affecting children.

14 15 *Community Preparedness*

16
17 Community disaster preparedness addresses the short- and long-term objectives of planning,
18 response, and recovery activities to include mobilization of resources to protect public health and
19 safety; restoration of essential government services; and provision of emergency relief to
20 government, businesses, and affected residents. Well-coordinated plans are essential for the
21 mobilization of assets from local, regional, and national sources in a predetermined manner. In a
22 catastrophic emergency, communities will face the challenge of allocating scarce resources to
23 minimize illness, injury, and death. Addressing the great diversity of special health concerns,
24 language and cultural barriers, and other life circumstances present multiple challenges for disaster
25 response and recovery systems. It is essential that children and individuals with special health
26 needs have valid emergency care plans in place before disaster strikes. To enhance community
27 preparedness, health officials and other emergency management personnel must collaborate with
28 other community partners to:¹⁸

- 29
30 • identify the types of events that might occur in their communities and regions;
31 • plan interagency emergency activities in advance to ensure a coordinated response to the
32 consequences of credible threats;
33 • build the capabilities necessary to respond effectively to the consequence of those events;
34 • identify the type and nature of an event when it occurs;
35 • implement the planned response quickly and efficiently; and
36 • mobilize resources to recover from the incident.

37
38 Resilience is the sustained ability of individuals and communities to withstand, recover from, and
39 more successfully adapt – in both the short and long terms – to adverse events.¹⁹ Resilient people
40 and communities are prepared to (1) prevent, cope with, and mitigate the initial stress of a disaster
41 with limited expectation of external support; (2) undertake recovery activities that try to restore
42 their lives and communities to pre-disaster levels of functioning; and (3) apply knowledge gained
43 from analyses of disaster response efforts to strengthen individual and community capacities and
44 capabilities to withstand future events.

45 46 *Public Communications during Severe Weather Events*

47
48 In the United States, disaster warnings are issued primarily through the Emergency Alert System
49 (EAS) and the NOAA Weather Radio All-Hazards Network, both of which rely primarily on
50 broadcasting media.^{20,21} If the EAS is activated, national, state, and local television and radio

1 broadcast stations will deliver important emergency information to the public. FEMA is
2 responsible for national-level activation of the EAS as well as testing of the system. The NOAA
3 Weather Radio Network is a network of radio stations broadcasting continuous weather
4 information directly from a nearby National Weather Service (NWS) office. NOAA Weather Radio
5 broadcasts severe weather warnings, watches, forecasts, and other hazard information 24 hours a
6 day, 7 days a week. More recently, the NOAA Weather Radio has been adapted to become an all-
7 hazards emergency communication tool. Although used most often for weather threats, emergency
8 management agencies can request the NWS to automatically sound an alarm on individual radio
9 receivers and trigger cable television and broadcast media to display emergency messages.

10
11 All community residents should listen to commercial radio or television newscasts for the latest
12 weather information, and consider purchasing an NOAA Weather Radio All Hazards public alert
13 radio. These radios, which cost about \$30, operate on frequencies dedicated exclusively to the
14 National Weather Service. NOAA Weather Radio immediately broadcasts severe weather warnings
15 and civil emergency messages; this includes sheltering and evacuation instructions and the status of
16 the emergency event. Unlike a regular AM/FM radio or weather band radio, weather alert radios
17 sound an alarm even if the unit is in stand-by mode.^d

18
19 Given the advanced state of communication technologies, especially the Internet and wireless
20 devices, the capability to deliver emergency warnings is being expanded beyond radio and
21 television broadcasts. A number of states and communities are implementing alert systems that use
22 e-mail, wireless text messages, or the Internet for alerts; some issue mass alerts to telephones by
23 using autodialing technologies, or to wireless devices by using cellular broadcasting technology. In
24 addition to emergency alert broadcasts, many communities utilize outdoor warning systems.
25 Residents should be familiar with these systems, as communities have different ways of warning
26 residents about tornadoes. Typically, these consist of a network of sirens and highway message
27 boards that are activated by local authorities in an emergency.

28 29 *The Physician's Role*

30
31 AMA Policy H-130.946, AMA Leadership in the Medical Response to Terrorism and Other
32 Disasters, underscores the need for physicians and medical societies to participate directly with
33 public health, law enforcement, and emergency management authorities in developing and
34 implementing disaster preparedness and response protocols in their communities, hospitals, and
35 practices in preparation for disasters. Physicians should be knowledgeable of state and federal
36 resources that contribute to emergency management and response at the local level, and understand
37 their integrated roles and responsibilities in disaster management and response efforts. Physicians
38 also should be knowledgeable of ethical and legal issues in disaster response, including their
39 professional responsibility to treat casualties; their rights and responsibilities to protect themselves
40 from harm; and issues surrounding their responsibilities and rights as volunteers and associated
41 liability issues.

^d In 2007, Indiana enacted legislation requiring that all new and relocated manufactured homes install NOAA Weather Radio All Hazards public alert radios. The legislation was passed to honor a two-year-old boy who was killed when an EF-3 tornado struck his parent's Evansville, Indiana, manufactured home park in the middle of the night on November 6, 2005 (Indiana Code Section 16-41-27-16.6: Mobile Home Park Weather Radios and Smoke Detectors. <http://www.in.gov/legislative/bills/2007/EH/EH1033.1.html>. Accessed August 25, 2014).

1 DISCUSSION

2
3 The increase in manufactured homes as housing options has experienced particular growth in the
4 southeastern United States, which is prone to tornadoes, hurricanes, and other extreme weather
5 events. Improvements in the accuracy and lead time of weather forecasts and warnings may have
6 little effect on decreasing deaths if the problem of deaths in manufactured homes is not addressed.
7 Although these homes may meet federal and local government safety and zoning standards, federal
8 authorities recommend against taking shelter in a manufactured home during a tornado. The key
9 objective is to provide safer places for residents. As part of disaster preparedness planning efforts,
10 local jurisdictions should review their local zoning and code requirements to ensure manufactured
11 housing and storm refuge options can be accommodated safely and effectively. Citizens also
12 should develop emergency plans for where they will go and what they will do when a severe
13 weather alert is issued. Without a plan or clear instructions, severe weather alerts create anxiety
14 without significantly promoting safety.

15
16 Manufactured homes may not withstand even a weak tornado, and residents should make plans
17 before the storm arrives to get to a safe location. This underscores the critical importance of
18 tornado safety plans for residents of these homes. Due to the potentially short amount of time
19 between a warning and the arrival of a tornado, people should consider executing their safety plans
20 when a tornado watch is issued rather than wait for a tornado warning. Occupants will likely not be
21 safe in a manufactured home and should seek shelter elsewhere. To better ensure safety,
22 manufactured home residents should: (1) have the home inspected periodically to be sure it is
23 anchored properly; (2) become familiar with the emergency procedures that should be followed in
24 the event of severe weather since injuries can occur during high wind events even when proper
25 anchoring procedures have been used; and (3) be prepared to immediately evacuate the home and
26 seek a safe room or storm shelter in the event of a tornado, severe thunderstorm, or high wind
27 warning. Taking cover under sturdy furniture, in a bathtub or closet, or under a mattress will be
28 meaningless in a manufactured home if the home itself is destroyed, blown over, or rolled over by a
29 tornado. Occupants need to evacuate manufactured homes and find a more substantial shelter or
30 safe room as quickly as possible. Such facilities must be available at any time of the day or night.
31 While the manufactured housing industry has devised reliable anchors for manufactured homes,
32 anchors are not sufficient to withstand extreme winds such as tornadoes. And while the structures
33 of modern manufactured homes are well-designed and connected, they are not sufficient to
34 withstand tornado-force winds, even if the frame is anchored appropriately. In a tornado, the lack
35 of approved safe rooms or community storm shelters puts these residents at greater risk.

36
37 The most preferred life-safety protection from tornadoes is a safe room or storm shelter,
38 specifically one designed and tested to existing criteria (FEMA 320/FEMA 361 or the ICC 500
39 standard). However, practical ways to provide safe rooms inside manufactured homes have not
40 been identified. At this time, it is more prudent to promote other storm protection measures for
41 occupants of manufactured homes. Safe rooms, whether manufactured or site built, must have a
42 permanent foundation or slab to anchor them so they are not moved by extreme winds. By their
43 nature, most manufactured homes do not have permanent foundations, which preclude appropriate
44 installation of safe rooms within these homes. Options do exist for owners of manufactured homes
45 and owners of manufactured home parks that can provide a high degree of occupant protection
46 from extreme winds in structures constructed outside the home, anchored to a secure foundation,
47 and constructed to provide high resistance to wind-induced pressures and windborne debris.

48
49 RECOMMENDATIONS

50

- 1 The Council Science and Public Health recommends that the following recommendations be
- 2 adopted in lieu of Resolution 401-A-13 and the remainder of the report be filed.

1 Our AMA believes that:
2

- 3 1. Owners of manufactured home parks should provide a plan, developed with and approved
4 by local authorities, for the evacuation and sheltering of residents of the park in severe
5 weather events such as tornadoes, high winds, or floods. The plan should advise residents
6 of the vulnerability of manufactured homes in tornadoes and other extreme wind events
7 and that evacuation to a safer location is necessary. The shelter or evacuation plan should
8 be posted conspicuously in the park and the park owner should provide each resident with
9 a copy of the approved shelter or evacuation plan.
10
- 11 2. State and local government authorities in regions at increased risk for tornadoes and other
12 extreme wind events should enact measures to either provide, or require owners of
13 manufactured home parks in their jurisdiction to provide, as appropriate, an approved
14 common storm shelter or safe room for all residents of manufactured homes in the park as
15 protection against tornadoes and other extreme wind events.
16
- 17 3. Research is needed to enhance the design and construction of manufactured homes and
18 manufactured home tie down/anchoring systems to withstand extreme wind forces and
19 wind-blown debris.
20
- 21 4. Federal, state, regional, and local authorities should coordinate policies, processes, and
22 procedures to ensure that manufactured homes are installed and inspected in accordance
23 with established guidelines and standards, including requirements for the installation and
24 inspection of tie down/anchoring systems.
25
- 26 5. Incentives should be developed for all homeowners (including those who live in
27 manufactured homes), businesses, and local governments in regions at increased risk for
28 tornadoes and other extreme wind events for the installation of home or community safe
29 rooms and storm shelters, in accordance with federal and professional guidelines and
30 standards.
31
- 32 6. All citizens should consider purchasing a NOAA Weather Radio All Hazards public alert
33 radio for use in disasters and other emergency situations. Citizens also should develop a
34 plan for where they will go and what they will do when a severe weather alert is issued.
35 (New HOD Policy)

Fiscal Note: Less than \$500

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