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Empirical Validation of Medical Equipment Replacement Values in Life Care Plans

Irmo Marini, Ph.D., CRC, CLCP, FVE
Dana Harper, MS

Abstract. *The Daubert decision in 1993 essentially placed life care planning and other experts on notice regarding what evidence was acceptable and admissible in court. An essential element of this decision included providing evidence that was empirically supported or scientifically validated. One area life care planners continue to be questioned concerns the replacement values of assistive technology and durable medical equipment. Life care planners historically have relied upon warranty assurances, individual resource vendor opinions, and written advertising of the products. This study represents a first to empirically validate these replacement values by surveying 101 assistive technology practitioners from across the continental United States. Frequency data were analyzed in terms of ranges, median life expectancy and replacement parts for equipment, and current price ranges for equipment, repairs and maintenance.*

Introduction

The 1993 Daubert v. Merrill Dow Pharmaceuticals decision, whereby an expert witness's testimony was disqualified primarily due to the expert's inability to substantiate his opinions based on commonly accepted and a methodologically validated approach, has since changed how life care planners prepare, and other expert witnesses proffer their opinions (Daubert Ruling as cited in Field, 2000). Prior to this decision, expert witnesses could essentially base their opinions on their education, training and experience, which could not only be vastly different from other experts in the field, but also did not require a standardized methodology that was commonly accepted by the field (Isom & Marini, 2002). The Daubert decision, according to Weed (1999), required that expert testimony must be founded on a methodology that was scientifically valid and could be properly applied to the facts of the case. In addition, the methods or techniques used to derive at any opining conclusions had to be generally accepted by the profession and subjected to peer review and publication (Isom & Marini, 2002).

Although many life care planners have taken notice of the Daubert ruling and are more careful in following the guidelines of this ruling, there remains one critical area that has been scantily addressed in the field despite its ongoing vulnerability under cross-examination in the courtroom (Amsterdam, 2003). Specifically, the reliability and validity of methods in determining the replacement values of assistive technology (AT) and durable medical equipment (DME) has yet to be empirically validated by these professionals. Weed has noted how this issue continues to remain a controversial one in the field and needs to be addressed (R. Weed, personal communication, April 20, 2002, as cited in Amsterdam, 2003).

Historically, the approach many life care planners have taken in ascertaining replacement values stems from the commonly accepted and published standard protocol of calling one or

more vendors where cost quotations are needed for a specific life care plan, and asking the DME personnel how long the equipment is expected to last as well as the need for replacement parts in the interim (Deutsch & Sawyer, 2001). This method has, in the majority of cases, held up in court and is by default the commonly accepted standard for the profession. However, there are many variables that come into play regarding the life expectancy of DME and/or replacement parts, and some attorneys are beginning to challenge these values. Amsterdam (2003) cited a number of important factors needing to be considered when establishing these values.

One such variable includes the age of the client. Children typically are not only still growing but also may be more active regarding wear and tear of equipment. As such, replacement values for equipment such as wheelchairs during these younger years generally are more frequent than for adults. Younger persons are likely to use DME longer hours each day compared to middle-aged adults and elderly persons who tend to be less active.

Environment also has a significant bearing on DME or assistive devices that are exposed to the elements such as wheelchairs, van lifts, wheelchair hoists, outdoor wheelchair elevators, etc. Assistive technology professionals in the northern United States often cite the cold winters, melting snow on equipment, and rust as elements that have a critical impact on the life expectancy of such equipment (M. Byrd, personal communication, May 16, 2005). Amsterdam (2003) additionally addresses rural environments with unstable surfaces such as ground and rock having a negative impact on equipment life expectancy. Conversely, warmer or moderate winter climates near the ocean where beach sand and salt air come into regular contact with the equipment can erode metal, gears, and bearings considerably faster than not having such exposure. Overall, the life expectancy of these types of equipment can vary considerably if used for indoor only versus outdoor use.

Amsterdam (2003) also differentiates between the behaviors of equipment users. Children or adults with cognitive deficits may knowingly or unknowingly be very rough on equipment such as throwing it down (i.e., voice synthesizers, adaptive computers), carelessly banging it against walls (i.e., wheelchairs), or letting others (i.e., children) play with the equipment such as power wheelchairs. Children tend to be more active in using certain equipment and generally are not as concerned or aware of the consequences of roughhousing and subsequently damaging equipment (e.g., being without it or difficulty re-funding the equipment).

Lifestyle differences are important as well regarding the activities in which clients are engaged. Persons using sports wheelchairs (such as for wheelchair basketball or marathons), naturally subject their wheelchairs to a great deal of wear and tear. Obese clients, despite generally being more sedentary, can increase stress on wheelchairs, van lifts, Hoyer lifts and ceiling track lifts as well as power beds (Amsterdam, 2003). Durability of equipment for individuals using voice synthesizers at school or work could differ significantly from those persons who are neither employed or attending school regarding battery life and overall wear and tear.

The current study represents a first in that AT and DME practitioners were surveyed regarding the life expectancy and wear and tear replacement values of equipment commonly recommended for clients in a life care plan. Amsterdam (2003) previously presented some empirical data regarding certain equipment based on surveying 28 life care planners, however, only 20% of those surveyed responded, raising a question as to the overall generalization of the information.

Method

Participants

Participants for this study included 101 AT and DME practitioners from across the continental United States, representing 45 states. To be included in the study, participants had to: a) represent various geographical locations, b) either be on the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) web site as a certified assistive technology practitioner (ATP) or have at least two years work experience and currently working as an assistive technology supplier (ATS).

Procedure

The first author obtained a faculty research grant as well as permission to work with human participants approval from his university. A 16 item survey was designed to assess the life expectancy replacement rates as well as interim replacement part values of various AT and DME. The survey included questions regarding:

- power indoor/outdoor wheelchairs for adults and children
- power tilt and recline wheelchairs
- manual light weight non-sport wheelchairs
- sports and all-terrain wheelchairs
- commode shower wheelchairs
- power scooters
- power Hoyer® lift
- power track ceiling lifts
- power hospital beds
- various replacement type mattresses
- various wheelchair cushion replacements
- hydraulic bathtub chairlifts
- wheeled walkers
- gait trainers
- standing frame manual wheelchairs
- power standing frame wheelchairs
- environmental control units
- respiratory equipment including oxygen (O2) concentrators
- respiratory suction machines
- nebulizer machine
- portable home ventilator

The survey header asked participants to assume regular or daily use of the equipment by consumers. The survey was initially sent to a local certified AT and DME practitioner with over 10 years experience for comment/modification of the survey to strengthen its content validity. Once completed, a listing was compiled of certified RESNA practitioners working at medical equipment supply companies and through a state by state Internet yellow pages search for phone numbers of such suppliers in every state. The target goal was to have four suppliers participate from every state (200 total); however, difficulties in getting respondents to complete the survey in a timely manner occurred, leading to a 50% response rate.

Potential participants were contacted by phone, mail and e-mail inquiring about their interest in participating. Of the 200 practitioners contacted, 135 agreed to participate and 101 completed a useable survey. In order to potentially increase response rate, participants were offered five dollars to complete and return the survey. In the majority of instances, however, participants deferred payment and expressed appreciation for being able to respond. In cases where ATPs agreed to participate but had not returned their survey within two weeks, a second contact was made and, in 17% of the cases, a second survey was sent out. In some instances, ATPs could not answer all parts of the survey as they did not have experience with the type of equipment being queried. Items they did feel confident providing a response to

Table 1, Replacement Median and Range Rates of Equipment in Years

Device	N	Median Replacement Rate (years)	Range
Power Wheelchairs For Adults	99	5.0	2-8
Power Wheelchairs For Children	96	4.5	1-7
Power Tilt: New Wheelchair	89	5.0	2-8
Manual Wheelchair	98	5.0	2-7
Sports Wheelchair: If used 3 X week (avg.)	38	5.0	1-7.5
Sports/All Terrain Wheelchairs	45	4.0	1-6
Commode Shower Wheelchairs	87	4.6	2-7.5
Power Scooters for Adults	97	5.0	3-7.5
Power Hoyer®: New Lift Replacement	65	7.0	3-10
Power Hoyer®: New Sling Replacement	68	2.0	1-5
Manual Pump Hoyer®: Entire Hoyer® Lift	68	7.5	4-10
Manual Pump Hoyer®: Hydraulic Pump Only	69	5.0	2-10
Power Track Ceiling Lifts: Lift Replacement	36	7.0	4-10
Power Hospital Bed: New Bed Replacement	78	7.0	3-12.5
Bed Mattresses: Standard	82	3.0	1-6
Bed Mattress: ROHO®	60	4.0	1-7

were reported in the study which explains the varying response rates in Tables 1-4 as shown later in this article. Once the survey collection was completed, all surveys were analyzed using frequency counts and deriving range and median scores for each item (See Table 1). Median scores were deemed more statistically reliable than mean scores because the median is less effected by outlier variables and best represents the middle score weights.

Results

In over 90% of cases, ATPs were fairly consistent with one another in their responses. Only certain aspects of each of the four tables are summarized here, therefore the reader should look for specific items directly in each of the tables. Of particular interest in Table 1 is the common agreement by most ATPs that wheelchairs of any kind typically have a five year life expectancy. In the authors' experience, this is consistent with what Medicaid/Medicare acceptable new chair approval replacement time periods typically are and what many life care planners have relied upon in the past. As previously stated, these figures are based on daily use, and life care planners would, of course, have to assess less than daily use on an individual client basis. The noted exception for wheelchairs was a shorter life expectancy for sports, commode, children's and all-terrain wheelchairs.

Regarding patient lifts and lift replacement parts, total new lift replacements had a median of seven years, lift slings two years, and replacement of a Hoyer® lift hydraulic pump was five years. Power hospital beds were rated as needing replacement every 7.5 years, while ROHO® airflow and standard bed mattress changes had median replacement scores in the three to four year range (note this only applied to mattress and motor components, since most bed frames have a lifetime warranty). Cushions of various composition averaged 2.5-3 years life expectancy. Gait trainers, walkers and standing frames all ranged between 3-5 years, noting more frequent replacement rates for children, likely due to growth rates. A section devoted to respiratory equipment (i.e., nebulizer, ventilator, O2 concentrator) drew a smaller response rate and typically showed a range of 3–5 years as well, while computer-based and receiver environmental control units typically were rated obsolete after four years, likely due to advancements and changes in technology.

Table 2 highlights additional replacement parts, median cost and range of costs for wheelchairs, beds, lifts, annual maintenance costs, etc.

Table 2, Replacement Median, Range, and Cost Rates and Range of Equipment Replacement Parts in Months

Device	N	Median Months	Range (mths)	Cost	Cost Range
Power Wheelchair For Adults: New Batteries (2)	96	18	9-30 mths		
Power Wheelchair For Adults: Annual Maintenance	80			$300	$100-1,000
Power Wheelchair For Adults: New Tires	96	18	6-48 mths		
Power Tilt/Recline: New Batteries (2)	84	13.5	10-24 mths		

Table 2 cont'd

Power Tilt/Recline: Annual Maintenance	75			$500	$100-1,500
Power Tilt/Recline: New Tires	82	14	6-36 mths		
Manual Wheelchairs: Annual Maintenance	91			$150	$50-500
Manual Wheelchairs: New Tires/Spokes	81	15	6-36 mths		
Sports Wheelchairs: Annual Spare Parts	40			$250	$100-600
All Terrain Wheelchairs: New Batteries	38	18	1-2 yrs		
Power Scooters: New Batteries	93	18	11-36 mths		
Power Scooters: Annual Maintenance	86			$250	$50-1,000
Power Scooter Tires:	90	2 yrs	11-60 mths		
Power Hoyer®: New battery	73	2 yrs	1-3 yrs		
Power Hoyer® Sling:	68	2 yrs	1-5 yrs		
Manual Pump Hoyer®: Replacement of Pump	69	5 yrs	2-10 yrs		
Power Track Ceiling Lifts: New Battery	37	2 yrs	1-5 yrs		
Power Track Ceiling Lifts: Annual Maintenance	31			$150	$100-300
Power Hospital Bed: New Battery	67	5 yrs	2-10 yrs		
Power Hospital Bed: Maintenance Costs Yr	61			$100	$50-250
Bed Mattresses: Power Box for Air Flow	36	4 yrs	1-5 yrs	$850	$175-3,000
Hydraulic Bathtub: Parts For Tublift Chair	48	2.5 yrs	1-5 yrs		
Four Wheeled Walker Tires	90	2.5 yrs	1-8 yrs		

Table 2 cont'd

Power Standing Frame: New Batteries	54	2 yrs	1-5 yrs		
Power Standing Frame: Annual Chair Maintenance	40	1 yr	1-2 yrs	$200	$100-800
Respiratory Equipment: Ventilator Parts Changed	15	6 mths	3-12 mths	$200	$50-775

Table 3, Southern States Differences in Replacement Rates in Years

Device	N	Median (yrs)	Range (yrs)	Cost	Cost Range
Power Wheelchair Adults: New Chair	46	5	3-7		
Power Wheelchair Adults: Annual Maintenance	42			$300	$100-1,000
Power Wheelchair Adults: New Tires	39	24 mths	12-36 mths		
Power Wheelchair Children: New Chair	42	4.5	2-6		
Power Tilt/Recline: New Chair	40	5	2-8		
Power Tilt/Recline: Annual Maintenance	33			$500	$200-1,000
Power Tilt/Recline: New Tires	35	16 mths	10-36 mths		
Manual Wheelchairs: New Chair	45	5	4-7.5		
Manual Wheelchairs: Annual Maintenance	44			$150	$50-400
Manual Wheelchairs: New Tires	41	18 mths	8-36 mths		
Standing Frame: Manual Wheelchair	27	5	3-6.5		
Power Standing Frame Wheelchair:	25	5	3-6.5		
Power Standing Frame Maintenance	19	1	1-2.5	$200	$100-750

Table 4, Northern States Differences in Replacement Rates in Years

Device	N	Median (yrs)	Range (yrs)	Cost	Cost Range
Power Wheelchair Adults: New Chair	50	4-7	5		
Power Wheelchair Adults: Annual Maintenance	44			$350	$100-1,000
Power Wheelchair Adults: New Tires	49	6-36 mths	15 mths		
Power Wheelchair Children: New Chair	48	2-5	4		
Power Tilt/Recline: New Chair	47	4-7	5		
Power Tilt/Recline: Annual Maintenance	39			$500	$100-1,100
Power Tilt/Recline: New Tires	47	6-36 mths	12 mths		
Manual Wheelchairs: New Chair	49	3-7	5		
Manual Wheelchairs: Annual Maintenance	48			$200	$50-500
Manual Wheelchairs: New Tires	45	6-36 mths	12 mths		
Standing Frame Manual Wheelchair	27	4-8.5	5		
Power Standing Frame Wheelchair	26	4-7	5		
Power Standing Frame: Annual Maintenance	19	1-3	1	$200	$100-800

Overall, wheelchair batteries and tires/spokes wear and tear replacement medians ranged from approximately 12–18 months. Annual maintenance costs for power wheelchairs and scooters ranged from $100 - 1,500 per year (median $250 - 500), whereas manual wheelchair maintenance ranged from $50 - 500 per year (median $150) Note that in many instances, such as maintenance of new wheelchairs, the first year following purchase is typically covered under a standard one year warranty, therefore, annual maintenance costs should begin in the second year. Again, due to rapid child growth patterns, replacement of gait trainers for children was every three years compared to five years for adults. Respiratory devices, equipment and replacement filter questions were responded to by a smaller group who specialized in this

area, indicating replacement of filters every three to six months.

The final two tables, Tables 3 and 4, identify many of the same equipment and replacement parts as Tables 1 and 2, however, the authors wanted to distinguish any apparent differences in life expectancy for DME due to harsher weather conditions in the colder states (i.e., with several months of snow and generally freezing temperatures) than from DME used in warmer states. Included in the southern states were Florida, the Carolinas, Alabama, Georgia, Mississippi, Texas, New Mexico, Tennessee, Kentucky, Arizona, Arkansas, California, Nevada, Oklahoma, Louisiana, Missouri, Oregon and Indiana. All other unnamed states participating in this study were deemed northern states. Overall, there appeared to be no significant differences in life expectancy of equipment or parts between northern and southern climate states other than a relatively longer life expectancy for wheelchair tire replacement (i.e., 16 months) for southern states compared to approximate 12 months replacement rates for northern states.

Discussion and Conclusion

The impetus of this study was to provide empirical validation of the replacement values/rates of AT and DME most often recommended for clients in the development of life care plans. One hundred and one ATPs participated in the study; however, response rates for each item surveyed varied due to the ATPs experience/expertise with the device or equipment. The authors' concerted effort to compile the median rates of life expectancy for various devices was deemed important to the profession in meeting Daubert challenges by obtaining empirically supported validation of replacement values in this area. Prior to this study, only anecdotal reports existed via conference meetings and other professional forums as to how often life care planners are challenged on equipment replacement value rates. The standard methodology of querying one or two DME suppliers about the life expectancy of equipment always carries the possibility of potential bias by suppliers in order to make a sale; however, the authors recommend life care planners continue to practice this local market assessment and utilize our findings accordingly or as benchmark data since local market assessments are a generally accepted practice that remains relatively unchallenged.

Results of this study are, for the most part, fairly consistent with the replacement rates life care planners generally have come to rely upon in most instances. As noted earlier, however, life care planners must consider the merits of each case individually based on factors such as client age, weight, equipment usage and frequency of use, region of country, type of equipment, and type of disability. The present study showed no clinically significant differences in wear and tear replacement recommendations between the northern colder states and the warmer southern states, other than for slightly longer life expectancy for wheelchair tires in the southern states.

In looking at potential limitations of the study, the authors are fairly confident about the generalizability of the findings, however, they were unable to obtain usable surveys from five states and also unable to meet their target of 200 respondents. Future research could expand from this study and include other AT devices of the literally hundreds that are available on the market. Finally, these results should stand the test of time for experts wanting to cite median replacement rates in combination with an individualized assessment of the client; however, the cost and cost ranges for equipment replacement parts will become dated over time and life care planners should continue to obtain local prices for these items.

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About the Authors

Irmo Marini, Ph.D., CRC, CLCP, FVE, is Professor and Graduate Coordinator of the Rehabilitation Counseling program at the University of Texas-Pan American in Edinburg, Texas. He also operates a forensic rehabilitation consulting practice developing life care plans and vocational damage assessments. Dr. Marini serves on several national committees, editorial boards, and has over 55 refereed publications as well as over 50 presentations.

Dana Harper, MS, recently graduated from the Rehabilitation Counseling masters program at the University of Texas-Pan American. She holds a bachelor's degree in psychology from the University of Texas at Austin and was the graduate research assistant funded for this project. Her interests are in mental health counseling as well as expert testimony, and she currently does contract work for Marini & Associates forensic rehabilitation consulting.