

It is estimated that more than 8,000 children receive home mechanical ventilation (HMV) in the United States (Boroughs & Dougherty, 2016), and these children are at high risk for complications and adverse events (Ramsey et al., 2018). Preventable deaths in this population are estimated at an alarming 27.5% (Boroughs & Dougherty, 2012; Edwards et al., 2010). Home care nursing is critical for a safe and successful transition to the home setting; however, training for pediatric home care staff is often inadequate (Ramsey et al.). Kun et al. (2015) conducted a survey of 79 pediatric home care nurses (HCNs) about their knowledge of tracheostomy and ventilator care emergencies. The participants averaged only 4.87 out of a possible 10 points, and 97% described a desire for additional training and education. There is a need to address the variability in the quality of training for HCNs caring for children with medical complexity (CMC) (Nageswaran & Golden, 2017a). The American Thoracic Society's *Clinical Practice Guideline for Pediatric Home Invasive Ventilation* also addressed these issues and recommended standardizing the training and competency of professional caregivers caring for ventilator-dependent children (American Thoracic Society, 2016).

Pediatric Home Service (PHS) in Roseville, Minnesota, has provided home care for CMC for over 30 years. The training program at PHS reflects 30 years of experience in caring for children at home with artificial airways and mechanical ventilation. The company has been involved in developing comprehensive HCN training programs that benefit nurses at PHS as well as those from other agencies. The PHS training program offers hands-on experience with HMV, simulation training, and emergency response education. Since 2012, 4,293 HCNs have taken a PHS ventilator course (25% PHS nurses and 75% from other nursing agencies) and 2,159 HCNs have completed courses in tracheostomy care (37% PHS nurses and 63% from other agencies). These numbers include PHS nurses who were completing annual competencies. The PHS home care nursing division currently has approximately 150 HCNs providing care for 30 to 40 patients.

PHS's Program for Educating HCNs

The goals of the PHS program include high-quality patient care, patient safety, family satisfaction, and optimal communication. Comprehensive

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training includes office and field orientation and patient-specific training in the home. A multidisciplinary clinical education department augments the HCN training program with proprietary learning materials. Training and mentoring at PHS are provided by highly skilled clinicians, nurse supervisors, and case managers (CMs). Their responsibilities include signing off on new and ongoing HCN proficiencies. Nurse supervisors focus on clinical training and education and CMs work closely with supervisors when specific educational needs are identified. This allows CMs to carry larger patient loads. Additionally, CMs have more opportunity for involvement and communication with families to provide personalized patient care and care coordination.

Education and training of HCNs occur on a continuum and the timeline associated with the PHS program is displayed in Figure 1. The HCN's education begins with foundational coursework before patient care, followed by supervised training in the home, and proceeds with continuing education.

Component 1: Prepatient Care

Basic coursework

Pediatric home care agencies are responsible for ensuring their educational programs are comprehensive and address the needs of the population they serve. When pediatric care takes place in a home environment, unique clinical skill sets are required by HCN beyond those required in hospital settings. For example, the administration of prescribed drugs in the home is different than getting an ordered dose from the hospital pharmacy. Instructions for HCNs should include the safe preparation and administration of medications in the home (Berland & Bentsen, 2017). In addition, medical equipment used in home care often differs from that used in hospital care. Prior to a clinical assignment in a home, the nurse should be

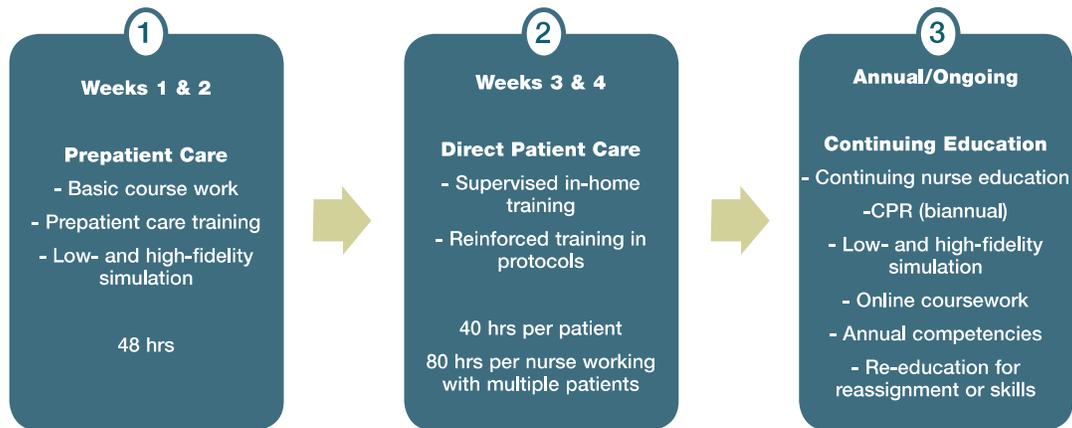


Figure 1. Recommended stages of educating home care nurses.
 Note. Pediatric Home Service, Roseville, Minnesota.

familiar with home care medical devices such as feeding pumps, pulse oximeters, and home ventilators.

Autonomy and flexibility are needed to work in home care. A high level of critical thinking and nursing skills are required to perform the job, especially when working alone in the home during an emergency. To instill independent thinking and confidence, PHS mandates online and instructor-led training courses to enhance the knowledge base and clinical skills of new HCNs (see Supplemental Digital Content 1, available at <http://links.lww.com/HHN/A115>).

This initial training for new HCNs is approximately 48 paid hours occurring in the first 2 weeks. Educational objectives include the implementation of physician orders, operation of medical equipment, and use of safety checklists. Instructions are also provided on skilled nursing interventions and emergency protocols. In some situations, additional patient-specific training may be required for managing enteral/parenteral nutrition, infusion therapy, dialysis, urinary/bowel dysfunction, wound care, and other therapies.

Prepatient care training

Once a foundation of knowledge is established with basic coursework, training focuses on technical aspects of medical devices and simulation scenarios (see Supplemental Digital Content 2, available at <http://links.lww.com/HHN/A116>). Training in home care equipment includes pri-

mary and back-up ventilator set-up and supporting equipment such as pulse oximeter, humidifier, and suction machine. Instructions on the use of ancillary devices including feeding pump and various oxygen sources are also required. Response to alarms and proper use of medical equipment during emergency response are integrated into simulation training. This includes elective and emergency tracheostomy tube changes and trouble-shooting ventilator circuits and alarms. These competencies are completed prior to direct patient care.

Simulation training

Simulation-based education challenges critical thinking during emergency response to real-life scenarios (Prickett et al., 2019), and allows learners to experience high-risk, low-frequency clinical situations in a safe, nonthreatening environment. A recent review describes an expanding role for simulation in the training of caregivers for technology-dependent children (Graham et al., 2019). At PHS, simulation is used for initial pre-clinical training and ongoing annual competencies and provides learners with a new realm of clinical experiences (Figure 2). Technological advances in simulation models allow realistic replication of emergency scenarios that may present in the home. Clinical scenarios may include seizures, acute cyanotic events, obstructed tracheostomy tubes, accidental decannulation, and ventilator alarm responses. Family caregivers may also benefit from simulation experiences and efforts



Figure 2. Pediatric home service simulation lab.
Note. Pediatric Home Service, Roseville, Minnesota.

are underway to promote this training method (Boroughs, 2017; Thrasher et al., 2018).

Component 2: Supervised Direct Patient Care

The introduction to direct patient care in the home is supervised by a nurse preceptor. This paid training period could last up to 40 hours per patient for the new HCN, or up to 80 hours per nurse planning to work with multiple patients. This training could be for a new nurse or a nurse who is unfamiliar with the medical technologies of a newly assigned patient. This supervisory period may last several days until the skills checklist for the assigned patient(s) is completed and the HCN has demonstrated competent and confident independent care of the child. During this training period, HCNs may receive direction on interventions prescribed by other practitioners such as respiratory, physical, occupational, or speech therapists, as well as from nutritional or pharmacy practitioners.

Component 3: Continuing Education

Nurses participate in tracheostomy and ventilator simulation annually, even if they are not actively assigned to a child with a tracheostomy or invasive mechanical ventilation. If reassigned, a nurse who has not cared for a ventilator-dependent child for more than 6 months receives additional training in tracheostomy and mechanical ventilation. Further education is also required if the status of an assigned patient changes. For example, nursing staff in the home of a child with a tracheos-

tomy who transitions to invasive mechanical ventilation will require training on the new device, care plan, and emergency protocols. Annual competencies as outlined (see Supplemental Digital Content 3, available at <http://links.lww.com/HHN/A117>) include approximately 3½ hours of online education and 3 hours of onsite training.

Conclusion

There are challenges involved in the education of HCNs. One is the lack of standardization for a universal curriculum for training HCNs. This may contribute to insufficient training, inexperience, and inadequate skill sets (Nageswaran & Golden, 2017b)—all of which may affect vulnerable patients. Standardizing the education and training of professional caregivers has the potential to overcome this challenge and improve the stability of home healthcare services for children. The home care environment requires unique knowledge and skills. To be highly qualified, an HCN should have a wide range of clinical skill sets, technical and scientific knowledge, and the ability to manage unforeseen situations in the home. Standardizing training of HCNs will improve outcomes for the technology-dependent children they serve. Increasing the aptitude and job satisfaction of HCNs will hopefully promote retention of experienced HCNs to care for the increasing population of CMC needing home healthcare. ▲

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