Willingness and Ability of Older Emergency Department Patients to Provide Clinical Information Using a Tablet Computer

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Running head: Use of Tablet Computers by Older ED Patients

ABSTRACT

Background/Objectives: Collecting clinical data from older emergency department (ED) patients is an important but time intensive process that may be expedited by tablet computers. We estimate the proportion of older ED patients willing and able to use a tablet computer to answer questions.

Design: Prospective, ED-based cross-sectional study.

Setting: Two U.S. academic EDs.

Participants: Patients aged 65 years and older.

Measurements: As part of screening for another study, potential study participants were asked if they would be willing to use a tablet computer to answer eight questions instead of answering questions verbally. A custom user interface optimized for older adults was used. Trained research assistants observed study participants as they used the tablets. Ability to use the tablet was assessed based on need for assistance and number of questions answered correctly.

Results: Of the 365 patients who were approached, 248 (68%) were willing to answer screening questions. Of these, 121/248 (49%) were willing to use a tablet computer. Of those willing, 91 patients (75%) were able to answer at least six questions correctly, and 35 (29%) did not require assistance. Only 14 (12%) were able to answer all eight questions correctly without assistance. Patients aged 65-74 years and those reporting use of a touchscreen device at least weekly were more likely to be willing and able to use the tablet computer. Among patients with no or only mild cognitive impairment, the percentage willing to use the tablet was 45% and the percentage answering all questions correctly was 32%.

Conclusion: In this sample of older ED patients, approximately half were willing to provide information using a tablet computer but only a small minority of these patients were able to correctly enter all information without assistance. Tablet computers may provide an efficient

means of collecting clinical information from some older ED patients, but at present will be ineffective for a significant portion of this population.

Key Words: elderly, emergency department, data collection, aged

INTRODUCTION

Older adults in the United States make over 20 million emergency department (ED) visits annually.[1] Many older adults have unmet and often undiagnosed needs that negatively affect both quality of life and health outcomes.[2, 3] Developing tools to efficiently identify and address these needs is a priority of geriatric emergency medicine research.[4, 5] Collecting accurate clinical information from older ED patients is vital to these efforts, but it is a labor-intensive process.

Mobile computing devices with a touchscreen interface have the potential to reduce the time required of ED personnel in collecting clinical information from older patients. These devices have been adopted for collecting information across a wide variety of commercial settings including healthcare, and the feasibility of this approach has been demonstrated in the ED,[6] primary care,[7] and specialty clinics,[8, 9] with accuracy comparable to patient-completed paper surveys.[10, 11] In the ED, these interventions are acceptable to most patients[12] with over 90% of adult ED patients preferring a technology-based approach in one study,[13] and 93% reporting comfort using a computer for an alcohol use reduction program.[14] However, older adults differ from younger adults in regard to their familiarity with the use of electronic devices and also in the prevalence of physical and cognitive impairments which might make these devices hard to use. Although it has been demonstrated that patients with mild dementia,[15] arthritis,[11] and visual impairment[16] can learn to successfully use tablet computers, the extent to which older ED patients who have not received specific training are willing and able to use such devices to provide clinical information is unknown. We sought to estimate the proportion of older ED patients who were both willing and able to use a touchscreen tablet computer to provide answers to basic demographic and clinical questions.

MATERIALS AND METHODS

Study Design, Setting, and Selection of Participants

We conducted a cross-sectional study of adults aged 65 years and older receiving care at two academic EDs (The University of North Carolina, Chapel Hill, North Carolina and Cooper University Hospital, Camden, New Jersey) in the United States that serve a racially and economically diverse population of older adults. ED's were located in two different regions (Southeast and Northeast). The primary purpose of the study was to obtain estimates of the proportion of older ED patients who were willing and able to use a tablet computer to provide clinical information. Enrollment occurred between 9 a.m. and 9 p.m. seven days a week for a period of two months at each site. Patients aged 65 years and older were identified by review of each ED's electronic tracking board. Patients were excluded if they were critically ill, had altered mental status, were on a psychiatric hold, or did not speak English. Patients were considered critically ill if their emergency severity index triage score was one or based on the judgment of the treating emergency provider. Altered mental status was considered present if the patient had a chief complaint of altered mental status, confusion, or delirium; a cognitive test was not used to determine eligibility. (The Six Item Screener was collected on a subset of patients, but this information was collected after the tablet was offered to the patient and was not used as an exclusion criterion.) The study was approved by the Institutional Review Boards at both sites. Data presented here were collected as part of an assessment of eligibility for another study assessing accuracy of self-reported ability to complete a simple mobility task.[17] Accordingly, all patients in this sample had verbally expressed a willingness to be screened to determine eligibility to be in a study. Consent to participate did not occur until after the tablet questions were offered to patient and consent was not a requirement for inclusion in this study.

Data Collection

Data were collected by research assistants (RAs) via in-person interviews. Prior to beginning the study, RAs were required to complete training in clinical research and demonstrate understanding of the study protocol. After this training, each RA was observed by the study investigator until he or she demonstrated proficiency.

Each patient who agreed to answer screening questions was asked, "Are you willing to use the tablet computer to answer these questions?" to determine if he or she was willing to answer eight questions on a tablet. Patients were not informed that this was a key question in the study. Rather, the question was presented as 'We need this information, are you willing to use the tablet?' For patients who agreed to use the tablet, the first two questions were designed to

ensure that the patient could use the tablet (e.g., mark the letter C). The next three questions assessed basic demographic information (i.e., age, gender, and race). The final three questions assessed orientation (i.e., day of week, month, and year). If patients were not willing to answer questions using the tablet, the relevant questions were asked verbally. Additionally, at the end of each survey, each participant who was willing to attempt to use the tablet was asked if he or she would prefer to complete surveys such as ours via in-person interview or via tablet computer. Tablet computers were chosen for data collection because they are small, portable, and lightweight. Additionally, because there is no physical keyboard, it is easier to clean than a conventional laptop computer; tablet computers were sanitized after each use with alcohol-based disinfectant wipes. Three tablets were used to collect data in this study: one ASUS Transformer TF101, one Apple iPad Mini, and one Apple 4th generation iPad. Tablet questions were presented and patient responses were recorded using an online survey instrument (Qualtrics, Provo, Utah). Responses were then transferred manually to a secure database (REDCap).

Outcomes and Analysis

The primary outcomes were willingness and ability to use a tablet. Willingness to use the tablet was determined based on the patient's yes or no response to the above-quoted question. Ability to use a tablet was characterized by a) use of the tablet without assistance, b) answering at least six of the eight assessment survey questions correctly, c) answering all eight questions correctly, and d) answering all eight questions correctly without assistance. The RAs observed each patient the entire time they used the tablet and indicated whether patients needed assistance to operate the device. Examples of assistance included the RA holding the tablet for the patient, reading the survey to the patient, or explaining to the patient how to scroll down on the screen to see the next question. RAs were instructed not to enter responses on behalf of patients or tell patients the answer to a question (i.e. this level of assistance was not allowed). Regardless of whether the patient was willing or able to use the tablet, the RA collected information about each patient's prior experience using computing devices.

The Six-Item Screener for cognitive assessment was administered to a subset of patients in this study. A post-hoc subgroup analysis was conducted on the subset of patients with a Six-Item Screener score of 4 or more, indicating no or mild cognitive impairment.[18]

Results are reported as medians and interquartile ranges or percentages with 95% confidence intervals overall, by sociodemographic characteristics and by prior exposure to

technology. The Chi-squared test was used to examine differences in willingness of specific patient subgroups to use a tablet computer. Results significant at the p<0.05 level are reported in the results without adjustment for multiple testing. Assuming that around 20% of study patients would be both willing and able to use the tablet for data entry, enrolling at least 240 patients would provide us with 95% confidence intervals (CIs) within 5% of the point estimate for the percentage of patients willing and able to use the tablet. All data analysis was conducted using STATA 14.0 (StataCorp, College Station, TX).

RESULTS

Of the 365 patients who were approached, 248 (69%) were willing to participate (Figure 1). Of these 248 patients, 121 (49%; 95% CI 43-55%) were willing to use a tablet to answer the questions. Older patients were less likely to agree to use a tablet (p<0.002; Table 1). Patients who reported using a computer or touchscreen device at least once a week were more likely to agree to use a tablet (p<0.001).

Among the 121 patients willing to use a tablet, the median completion time was three minutes (IQR 1 minute, 50 seconds - 5 minutes, 5 seconds); 29% (95% confidence interval (CI) 21-37%) did not require assistance; 75% (95% CI 67-83%) answered six or more questions correctly; 32% (95% CI 23-49%) answered all eight questions correctly; and 12% (95% CI 7-19%) answered all questions correctly without assistance. Patients aged 85 years and older took more time to answer the questions. The percentage of participants who answered 6 of the 8 questions correctly was higher among whites than blacks (p=0.02), and higher among those who reported weekly use of a touchscreen device than those who did not (p<0.001). (Table 2) Of the initial 248 patients who agreed to answer questions, only 39 (32%; 95% CI 23-40%) were both willing to use the tablet and able to answer all 8 questions without assistance.

Overall, 87% of patients who used a tablet indicated they were willing to use a tablet again for data entry. However, if given the choice, more of those who used a tablet stated they would prefer a verbal interview (74%) rather than tablet entry in the future. The preference for a verbal interview was particularly strong among individuals 85 years and older (93%). The majority of patients indicated they "liked" using the tablet computer for data entry (71%). However, 16% were neutral and 13% disliked using the tablet, including nine (8%) participants who indicated they "strongly disliked" it (Figure 2).

Of the 248 patients who participated in the study, 153 had cognition assessed with the Six Item Screener. Of these 153, 140 (92%) had a score of 4 or more indicating no or mild cognitive impairment and 85 (56%) had a score of 6/6. Among the 140 patients with no or mild cognitive impairment, only 63 (45%) were willing to try to use the tablet and only 20 (32%) of the 63 answered all tablet questions correctly (Appendix Tables 1 and 2). Further, in this subset of patients with no or mild cognitive impairment, only 56% of patients entered an age using the tablet computer that matched their verbally-reported age. Most of these patients (82%) would be willing to use a tablet again to answer questions, but, as with the entire sample, the majority stated they would prefer to provide information by verbal interview (78%).

DISCUSSION

In this sample of ED patients aged 65 years and older, approximately half of patients approached for participation in the parent study were willing to use a tablet. Among the willing, the majority required assistance in completing the questionnaire and were unable to answer all eight questions correctly. Patient factors associated with better performance included younger age, white race, and prior technology use. Overall, patients liked using the tablet for data entry, but the majority would prefer a traditional face-to-face interview in the future. Our results are consistent with prior studies of patient data entry using tablet computers which observed decreased data accuracy with increasing age as well as differences based on race and prior technology use.[6, 7]

We find that only 51% of older adults were willing to use a tablet and that, of those, many had difficulty providing correct responses with 32% correctly answering all questions. Among patients with mild or no cognitive impairment, only 45% were willing to try to use the tablet and only 32% answered all questions correctly. Among the subset of patients who were cognitively intact, only 56% correctly reported their age, suggesting that these patients had difficulty using the tablet to enter this information. These findings indicate the presence of substantial barriers to incorporation of this technology in the routine care of older adults. Observed reasons for patients marking the wrong answer included difficulty touching the desired spot on the screen and difficulty getting the tablet to register when they touched the screen. Additionally, in some cases it appeared the patient had difficulty in reading the question but did not feel comfortable asking the RA for assistance. In our sample, those aged 65 to 74 years were

more willing to use a tablet, less likely to require assistance, more likely to get answers right, and more likely to state they would be willing to use this technology again. Similar to previous literature,[15] these differences based on patient age may represent a greater comfort with and exposure to handheld technology among the young-old as this age group was more likely to use technology weekly. It is likely that the observed unwillingness or inability of many older old patients to use tablet computers may be related to factors associated with age, particularly prior exposure to this technology, rather than age itself. Over the next two decades, as the current middle-aged population become older adults, it is likely that a larger proportion of older adults will be comfortable with this technology. However, other factors which increase with age such as visual problems and loss of dexterity are likely to remain present in this next generation of older adults and may restrict use of this technology for some individuals.

The use of tablet computers for direct data entry by patients either for clinical assessments or for data collection within a study has several advantages. First, this approach reduces time required of clinical providers or research assistants. Second, patients are generally more likely to disclose sensitive personal information when answering self-administered questions than in a face-to-face interview.[19, 20] Thus, assessments of common but sensitive problems among older adults in the ED such as elder abuse or neglect, depression, or unmet non-medical needs may be more accurate using tablet computers.[3] Third, the use of tablet computers for assessments has the potential to facilitate broad and consistent dissemination of screening instruments or questionnaires. Furthermore, if older adults can provide accurate information via tablet computers, patients may be able to provide patient-supplied information such as demographic and medical history directly into electronic health records.

This study has several limitations. First, there were slight differences between the tablets. The devices had displays that differed slightly in size, contrast, resolution, and sensitivity of the screen to touch. The two Apple iPad tablets offered a zoom function within the survey that the ASUS Transformer did not; this may have assisted patients with visual impairment. The iPad Mini was slightly smaller, which resulted in smaller final rendered text. On the other hand, the iPad Mini was lighter and presumably easier for patients to handle. Additionally, while both tablets had contrasting text and background, the Apple devices had dark text on white background and the ASUS device had the opposite. This difference may have affected legibility.[21] Tablet computer with large text options and easy-to-use operating systems have been

developed specifically for use by older adults.[22] Use of such tablets may have yielded different results. One patient had difficulty using the tablet due to long acrylic nails. Providing a stylus, which we did not do in this study, may make the tablet easier to use for some patients. We did not assess level of formal education, which has previously been shown to impact patient performance on electronic questionnaires.[6, 7] The subjects in our study were predominantly white, which may limit generalizability to more ethnically diverse populations. We did not assess for delirium,[23, 24] which may have been present in some patients and may have contributed to either unwillingness or inability to use the tablet. We only included English-speaking patients seeking care between 9 a.m. and 9 p.m. at two academic EDs in the U.S. Willingness and ability to use tablets computers may be different for non-English speakers and for older adults seeking care in other settings. Patients who were unwilling to use the tablet in our study were also less likely to use technology on a regular basis. This would not affect our estimate of the percentage of patients who are "willing and able" to use a tablet, but would limit the generalizability of our estimate of the percentage of patients who are able to use a tablet to those who are willing to use it. Our results tell us about results in 2014. At present, an estimated 18% of U.S. adults aged 65 years and older own tablets, but 49% of adults age 35-44 own tablets. It is likely that when younger generations turn 65, a larger percentage of these individuals will be comfortable with tablets and other forms of electronic data entry than the current population of older adults.

Finally, there was neither penalty nor reward attached to using the tablet device. In other settings, such as self-check-out lines in a grocery store or automated voice response systems for phone calls, people make choices regarding the use of the system based on penalties and rewards. One might choose to use the self-checkout lane in a grocery store because it is quicker even though it requires more effort, but might choose to pay a premium in order to speak to a human agent rather than endure frustration with an automated voice response system. Similarly, if use of a tablet was associated with some other improved service (i.e. completion expedites access to a physician), the willingness of patients to use these devices (or find someone to help them use these devices) might change. Similarly, penalties or rewards for accurate data entry might also influence the quality of the information obtained.

In this sample of older ED patients, approximately half of patients were willing to provide clinical information using a tablet computer but only a small portion of these were able to correctly enter all information without assistance. Tablet computers may provide an efficient

means of collecting clinical information from some older ED patients, but at present will likely be ineffective for a significant portion of this population. Nonetheless, if a substantial subset of older patients are willing and able to use these devices, it would result in a significant labor savings for some clinical processes and research studies.

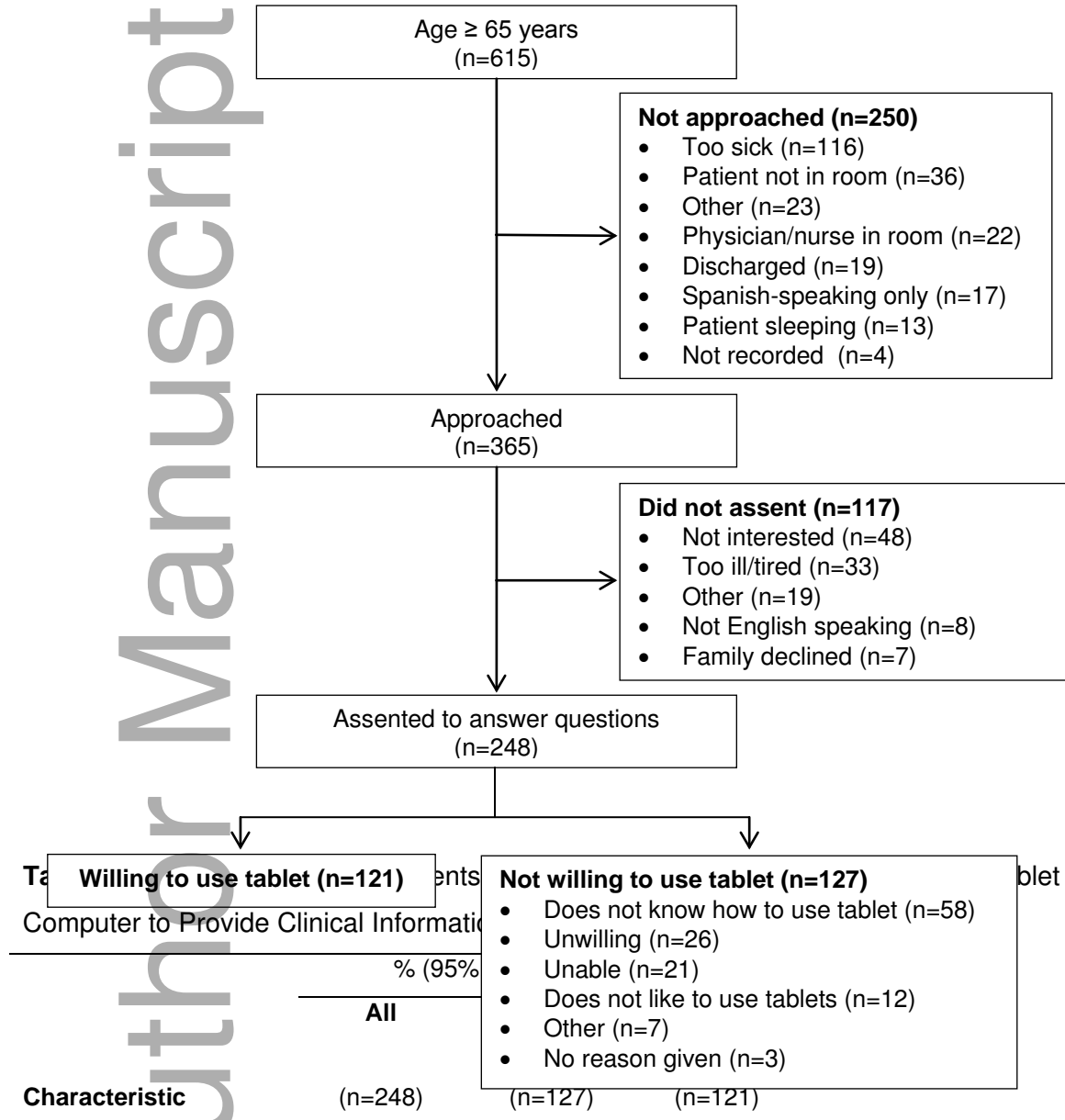## REFERENCES

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Figure 1. Enrollment and Eligibility of Patients.

Age ≥ 65 years
(n=615)

Not approached (n=250)
- Too sick (n=116)
- Patient not in room (n=36)
- Other (n=23)
- Physician/nurse in room (n=22)
- Discharged (n=19)
- Spanish-speaking only (n=17)
- Patient sleeping (n=13)
- Not recorded (n=4)

Approached
(n=365)

Did not assent (n=117)
- Not interested (n=48)
- Too ill/tired (n=33)
- Other (n=19)
- Not English speaking (n=8)
- Family declined (n=7)

Assented to answer questions
(n=248)

Willing to use tablet (n=121)

Not willing to use tablet (n=127)
- Does not know how to use tablet (n=58)
- Unwilling (n=26)
- Unable (n=21)
- Does not like to use tablets (n=12)
- Other (n=7)
- No reason given (n=3)

Table ... Patients ... tablet Computer to Provide Clinical Information ...

% (95% ...

Characteristic	All (n=248)	(n=127)	(n=121)
Age			
65-74 years	46 (40-53)	35 (27-44)	58 (49-67)
75-84 years	38 (31-44)	45 (36-54)	30 (21-38)
≥85 years	16 (12-21)	20 (13-27)	12 (6-18)
Sex			
Male	40 (34-46)	33 (25-41)	48 (39-57)

Female	60 (54-66)	67 (59-75)	52 (43-61)
Race (N=153)			
White	63 (55-70)	57 (46-68)	70 (59-81)
Black	27 (20-35)	30 (20-40)	24 (13-34)
Hispanic	8 (4-12)	10 (4-17)	5 (0-10)
Other	2 (0-4)	2 (0-6)	1 (0-4)
Technology use[a,b]			
Computer[c]	40 (34-46)	24 (16-31)	57 (48-66)
Touchscreen device[d]	30 (24-36)	20 (13-27)	41 (32-50)
None	37 (31-43)	50 (41-58)	24 (16-32)

[a] Used at least once a week

[b] Not mutually exclusive

[c] Desktop or laptop computer

[d] Smart phone or tablet

Table 2. Among Patients Willing to Use a Tablet, the Time Required to Complete Survey, Whether Assistance was Required, and Accuracy of Data Input.

		% (95% CI)			
Characteristic	**n**	**No Assistance Required**	**≥6/8 Questions Correct**	**All Questions Correct**	**Time (seconds) Median (IQR)[a]**
All patients	121	29 (21-37)	75 (67-83)	32 (23-40)	180(195)
Age					
65-74 years	70	33 (22-44)	80 (70-90)	32 (21-43)	160(151)
75-84 years	36	31 (15-46)	72 (57-87)	26 (11-41)	183(201)
≥85 years	15	7 (0-20)	60 (34-86)	47 (20-73)	296(276)
Sex					
Male	58	33 (20-45)	76 (65-87)	38 (25-50)	180(180)
Female	63	25 (14-36)	75 (64-86)	27 (16-38)	195(223)
Race					
White	47	25 (13-38)	77 (64-89)	40 (25-55)	176(199)

|				
Black	16	19 (0-39)	44 (18-69)	13 (0-30)	277 (208)
Hispanic	3	0 (0-56)	100 (44-100)	33 (6-79)	271 (333)
Other	1	0 (0-79)	0 (0-79)	0 (0-79)	260 (0)
Technology use[b,c]					
Computer[d]	69	43 (32-55)	81 (72-91)	39 (27-51)	150 (171)
Touchscreen device[e]	50	56 (42-70)	98 (94-100)	45 (31-59)	126 (113)
None	29	7 (0-16)	55 (37-74)	10 (0-22)	262 (213)
Willing to use tablet again					
Yes	104	33 (24-42)	77 (69-85)	31 (22-40)	174 (191)
No	16	0 (0-19)	63 (38-87)	40 (14-66)	235 (316)
Preference in future					
Tablet	31	45 (27-63)	90 (80-100)	39 (21-56)	151 (204)
Verbal interview	90	23 (14-32)	70 (60-80)	30 (20-39)	211 (197)

[a] n=115

[b] Used at least once a week

[c] Not mutually exclusive

[d] Desktop or laptop computer

[e] Smart phone or tablet

Figure 2. Among Those Willing to Use a Tablet Computer, Responses to the Question "How Much Did You Dislike or Lik
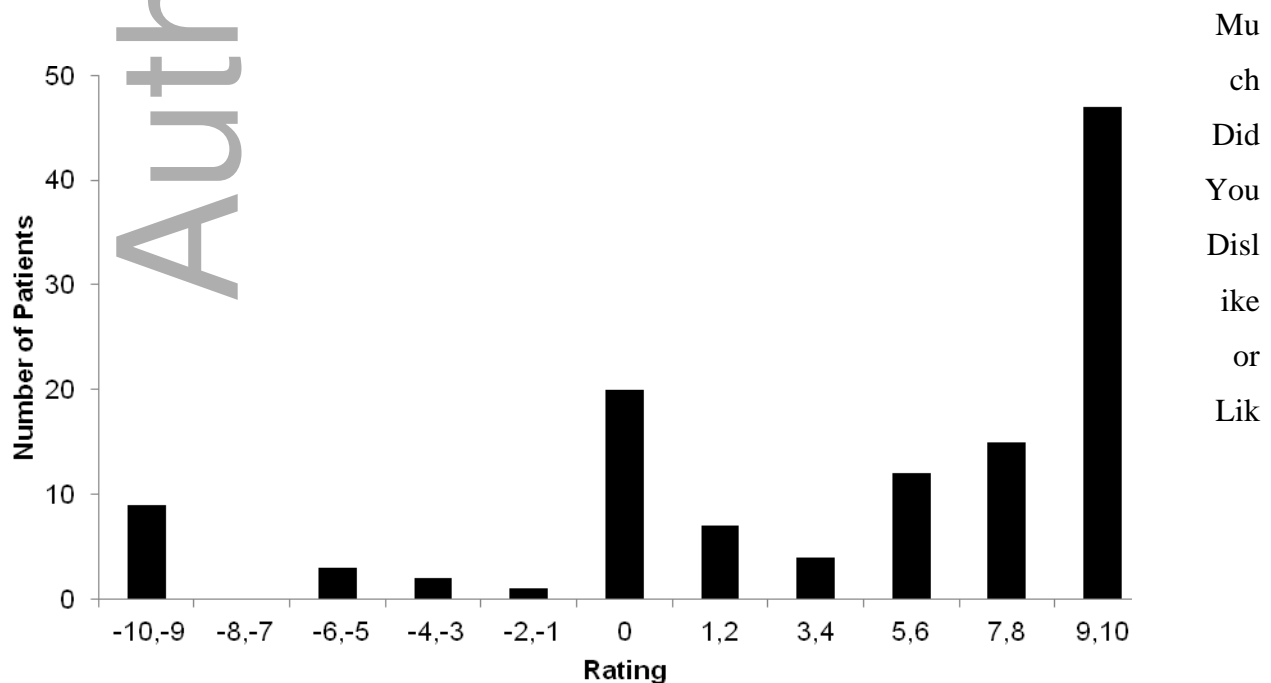
e Using the Tablet Computer Today (-10 Indicates Strongly Disliked, 10 Indicates Strongly Liked)?" (N=120).