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Validation of the Greek version of the device subscale of the Quebec User Evaluation of Satisfaction with Assistive Technology 2.0 (QUEST 2.0)

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ABSTRACT

The purpose of the study was to evaluate the device subscale of the QUEST 2.0 instrument and provide evidence for the validity and reliability of the Greek version. To this end, a cross-cultural adaptation was performed. Field test studies were conducted to validate the appropriateness of the final outcome. Data were drawn from a study of 115 subjects who had been administered the GR-QUEST questionnaire. Ratings related to the different items were statistically analyzed. The exploratory factor analysis with varimax rotation conducted revealed a three factors structure of the device subscale in contrast with previous studies. Our "Safe Use" subscale contains the items adjustments, safety and effectiveness of the original instrument, the "Fit to Use" subscale contains the dimensions, weight and ease of use items, and the "Endurance" subscale contains the items durability and comfort of the original questionnaire. Reliability measures (ICC=0.949, Pearson´s correlation=0.903, Cronbach´s α=0.754) yielded high values. Test-retest outcome showed great stability. Based on the results, the GR-QUEST can be considered as a valid and reliable instrument and thus it can be used to measure the satisfaction of patients with assistive devices, while it is applicable to the Greek population. Further assessment of the services subscale is needed.

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assessment; assistive technology; Greece; QUEST 2.0; user satisfaction; validation

Introduction

Patient satisfaction is considered crucial in any aspect of healthcare services. Its importance has been widely studied and reported (Avis, Bond, & Arthur, 1997; Cordeiro, Dixon, Coburn, & Holloway, 2015; Graham, Green, James, Katz, & Swiontkowski, 2015; Gu & Itoh, 2014; Huerta, Harle, Ford, Diana, & Menachemi, 2016; Krol et al., 2015; Locker & Dunt, 1978; Williams, Coyle, & Healy, 1998). The monitoring of satisfaction data can be proved valuable in any effort related to the redesigning of the existing infrastructures and services, planning of new healthcare services, designing new strategies and policies, etc. The several actors involved (physicians, managers, etc.) can benefit by the analysis of these data and improve significantly the loyalty of their "customers" by making the appropriate corrections according to the feedback gained. The same situation appears even when a health "consumer" is using any kind of assistive devices (i.e., wheelchair, assistive robot, hearing assistive technology, health application, etc.). The level of satisfaction when using an assistive device is of great importance for choosing the right one at the beginning. This drives to a more reliable use of the device and better rehabilitation progress without abandoning the device at an early stage, which would thus delay the treatment process (Samuelsson & Wressle, 2008; Simon & Patrick, 1997; Zastowny, Roghmann, & Cafferata, 1989). Taking into account the perspective of the patient is therefore crucial to achieve a better compliance with the treatment regimen (deRuyter, 1997; Galvin, 1995).

One of the most well-known and widely used instruments to measure users' satisfaction in the rehabilitation field is the Quebec User Evaluation of Satisfaction with Assistive Technology, version 2.0 (QUEST 2.0) (Demers, Weiss-Lambrou, & Ska, 2000b). QUEST is an instrument specifically designed to measure satisfaction with a broad range of assistive technology devices in a structured and standardized way. Although its experimental version consisted of 24 items, an item analysis subsequently resulted in a reduced 12-item scale: the QUEST 2.0. These 12 items relate to device characteristics (n = 8) and assistive technology services (n = 4) (Demers, Monette, Lapierre, Arnold, & Wolfson, 2002). The eight device characteristics items assess the user's degree of satisfaction with device properties and the remaining four items are related to assistive technology services. The QUEST 2.0 is one of the most popular standardized instruments designed to measure user satisfaction with a broad range of assistive technology devices (Holz, Höhne, Staiger-Sälzer, Tangermann, & Küblera, 2013; Jardón, Gil, DelaPeña, Monje, & Balaguer, 2011).

The measurement properties of the QUEST 2.0 have been investigated with respect to reliability, test–retest stability, alternate form reliability, construct validity, and applicability (Demers et al., 2002) by its developers. Also, the QUEST 2.0 has been used in many studies in order to evaluate perceived

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satisfaction among users of different assistive devices (Hill, Goldstein, Gartner, & Brooks, 2008; Holz et al., 2013; Jardón et al., 2011; Kirby, MacDonald, Smith, MacLeod, & Webber, 2008; Laffont et al., 2008; Samuelsson & Wressle, 2008).

QUEST 2.0 was originally developed in English and French and then translated and validated in several languages (i.e., Norwegian, German, Japanese, Arabic, etc.). The purpose of this study was to investigate the validity and reliability of the QUEST 2.0 in Greek reality (GR-QUEST 2.0).

Methodology

For the purposes of the study we followed a two-stage methodology: at the first stage we translated the English questionnaire QUEST 2.0 into Greek, and at the second stage we tested the reliability and validity of the Greek version of QUEST 2.0 (GR-QUEST).

First stage: Translation phase

The translation phase and the cultural adaptation of the questionnaire is of high importance. We studied the several methodologies and concepts proposed in the bibliography (Beaton, Bombardier, Guillemin, & Ferraz, 2000, 2002; Guillemin, Bombardier, & Beaton, 1993; Vallerand, 1989) and concluded in a three-step process. At the first step, a bilingual team of a professional translator, a biomedical engineer, an occupational therapist, and a physical therapist translated the original instrument into Greek. In parallel, another translator with no medical background and a native English speaker produced a second version of the GR-QUEST. The two versions were back-translated into English by a professional translator with no medical background and with no access to the original instrument. At the second step, the four questionnaires and the original one were then forwarded to a team of six experts and researchers in the field (four engineers, one physiatrist, and one occupational therapist), in order to consent in the pre-final GR-QUEST. This preliminary version, during the third step, was pre-tested while administered by a physical therapist to 10 participants. These subjects were then interviewed in order to assure the clarity and the appropriateness of the Greek version.

Second stage: Field testing

Subjects recruitment and data collection procedures

A sample of 115 individuals was included in the evaluation of the GR-QUEST 2.0. The study initiated at the beginning of July 2014 and lasted until January 2015. The subjects were of both sexes, aged from 16 to 93 and users of mobility assistive devices (i.e., canes, walkers, manual or electric wheelchair, rollator with brakes or not, scooter, orthosis, etc.) for at least 1 month. According to the inclusion criteria selected, all of them scored above 17 in the Mini Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975). In parallel, the subjects' demographic data were recorded, along with their scores in the performed examinations and scores (MMSE and Functional Independence Measure [FIM]) and their individual characteristics (assistive technology used, frequency of use, pathology, etc.). The study was conducted by experienced physical therapists in a Greek private rehabilitation center. The participants were selected in order to meet the inclusion criteria (MMSE > 17, using an assistive device for at least 1 month, and being older than 15 years). A very careful pre-selection phase lasted for a month. During this period, a physiatrist and a physical therapist were studying the patient records of both the inpatients and the outpatients of the hospital in order to prequalify the ones that could meet the desired criteria and communicate with them in a later step. Upon agreement, the subjects were administered the translated scale in two time intervals. The second assessment session was conducted a week after the first interval. For this to be achieved there was a very careful monitoring and processing of the patients in order to both meet the inclusion criteria, and be able to participate in the second interval without a problem as well. To this end, our staff had to manage and organize accordingly the therapies of the subjects in order to be sure that they will be available upon request. All 115 participants completed both administrations. The study was approved by the Bioethics and Deontology Committee of the Technological Educational Institute of Athens. Table 1 summarizes the subjects' exclusion criteria.

Table 1. Subjects' exclusion criteria.

Variables	Exclusion criteria
Age	<16
MMSE score	<18
Time of use of the assistive device	<1 month

Statistical analysis

The assumption of normal distribution of the collected data was tested using the Kolmogorov–Smirnov test. Item analysis was carried out and exploratory factor analysis (EFA) with Varimax rotation was carried out to investigate the factor structure of the GR-QUEST.

The GR-QUEST 2.0 was measured in order to investigate its reliability and validity. The reliability was evaluated by assessing the instrument's internal consistency, test–retest reliability, and repeatability. The internal consistency was assessed with Cronbach's alpha coefficient using the data obtained from the initial assessment. A threshold value of 0.70 was chosen, which indicates sufficient reliability for research purposes. The Cronbach's α "if item deleted" was used as an additional evaluation test. Test–retest reliability was evaluated using the intra-class correlation coefficient (ICC) with 95% confidence interval (CI). The ICC, which is the most suitable statistical test for the assessment of reliability, ranges from 0 to 1, with 1 indicating perfect reliability. The Cronbach's α and ICC correlations were characterized as follows: 0.00–0.25 = little, if any, correlation; 0.26–0.49 = low; 0.50–0.69 = moderate; 0.70–0.89 = high; and 0.90–1.00 = excellent. The repeatability is determined by calculating Pearson's product moment correlation coefficient (Pearson's r) between the initial and re-assessment total scores of questionnaire. The Pearson correlation coefficient values were specified as

Table 2. Characteristics of the participants.

Variables	Mean	*SD*	*N*
Age	62.45	19.29	115
FIM score	104.74	65.06	115
MMSE score	25.41	4.01	115
	Option	*N*	%
Sex:			
	Men	51	44.35
	Women	64	55.65
Type of assistive device used:			
	Cane	37	32.17
	Walker	31	26.96
	Rollator	2	1.74
	Scooter	3	2.61
	Wheelchair	28	24.35
	Orthosis	11	9.57
	Prostheses	1	0.87
	Hearing aid device	2	1.74
Education level:			
	No education	16	13.9
	Primary (is divided into kindergarten lasting 1 or 2 years, and primary school lasting 6 years, where children are admitted at the age of 6)	34	29.6
	Secondary (children are admitted at the age of 12 and lasts 6 years; high school level)	52	45.2
	Tertiary (university level)	13	11.3
Diagnosis:			
	Stroke	23	20.00
	Hip fracture	24	20.87
	Guillain Barre	2	1.74
	Total knee replacement	7	6.09
	Femoral fracture	2	1.74
	Myopathy	4	3.48
	Traumatic brain injury	6	5.22
	Multiple Sclerosis	6	5.22
	Motor neuron diseases	6	5.22
	Ageing	6	5.22
	Anterior cruciate ligament rupture	2	1.74
	Quadriplegia	5	4.35
	Others*	22	19.13
Frequency of using the assistive device:			
	Not often	11	9.50
	Normal	16	13.90
	Often	18	15.70
	Very often	70	60.90

Note. *Others include patients from the following categories: Reye syndrome, cerebral palsy, gait disorder, parencephalitis, meningitis, obesity, muscular dystrophy, lung cancer-lower limbs weakness, cancer of central nervous system, lumbar spine fusion, lower limbs fracture, multiple system atrophy, osteoporosis, burn, cervical spine syndrome, meningioma, knee fracture, and bone edema.

follows: 0.00–0.19 = very weak correlation; 0.20–0.39 = weak correlation; 0.40–0.69 = moderate correlation; 0.70–0.89 = strong correlation; and 0.90–1.00 = very strong correlation.

There are various types of validity, such as construct validity, criterion-related validity, and content validity. The construct validity refers to the degree to which an instrument measures the construct under investigation. The item-total correlations within each QUEST 2.0 subscale were compared in order to test whether all items of each subscale were related to the same construct. Acceptable construct validity should be indicated by high or excellent (0.70 to 1.00) item inter-correlations for all item pairings. The discriminant validity (one of the two types of construct validity) tests whether concepts or measurements that are supposed to be unrelated are, in fact, unrelated. A successful evaluation of discriminant validity shows that a test of a concept is not highly correlated with other tests designed to measure theoretically different concepts. Although there is no standard value for discriminant validity, a result greater than 0.85, however, tells us that the two constructs overlap greatly and they are likely measuring the same thing. In our study, we performed discriminant validity test between the different subscales of the QUEST 2.0. For the purposes of the study we used the Statistical Package for the Social Sciences (IBM SPSS version 19).

Results

The characteristics of the participants are presented in Table 2. The mean age of the patients was 62.45 years (*SD* 19.29), and 55.7% (64/115) were women. The mean FIM and MMSE scores were 104.74 (*SD* 65.06) and 25.41 (*SD* 4.01), respectively. An average time to complete the questionnaire was around 10 minutes. A range of assistive technologies was evaluated, such as cane, walker, rollator with brakes, scooter, wheelchair, orthosis, and hearing aid device (Table 2).

Translation and cultural adaptation process

There were no major difficulties during the translation phase of the original instrument. However, because of differences in Greek and English wording, the terms "safe" and "secure" of item 4 of the original version cannot be distinguished in Greek. After discussion among the panel members, the two terms were translated in the target language into one single term "ασφαλής".

Table 3. EFA of the GR-QUEST 2.0.

Item	Factor 1: Endurance	Factor 2: Fit to Use	Factor 3: Safe Use
1. Dimension		0.821	
2. Weight		0.843	
3. Adjustment	0.415		0.449
4. Safety			0.836
5. Durability	0.659		
6. Easy to use	0.533	0.470	
7. Comfort	0.722		
8. Effectiveness			0.846

Table 4. Item analysis of the GR-QUEST.

	Mean (*SD*)	Cronbach's α if item deleted	ICC for each item
Item 1 (dimensions)	4.80 (0.232)	0.694	0.892
Item 2 (weight)	4.92 (0.108)	0.728	0.644
Item 3 (adjustments)	4.71 (0.452)	0.696	0.887
Item 4 (safety)	4.66 (0.542)	0.685	0.971
Item 5 (durability)	4.90 (0.164)	0.730	0.902
Item 6 (Ease of use)	4.72 (0.659)	0.754	0.918
Item 7 (comfort)	4.65 (0.562)	0.673	0.959
Item 8 (effectiveness)	4.79 (0.289)	0.674	0.854

Table 5. Measures of reliability of the GR-QUEST.

Characteristics	Measure/test	Value	Significance (p-value)
Internal consistency	Cronbach's α	0.754	0.000
Repeatability	Pearson's r	0.903	0.000
Test–retest reliability at initial assessment	ICC (95% CI)	0.949	0.000
Test–retest reliability at reassessment	Paired-samples *t*-test		0.162

Exploratory factor analysis

According to the results from the exploratory factor analysis (EFA) with Varimax rotation performed (Table 3), the GR-QUEST 2.0 instrument presents a three-factor model. The resulting three factors satisfy the rule that meaningful factors should be associated with eigenvalues greater than 1.0. Also, according to the screen plot test (not shown) three factors were extracted. Criteria used to select factors included eigenvalue >1 and factor loading >0.30. The three factors extracted explained 59.686% of the total variance with eigenvalues 2.195, 1.528, and 1.052, respectively. The "Safe Use" factor explaining 27.440% of the variance, and the Fit to Use and "Endurance" factors explained the 19.095% and 13.151%, respectively. Factor loadings, which are the correlation coefficients between the items and the factor, ranged from 0.415 to 0.722 for the first factor, from 0.470 to 0.843 for the second, and from 0.449 to 0.846 for the third (Table 3). Item 3 was almost equivalent loaded to the factors one and three, but since it was slightly more loaded to the third one it was proposed to belong to the Safe Use domain. The

Table 6. Construct validity of the GR-QUEST (item-total score correlations).

	Pearson's *r*	Frequency of being selected as an importance item
Factor1 subscale item, Safe Use		
Item 3 (Adjustments)	0.691	19
Item 4 (Safety)	0.794	96
Item 8 (Effectiveness)	0.769	34
Factor2 subscale item, Fit to Use		
Item 1 (Dimensions)	0.708	23
Item 2 (Weight)	0.615	26
Item 6 (Ease of use)	0.829	74
Factor3 subscale item, Endurance		
Item 5 (Durability)	0.635	21
Item 7 (Comfort)	0.909	51

Table 7. Discriminant validity of the GR-QUEST (Pearson's *r* between subscales).

	Subscale Safe Use	Subscale Fit to Use	Subscale Endurance
Subscale Safe Use	1	0.146	0.317
Subscale Fit to Use	0.146	1	0.239
Subscale Endurance	0.317	0.239	1

item 6, even if it is slightly more loaded to the third factor, was decided to be included to the Fit to Use domain.

Reliability

According to the analysis conducted, the overall Cronbach's α was 0.754 (ranging from 0.685 to 0.754 with individual items deleted), indicating sufficient consistency (Table 4). The various reliability measures are summarized in Table 5. The ICC (=0.949) was excellent, indicating that the GR-QUEST total scores were highly consistent between the two occasions (initial assessment and reassessment), whereas the ICC for each item (ranging from 0.644 to 0.971) were also highly consistent between the two occasions and are presented in Table 4. The paired-samples *t*-test between the initial assessment and the reassessment indicated no statistically significant systematic bias. The Pearson correlation coefficient was 0.903, thereby indicating stability of participants' responses over time.

Validity

Examination of item construct validity showed that all item intercorrelations for all item pairings were strong or excellent. Pearson's *r* ranged from 0.691 to 0.794 for the first subscale Safe Use, from 0.615 to 0.829 for the second Fit to Use, and from 0.635 to 0.909 for the third subscale Endurance. This would provide evidence that all subscales' items are related to the same construct (Table 6).

Examination of discriminant validity is presented in Table 7. Since 0.146 and 0.317 is less than 0.85, we can conclude that discriminant validity exists between the subscale measuring Safe Use and the subscales measuring Fit to Use and Endurance, respectively. Also, 0.239 is less than 0.85. Thus, we can also conclude that discriminant validity exists between the subscale measuring Fit to Use and the subscale measuring Endurance. The three subscales measure theoretically different constructs.

Discussion

The objectives of this study were to evaluate the validity, reliability, and applicability of the QUEST 2.0 instrument in the Greek population. The target population was composed of heterogeneous groups. The population participated in the study can assure the usage of the instrument in patients with different diseases, ages, and disabilities using various assistive devices. This can be considered as an asset in our study in order to generalize the outcomes. The subjects of our study were chosen carefully in order to be able to fill the instrument by their own or with the help of a therapist. Thus, the interview-based format was marginally used. All subjects were scored with 17 or higher in the MMSE scale, indicating that all of them had not a cognitive impairment.

The cross-cultural adaptation of the questionnaire was very demanding. There may be cases were a word in English may have an equivalent in Greek, but the two words can cover different areas of meaning that may overlap but not be synonymous. The effect of context, in interpreting the meaning of these words, may also differ from one language to other (Leplege, Ecosse, Verdier, & Perneger, 1998).

According to the results of the study, the GR-QUEST 2.0 is a valid tool of assessment of satisfaction with assistive technology. However, some questions should be raised regarding the structural validity of the QUEST 2.0. The major concern refers to the service section. In our investigation, the participants did not complete this section (items 9 to 12) of the original QUEST 2.0 instrument, and thus our analysis limited to the rest items (device domain). To this end, the first eight items were finally evaluated since we did not collect enough data from the participants in regard to the service domain of the original instrument. This will be a future study in order to evaluate and the second domain of the prototype instrument in Greek reality. For this to be achieved we will recruit more patients using wheelchairs, scooters, and other assistive devices that may need service. The neglectfulness of answering that part of the original questionnaire can be justified by the fact that most of the end-users were using "simple" assistive technologies like canes, walkers, and rollators, and no significant services (i.e., after sales support, repair, maintenance, further information, etc.) are required. Moreover, it is important to notice that the patients (both outpatients and inpatients as well) of our rehabilitation center obtain their assistive device through us. This means, that all the procedures for choosing and final buying any assistive device are a sole responsibility of the therapists of our center, according to the individual needs of each patient. Thus, the patients do not have any direct communication with the company that sells these devices. Any information regarding the usability, customization, specifications, training, service needs, etc., is therefore passed to our personnel, since our specialized therapists bought the assistive device and are responsible for it. However, this is not the only study that faced the problem of collecting answers relevant to the service domain (Brandt, 2005; Demers et al., 2002). As a conclusion, we also support the outcome that QUEST 2.0, even if it is intended for even simpler devices (e.g., canes, etc.), may be questioned whether it is applicable for evaluation of all devices as stated in the manual (Demers et al., 2000b). This needs to be studied further.

Another significant issue that arose refers to the number of factors extracted. More specifically, the factor analysis conducted in our study even confirmed the multidimensionality of the instrument, it presents a three-factors structure unlike other studies where a two-factors model appeared (Chan & Chan, 2006; de Carvalho, Gois Júnior, & Sá, 2014; Demers, Weiss-Lambrou, & Ska, 2000a; Demers, Wessels, Weiss-Lambrou, Ska, & de Witte, 2001; Mao et al., 2010). According to the results presented, items 3, 4, and 8 constitute the Safe Use subscale; items 1, 2, and 6 represent the Fit to Use subscale; and items 5 and 7 represent Endurance. This difference could be justified by the fact that we performed

factor analysis only in the first eight items of the scale instead of all the other studies that performed EFA in all 15 items (Brandt, 2005; Chan & Chan, 2006; de Carvalho et al., 2014; Demers et al., 2000a, 2000b, 2001, 2002, Mao et al., 2010). This may explain the presence of our factors, or it may be a peculiarity of the Greek population. To our knowledge this is the first EFA challenging the two-factor model. This is also the first Greek version of the QUEST 2.0 questionnaire.

The results of statistical analysis support the validity and reliability of the scale because all the items were related to the total score and Cronbach's α and ICC values were excellent, thus indicating that the responses of our sample were internally consistent and stable across time.

In our study, the safety and ease of use were rated highest by the end-users in terms of satisfaction. This reveals the subjective opinions of the Greek population in relation to what is considered important in an assistive device. These results are in line with the findings of other studies (Chan & Chan, 2006; de Carvalho et al., 2014). As far as the cross-cultural adaptation is concerned, we did not encounter any major difficulty. Only item 4 of the original version had to be adjusted due to the fact that the distinctions between the original terms ("safe" and "secure") are lost in Greek. Other studies were faced with different problems. More specifically, the translation of QUEST 2.0 into Arabic altered the syntax of item 7 (Bakhsh et al., 2014). In another study (Chan & Chan, 2006), while working on the Chinese version of the instrument, items 6 and 11 bore the least satisfactory rating from the raters in terms of translation equivalent. Mao et al. (2010) added a new item related to the cost of the assistive device for the Taiwanese culture. Another effort (de Carvalho et al., 2014), mentioned the need for potential cross-cultural adaptation in order to assure QUEST's applicability in different culture conditions in Brazil. However, this is not the case in Greece.

The current study confirms the applicability of the instrument in the Greek population, as well as its potential to be adapted in different cultures and languages. Our intention is to study further the GR-QUEST 2.0 in a bigger audience and for longer time interval in order to ensure its capability in a longitudinal evaluation. According to the results, the produced GR-QUEST 2.0 (the first eight items) can be used to measure the satisfaction of the end users with assistive technology, particularly with almost any kind of mobility aid devices.

Conclusion

The study showed that the device subscale of the GR-QUEST 2.0 is a valid and reliable tool and it can therefore be used to measure the satisfaction of people using assistive devices.

References

Avis, M., Bond, M., & Arthur, A. (1997). Questioning patient satisfaction. *Social Science and Medicine*, *44*, 85–92. doi:10.1016/S0277-9536(96)00140-2

Bakhsh, H., Franchignoni, F., Ferriero, A. G., & Demers, L. (2014). Translation into Arabic of the Quebec User Evaluation of Satisfaction With Assistive Technology 2.0 and validation in orthosis users. *International Journal of Rehabilitation Research*, *37*, 361–367. doi:10.1097/MRR.0000000000000086

Beaton, D., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2002). *Recommendations for the cross-cultural adaptation of health status measures*. New York: American Academy of Orthopaedic Surgeons.

Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila Pa 1976)*, *25*, 3186–3191. doi:10.1097/00007632-200012150-00014

Brandt, Å. (2005). Translation, cross-cultural adaptation, and content validation of the QUEST. *Technology and Disability*, *17*, 205–216.

Chan, S. C., & Chan, A. P. (2006). The validity and applicability of the Chinese version of the Quebec User Evaluation of Satisfaction With Assistive Technology for people with spinal cord injury. *Assistive Technology: The Official Journal of RESNA*, *18*(1), 25–33. doi:10.180/10400435.2006.10131904

Cordeiro, E., Dixon, M., Coburn, N., & Holloway, C. M. B. (2015). A patient-centered approach to wait times in the surgical management of breast cancer in the province of Ontario. *Annals of Surgical Oncology*, *22*, 2509–2516. doi:10.1245/s10434-014-4320-3

de Carvalho, K. E. C., Gois Júnior, M. B., & Sá, K. N. (2014). Translation and validation of the Quebec User Evaluation of Satisfaction With Assistive Technology (QUEST 2.0) into Portuguese. *Revista Brasileira De Reumatologia*, *54*(4), 260–267. doi:10.1016/j.rbr.2014.04.003

Demers, L., Monette, M., Lapierre, Y., Arnold, D. L., & Wolfson, C. (2002). Reliability, validity, and applicability of the Quebec User Evaluation of Satisfaction With assistive Technology (QUEST 2.0) for adults with multiple sclerosis. *Disability and Rehabilitation*, *24*(1–3), 21–30. doi:10.1080/09638280110066352

Demers, L., Weiss-Lambrou, R., & Ska, B. (2000a). Item analysis of the Quebec User Evaluation of Satisfaction With Assistive Technology (QUEST). *Assistive Technology*, *12*, 96–105. doi:10.1080/10400435.2000.10132015

Demers, L., Weiss-Lambrou, R., & Ska, B. (2000b). *Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST Version 2.0) An outcome measure for assistive technology devices*. Quebec, Canada: Institute for Matching Person & Technology.

Demers, L., Wessels, R., Weiss-Lambrou, R., Ska, B., & de Witte, L. P. (2001). Key dimensions of client satisfaction with assistive technology: A cross-validation of a Canadian measure in The Netherlands. *Journal of Rehabilitation Medicine*, *33*, 187–191. doi:10.1080/165019701750300663

deRuyter, F. (1997). The importance of outcome measures for assistive technology service delivery systems. *Technology and Disability*, *6*(1–2), 89–104. doi:10.1016/S1055-4181(96)00197-5

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Mini-mental state. A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*(3), 89–98.

Galvin, J. (1995). Comments on DeRuyter's "Evaluating outcomes in assistive technology." *Assistive Technology*, *7*, 12–13.

Graham, B., Green, A., James, M., Katz, J., & Swiontkowski, M. (2015). Measuring patient satisfaction in orthopaedic surgery. *The Journal of Bone & Joint Surgery*, *97*(1), 80–84. doi:10.2106/JBJS.N.00811

Gu, X., & Itoh, K. (2014). Factors behind dialysis patient satisfaction: Exploring their effects on overall satisfaction. *Therapeutic Apheresis and Dialysis*, *19*(2), 162–175. doi:10.1111/1744-9987.12246

Guillemin, F., Bombardier, C., & Beaton, D. (1993). Cross-cultural adaptation of health-related quality of life measures: Literature review and proposed guidelines. *Journal of Clinical Epidemiology*, *46*, 1417–1432. doi:10.1016/0895-4356(93)90142-N

Hill, K., Goldstein, R., Gartner, E. J., & Brooks, D. (2008). Daily utility and satisfaction with rollators among persons with chronic obstructive pulmonary disease. *Archives of Physical Medicine and Rehabilitation*, *89*, 1108–1113. doi:10.1016/j.apmr.2007.11.032

Holz, E. M., Höhne, J., Staiger-Sälzer, P., Tangermann, M., & Küblera, A. (2013). Brain–computer interface controlled gaming: Evaluation of usability by severely motor restricted end-users. *Artificial Intelligence in Medicine*, *59*, 111–120. doi:10.1016/j.artmed.2013.08.001

Huerta, T. R., Harle, C. A., Ford, E. W., Diana, M. L., & Menachemi, N. (2016). Measuring patient satisfaction's relationship to hospital cost efficiency: Can administrators make a difference? *Health Care Manage Review*, *41*(1), 56–63. doi:10.1097/HMR.0000000000000045.

Jardón, A., Gil, A. M., DelaPeña, A. I., Monje, C. A., & Balaguer, C. (2011). Usability assessment of ASIBOT: A portable robot to aid

spinal cord injury patients. *Disability and Rehabilitation: Assistive Technology*, *6*(4), 320–330. doi:10.3109/17483107.2010.528144

Kirby, R. L., MacDonald, B., Smith, C., MacLeod, D. A., & Webber, A. (2008). Comparison between a tilt-in-space wheelchair and a manual wheelchair equipped with a new rear anti-tip device from the perspective of the caregiver. *Archives of Physical Medicine and Rehabilitation*, *89*, 1811–1815. doi:10.1016/j.apmr.2008.01.019

Krol, M. W., Boer, D. D., Sixma, H., Hoek, L. V. D., Rademakers, J. J. D. J. M., & Delnoij, D. M. (2015). Patient experiences of inpatient hospital care: A department matter and a hospital matter. *International Journal for Quality in Healthcare*. *27*(1), 17–25 December 13, 2014. doi:10.1093/intqhc/mzu090

Laffont, I., Guillon, B., Fermanian, C., Pouillot, S., Even-Schneider, A., Boyer, F., … Lofaso, F. (2008). Evaluation of a stair-climbing power wheelchair in 25 people with tetraplegia. *Archives of Physical Medicine and Rehabilitation*, *89*, 1958–1964. doi:10.1016/j.apmr.2008.03.008

Leplege, A., Ecosse, E., Verdier, A., & Perneger, T. V. (1998). The French SF-36 Health Survey: Translation, cultural adaptation and preliminary psychometric evaluation. *Journal of Clinical Epidemiology*, *51*, 1013–1023. doi:10.1016/S0895-4356(98)00093-6

Locker, D., & Dunt, D. (1978). Theoretical and methodological issues in sociological studies of consumer satisfaction with medical care. *Social Science and Medicine*, *12*, 283–292.

Mao, H.-F., Chen, W. Y., Yao, G., Huang, S.-L., Lin, C.-C., & Huang, W.-N. W. (2010). Cross-cultural adaptation and validation of the Quebec User Evaluation of Satisfaction With Assistive Technology (QUEST 2.0): The development of the Taiwanese version. *Clinical Rehabilitation*, *24*(412), 412–421. doi:10.1177/0269215509347438

Samuelsson, K., & Wressle, E. (2008). User satisfaction with mobility assistive devices: An important element in the rehabilitation process. *Journal of Disability and Rehabilitation*, *30*(7), 551–558. doi:10.1080/09638280701355777

Simon, S. E., & Patrick, A. (1997). Understanding and assessing consumer satisfaction in rehabilitation. *Journal of Rehabilitation Outcomes Measurement*, *1*(5), 1–14.

Vallerand, R. J. (1989). Toward a methodology for the transcultural validation of psychological questionnaires: Implications for research in the French language. *Can Psychol*, *30*, 662–680. doi:10.1037/h0079856

Williams, B., Coyle, J., & Healy, D. (1998). The meaning of patient satisfaction: An explanation of high reported levels. *Social Science and Medicine*, *47*(9), 1351–1359. doi:10.1016/S0277-9536(98)00213-5

Zastowny, T. R., Roghmann, K. J., & Cafferata, G. L. (1989). Patient satisfaction and the use of health services, Explorations in causality. *Medical Care*, *27*(7), 705–723. doi:10.1097/00005650-198907000-00005