

A Randomized Trial of the Disabilities of the Arm, Shoulder, and Hand Administration: Tablet Computer Versus Paper and Pencil

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Purpose To compare the Disabilities of the Arm, Shoulder, and Hand (DASH) patient-reported outcome measure as administered by tablet computer to the traditional paper format.

Methods In a prospective, randomized study design, 223 consecutive adult patients who presented to the clinic of a single hand surgeon at a tertiary medical center were randomized by visit time to receive the DASH by either paper or tablet computer. Test completeness, time to completion, DASH score, and diagnostic and demographic data were collected and compared between the two cohorts. In total, 120 participants took the DASH using the tablet and 103 using paper.

Results 43% of the paper surveys had at least one question that was omitted, compared with 13% in the tablet group; 14% of the paper surveys were not scoreable (< 27 questions answered) compared with 4% of the tablet surveys. The mean time to complete was 3.1 minutes for the paper version of the DASH and 4.3 minutes for the tablet version. Among our study population, there was no influence of age, sex, or diagnosis category on the time required to complete either version of the test. The mean DASH score was 45 for the paper version and 32 for the tablet version.

Conclusions The use of digital data entry methods in the arena of health care outcomes research is increasing. Administration of the DASH via a tablet computer resulted in more complete data, slightly increased responder burden, and a lower DASH score. This finding may have important implications for the use of this metric in an electronic format in future research endeavors. (*J Hand Surg Am. 2015;40(3):554–559. Copyright © 2015 by the American Society for Surgery of the Hand. All rights reserved.*)

Type of study/level of evidence Diagnostic II.

Key words DASH score, patient-reported outcomes, research methodology.

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This study protocol was reviewed by our institution's IRB and was classified as exempt.

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PATIENT-REPORTED OUTCOMES (PROS) are increasingly important measures that help determine the value of medical interventions. For the hand and upper extremity, a variety of PRO metrics have been used to assess several relevant domains, including upper extremity function, disability, pain, anxiety, depression, appearance, sensation, and dexterity.^{1,2}

Rigorous validation of commonly used upper extremity PROs such as the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire has

generally used the in-person paper format of the metric.^{3,4} With the rapid adoption and increasing use of computers by both the public and health care organizations, however, the administration of PROs will most likely transition from paper input to digital formats such as computers, tablets, or smartphones. The method of administration of PROs may affect the responder burden, completeness, and the validity and/or reliability of PROs.

Several studies have attempted to address the equivalence of various methods of data collection including handheld computers, tablets, phone, and Internet-based questionnaires. Differences in PRO scores have been only rarely observed between various methods of test administration in the majority of the cited reports, and observed differences in scores have been small and likely clinically insignificant.^{5–12}

The DASH is the most commonly used outcome measure in the upper extremity.¹³ Prior studies have investigated the measurement properties of the paper DASH, finding overall excellent reliability and responsiveness.¹ Available in over 15 different languages, the DASH is freely distributed in multiple formats including printable paper and newer mobile applications. One report has investigated a computer-based version of the DASH.⁷

The purpose of this study was to compare the administration of a tablet-based DASH to the traditional paper method. Specifically, we sought to investigate the completeness of responses, time for completion, and scoring between the two methods of DASH administration. We hypothesized that increasing patient age would have a negative impact on both the time to complete the test and the test completeness in the tablet computer group in comparison to the paper group.

METHODS

A total of 222 consecutive adult patients who presented to the clinic of a single hand surgeon at a tertiary medical center between March 2013 and June 2013 were randomized by visit time to receive the DASH by either paper or tablet computer (Apple iPad 2, Cupertino, CA). This study was reviewed by our institution's institutional review board and was classified as exempt. The patients who received the paper DASH (Fig. 1) also received a digital timer and were prompted to record their time to completion of the test. The tablet computers were loaded with the Internet-based DASH (Fig. 2) administered via the Assessment Center (www.assessmentcenter.net), a free, U.S. National Institutes of Health–developed,

secure Web site designed to facilitate such data collection that also catalogs the time to completion automatically. Each question in the tablet version of the DASH was asked individually (one question per screen), with vertically oriented response choices. There was no electronic prompt to prevent missing/skipped questions or to complete the test.

Descriptive statistics were reported as count and percentage for categorical variables and mean (\pm SD) for numerical variables. Skewed numerical variables were reported as medians (IQR). The chi-square test was performed to evaluate sex, diagnosis, a testable score, and completeness of the test between the two methods. Two-tailed independent *t* tests were performed for the association of age, DASH score, and time to take the test between the two methods. The association of each individual survey question between the two methods was examined using the Wilcoxon rank sum test. The Pearson correlation coefficient was used to examine the correlation of DASH score with time (minute) and age (years). A two-tailed independent *t* test was performed to analyze the association of the DASH score, age, and time to take the test between sex for individual methods. Analysis of covariance was used to model DASH score with age and sex adjusted to evaluate the effect between the two methods. Statistical significant level of the statistical inference was set at $P < .05$.

The minimally clinically important difference in the DASH score has been reported to be 10 points (95% confidence interval, 5–15).¹⁴ In order to detect a 10-point difference between the two groups with 95% power and significance set at $P = .05$, a post hoc sample size calculation demonstrated a requirement of $N = 39$ per group. A total of 222 surveys were included in the analysis, with 120 patients using the tablet and 103 using paper to fill out the DASH in a parallel study design.

RESULTS

There were no significant differences between the groups with regard to demographic or diagnostic characteristics. (Table 1).

A total of 43% of the paper surveys had at least one question that was omitted, compared with 13% in the tablet group. Also, 14% of the paper surveys were not scoreable (<27 questions answered) compared with 4% of the tablet surveys ($P = .048$). The mean time to complete the DASH was 3.1 minutes for the paper version and 4.3 minutes for the tablet version ($P < .001$). The mean DASH score for the paper version was 45, and was 32 for the tablet version ($P < .001$).

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