Long-Term Living
FOR THE CONTINUING CARE PROFESSIONAL

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Upgrading Respiratory Services
by the staff of **The Silvercrest Center for Nursing and Rehabilitation,** Briarwood, New York

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Mechanical ventilation incurs substantial morbidity, mortality, and costs. Because premature or delayed weaning can cause harm, weaning that is both expeditious and safe is highly desirable. We assessed 312 patients/residents over a three-year period, beginning in 2003, with the baseline and treatment populations well matched on population characteristics, age distribution, sex, and primary diagnosis. Implementation of our initiative increased the wean success rate by 40.9% from 2003 to 2004, and by 65.5% from 2003 to 2005. In 2005, the number of ventilator-associated complications decreased to zero.

Background and Planning

The target population included adults with various degrees of cardiopulmonary diseases and conditions requiring mechanical ventilation and other levels of respiratory support. Our goals were threefold:

- To provide safe liberation or weaning from mechanical ventilation and other respiratory support for patients/residents admitted to a subacute/long-term care ventilator unit from an acute care setting where prior weaning efforts had failed.
- To assist the patient/resident in achieving an optimal level of functioning.
- To set standards of practice that enhance patient/resident safety, quality of life, and quality of care.

The ventilator unit was established in 1992 to complete a natural continuum of care for ventilator-dependent patients/residents from the affiliated acute care hospital to the community, and to ensure that adequate long-term beds were available for those unable to return home immediately. Ventilator beds outside the acute care setting had been limited in this area. Individuals who could not be liberated or weaned from the ventilator spent months in hospitals, typically with a compromised quality of life and at a tremendous expenditure of resources and finances.

Facility staff worked collaboratively with the New York State Department of Health to develop a program that would meet the needs of patients/residents outside the hospital setting. In the early years of the facility, the facility ventilator wean rate of approximately 40% matched or exceeded success rates at large regional weaning centers, demonstrating the benefits of ventilator programs in long-term care settings.

As respiratory services expanded, the number of subacute ventilator beds was increased from 8 to the current capacity of 48, making it the largest long-term ventilator program in the state. Noninvasive ventilation was introduced and initiated throughout the facility and, beginning in early 2003, upgrades to the facility's physical plant (an emergency electrical system) and ventilator alarm system were implemented. A larger supply of bulk oxygen was obtained, and the inventory of specialty beds and augmentative communication devices was increased. From 2003 through 2005, mechanical ventilators were replaced systematically with sophisticated models that more effectively accommodated weaning. Staff education was provided and competencies were established on revised policies and procedures resulting from the expansion of the program and allocation of the additional ventilator beds.

During 2003, as planning for the expansion of the unit continued, the facility's Performance Improvement Steering Committee (PISC) chartered the formation of a Respiratory Care Committee (RCC) consisting of both leadership and clinical staff. The PISC is an interdisciplinary group that includes facility leadership and is authorized by the Board of Trustees to provide oversight for the development, implementation, and evaluation of the Performance Improvement (PI) and Patient/Resident Safety Plan. Three representatives from the Board of Trustees are active members of this committee.

The RCC's mandate was to improve systems and processes that would facilitate optimal patient/resident outcomes, and respond to any care concerns or trends. The committee reported activities and outcomes to the Performance Improvement Committee (PIC) on a quarterly basis. A primary task of the group was to revise methods of data aggregation and analysis for identified respiratory measures, including patient/resident wean rates.

Current wean rates were difficult to compare with previous years' rates because the patients/residents admitted to our facility had increasingly complex medical and clinical presentations, requiring extensive nursing care, as well as equipment such as specialty tracheostomy tubes and augmentative communication devices. This increased clinical complexity was validated by the changing Case Mix Index (CMI), which increased from 1.7429 in 2003 to 1.7460 in 2005. A corresponding increase was noted in the CMI of the skilled nursing population. This overall increase in the CMI, coupled with the expansion plans for the respiratory programs, triggered recognition that existing systems should be revised to ensure continued quality and safety for our patients/residents.

Length of stay and individual care needs on our ventilator unit vary greatly among patients/residents, dependent on cardiopulmonary diagnoses, medical comorbidities, and candidacy to enter the facility weaning protocol. The facility's interdisciplinary ventilator team (known as the "vent" team) focuses on providing individualized care to achieve successful ventilator liberation and improve quality of life. While liberation from mechanical ventilation and discharge to home are the ultimate goals, each discipline works to optimize functional status and quality of life for each individual in treatment. Ventilator-dependent individuals who cannot be weaned benefit from an individualized care plan that emphasizes improved quality of life.

Other goals for each patient/resident include reducing ventilator support, decannulating the tracheostomy tube, facilitating vocal or nonvocal communication, initiating oral feeding, and increasing both independence in activities of daily living and attendance at recreational/spiritual activities. The availability of portable ventilators, with battery backup, that can be accommodated on wheelchairs allows patients/residents the freedom to participate in those activities.

Resources

Involvement of facility leadership has been integral to the success of the program. Our leaders promote an organization-wide commitment to the provision of quality care and services, enabling a proactive approach to program development, expansion, and systems improvement, as defined in our mission statement. This philosophy creates a culture of excellence and a continuum of quality care through diverse programs that promote health, independence, and dignity.

Expenditures for capital improvements and staffing related to the expansion of the respiratory and ventilator program were budgeted by leadership and approved by the facility Board of Trustees. Examples of initiatives for which resources were allocated included:

- increases in staffing, including respiratory therapy, nursing, and speech pathology;
- facility improvements, including an upgrade of emergency electrical power and of the central alarm system;
- purchase of state-of-art portable ventilators to facilitate weaning and increase participation in facility and community activities; and
- acquisition of specialty equipment, including pressure-relief mattresses and augmentative communication devices.

Oversight of the respiratory and ventilator program was assigned to the RCC, chaired by the Director of Respiratory Therapy. Members of the RCC include the Vice-President of Medical Services, a Pulmonologist, a Primary Care Physician (PCP), the Director of Respiratory Therapy, the Associate Director of Nursing, a Nurse Practitioner, Clinical Care Coordinators of the ventilator and respiratory units, the Clinical Nutrition Manager, the Assistant Vice-President (AVP) of Rehabilitation Services, the Director of Social Services, the Director of

Speech Pathology, a unit Social Worker, the Director of Therapeutic Recreation, and the Vice-President of Finance.

All patients/residents are considered candidates for weaning unless excluded by pulmonary/respiratory assessment. If not excluded from the protocol, patients/residents either enter the program immediately or at a later date, as determined by their clinical condition.

The vent team assesses patients/residents upon admission, upon readmission, and at additional scheduled intervals. The members of the vent team, which meets weekly in a clinical rounds format, are the PCP, Pulmonologist, Director of Respiratory Therapy or designee, Nursing Clinical Care Coordinators, AVP of Rehabilitation, Director of Speech-Language Pathology, Chief Clinical Dietitian, Social Worker, Therapeutic Recreation Leader, and consulting Psychologist (ad hoc). While staff respiratory therapists drive the weaning process, the interdisciplinary team develops a comprehensive care plan for each individual, with a focus on both quality of care and quality of life.

Family members are considered vital members of the team and participate in the care-planning process by providing information about patient/resident goals, care, and treatment preferences, as well as about advance directives and end-of-life decisions.

Significant staff training and education activities were required for expansion of this program. Standards of care and safety were the primary focus, with topics including disease states leading to respiratory failure, concepts of mechanical ventilation and alarm response, assessment techniques, noninvasive monitoring tools, potential complications associated with long-term ventilator dependence, and managing respiratory emergencies. Use of new equipment and revised policies and procedures were also covered.

Table 1. Detailed Ventilator Data Sheet.

		1Q-03	2Q-03	3Q-03	4Q-03	1Q-04	2Q-04	3Q-04	4Q-04	1Q-05	2Q-05	3Q-05	4Q-05
Total vent patients		57	53	65	66**	73	67	67	73	81	67	80	61
Total vent days		3345	3490	3922	4243	4093	4135	3694	3945	3932	4217	3886	4382
Total new vents		17	12	23	19	23	19	20	26	27	18	29	7
	Male	7	4	10	11	9	6	10	10	14	6	13	2
	Female	10	8	13	8	14	13	10	16	13	12	16	5
	Age range	39-86	25-89	55-91	20-97	20-98	25-95	49-91	45-90	18-102	47-92	35-98	24-83
	Avg. age	67	71	77	74	75	76	76	74	73	75	76	66
Total readmits and/or previously known		29	20	77 *	25	30	30	27	31	24	27	30	35
Total previously weaned		0	0	2	2	3	1	1	1	2	3	8	4
Total # palliative, no wean potential, weaning deferred										19	20	19	17
Total # wean potential										62	47	59	44
Total new pts entered into weaning protocol		18	10	17	13	15	19	29	19	31	27	30	27
	Male	9	3	6	5	8	5	9	11	12	6	14	10
	Female	9	7	11	8	7	14	20	8	19	21	16	17
Total # in weaning protocol		30	28	36	43	43	41	52	44	43	40	49	41
Total % in weaning protocol		53%	53%	55%	65%	59%	61%	78%	60%	53%	60%	61%	67%
		1Q-03	2Q-03	3Q-03	4Q-03	1Q-04	2Q-04	3Q-04	4Q-04	1Q-05	2Q-05	3Q-05	4Q-05
Total # of pts with weaning held, D/C'd,or expired while in protocol		2	5	4	5	9	18	19	12	19	11	23	5
Total % in weaning protocol/total # wean potential										69%	85%	61%	67%
Total # remaining in protocol		28	23	32	38	34	23	33	32	24	29	26	36
Total # patients weaned		10	4	2	10	12	6	8	11	11	10	12	8
	Male	5	2	1	7	5	2	1	7	7	2	4	3
	Female	5	2	1	3	7	4	7	4	4	8	8	5
Average # days to wean from entry into protocol						76	51	36.5	50	60	86.7	54.6	67.6***
Average # days to wean from date of admission						93.2	82.5	108	125	84	127	109	102.8****
% weaned/total # remaining		35.7%	17.4%	6.3%	26.3%	35.0%	26.0%	24.2%	34.0%	45.8%	34.4%	46.0%	23.0%
% weaned/total # in protocol		33.3%	14.3%	5.6%	23.3%	28.0%	14.6%	15.4%	25.0%	26.0%	25.0%	25.0%	20.0%
% weaned/total # vents		18.0%	7.5%	3.1%	15.2%	16.4%	9.5%	12.0%	15.0%	13.6%	14.9%	15.0%	13.1%
Vent-associated complications		1	1	0	0	1	1	0	2	0	0	0	0

* 43 hospital admissions and 39 readmits were caused by the August 2003 blackout

** 4th quarter 2003 data include 5S

*** # days to wean from entry into protocol (range = 46–301)

**** # days to wean from date of admission (range = 46–1838) excludes 1 resident admitted 11/8/2000—weaned 12/21/2005

Performance Measurement and Data Analysis

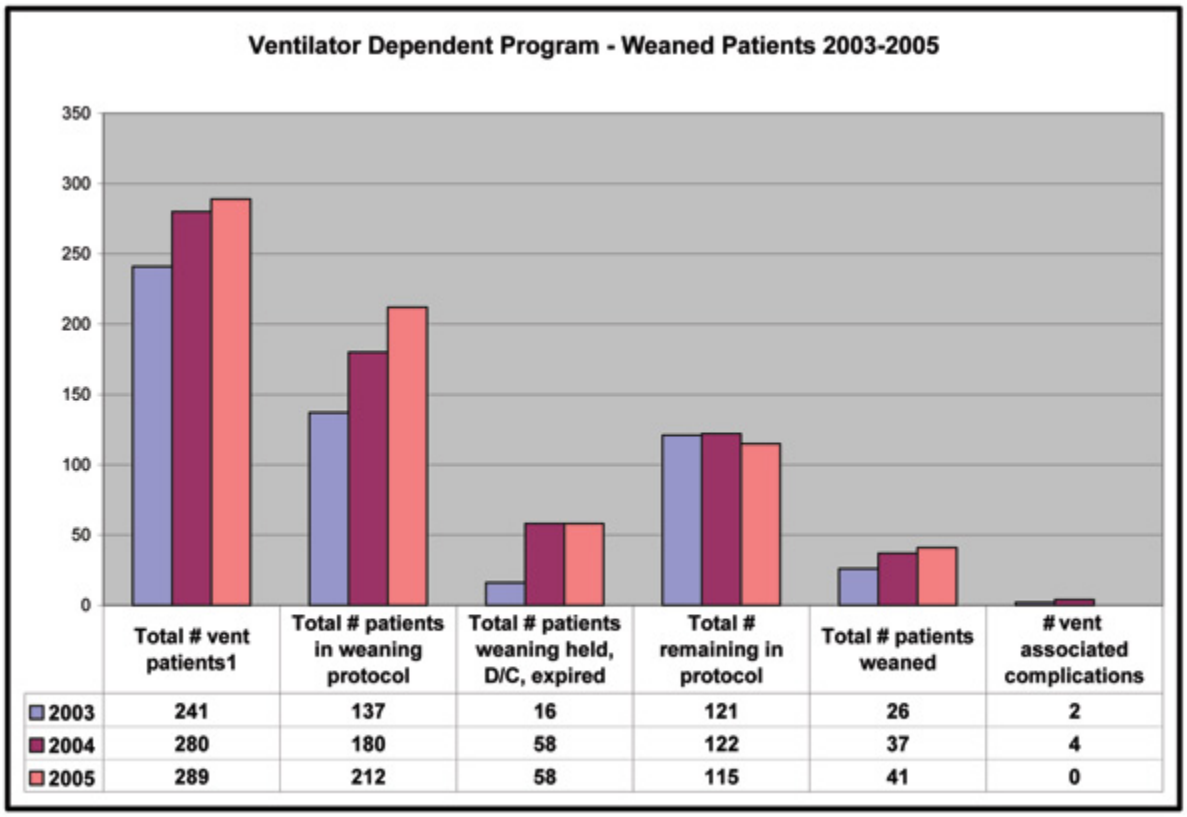
Our data analysis compares two populations: the Baseline group comprising data from the year 2003, and the Treatment group after the key performance improvement initiatives were implemented in 2004 and 2005. The analysis includes 312 cases measured over three years. The data were extracted by the Director of Respiratory Therapy from patient/resident charts as recorded and were subsequently reviewed for accuracy.

Analysis was done on purely objective measures collected and reported quarterly, using mean numbers on the

Detailed Ventilator Data Sheet (table 1), compared in aggregate and in isolation with the base-year outcomes. Data elements were recorded on the Ventilator Dependent Patient/Resident Data Form.

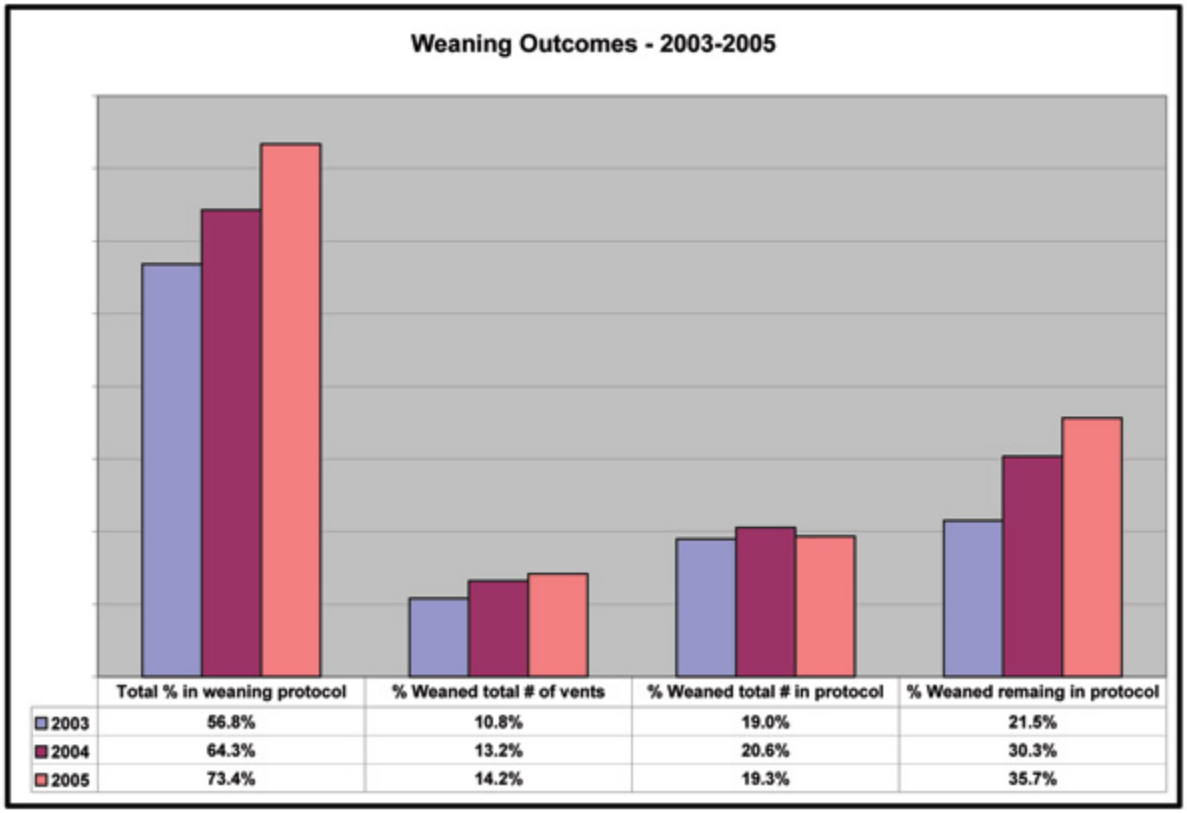
Risk adjustment was performed using population characteristics, age distribution, and sex to determine if the similarities between cohorts were statistically significant. Further evaluation was done using the SPSS 13.0 package, running a regression analysis of weaned versus non-weaned patients/residents based on primary diagnosis to determine its relation to probability of weaning. The analysis concluded that the population characteristics, age distribution, sex, and primary diagnosis of the Baseline and Treatment populations were well matched.

Primary endpoints were the wean success rate for those residents entered into and remaining in the wean protocol compared with the Baseline population. Any reduction in the number of ventilator days was also of interest, as it represented reduced costs and increased patient/resident safety and quality of life.



	Total # vent patients1	Total # patients in weaning protocol	Total # patients weaning held, D/C, expired	Total # remaining in protocol	Total # patients weaned	# vent associated complications
2003	241	137	16	121	26	2
2004	280	180	58	122	37	4
2005	289	212	58	115	41	0

Figure 1.



	Total % in weaning protocol	% Weaned total # of vents	% Weaned total # in protocol	% Weaned remaing in protocol
2003	56.8%	10.8%	19.0%	21.5%
2004	64.3%	13.2%	20.6%	30.3%
2005	73.4%	14.2%	19.3%	35.7%

Figure 2.

Data Analysis

Following implementation, the wean success rate for the Treatment population increased by 40.9% in 2004, and by 65.5% in 2005, compared with the Baseline population. The average number of days on the ventilator for weaned patients decreased from 121.6 in the Baseline population to a low of 108.8 in the Treatment population, and the average number of days to wean a patient/resident from date of entry into the protocol declined from 62.2 in the Baseline population to a low of 56.7 for the Treatment population. Also, the percentage of patients/residents in the wean protocol increased 18% from the Baseline population (table 2).

Data Dissemination

On a quarterly basis, the Director of Respiratory Therapy presents outcome data (figures 1 and 2) and subsequent improvement activities to the RCC, which reports these results to the PISC and PIC. The Board of Trustees receives copies of all PISC and PIC minutes and an annual evaluation of the PI program. Department directors disseminate findings of performance improvement activities and root cause analysis (RCA) findings to their respective departments. Information is also shared during informal venues, such as clinical "vent" rounds. This sharing of vent outcomes has helped to create a data-conscious, data-driven culture on the unit.

Table 2.

Ventilator Outcomes	2003	2004	2005
Total # vent patients[1]	241	280	289
Age range	25-97	20-98	18-102
Average age	72.25	75.25	72.5
Total vent days	15,000	15,867	16,417
Average # of days from admission to wean	121.6	108.0	163.5
Average # of days from protocol entry to wean	62.2	57.6	76.1
# palliative, no wean potential[2]	--	--	75
# new patients entered wean protocol	58	82	115
Total # patients in weaning protocol	137	180	212
Total % in weaning protocol	56.8%	64.3%	73.4%
Total # patients weaning held, D/C	16	58	58
Total # remaining in protocol	121	122	115
Total # patients weaned	26	37	41
% weaned total # of vents	10.8%	13.2%	14.2%
% weaned total # in protocol	19.0%	20.6%	19.3%
% weaned remaining in protocol	21.5%	30.3%	35.7%
# vent-associated complications	2	4	0

[1]Total of the four quarters

[2]Measure started in 2005

Performance Improvement

Both the expansion of the respiratory care services and the refinement of the weaning protocol were implemented using the "organizational cycle for performance improvement" (plan, do, check, act). Specific improvements included:

- Staffing revisions, including increasing the ratio of respiratory therapists to patients/residents (with the addition of a lead respiratory therapist position), reallocation of nursing (RN) support, and increased speech pathology hours beginning in January 2003. These increased hours of direct staff care facilitated identification of appropriate candidates for attempts at ventilator liberation, as well as continued assessment and monitoring of patients/residents while in the weaning protocol.
- Ongoing staff education and competency training on all revised policies, procedures, and programs, integrating all training into facility orientation and annual mandatory training. Certain aspects are included in annual competency evaluations to maintain established standards of practice.
- Revised weaning protocols (in 2004), shifting from an acute care model to one that was more flexible and allowed the respiratory therapist to change weaning modes based on clinical parameters and patient/resident need. This results in a more flexible, individualized approach that accommodates patient/resident tolerance of the changes in respiratory support that occur during weaning.
- Equipment upgrades (beginning in 2003), including systematic replacement of ventilators and clinical alarms with

state-of-the-art models that more effectively accommodate weaning and improved safety.

- Formation of the Respiratory Care Committee in November 2003.
- Standardized respiratory order forms to reduce the chance of transcription errors in handwritten information. Including orders for the weaning process, these forms were developed, piloted, revised, and finally implemented between January 2004 and July 2004.
- Revised respiratory data'collection efforts to more accurately measure wean rates and unplanned tracheostomy tube decannulations, and respond to any trends or concerns. In 2004, data collection was expanded to include length of time from entry into the protocol to its successful completion. In 2005, data collection was further expanded to identify those individuals whose weaning was deferred or discontinued because of medical instability and/or hospitalization. Patients/residents were also identified as having no wean potential because of medical diagnosis or placement into the palliative care program. These two groups of patients/residents were removed from the denominator when calculating wean data, thereby obtaining a more accurate measure.
- Streamlining of the clinical rounds format for greater efficiency and effectiveness. Members of the vent team meet weekly and collaborate to identify patients/residents ready to enter the weaning protocol. For example, the team monitors nutritional status (through lab values), wound healing, and the ability to participate in restorative rehabilitation as measures of readiness to begin attempts at ventilator liberation.
- Creation of a Supplemental Data Form to be completed by the transferring facility, ensuring that patients/residents have comprehensive and accurate clinical information available upon admission. The form identifies high-risk patients, clinical concerns, or special needs (e.g., specialty tracheotomy tubes or modified oral diets for swallowing problems). This form was piloted in December 2004 and implemented in March 2005.
- Completion in February 2005 of a RCA for patients/residents with specialty tracheostomy tubes. The Supplemental Data Form and the facility transfer form were modified to highlight information that, if not communicated to the receiving caregiver, would place the patient/resident at risk.
- A standardized respiratory assessment form with input from the respiratory staff. The form is used upon admission or readmission to the facility, at scheduled periodic tracheostomy tube changes, after an unplanned decannulation, and during weaning attempts. The form was created in early 2005 and implemented in May of that year.
- Revised weaning or ventilator liberation policy to standardize monitoring criteria for patients/residents in different phases of the weaning process. Revisions include ongoing respiratory therapy assessment during the liberation phase and transfer of the patient/resident to a respiratory step-down unit at completion of the weaning protocol. This policy was revised in December 2005 and implemented in January 2006.

After collecting, monitoring, and analyzing approximately three years of data, team members recognized the potential value of a predictive weaning scale that would identify patients/residents who could not initially be entered into the weaning protocol. Initial criteria for entry into the weaning protocol were limited to respiratory and clinical parameters that reflected cardiopulmonary and hemodynamic stability. Individuals who did not meet criteria would benefit from other programmatic aspects of the unit and would be reassessed for weaning potential at a later time, allowing for certain key clinical indicators to improve.

Table 3.

Ventilator Cost Comparison	2003	2004	2005
Total # patients weaned	26	37	41
ICU costs (vent days x rate)*	$ 33,000,000	$ 34,907,400	$ 36,117,400
Vent costs (vent days x rate)*	$ 12,615,000	$ 9,876,890	$ 10,219,254
SNF cost (vent days x rate)*	$ 4,980,000	$ 5,394,621	$ 5,581,616
LTC vent savings vs. ICU	$ 20,385,000	$ 25,030,510	$ 25,898,146
SNF savings vs. LTC vent	$ 7,635,000	$ 4,482,269	$ 4,637,638
Average vent days — average wean days	59.35	50.40	87.46
Wean savings vs. ICU	$ 2,882,324	$ 2,534,263	$ 4,873,374
Wean savings vs. LTC vent	$ 785,387	$ 949,183	$ 1,825,274

*Rates: ICU = $2200 per patient per day. LTC vent = $821 per patient per day DNF = $332 per patient per day

As the process evolved, other measures were identified as potentially having predictive value for the success of weaning efforts. The facility Minimum Data Set (MDS) report was considered a source of comprehensive clinical information, with individualized assessments generating quality indicator reports that offered data on measures affecting care outcomes. Examples of these measures include the ability to understand and be

understood, pressure ulcers, infections, pain, and presence of indwelling catheters. These standardized clinical parameters can be incorporated into a predictive weaning tool, ultimately producing a Wean Assessment Score. Currently the RCC is developing a Wean Assessment Scale to predict candidacy for entry into and potential success within the weaning protocol. This scale is being piloted on the ventilator unit.

Obstacles

The ventilator program performance improvement initiative had to overcome several obstacles, including:

- The acuity of the ventilator population and the overall patient/resident population significantly increasing from baseline.
- A significant need for staff education to ensure success and patient/resident safety.
- A need for additional resources, such as facility and equipment upgrades. Trustee and executive-level support facilitated these upgrades.
- A need for widespread revision of policies, procedures, and tools.
- Unrealistic family expectations, patient/resident anxiety, and need for support, and occasional communication barriers and cultural issues.

Results

In addition to the increases in weaning rates by 40.9% in 2004 and by 65.5% in 2005, the number of days to wean from entry into protocol and the average number of days on vents decreased initially from baseline. Moreover, there was a positive impact on costs: In comparison with acute care ventilator care, the cost of long-term ventilator care is significantly lower ($2,200/patient/day versus $821/patient/day). When calculating implied savings, weaning patients/residents in the long-term care setting saves approximately $489/patient/day or, compared with baseline, an aggregate of $1,258,773 in 2004 and $2,188,164 in 2005 (table 3).

A successful weaning protocol attempts to improve the overall quality of life and health status for all ventilator-dependent patients/residents. Our results show that improvements in clinical care can be realized even when weaning cannot be immediately achieved. ■

The Silvercrest Center for Nursing and Rehabilitation is a state-of-the-art Center of Excellence that has a widespread reputation for combining the best in clinical care with the best in nursing care, and for the broadest menu of services to ease a patient's path to recovery-from hospital to home. It features New York State's largest and oldest ventilator-dependent program. The Silvercrest Center is a member of the New York-Presbyterian Healthcare System and an affiliate of the Weill Medical College of Cornell University, with immediate access to the full range of specialists, advanced technology and other resources the system offers. *To send your comments to the editors, e-mail 1optima0906@nursinghomesmagazine.com.*

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