This perspective paper was intended to raise awareness and the urgency of needing additional evacuation-related, hospital building design policies. We addressed the challenges to maintain the integrity of exits and inadequate hospital design considerations for individuals with restricted mobility. Hospitals are occupied by people who may have restricted mobility and visitors who are likely unfamiliar with their surroundings. A hospital fire threatens all people in the building, but especially patients in the intensive care unit who are frail and have limited mobility. Evacuating immobile patients is complex, involving horizontal and vertical evacuation approaches. Hospital design must consider the needs of individuals with restricted mobility, who are the most vulnerable in case of a hospital fire. Consequently, we urge that acutely ill patients and others with restricted mobility should occupy units located on the ground floor or Level 2. In addition, when configuring the physical environment of hospitals, providing step-free ground floor access (indoor or outdoor ramps) and evacuation aids for vertical evacuation is crucial. Step-free ground floor access between Level 2 and the ground floor should be wide enough to allow transporting patients on their beds. A standard revision to include these recommendations is desperately needed.
2011; Murphy & Foot, 2011). Severe weather conditions (e.g., Hurricane Irene in New York in August 2011, and severe tropical cyclone Yasi in Cairns, Australia, in February 2011) (Little et al., 2012; Verni, 2012) may also necessitate evacuation, in addition to fire. Thus, in this paper, we chose to have a focus on fire and life safety. We were inspired to assist in promoting a fire and life safety environment of care in responding to a recent deadly fire in a nursing home in Taiwan.

In October 2012, a fire in a nursing home located in southern Taiwan caused 13 deaths. This nursing home was affiliated with one of the 18 public hospitals owned by Taiwan’s Department of Health. This deadly fire led to an investigation concerning the fire safety compliance of hospitals in Taiwan. The statistics released by Taiwan’s Ministry of the Interior National Fire Agency were alarming, with 74.6% of all the 118 hospitals that underwent fire safety inspections in April and June 2012 noncompliant to the fire safety codes for healthcare facilities. The fire safety noncompliance rate was only 83.4% among the 18 public hospitals owned by Taiwan’s Department of Health. In responding to public opinion concerning this deadly fire, the head of Taiwan’s Department of Health promised to revise the fire safety codes for healthcare facilities with more rigid rules, to allocate funding for improving hospitals’ fire safety equipment, and to mandate a reasonable nurse–patient ratio for healthcare facilities (Chang, 2012).

Responding to a catastrophic situation seems to be the key motivator for policy changes in Taiwan (a developing country). We assume that this assumption is also shared in other underdeveloped, developing, or developed countries (e.g., United States and United Kingdom). Therefore, this paper addresses the urgency of raising the awareness of needing additional evacuation-related, hospital building design policies in the context of any countries.

**Significance of the Issue**

In the United Kingdom, a total of 10,662 fires were reported to the Department of Health from May 1994 through May 2004; each year, about 500 fires occurred in acute hospitals, causing about 477 people to be evacuated, 65 injuries, and 2 deaths (Department of Health, 2007). In the United States, from 2004 through 2006, an average of 6,400 fires occurred in medical facilities each year, resulting in the following:

- 1.2 deaths per 1,000 fires
- 25.6 injuries per 1,000 fires
- $5,312 in losses per fire (U.S. Fire Administration, 2009)

Additional statistics on these 6,400 fires follow (U.S. Fire Administration, 2009):

- 55% of these fires were small and confined to cooking ones
- among these nonconfined fires (45%), 15% began in the laundry area, followed by bedrooms (14%), and kitchen and cooking areas (10%)
- 89% of these fires occurred in facilities offering 24-hr care: 24-hr care nursing homes (four or more persons; 43.8%) are the first most common type of medical facility fires, followed by hospital fires (23%)

It is well recognized that evacuating immobile patients is complex, involving horizontal and vertical evacuation approaches. Horizontal evacuation refers to moving people from a fire-affected area through a fire-resistant barrier to an area on the same level. Vertical evacuation describes moving occupants from a fire-affected area to an area on the lower level (Courson, 2011; MacInnes & Rankin, 2012). Enacting fire and life safety requirements and developing fire and life measures (e.g., providing clear exit routes, ramps at exits, fire compartmentation within hospitals) to inhibit or delay the spread of fire and smoke and to facilitate rapid evacuation are key to reducing the number of fire deaths (Courson, 2011; The Facility Guidelines Institute, 2010; National Fire Protection Association [NFPA], 2011a, 2011b).

**Challenges to Maintain the Integrity of Exit**

During Joint Commission hospital surveys in the United States, a frequently cited issue related to fire and life safety standards is noncompliance with maintaining the integrity of exits (“Compliance Rates,” 2010; McLaughlin, 2012). In the United Kingdom, Murphy and Foot (2011) surveyed ICU fire evacuation preparedness at 35 adult and pediatric ICUs within London in 2008, and found that fire evacuation preparedness was compromised by inadequate escape routes (62% had only one or two escape routes), a lack of portable monitoring equipment and emergency drug supplies, and no evacuation plan rehearsals. Only 14 ICUs had a formal triage policy for patient evacu-
ation, which was based on the proximity to the fire and illness severity (Murphy & Foot, 2011). Additional statistics follow (Murphy & Foot, 2011):

- these 35 ICUs were located in the basement and as high as the eleventh floor
- 34 ICUs (97%) expected to evacuate using the stairs, and only seven (20%) of them had step-free ground floor access (e.g., ramps)
- 11 of the 28 ICUs located above the ground floor had an under-mattress evacuation sheet (e.g., ski sheets) or alternative evacuation aids
- only one of the 28 ICUs located above the ground floor had an evacuation plan to transport patients downstairs

Based on the statistics above, it is our opinion that the majority of the executives and administrators seem to have a mind-set that hospital fires are small and confined, and therefore vertical evacuation is not warranted. This assumption could undermine the importance of preparedness for vertical evacuation for acutely ill patients.

**Hospital Design Considerations for Individuals With Restricted Mobility**

In many hospitals, administration departments, cafeteria, cashier, chapel, conference rooms, gift shop, laboratory, medical library, and medical records are often on the lowest level. The people in these areas are unlikely to have mobility issues, and it would be logical for the lower floors to be allocated to patients with the most restricted mobility, while the administration and service departments/facilities could be placed on higher levels. However, the most recent NFPA 99 Health Care Facilities Code (2012 ed.; NFPA, 2011b) and the Guidelines for Design and Construction of Health Care Facilities (2010 ed.; The Facility Guidelines Institute, 2010), which were published in the United States, do not address hospital floor space allocation for acutely ill patients and others with restricted mobility.

**Recommendations: Demanding a Change in Policies and Hospital Design Principles**

It is common sense that hospital design must consider the needs of individuals with restricted mobility, who are the most vulnerable in case of a hospital fire. Consequently, we strongly urge that acutely ill patients and others with restricted mobility should occupy units located on the ground floor or Level 2 (Yin & Tzeng, 2008). In addition, when configuring the physical environment of the hospitals, providing step-free ground floor access (indoor or outdoor ramps) and evacuation aids (e.g., an under-mattress evacuation sheet) for vertical evacuation is crucial. Step-free ground floor access between Level 2 and the ground floor should be wide enough to allow transporting patients on their beds (Yin & Tzeng, 2008).

As an example of a U.S.-based, single-building hospital, in the St. Elizabeth Medical Center in Utica, New York (http://www.stemc.org/patients/hospital-layout/), the cardiothoracic ICU is on Level 4, the general ICU is on Level 3, the operating room is on Level 4, the recovery room is on Level 4, and the postanesthesia care unit is on Level 4. The hospital and nursing administration departments, cafeteria, cashier, chapel, conference rooms, gift shop, laboratory, medical library, and medical records are all on Level 1.

The people in these non-patient care areas are unlikely to have mobility issues. It would be logical for

© 2014 Wiley Periodicals, Inc
Nursing Forum Volume 49, No. 3, July-September 2014
Said Another Way

H.-M. Tzeng and C.-Y. Yin

ment that promotes fire and life safety, regular and mandatory staff training (e.g., understanding of the fire strategies, evacuation lifts, and zoned smoke management) is key to ensuring an effective evacuation during crisis (Courson, 2011; Maclnnes & Rankin, 2012).

References


Verni, C. (2012). A hospital system’s response to a hurricane offers lessons, including the need for mandatory interfacility drills. Health Affairs (Project Hope), 31(8), 1814–1821.
