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Home mechanical ventilation in the USA

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Long term mechanical ventilation outside the hospital has progressed since the late 1940's. The iron lung has been responsible for HMV (home mechanical ventilation) in patients with poliomyelitis in the 1950's and 1960's. Some of these patients continue to survive today. Recently, interest in HMV has grown dramatically due to, but not limited to the following : cost containment, better home care services, and advancements in equipment. There has also been a greater awareness for the patient and quality of life.

Current United States estimates for the number of patients receiving HMV are between 13,000 and 18,000. With approximately 1,400 new discharges per year, these numbers are certain to increase. There are few options for persons dependent upon chronic ventilatory assistance, particularly those who require a tracheostomy and positive pressure ventilation. Most patients seem to go through the cycle of attempted weaning in the ICU even when it is clear that weaning will be unsuccessful. Some are faced with the possibility of discontinuation of ventilatory support. Currently, other options, such as home, or a chronic care facility may provide adequate care for the chronic patient.

Patient goals, education, equipment needs, psychosocial, environmental, and financial aspects must all be considered in the care of the HMV patient. Recent technological and clinical advances can have a positive affect on all of the aforementioned areas. HMV can now incorporate the use of new modalities, such as Non-invasive ventilation, BiPAP®, and the resurgence of Negative pressure ventilation.

HMV continues to be the most economical method to treat the ventilator dependent patient while allowing for a better quality of life and more productive lifestyle for the individual.

Home mechanical ventilation (HMV) grew in the United States during the 1950's with the influx of post-polio patients. America's healthcare system became stressed by thousands of stable, ventilator-dependent, post-polio patients in the ICU. The only cost-efficient measure available at that time, was to send the patients home. This was possible through utilization of the Iron Lung.

In recent decades, there has been a significant increase in the number of patients and the type of diagnosis of those receiving HMV (see **Table 1**). Current US estimates for the number of patients receiving HMV are between 13,000 and 18,000. With approximately 1,400 new discharges per year, these numbers are certain to increase. There are few options for persons dependent upon chronic ventilatory assistance, particularly those who require a tracheostomy and positive pressure ventilation.

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Table 1　ventilator mode by diagnosis group

	SIMV	A/C	Control	Assist	Pressure Limit
Adult Neuromuscular	14.1	74.2	10.2	0.8	0.8
Adult Ches Wall	18.2	72.7	4.6	4.6	
COPD	21.8	78.1			
Adult Apnea	27.8	66.7	5.6		
BPD	50.0	20.0	10.0		20.0
Ped Neuro	26.7	53.3	20.0		20.0
Ped Chest Wall		50.0			50.0
Ped Apnea	25.0	25.0	25.0		25.0
All Diagnosis	18.0	69.1	8.6	0.9	3.4

Table 2　diagnosis group

	% of total
Adult Neuro-muscular	55.2
Adult Chest wall	9.5
COPD	13.8
Adult Apnea	7.8
BPD	4.3
Ped Neuro-muscular	6.5
Ped Chest wall	0.8
Ped Apnea	1.7
Other	0.4

The time patients require the assistance of HMV varies with independent diagnosis and severity of illness (see **Table 2**). Ventilatory muscle dysfunction, Central Hypoventilation Syndromes, and COPD are currently the most common categories utilizing HMV There are choices other than HMV which are available to the chronic ventilator dependent patient. These choices are as follows：

- Stay in ICU
- Chronic Care Facility
- Death

HMV continues to be the most economical method to treat the ventilator dependent patient while allowing for a better quality of life and more productive lifestyle for the individual. Some of the documented benefits of HMV are listed below：

- Reduced Pco_2 on and off the ventilator
- Improved Pa_{O_2}
- Improved tolerance to activity
- Decreased symptoms
- Decreased hospitalization
- Decreased mortality

When considering ventilation, patient/family wishes, life expectancy, level of care, and quality of life should all be examined. Some terminally ill patients may be candidates for HMV so they may spend their remaining time with friends and family. However, we must strive to keep the patient's best interests in mind without overutilization of current technology.

Home care goals must be formulated with input from the patient/family and healthcare providers. Thorough documentation and communication are essential while maintaining a flexible profile. Hospital discharge should be coordinated by a team made up of the following：

- The patient
- The physician
- Nursing staff
- Respiratory therapist

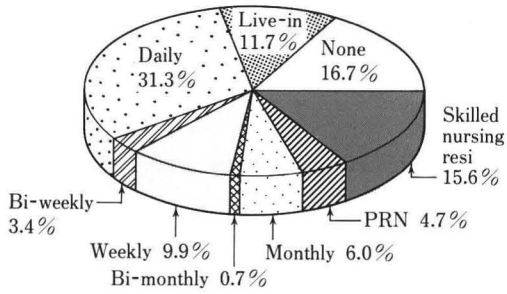

Figure 1 frequency of nursing visits

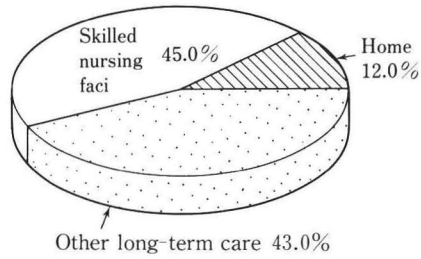

Figure 2 discharge sites

- Social services
- Care giver
- Equipment company
- Other support personnel

The most important member of the above " team" is the PATIENT.

Equipment is another important area of home care for the HMV patient. The equipment, though similar in function, is specifically designed for home use. Although home care equipment needs vary by individual, the following is an example of what may be needed by a HMV patient：

- Portable ventilator
- Hose assemblies
- Oxygen analyzer
- Sterile saline and H_2O
- Trach care supplies
- Suction Supplies
- Manual resuscitator
- Mobility aide
- Nutritional supplies
- Oxygen system
- Medication and supplies

Today's technology has afforded a large number of options for mechanical ventilation. The resurgence of Negative pressure ventilation has prompted manufacturers to produce highly innovative equipment. HMV can now incorporate the use of new modalities, such as Non-invasive ventilation and BiPAP® Due to these innovations, it is now easier to manage the H.M.V patient.

The hospital discharge "team" also be responsible for establishing patient support in the home setting. Home care support after (hospital) discharge should cover the following：

- Create respite care options
- Ensure financial stability
- Provide continuos psychosocial counseling
- Schedule comprehensive reviews at defined times

At the time of hospital discharge, the "team" must also establish emergency procedures. These procedures should include emergency supplies and emergency contacts. Emergency supplies must include manual resuscitator, alternate power source, telephone, and back-up oxygen. Some patients may also require a back -up ventilator. Emergency contacts include (in order of importance) ambulance, patients physician, and equipment company. It is imperative that the ambulance, or local emergency services are called first.

Once the patient is home, preventative services should be initiated. Preventative services should include monthly services and yearly equipment calibration——usually performed by the equipment vendor.

Scheduled nursing intervention varies with

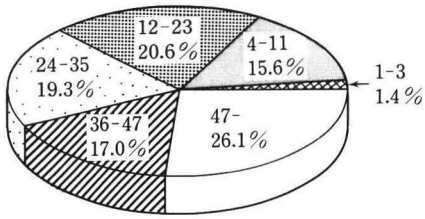

Figure 3 duration of home mechanical ventilation (months)

patient need and financial considerations. The following graph illustrates the frequency of nursing visits for HMV patients in the U.S. (see **Figure 1**).

Not all ventilator dependent patients are candidates for home placement. The following graph (**Figure 2**) illustrates current U.S. AARC/Gallop poll results：

The most dramatic result of recent advances in healthcare and the push towards home placement of the ventilator dependent patient, is a decrease in patient mortality (see **Figure 3**).