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Validation of quick DASH outcome measure in breast cancer survivors for upper extremity disability

M LeBlanc¹, M Stineman², A DeMichele³, C Stricker⁴, and JJ Mao⁵

¹Department of Physical Medicine and Rehabilitation, University of Pennsylvania Health System, Philadelphia, PA; Abramson Cancer Center, University of Pennsylvania Health System, Philadelphia, PA

²Department of Physical Medicine and Rehabilitation, University of Pennsylvania Health System, Philadelphia, PA; Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania Health System, Philadelphia, PA

³Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania Health System, Philadelphia, PA; Abramson Cancer Center, University of Pennsylvania Health System, Philadelphia, PA

⁴Abramson Cancer Center, University of Pennsylvania Health System, Philadelphia, PA

⁵Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania Health System, Philadelphia, PA; Abramson Cancer Center, University of Pennsylvania Health System, Philadelphia, PA; Department of Family Medicine and Community Health, University of Pennsylvania Health System, Philadelphia, PA

Abstract

OBJECTIVE—To validate the quickDASH as a patient-reported outcome measure for assessing upper extremity disability in breast cancer survivors.

DESIGN—Large cross-sectional survey

SETTING—Ambulatory care center at a university hospital

PARTICIPANTS—Postmenopausal women with stage I to III hormone receptor-positive breast cancer currently taking a third-generation aromatase inhibitor (N = 150)

INTERVENTIONS—Not applicable

MAIN OUTCOME MEASURE—QuickDASH, an 11- item self-administered questionnaire assesses global arm function over the past seven days.

RESULTS—148 (99%) of 150 surveys were scorable. The factor analysis demonstrated one factor with Eigen value of 6.7, which explains 61% of variance. Score was reliable with Cronbach's $\alpha=0.93$. The test-retest reliability was 0.78 over two weeks. The mean quickDASH score for all patients was 19(SD19). Those with upper extremity arthralgias reported higher

quickDASH scores than controls without pain (26 vs. 12, $P=0.001$). Those with frozen shoulder pain also reported higher quickDASH scores than controls without pain (37 vs. 15, $P=0.001$).

CONCLUSION—The quickDASH instrument is a convenient, reliable, and valid patient-reported outcome measure to assess upper extremity disability in breast cancer patients.

Keywords

validation studies; disability evaluation; upper extremity; breast neoplasms; rehabilitation

While treatment advances have resulted in better 5-year survival rates (74.2% in 1979 vs 89.2% in 2013), upper extremity disability remains a significant morbidity in the growing breast cancer survivor population¹. Breast cancer survivors continue to experience upper extremity disability as a result of current treatment modalities including surgery, radiotherapy, and chemotherapy despite the development of less invasive treatments including sentinel lymph node biopsy or image modulated radiotherapy (IMRT). Hormonal treatment via aromatase inhibitors (AI) poses an additional risk for upper extremity disability, with 33 – 74% of those taking AI's reporting musculoskeletal pain most commonly involving the hand and wrist^{2, 3}. The most frequently documented impairments after breast cancer treatment are reduction in range of motion of the shoulder (51%), pain (51%), reduced grip strength (33%), and lymphedema (36%)^{2, 4, 5}. Thus, we choose to investigate disability in survivors with reduced shoulder range of motion (ie frozen shoulder) and those with pain from AI induced arthralgias.

Optimal arm functioning is vital for independence, return to work, performance of household chores and overall quality of life. Six years following treatment, upper extremity impairments continue to be evident, having a significant impact on quality of life and precluding full resumption of activities of daily living^{5,6}. Levy et al found that greater than 35% of breast cancer survivors report limitations in performing household chores and carrying or lifting items, thus limiting their ability to perform normal activities of daily living⁷. Significant detriment in quality of life was further demonstrated in a large study of 90,000 cancer survivors, which found that the risk of psychological distress correlated more strongly with level of disability than the cancer diagnosis itself⁸.

To date, few published studies assess impairment of functional capacity otherwise known as disability. Instead, the majority of studies of breast cancer associated disability are descriptive studies that offer vastly discrepant findings concerning the prevalence of impairments⁵. While the reason for these discrepancies is likely multi-factorial, it is clear that the use of diverse and non-validated outcome measures across studies likely plays a significant role^{4, 5}. In an attempt to assess disability, a meta-analysis of breast cancer survivors analyzing the relationship of late impairments to quality of life and performance of activities of daily living initially yielded 1642 articles; but only five met the inclusion criterion of use of valid and reliable outcome measures to assess upper extremity impairment⁴. This is in large part due to a dearth of measures that have been validated in the breast cancer population. Furthermore, function has recently been associated with survival rates in breast cancer⁹. Thus, the development and validation of appropriate instruments to measure upper extremity impairment is greatly needed.

The DASH (disability of shoulder, arm and hand questionnaire) is one of the most commonly used patient reported outcomes (PRO) measures for upper extremity assessment. It has been validated in the general population and was found to be the most effective instrument for evaluating patients with disorders involving multiple joints of the upper limb¹⁰. Despite its common usage in breast cancer survivorship research, its psychometric properties have not been investigated in this population². Alternatively, QuickDASH, is an 11-item questionnaire assessing upper extremity disability affecting multiple upper extremity joints compared to the 30 item DASH questionnaire. Given clinical time constraints, a shortened version, quickDASH, would be preferable to use with breast cancer survivors, who are at risk for developing disability involving multiple upper extremity joints; particularly from AI induced arthralgias and restriction in shoulder range of motion (frozen shoulder). Thus, the goal of this study is to determine the validity, reliability, and clinical feasibility of use of the quickDASH as an outcome measure for breast cancer survivors on AI's experiencing upper extremity disability. We hypothesized that the quickDASH is a valid and reliable outcome measure with a Cronbach's alpha > 0.70, with acceptable test-retest reliability that is higher than 0.60. We also hypothesized that quickDASH could adequately discriminate between the subgroups of those with and without frozen shoulder or upper extremity arthralgias (shoulder, elbow, wrists and hands) and those with and without recent pain symptoms.

METHODS

Participants

This study was conducted in the context of a large cross-sectional survey at the Rowan Breast Cancer Center of the Abramson Cancer Center of the University of Pennsylvania Health System (Philadelphia, PA). Potential participants included all postmenopausal women with a history of stage I to III hormone receptor-positive breast cancer who were currently taking a third-generation aromatase inhibitor (anastrozole, letrozole, or exemestane) and were treated between April and August 2007. Additional inclusion criteria were completion of chemotherapy or radiotherapy for at least one month, approval of the patient's primary treating oncologist, and the patient's ability to understand and provide informed consent in English. Research assistants screened medical records and approached potential study subjects for enrollment at their regular follow-up appointments. After informed consent was conducted and obtained, each participant was given a self-administered survey between April and August 2007. The Institutional Review Board of the University of Pennsylvania approved the study.

Outcome measure - QuickDASH

The QuickDASH questionnaire was modified from the lengthy 30-item DASH questionnaire via a concept retention approach used on field testing data of 407 patients with various upper extremity pathologies¹¹. The Cronbach alpha coefficient was 0.929, demonstrating high internal consistency. Furthermore, the overall construct validity, test-retest validity and responsiveness show comparable results between the QuickDASH and DASH.

QuickDASH is graded on a 100 point scale, with higher scores indicating a greater level of disability. The scale assesses upper extremity function using questions that ask patients to rate level of difficulty in performing several tasks including opening a tight jar, washing their back and level of perceived pain over the past week. The questionnaire consists of 11 questions scored 1 to 5 with patients answering 1 for activities performed with “no difficult” and 5 for activities unable to perform or performed with “extreme difficulty” (See Table 2). The final score is calculated by first summing total responses and then dividing this figure by the total number of completed items. This figure is then subtracted by one and multiplied by 25. A score can only be calculated with a maximum of one omitted item.

$$\text{Score} = [(\text{sum} / \# \text{ responses}) - 1] \times 25$$

Analyses

To evaluate reliability of the scale, we determined 127 item-item and item-total correlations to ensure that all items positively related to one another, but were not redundant. We also calculated the Cronbach’s alpha coefficient. To evaluate scale structure, we performed a principal components analysis exploring the potential number and characteristics of domains of related items. Interpretation of the results of the principal components analysis was guided by identifying Eigen values greater than 1.0 and the rotated loadings of variables on the identified components.

We evaluated the construct validity by calculating the scores of quickDASH for stratified subgroups with frozen shoulder or arthralgias (joint pain) and correlated results to a single question asking if patients experienced pain within the past week. Our primary hypothesis was that the quickDASH score would be higher for individuals who reported pain from frozen shoulder or arthralgias involving the upper limbs within the previous week. These sets of analyses were performed using wilcoxon rank sum to compare scores between groups because of the non-normal nature of the data. Furthermore, we assessed test-retest reliability among a subset of 56 patients with a 2 week retest time interval by using intra-class correlation. All statistical analyses were performed using STATA 12.0 for Windows. All statistics were two sided with an alpha of 0.05.

RESULTS

Patient Sample

The demographic, social and clinical characteristics of the 150 women participating in this study are listed in Table 1. The mean age of the cohort was 61.5 years old. The majority of patients were Caucasian (81%) with 16% being African American. The majority of the women were unemployed 151 with a high school education or less and the average body mass index was 28. Twenty percent of participants self-reported experiencing frozen shoulder symptoms (“sensation of restriction, heaviness, or inability to move in the shoulder area”), and 51% reported having arthralgias (“pain or ache in or around joints”) in the upper extremities in the last seven days. Those responding as “none” to the questions about frozen shoulder or arthralgias in the upper extremities served as controls.

Descriptive data

Two patients were omitted from the final analysis, because 2 items were not completed on their questionnaires. The mean quickDASH score for all patients was 19 (SD 19) with a range from 0–80 and a median of 11. The distribution of scores per question item is detailed in Table 2.

Factor Analysis

Only one factor with an Eigenvalue of 6.7 was identified to be greater than 1.0, which explained 61% of the variance among items.

Reliability

Internal consistency was achieved with a Cronbach alpha score of 0.93 indicating a high level of reliability. Among 56 individuals with data available at baseline and at two weeks follow up, intra-class coefficient was 0.78.

Validity

To assess construct validity, the quickDASH scores of patients with a self reported diagnosis of frozen shoulder or upper-extremity arthralgias were compared to patients without either disease pathology. Furthermore, those experiencing recent pain from frozen shoulder and upper-extremity arthralgias 174 were compared to those with identical pathology without recent pain. The mean quickDASH scores in the frozen shoulder and upper extremity arthralgia groups who experienced pain within the past 7 days were consistently higher than patients *without* either disease and higher than patients *with* those disease pathologies who had *not* experienced pain within the past week. The quickDASH mean for subgroups with recent pain was 26 for the group experiencing arthralgias, while the mean was 37 for those with frozen shoulder. Conversely, controls with arthralgias or frozen shoulder *without* recent pain had mean scores of 12 and 15 respectively (see Figures 1 and 2). Furthermore, the z values for both disease cohorts were highly significant, less than 0.001 in analyzing rank sum scores.

DISCUSSION

The quickDASH is an 11- item self-administered survey assessing upper extremity disability referenced over a 7 day period prior to administration. It has been validated in the general public but this is the first study to attempt to validate this measure in the breast cancer survivor population. The results of this study show that the quickDASH demonstrates strong psychometric properties with a high internal consistency, construct validity and test-retest reliability and therefore is a valid and reliable instrument to assess and monitor upper-extremity disability in breast cancer survivors.

The results of this study are consistent with 195 prior studies analyzing the internal consistency of the quickDASH measure. Our Cronbach alpha of 0.93 was identical to the study that first validated quickDASH as an outcome measure¹². That prior study consisted of 407 subjects with various upper limb conditions including shoulder, wrist and hand disorders. This finding is promising since it indicates equal reliability in assessing upper

extremity disability within a cohort of breast cancer patients to that of the general public. While this high alpha may also indicate some level of redundancy among the individual items, we feel that because the instrument is fairly short, with little missing data and low subject response burden, that the redundancy is acceptable. QuickDASH demonstrated high test-retest reliability in our population, further supporting its use as an appropriate instrument for measuring disability in breast cancer patients with chronic arm pain. Schmitz et al found that the level of upper extremity impairment in post-operative breast cancer survivors was essentially constant when followed over six years⁶. Consequently, because pain and disability associated with neuropathy, lymph edema, arthralgias and frozen shoulder pathology are chronic in nature, upper extremity impairment would be expected to be relatively stable when evaluated by a patient reported outcome (PRO) measure.

Patient reported outcomes (PRO) are ideal for research in that they are convenient, easy to use, cost-effective, reliable and necessitate smaller sample sizes in order to see significant differences between treatment arms¹³. Although clinician assessment is often viewed as the gold standard in patient evaluation, multiple studies demonstrate that outcomes are best when clinician assessments are used in combination with PRO's¹⁴. PRO's assess very different aspects of functionality than clinician's subjective observations and are often better at assessing overall disability and symptoms (ex: pain, swelling, numbness, etc) versus performance-based clinician assessment, which capture disability at snapshots in time and is affected by patient motivation and other short-term limitations¹³. Moreover, PRO's may more accurately capture symptoms and impairments than clinicians. Boon et al found that while 74% of breast cancer survivors had arthralgias, only 26% had these findings documented in the medical chart³. Currently, three PRO's (EORTC-QLQ BR23, FACT-B, Breast-Q) demonstrate evidence of psychometric properties in breast cancer survivors and address functional capacity but their lengthiness renders them non-optimal for clinical use².

QuickDash is quick, convenient and easily scored. Out of 150 subjects, only 2 subjects were excluded from final analysis. A score can only be calculated if no more than one response is omitted. This makes the quickDASH convenient to use for research purposes by allowing a degree of buffer room to utilize questionnaires with one blank item. We found that of the patients that left an item blank (10%), nearly all left item #6 blank, which asks patients to rate the level of impairment experienced with recreational activities that take some force on the upper extremity such as "golf, hammering, tennis, etc." We feel this likely may be explained in that most women at the age of 61 years old are not involved in golf or tennis and certainly are even more unlikely to spend significant time hammering. More gender and age appropriate examples should be given to patients and may include playing "fetch" with a dog, gardening or pushing a grandchild on a swing set.

QuickDASH, as a comparable and more convenient 240 alternative to the full DASH, is brief and appears to be a reliable and valid PRO measure in the breast cancer population. While the most commonly used validated outcome measures in the general population for upper extremity assessment are the DASH scale (disability of shoulder, arm and hand), PRWE questionnaire (patient-rated wrist evaluation), Brigham and Women's carpal tunnel questionnaire, Gartland and Werley scale, it is the DASH scale that was deemed to be the most effective instrument for evaluating patients with disorders involving multiple joints of

the upper limb^{10, 247}. This is particularly relevant for breast cancer survivors on AI's who frequently have pain in multiple upper extremity joints^{15, 16}. Other functional assessment outcome measures that have been utilized in breast cancer patients include Pennsylvania Shoulder Score, FACT-B, and SF-36, but are limited in use because of lengthiness^{17, 18}. Therefore, the quickDASH is an easy to administer assessment tool for breast cancer patients that experience pathology in any upper extremity joint.

Furthermore, quickDASH is highly effective in discriminating between populations with upper extremity pathology versus those without as well as between populations indicating recent upper extremity pain and those without pain. Considering that the quickDASH assesses functional limitation within the past 7 days, we chose to examine construct validity by examining if there was any difference between patients with upper extremity pathology experiencing pain within the past 7 days and those with identical pathology that did not have pain. Subjects with frozen shoulder and upper-extremity arthralgias that acknowledged having upper extremity pain within the past 7 days displayed significantly higher mean scores than those without pain.

Finally, there is a critical need to utilize validated 263 assessment instruments and to develop rehabilitation protocols to prevent permanent disability in breast cancer patients. It is important to accurately assess level of disability in order to effectively monitor rehabilitation progress and attainment of rehabilitation goals. Early intervention with physical therapy has led to a significant increase in functionality and range of motion post operatively¹⁹. Furthermore, exercise is effective in improving overall quality of life, cardio respiratory fitness, and fatigue²⁰. As an added benefit, exercise as an intervention showed an inverse relationship between amount of weekly exercise and risk of death even when adjusted for relative risk of death from breast cancer⁹. Despite these findings, one study noted that only 21% of breast cancer patients studied had received any rehabilitation at all even when greater than 90% had documented rehabilitation needs²¹. Another study found that only 15% of cancer survivors (breast, lung, and gastrointestinal) received physical therapy and a mere 4% were ever evaluated by a physiatrist since cancer diagnosis²².

This is the first instrument specifically measuring upper-extremity disability to be validated in this patient population, and has the potential to become a new precedent for future research and clinical assessment for breast cancer patients. Cancer rehabilitation will likely continue to emerge as a key component in the management of breast cancer survivors. Therefore we feel that the findings of our study are important for further research as well as a clinical application.

Study Limitations

One limitation is that our sample is from 284 a single major academic center with a high volume of breast cancer surgical patients and thus may not be generalizable. An interesting finding noticed by Tasmuth et al was that treatment centers with a high volume of breast surgery were found to have patients with significantly lower incident rates of chronic pain, paresthesias, and phantom breast syndrome²³. Thus while our study may under estimate the prevalence of these symptoms, we do not believe that given the robustness of our psychometric findings that this will affect conclusions about validation of the instrument.

Another limitation is that we did not test the responsiveness of this instrument to intervention. Thus, future studies need to investigate the responsiveness of QuickDASH to upper extremity interventions such as physical therapy.

CONCLUSION

In summary, the quickDASH is a quick, easy to use and understand, upper extremity functional assessment tool that is psychometrically robust and thereby a valuable outcome measurement for upper extremity disability among breast cancer survivors. Future research needs to determine the responsiveness of this measure to interventions that are intended to improve upper extremity functional outcomes. Ultimately, the use of validated outcome measurements will facilitate more accurate and uniform incidence reporting, will allow for a means to measure effects of treatment interventions and will ultimately facilitate better patient care.

ABBREVIATIONS

PRO	patient reported outcomes
DASH	Disability of Shoulder and Hand scale
PRWE	patient-rated wrist evaluation questionnaire
FACT-B	functional assessment of cancer therapy- breast quality of life instrument
SF-36	Short form 36 Health survey
EORTC-QLQ BR23	European Organization for Research and Treatment of Cancer quality-of life questionnaire for breast cancer

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Figure 1.
Patients with upper extremity joint pain had higher qDASH score than controls

Figure 2.
Patients with frozen shoulder has higher qDASH score than controls

Table 1

Characteristics of the study sample (N=150)

	N (%)
Age, Mean(SD)	61.5(11)
White	121(81)
Non-white	29(19)
Education	
High school or less	70(47)
College	39(26)
Graduate/professional school	41(27)
Employment	
Full time	52(35)
Part time	19(13)
Not currently employed	147(52)
BMI	
Normal	43(29)
Overweight	47(31)
Obese	60(40)
Previous surgery	
Mastectomy	78(52)
Lumpectomy	84(56)
Lymph node dissection	
Yes	118(79)
No	27(18)
Previous chemotherapy	
Yes	88(59)
No	62(41)
Previous radiation therapy	
Yes	98(65)
No	52(35)

Table 2

Distribution of score per item*

	1	2	3	4	5
	N(%)	N(%)	N(%)	N(%)	N(%)
Open a tight or new jar	49(32.7)	46(30.7)	37(24.7)	11(7.3)	7(4.7)
Do heavy household chores (e.g., wash walls, floors).	52(35.9)	37(25.5)	28(19.3)	21(14.5)	7(4.8)
Carry a shopping bag or briefcase.	72(48)	44(30)	21(14)	8(5)	4(3)
Wash your back.	87(58)	38(25)	14(9)	8(5)	3(2)
Use a knife to cut food.	124(83)	18(12)	5(3)	2(1)	1(1)
Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	71(51)	35(25)	20(14)	8(6)	6(4)
During the past week, to what extent has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbors or groups?	97(65)	30(20)	14(9)	6(4)	3(2)
During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	97(65)	33(22)	12(8)	7(5)	1(1)
Severity of arm, shoulder or hand pain within the last 7 days shoulder or hand within the last 7 days.	59(39)	55(37)	26(17)	7(5)	3(2)
Severity of tingling (pins and needles) in your arm, shoulder or hand within the last 7 days.	75(50)	46(31)	19(13)	8(5)	2(1)
During the past week, how much difficulty have you had sleeping because of pain in your arm, shoulder or hand	93(62)	36(24)	11(7)	6(4)	4(3)

* Higher number indicating greater disability