

**Informal Caregiver Burden Among Survivors of Prolonged
Mechanical Ventilation**

Online data supplement

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METHODS

Study design

This prospective, parallel cohort study was designed to examine longitudinal outcomes of survivors of critical illness and their informal caregivers. A detailed description was previously reported (E1). The QOL-MV cohort included patients admitted to the medical, surgical, neurotrauma, and neurologic ICUs at a tertiary-care teaching hospital in Pittsburgh, PA over a 26-month period (from June 1997 through July 1999). Patients and their caregivers were eligible if mechanical ventilation in an ICU was required for ≥ 48 hours. Mechanical ventilation for at least 48 hours was chosen as an inclusion criterion because, independent of diagnosis, it incurs a 40% mortality rate, making it a useful surrogate screen for critical illness. Patients were excluded if they were hospitalized following solid-organ transplantation, under 18 years old, chronically ventilator dependent prior to hospital admission, or intubated more than 24 hours prior to transfer from an outside hospital. An informal caregiver was defined as an unpaid person, identified by the patient or a proxy, who provided the majority of the patient's care. Caregivers were enrolled into the study during hospitalization of the patient and during the initial 2-month follow-up period. This report describes caregiver outcomes 2, 6 and 12 months following the initiation of mechanical ventilation. The protocol was approved by the University of Pittsburgh Institutional Review Board.

Patient data collection and measurements

Baseline patient data were obtained by interviews with proxies and from medical records at the time of enrollment, and included sociodemographics, ICU admission diagnosis, Acute Physiology and Chronic Health Evaluation (APACHE) III score (E2), Short Form-36 Physical Function (SF-36 PF) (E3), and the Charlson comorbidity score (E4). Baseline functional status was assessed retrospectively at the time of enrollment, a previously validated approach (E5). Post-ICU functional status and residence location data were collected at 2, 6 and 12 months after the initiation of mechanical ventilation. Functional status was measured with two scales; the activities of daily living (ADL) scale, ranging from 0 to 6, and the instrumental activities of daily living (IADL) scale, ranging from 0 to 8 (E5, E6). The ADL scale assesses the need for help in performing basic activities of daily living (bathing, dressing, using the toilet, transfer in and out of bed/chair, continence, and feeding). The IADL scale assesses the ability to perform common chores (using the telephone, shopping, food preparation, housekeeping, doing laundry, traveling, taking medications, and handling finances). Functional dependency was defined as the presence of at least one ADL or three IADL dependencies (E7). Patient or caregiver use of paid assistance was measured by asking the question: "In the past week have any paid caregivers provided help?" 'Help' was defined as supervision, direction or personal assistance.

Informal caregiver data collection and measurements

Informal caregiver data were collected 2, 6 and 12 months after the initiation of mechanical ventilation and included sociodemographic information and outcomes in three domains: depression risk, lifestyle disruption, and reduction in employment.

Depression symptoms were measured using the Center for Epidemiologic Studies Depression (CES-D) scale (E8), a 20-item instrument which has very good reliability and validity (E9). A score ≥ 16 indicates being at risk of suffering from depression.

Reliability in this cohort was good at each time point (alpha range 0.91 to 0.92). CES-D validity has been demonstrated by correlation with other depression instruments such as the Raskin scale (E3). Importantly, the CES-D scale is a screening tool for depression; formal diagnosis of depression requires further evaluation. Lifestyle disruption was evaluated using the activity restriction scale (ARS), an 11-item instrument designed to measure changes in caregiver activities due to caring for the patient (E10). Caregivers were asked, "Please tell me how much you have restricted your activities in each of the following areas." The areas assessed include the following: caring for self, caring for others, eating habits, sleeping habits, doing household chores, going shopping for self, visiting friends, working on hobbies, sports and recreation, going to work, and maintaining friendships. Each item had 4 response options ranging from 'not restricted at all' to 'greatly restricted' yielding a potential range of scores from 11 to 44. Reliability in this cohort was good at each time point (alpha range 0.89 to 0.92). Though the validity of the ARS has not been formally evaluated, it has been shown to correlate

positively with the severity of patient symptoms (E11). In other words, caregivers of more severely ill patients manifest greater degrees of activity restriction. Reduction in employment was assessed by measuring the proportion of caregivers that stopped working in order to provide care. All longitudinal data are reported as 2, 6 and 12-month values.

Statistical analysis

To be included in the analysis of caregiver outcomes, patients had to survive at least until the initial 2-month caregiver interview. Continuous variables are reported as mean (standard deviation (SD)) or median (interquartile range [IQR]) where appropriate and categorical variables are reported as proportions. Comparisons between cohorts stratified by pre-ICU functional status were made using a t-test or Wilcoxon rank sum test for continuous variables and a chi-square test or Fisher's exact test for categorical variables. Longitudinal analyses were performed using pattern mixture models accounting for repeated measures and missing data (E12, E13). Changes over time in individual variables were analyzed using time as an independent variable, with the caregiver outcome of interest as the dependent variable (i.e. CES-D, ARS, or employment status). Predictors of depression risk ($CES-D \geq 16$) were determined by building a pattern mixture model in a step-wise manner. Patient and caregiver specific independent variables were included in the model if associated with caregiver depression risk in univariate analysis at a significance level of $p < 0.20$. *Patient* specific variables considered for inclusion were age, race (white, black, other), gender,

education (≥ 12 years, < 12 years), pre-ICU functional status (dependent vs. independent), Charlson comorbidity, APACHE III score, admission category (medical, surgical, trauma), mechanical ventilation duration, hospital and ICU length of stay, tracheostomy, post-ICU functional dependency, and location (home vs. institution) at 2, 6 and 12 months. *Caregiver* specific variables considered for inclusion were age, race, gender, education, relationship (spouse, non-spouse family, not family), hours per day spent helping, assistance from other family members, and paid assistance. Because their distributions were skewed, the CES-D and ARS scores were square root transformed prior to regression analysis. A p value of < 0.05 was used to indicate statistical significance in the final multivariable pattern mixture model. The Hosmer-Lemeshow statistic was used to test for goodness-of-fit. Statistical analyses were performed using SAS (Version 8.2; SAS Institute; Cary, NC) and Stata (Version 8; StataCorp; College Station, TX).

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Table E1 -- Characteristics of the 2-month survivors included and not included in the QOL-MV caregiver study.

Patient characteristic*	Included	Not included	p value
n	169	300	
Male, n (%)	101 (59.8)	159 (53.0)	0.18
Age, years, mean (SD)	56.6 (19.0)	56.6 (19.3)	0.99
Charlson comorbidity	1 (0, 3)	1 (0, 2)	0.06
Missing, n (%)	0 (0.0)	1 (0.30)	
Pre-ICU ADL	0 (0, 1)	0 (0, 1)	0.79
Missing, n (%)	0 (0.0)	30 (10.0)	
Pre-ICU IADL	1 (0, 4)	0 (0, 4)	0.19
Missing, n (%)	0 (0.0)	63 (21.0)	
APACHE III,	56 (44, 73)	56 (41, 73)	0.79
Missing, n (%)	8 (4.7)	21 (7.0)	
SF-36 PF	70 (20, 100)	75 (20, 100)	0.73
Missing, n (%)	5 (3.0)	64 (21.3)	
ICU LOS, days	14 (8, 23)	13 (8, 20)	0.24
Hospital LOS, days	23 (16, 34)	23 (16, 33)	0.53
MV duration, days	9 (5, 18)	9 (5, 16)	0.53

*Values are reported as median (interquartile range) unless otherwise specified.

QOL-MV = Quality of Life after Mechanical Ventilation, n = number, SD = standard deviation, ICU = intensive care unit, ADL = activities of daily living, IADL = instrumental activities of daily living, APACHE = Acute Physiology and Chronic Health Evaluation, SF-36 PF = Short Form-36 Physical Function, LOS = length of stay, MV = mechanical ventilation