ORIGINAL ARTICLE

The abandonment of assistive technology in Italy: a survey of National Health Service users

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ABSTRACT

BACKGROUND: This study was an extension of research which began in the Umbria region in 2009.
AIM: To investigate the extent to which assistive technology (AT) has been abandoned by users of the Italian National Health Service (ULHS) and the reasons for this.
DESIGN: Observational study.
SETTING: Users who received a hearing device (HD) or mobility device (MD) by ULHS between 2010 and 2013.
POPULATION: 749 out of 3,791 ULHS users contacted via telephone completed the interview: 330 (44.06%) had a HD and 419 (55.94%) a MD.
METHODS: Data were collected using a specially developed telephone interview questionnaire including the Italian version of the Quebec User Evaluation of Satisfaction with AT (QUEST 2.0) and Assistive Technology Use Follow-up Survey (ATUFS).
RESULTS: 134 users (17.9%) were no longer using their assigned AT device within seven months of issue and 40% of this group reported that they had never used the device. Duration of use (for how long the AT device was used before abandonment) and satisfaction with service delivery did not predict AT abandonment. People who received a HD where more likely to abandon their device (22.4%) than those who received a MD (14.4%).
CONCLUSIONS: Abandonment may be due to assignment of inappropriate devices or failure to meet user needs and expectations. These findings are consistent with previous data collected by Federici and Borsci in 2009. Utility of AT in use, reasons of abandonment, and importance of device and service satisfaction for the use or non-use of an AT are presented and discussed. CLINICAL REHABILITATION IMPACT: AT abandonment surveys provide useful information for modelling AT assessment and delivery process. The study confirms the relevance of person centredness approach for a successful AT assessment and delivery process.

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Since Batavia and Hammer [1, 2] first developed consumer-based criteria for the evaluation of assistive technology (AT) [3] a large number of tools [4] for measuring AT outcomes have been developed. There are instruments which evaluate user satisfaction (*e.g.*, the Quebec User Evaluation of Satisfaction with AT [5]), the effectiveness of AT (*e.g.*, the Individual Prioritized Problem Assessment [6]), the effects of an AT on the user's life (*e.g.*, the Psychosocial Impact of Assistive Devices Scale [7]) and the effects on the user's family (*e.g.*, the Family Impact of Assistive Technology Scale [8]). At present, there is no standardized instrument for investigating AT abandonment although the phenomenon has been the subject of surveys, particularly in the United States,[9-17] but also in Australia,[18] Italy,[19-21] and the Netherlands.[22, 23]

Despite some negative reasons affecting why AT users abandon their devices (*e.g.*, user's health/physical condition worsening), there are also many neutral

or positive reasons (*e.g.*, health/physical condition improving) justifying the disposal. Consistently, Lauer *et al.*[24] suggests a replacing the term "abandonment" with "discontinuance", which is considered as a more encompassing term. Because the most common use in literature is of the term 'abandonment' rather than other synonyms, in this study we use abandonment as an umbrella term for any non-use (positive or negative) of assigned AT, also in continuity with the study of Federici and Borsci.[19, 20]

Abandonment has been investigated using specific questions on AT use in face-to-face or telephone interviews. Phillips and Zhao [15] and Federici and Borsci [19, 20] investigated abandonment by asking users "Do you currently use this device?" and assessed the period of use with the question "For how long [have you been using/did you use] it?". Similarly Bynum and Rogers[9], Man *et al.*,[14] Riemer-Reiss and Wacker [16] measured abandonment using the question "Are you still using your assistive technology?" followed by a dichotomous response choice. Dijcks *et al.*[22] took a different approach, using a multiple-choice question about non-use which asked respondents whether they used their device "less", "more" or "about as much" as they had expected to. Wielandt *et al.*[18] asked respondents to use a five-point Likert scale to report how much they used their AT (from "none of the time" to "all of the time"). Gitlin *et al.*,[12] Cushman and Scherer [10] and Kittel and colleagues[13] used open questions to collect information about current use of AT. Most researchers have used open-choice questions to elicit reasons for AT abandonment, although Phillips and Zhao [15] and Federici and Borsci [19, 20] used multiple-choice questions.

Most studies converge on an AT abandonment rate of around 30% one year after device delivery.[10, 15, 16, 18, 21] The 30% rate has been used as a threshold for defining low and high rates of AT abandonment.[16, 17, 23, 25] There are, however, other reports of abandonment data which are very different from each other and diverge from the typical rate of abandonment.[9, 11, 12, 14, 19-23, 26-30] Undoubtedly differences in methodology make it difficult to compare studies, but this is not the only reason that makes the abandonment rate so undefined.

One factor which may contribute to the variance in abandonment rates is the heterogeneity of AT service delivery systems in regional and national health and social care, and across public and private providers within countries.[31] In Europe and Canada, healthcare is provided through a wide range of systems which are primarily funded through taxation (universal health care), whereas in the USA the health system is largely owned and operated by private sector businesses. In Australia and New Zealand, healthcare is delivered by a mixture of public and private providers. Depending on the economic model behind a health care system, a health service user can be characterized as a user of a non-commercial AT service, as a client of a commercial AT provider, or as a patient of a medical center specializing in AT. The different types of service provision tend to overlap, for example an AT user whose device was provided by a specialist AT medical center might be a patient both in private and public health systems. Finally, the cost of the AT to the user varies according to the health system; it may be free of charge, covered by insurance or paid for at the point of use by the user.

It has been shown that differences in health care systems and AT service delivery models affect AT outcomes. The Position Paper by the Association for the Advancement of Assistive Technology in Europe (AAATE) and European Assistive Technology Information Network (EASTIN) stated that there is reliable evidence that a badly designed AT delivery system results in a high rate of non-use of AT and hence "waste of resources, an unchanged situation in the person's disability, and frustration for the users".[32] Research has shown that satisfaction with, and long-term use of AT increases when, for instance, users are properly informed and involved during the issuing process,[13, 15, 33, 34] and the health service provides active support and follow-up after the device is issued.[35] In a recent study, Federici and Borsci [19] demonstrated that different AT service delivery strategies resulted in different rates of AT abandonment, ranging from 12.61% to 24.26%. The user's experience of an AT is affected not only by the quality of his or her interaction with the AT, but also by the quality of the assessment and selection process and the delivery model.[36]

There are three other main factors which contribute to the high reported variance in AT abandonment:[19] 1) differences in the samples of AT users (*e.g.*, in terms of age, disability, education, employment, etc.); 2) the large differences in the type of device investigated; 3) lack of consensus on the definition of a threshold for distinguishing between use and non-use.[37]

Notwithstanding the variability in abandonment rates, a large part of the scientific community agrees that AT abandonment is the outcome of a complex interaction of four main factors:[37] 1) personal factors (age, gender, diagnosis, expectations, acceptance of disability, emotional maturity/inner motivation, change in severity of disability, etc.); 2) device factors (quality, appearance); 3) environment factors (social support, physical barriers, etc.); 4) delivery factors (taking users' opinions into account, instruction and training, follow-up service, etc.).

As Scherer and colleagues have already stated,[4, 38-40] in order to minimize the risk of abandonment all these factors have to be carefully managed, observed, and assessed by the professionals involved in AT delivery throughout the process of matching the user to the AT device.

Purpose

The goal of this study was to investigate the extent of AT abandonment among Italian National Health Service users and the reasons for it. Subjects were recruited from the population of patients who received a hearing device (HD) or mobility device (MD) in the Umbria Region of Italy between 2010 and 2013.

The present research was conceived in the political and economic context of rationalization of Italian public spending policy. Since 2007, the Italian Council of Ministers has adopted laws concerning revision of the expenditures borne by Italian administrations, including a number of provisions aimed at rationalizing and possibly reducing the expenses of the national healthcare system. These national policies were also adopted by the Health Care Plan of the Umbria Region.[41] Therefore, an investigation on the extent of AT abandonment might provide relevant indications for the management of the local health services of the Umbria Region.

Materials and methods

Data on rates and reasons for AT abandonment were collected by surveying users who had received devices through two different units of local health services (ULHS) of the Umbria Region (hereafter ULHS 1 and ULHS 2). The survey was carried out between December 2013 and September 2014. In a telephone interview

users were asked to respond to a three-section questionnaire consisting of both open and closed questions.[42] The questionnaire included the Italian versions of the Assistive Technology Use Follow-up Survey (ATUFS) 1.1,[43, 44] adapted to collect data on use and non-use of AT, and the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST).[5] This research was part of a project entitled "VITA - Visualizzazione dell'Informazione e Tecnologie Assistive" (Information visualization and AT) [45] promoted by the Department of Health and Social Services of the Umbria Region in 2013 (DGR 328/13). This project is an extension of the research on AT abandonment which began in the Umbria Region in 2009.[19, 20]

Subjects

AT services in Umbria are delivered via two units, ULHS 1 and ULHS 2. In order to recruit a sample in which we could assess whether users were still using their device at least six months after issue we conducted a retrospective search of users who had received an AT from ULHS 1 or 2 between January 1, 2010 and May 31, 2013. The inclusion criteria were users who received a MD (wheelchair: manual and powered; walking frame; lifting person; stairlift) or HD; exclusion criteria were age <18 years and age >85 years, and the year of AT assignment, before January 2010 and after May 2013. Selected users were interviewed by telephone between December 2013 and September 2014.

The subjects —or their proxy —provided informed consent to participation before the interview. No children were enrolled. The study represented "no more than minimal risk" to subjects.

Materials

The telephone interview questionnaire was developed specifically for this research [42] from tools developed by Federici and Borsci [19, 20] for their previous survey of AT abandonment in the Umbria Region. The questionnaire is subdived in the three sections described below.

SECTION I (PARTS A AND B)

The interviewer uses open and closed questions to collect data to identify the user and the type of AT

device issued (part A) and captures the user's evaluation of ULHS's AT service (part B, item V3) using a four-point Likert scale, ranging from 1 ("very bad") to 4 ("excellent"). If the user gives a negative evaluation (score of 1 or 2) of the ULHS's AT service then question V4 is administered to elicit the reasons. Items V1 and V2 in part B respectively capture information about the number of visits to the ULHS's AT service required during the AT assignment process (response options: 2 to >5) and the user's opinion of whether this number of visits was appropriate (responses on a Likert scale ranging from 1 [far too many]) to 5 [far too few]).

SECTION II (PARTS C1 AND C2)

The user's experience with his or her AT device is measured using the appropriate version of the ATUFS (ATUFS-MD or ATUFS-HD; these differ only with respect to items 10 and 11, which refer to specific device functions). The Italian versions were developed by Federici et al.[43, 44] from the original English version by Scherer.[46] ATUFS 1.1 (-MD and -HD) is a seventeen-item questionnaire designed to capture the respondent's experience with an AT device he or she is using or the reasons for having abandoned an AT device. Item 1 identifies the brand of the device. Use is assessed with item 2: "Are you presently using this device?" (response options: "no", "yes"). Phillips and Zhao,[15] defined abandonment as non-use of an AT at the time of the survey. This means that abandonment is recorded regardless of whether the user has stopped using the device or never used it. Items 3 and 4 investigate the duration and frequency of AT use at present or before abandonment.

If the user responded positively to the question about current use, the interview then proceeds with items 5 to 16. Items 5 and 6 investigate the user's autonomy when using the device, i.e. how often he or she needs help when using the device and how often he or she uses the device in a public context, respectively. Responses are given on a Likert Scale ranging from 1 ("every time") to 5 ("never"). The other nine items investigate the user's experience with the AT on three domains of daily life: well-being and comfort (e.g., "To what degree [does/did] the device enhance your well-being?), personal care (e.g., "To what degree [does/did] the device help you to take care of your health?", and participation (e.g., "To what degree [does/did] the device help you to keep

in touch with others?"). Responses are given on a Likert Scale ranging from 1 ("not at all") to 5 ("a lot"). This section of the questionnaire concludes with item 16, an open question about what might improve the usefulness of the user's current AT device.

If the respondent indicated at item 2 that he or she was no longer using the device the interviewer moves from item 4 to item 17, which consists of a scale with 21 sub-items investigating reasons for abandonment; it covers the following reasons: ineffectiveness, unreliability, difficulty of operating the device (items #1, 6, 7, 9, 12, 13, 14, and 20); preference for, or necessity of human help (items #2 and #8); characteristics of the milieu (item #3); changes in functional capacity (items #4 and #5); interference with daily activities (item #17); negative attitudes (item #18); maintenance costs (item #19); alternative solutions (item #21); appearance or size of the device (items #10, 11, and 16); inadequate training or support (item #15).

SECTION III (PART D)

Users' satisfaction with AT is assessed using the Italian version of QUEST 2.0,[5, 19, 20, 47] a twelve-item questionnaire which uses five-point Likert scales (from "not satisfied at all" to "very satisfied") to capture the user's satisfaction with interactions with the device and with the service provider. QUEST responses can be analyzed in terms of subscale scores, i.e., Device (Q1 to Q8) and services (Q9 to Q12), or total score. All scores are calculated by averaging valid responses to relevant items. Because the QUEST was also administered by Federici and Borsci [19, 20] in their previous investigation of ULHS users, we were able to compare the results of this study with their earlier results.

Statistical analysis

Descriptive statistics (mean, standard deviation [SD]) were calculated to provide a profile of the sample. Inferential statistics (one-way ANOVA, t-test, and chi-square test) were used to compare subjects who received HDs and MDs in terms of perceptions of the quality of ULHS's AT service, rate and reasons of AT abandonment (i.e., ATUFS), and satisfaction (i.e., QUEST scores). Reasons for AT abandonment and user satisfaction with the device and the service they received were analyzed

according to the scoring procedures for the relevant questions.[5, 43, 44] Cronbach's α was calculated to provide a measure of the reliability of the Italian versions of the scales. We also conducted correlation analyses to evaluate relationships between AT service delivery, reasons for AT abandonment, and satisfaction. All analyses were carried out using SPSS Statistics v.23 (IBM Corp., Armonk, NY, USA).

Results

Sample

Seven hundred and forty-nine out of 3791 ULHS users contacted via telephone completed the interview (male: N.=287, 38%; female: N.=462, 62%; mean age 71.02 year, SD 13.94, range 18-85), a response rate of 19.76%. Roughly 45% of non-responses were household-level refusals (*i.e.*, they occurred before the appropriate respondent in the household could be determined [48]) and 35% were respondent-level refusals (*i.e.*, occurred after the appropriate respondent was identified [48]). On average female respondents were older than male respondents. There were no other gender differences with respect to the main dependent variables. In 35.38% of cases the respondent was the device user and in 64.62% the respondent was a proxy; the older the device user the more likely it was that the respondent would be a proxy (one-way ANOVA, F=2.12, P<0.001).

Three hundred and thirty users (44.06%) had been issued with a HD and 419 (55.94%) with a MD. The most frequently issued MD was a wheelchair (N.=279, 66.59%; manual wheelchairs 85%; powered wheelchairs 15%).

Evaluation of ULHS's AT service: telephone interview questionnaire part B, items 1-4

Responses to the item about service delivery (V3) indicated that 90.2% of users were satisfied ("quite satisfied" 74%; "very satisfied" 16.2%); only 9.8% of users declared themselves unsatisfied ("not very satisfied" 8.1%; "not at all satisfied" 1.7%). Satisfaction with the AT service was negatively correlated with the number of the visits required during AT assignment (item V1; P<0.001) and with user opinion about the appropriateness of the number of visits (item V2; P<0.001). The reason most commonly given for dissatisfaction with

the ULHS's AT service (N.=74) was "It takes too long [to get the AT device]" (mode: 26; 35.1%). *T*-tests indicated that there were no differences between MD and HD users and AT in use and abandoned with respect to data in part B.

AT use and abandonment: ATUFS-MD and -HD, items #1-4

Parts C1 and C2 of the telephone interview questionnaire consisted of the MD and HD versions of ATUFS 1.1 respectively. Item #1 gathered information about the brand and model of the device to which other responses related; these data are not relevant to this study and are not reported. The majority of respondents (N.=615, 82.1%) indicated at item 2 that they were still using their device. Abandonment of the device occurred on average in the 7th month after issue. Among the 134 users (17.9%) who reported that they were no longer using their assigned AT device the average duration of use before abandonment was between 6 and 7 months (the average time since device issue until the interview was 32 months). There was a difference in the length of time for which devices were used before abandonment (t=4.67, P<0.001); MDs were used for longer than HDs (mean 14 months and 3.5 months, respectively). Forty percent of those recorded as having abandoned their AT device reported that they had never used it. HD users were more likely never to have used their device than MD users ($\chi^2_{(1,53)}$=26.84, P<0.001).

As expected, amongst current users there was a correlation between the period of time that had elapsed since AT issue and the reported frequency of AT use (P<0.001); however, among ex-users there was no correlation between time elapsed since issue and the duration of use before abandonment.

Autonomy and utility of AT in use: ATUFS-MD and -HD, items #5-15

ATUFS items #5-16 were administered to the 615 users (82.1% of the sample) who reported that they were still using their device; 358 (58.2%) were MD users and 257 (41.8%) were HD users.

MD users reported that they needed help to use their device almost every time (item #5: mean 1.53±1.20) and used their device in a public setting about half of

TABLE I.—*Current AT users' assessment of the utility of their device (ATUFS-MD and -HD items #7-15).*

ATUFS-MD and -HD on AT utility (items #7-15)	Mobility device			Hearing device		
	Low utility (score ≤3)	High utility (score ≥4)	Mean (SD)	Low utility (score ≤3)	High utility (score ≥4)	Mean (SD)
7. To what degree does (did) the device improve your quality of life?	22.6%	77.4%	4.00 (1.13)	14.8%	85.2%	4.29 (0.84)
8. To what degree does (did) the device enhance your comfort?	28.8%	71.2%	3.85 (1.19)	13.6%	86.4%	4.27 (0.80)
9. To what degree does (did) the device enhance your well-being?	26.5%	73.5%	3.90 (1.16)	13.2%	86.8%	4.27 (0.82)
10. To what degree does (did) the device help you to… get around one floor of where you live (to communicate with those who live with you or attend daily)*?	22.1%	77.9%	4.15 (1.32)	12.1%	87.9%	4.46 (0.80)
11. To what degree does (did) the device assist you to… move one mile outdoors (to communicate outside of your home environment)*?	57%	43%	2.85 (1.77)	12.1%	87.9%	4.42 (0.81)
12. To what degree does (did) the device help you to take care of personal errands?	66.2%	33.8%	2.47 (1.60)	20.2%	79.8%	4.16 (1.18)
13. To what degree does (did) the device help you to keep in touch with others?	41.9%	58.1%	3.50 (1.46)	11.3%	88.7%	4.42 (0.86)
14. To what degree does (did) the device help you to take care of your health?	42.5%	57.5%	3.45 (1.42)	20.6%	79.4%	4.10 (1.07)
15. To what degree does (did) the device help you be more active and involved in the community and with other people?	43.9%	56.1%	3.45 (1.51)	10.9%	89.1%	4.37 (0.87)
Total score			3.51 (0.83)			4.30 (0.66)

*Question wording in parentheses applies to HD users.

the time (item #6: mean 2.67±1.81). HD users did not need help to use their device (item #5: mean 4.20±1.40) and reported that they wore their device every time they went out into the community (item #6: mean 1.24±0.68).

The items dealing with device utility (items #7-15) showed good internal consistency (ATUFS-MD: Cronbach's α=0.76; ATUFS-HD: Cronbach's α=0.89).

Scores on items 7-15 were dichotomized into low utility (scores ≤3) and high utility (scores ≥4) categories. Mean values, standard deviations and category frequencies for all items are reported in Table I.

The mean overall utility reported by MD users was greater than the midpoint on the response scale (total score: mean 3.51±0.83). They also reported that the device was very useful in helping them to get around their home (item #10: mean 4.15±1.32) and that it greatly improved their quality of life (item #7: mean 4.00±1.13). Conversely MD users considered their device more or less useless for helping them to take care of personal errands (item #12: mean 2.37±1.60) or travelling one mile outdoors (item #11: mean 2.85±1.77).

HD users reported that their device was very useful (Total score: mean 4.30±0.66). It was reported to be most useful for helping users communicate with the people they were living with (item #10: mean 4.46±0.80) and was considered least useful for taking care of their health (item #14: mean 4.10±1.07) or personal errands (item #12: mean 4.16±1.18).

An independent-samples *t*-test revealed that HD users were significantly more satisfied overall with their device than MD users (*t*=12.65, P<0.001; total score for ATUFS items #7-15).

The open question about suggestions for improving device utility (item #16) prompted many suggestions from users on features and options that might improve practical utility of their devices. In view of the volume of qualitative data gathered, we plan to discuss them in a future work.

Reasons for non-use of AT: ATUFS-MD and -HD sub-items #17.1-17.21

ATUFS item #17 was administered to subjects (N.=134, 17.9%) who reported that they were not using the assigned device; 74 (55.2%) were HD users and 60 (44.8%) were MD users. The AT non-use was 22.4% for HD, whereas 14.4% for MD. ATUFS item #17 consists of a scale with 21 sub-items that showed good internal consistency (Cronbach's α=0.79).

Scores on sub-items #1-21 were dichotomized into low importance (scores ≤5) and high importance (scores ≥6) categories. Means, standard deviations and category frequencies for all items are reported in Table II.

TABLE II.—*Reasons for non-use of AT (ATUFS-MD and -HD sub-items #17.1-17.21).*

ATUFS-MD and -HD sub-items #17.1-17.21	Mobility device			Hearing device		
	Low importance (score ≤5)	High importance (score ≥6)	Mean (SD)	Low importance (score ≤5)	High importance (score ≥6)	Mean (SD)
17.1. It was part of another device or system that I stopped using.	93.3%	6.7%	0.52 (1.99)	97.3%	2.7%	0.23 (1.13)
17.2. I prefer to have someone help me rather than use the device.	86.7%	13.3%	1.60 (3.28)	91.9%	8.1%	0.65 (2.08)
17.3. An important change in the make-up of my family.	95%	5%	0.45 (2)	100%	0%	0.12 (0.74)
17.4. My health/physical condition got worse.	61.7%	38.3%	3.77 (4.78)	85.1%	14.9%	1.58 (3.44)
17.5. I no longer needed to use it because my health/physical condition got better.	86.7%	13.3%	1.35 (3.38)	100%	0%	0.03 (0.23)
17.6. It stopped working properly.	85%	15%	1.38 (3.37)	90.5%	9.5%	1.07 (2.76)
17.7. It was too inconvenient to use.	83.3%	16.7%	1.75 (3.39)	77%	23%	2.07 (3.69)
17.8. There was no one to help me use it.	93.3%	6.7%	0.68 (2.35)	100%	0%	0.11 (0.67)
17.9. It did not work as I expected it would.	80%	20%	1.92 (3.68)	81.1%	18.9%	1.93 (3.69)
17.10. It was not the right design for me.	71.7%	28.3%	2.88 (4.34)	41.9%	58.1%	5.34 (4.53)
17.11. It was not the right size for me.	76.7%	23.3%	2.50 (4.08)	75.7%	24.3%	2.31 (3.85)
17.12. It was too uncomfortable to use.	63.3%	36.7%	3.43 (4.39)	78.4%	21.6%	2.23 (3.94)
17.13. It was too painful to use.	95%	5%	0.47 (2.06)	87.8%	12.2%	1.07 (2.76)
17.14. It did not help me because I needed a better or different device.	55%	45%	4.22 (4.63)	60.8%	39.2%	3.74 (4.45)
17.15. I did not get the training or support I needed to use it.	91.7%	8.3%	0.98 (2.56)	98.6%	1.4%	0.18 (1.09)
17.16. It did not suit my basic needs.	70%	30%	3.33 (4.13)	54.1%	45.9%	3.77 (4.20)
17.17. It interfered too much with my normal routines and patterns of doing things.	86.7%	13.3%	1.32 (3.13)	79.7%	20.3%	1.84 (3.50)
17.18. I felt self-conscious using it.	95%	5%	0.47 (1.96)	79.7%	20.3%	1.89 (3.47)
17.19. The lease/rental expired and I could not afford it.	100%	0%	0.10 (0.54)	97.3%	2.7%	0.22 (1.35)
17.20. It broke and I cannot use it.	90%	10%	0.97 (2.93)	93.2%	6.8%	0.69 (2.43)
17.21. I replaced it with a better device.	63.3%	36.7%	3.70 (4.68)	83.8%	16.2%	1.59 (3.66)

MD users reported that they abandoned the device mainly because they needed a better or different device (item #17.14: mean 4.22±4.63), because their health or physical condition had worsened (item #17.4: mean 3.77±4.78), or because it had been replaced with a better device (item #17.21: mean 3.70±4.68). The main reasons given by HD users for no longer using, or never having used their device were that the device wasn't the right design for them (item #17.10: mean 5.34±4.53), or did not meet their basic needs (item #17.16: mean 3.77±4.20) and that they needed a better or different device (item #17.14: mean 3.74±4.45).

Independent-sample *t*-tests were carried out to assess the differences between MD and HD users in terms of reasons for abandoning an AT device. Wrong design of device (item #17.10: t=-3.17, P<0.01) and embarrassment when using it (item #17.18: t=-2.83, P<0.01) were significantly stronger reasons for abandonment among HD users. Preferring human help (item #17.2: t=2.04, P<0.05), and worsening of health or physical condition (item #17.4: t=3.07, P<0.01), or an improvement in health or physical condition (item #17.5: t=3.35, P=0.001), lack of human help (item #17.8: t=2.01, P<0.05), lack of train-

ing (item #17.15: t=2.45, P<0.05), and replacement with a better device (item #17.21: t=2.92, P<0.01) were significantly stronger reasons for abandonment among MD users.

QUEST 2.0

QUEST 2.0 was administered to all subjects (N.=749) regardless of whether they were still using their device. The scale as a whole and the Device subscale showed good internal consistency (α=0.84 and 0.85, respectively), but internal consistency was weaker for the Service subscale (α=0.67).

The scores obtained were dichotomized into low satisfaction (scores ≤3) and high satisfaction (scores ≥4) categories. Category frequencies for all items and means and standard deviations for both subscales and the scale as a whole are reported in Table III.

MD users who were still using their device reported significantly higher satisfaction than users who had abandoned their device in terms of Total score (t=5.90, P<0.001) and Device score (t=6.78, P<0.001), but not Service score. HD users who were

TABLE III.—*Satisfaction with the mobility device (MD) or hearing device (HD) issued (QUEST 2.0 scores).*

QUEST 2.0		Users with AT in use				Users with abandoned AT			
		MD low satisfaction (score ≤3)	MD high satisfaction (score ≥4)	HD low satisfaction (score ≤3)	HD high satisfaction (score ≥4)	MD low satisfaction (score ≤3)	MD high satisfaction (score ≥4)	HD low satisfaction (score ≤3)	HD high satisfaction (score ≥4)
Q1.	Dimension	24.3%	75.7%	25.3%	74.7%	40%	60%	75.7%	24.3%
Q2.	Weight	19.6%	80.4%	7.8%	92.2%	36.7%	63.3%	63.5%	36.5%
Q3.	Ease in adjusting	12.3%	87.7%	14.4%	85.6%	30%	70%	68.9%	31.1%
Q4.	Safe/secure	7.3%	92.7%	13.6%	86.4%	33.3%	66.7%	75.7%	24.3%
Q5.	Durability	14.5%	85.5%	27.6%	72.4%	28.3%	71.7%	74.3%	25.7%
Q6.	Ease in use	9.5%	90.5%	5.4%	94.6%	25%	75%	66.2%	33.8%
Q7.	Comfort	13.4%	86.6%	12.5%	87.5%	40%	60%	77%	23%
Q8.	Effectiveness	11.2%	88.8%	16%	84%	45%	55%	79.7%	20.3%
Device scale percentage		3.4%	96.6%	1.9%	98.1%	28.3%	71.7%	64.9%	35.1%
Device scale mean score		4.24±0.57		4.18±0.49		3.63±0.99		3.28±0.53	
Q9.	Service delivery	28.5%	71.5%	31.9%	68.1%	31.7%	68.3%	73%	27%
Q10.	Repairs and servicing	68.4%	31.6%	15.6%	84.4%	71.7%	28.3%	64.9%	35.1%
Q11.	Professional services	20.1%	79.9%	6.6%	93.4%	28.3%	71.7%	63.5%	36.5%
Q12.	Follow-up	70.1%	29.9%	30%	70%	75%	25%	78.4%	21.6%
Service scale percentage		18.7%	81.3%	5.1%	94.9%	25%	75%	64.9%	35.1%
Service scale mean score		3.62±0.71		4.09±0.58		3.43±0.73		3.35±0.67	
Total mean score		4.04±0.52		4.15±0.44		3.57±0.80		3.30±0.51	

still using their device were significantly more satisfied than users who had abandoned their device in terms of total score (t=13.98, P<0.001), device score (t=13.72, P<0.001), and service score (t= 9.21, P<0.001).

When the analysis was restricted to subjects who were still using their device HD users reported higher satisfaction than MD users in terms of both total score (t=-2.87, P<0.01) and service score (t=-8.61, P<0.001), but there was a similar level of satisfaction in terms of device score. Users who had abandoned a MD had been significantly more satisfied with it overall than users who had abandoned a HD (total score: t=2.31, P<0.05), but this group difference applied only to the device itself (device score: t=2.65, P<0.01) and not the service associated with it.

Correlations between user evaluation of ULHS's AT service and QUEST scores

Among current AT users there was a significant correlation between user evaluation of the ULHS's AT service (item V3) and scores on the Device and Service subscales of QUEST (P<0.001). Among ex-users the item V3 score was only correlated with QUEST Service score (P<0.01). Only in current AT users was the reported number of visits needed to obtain the device (item V1) negatively correlated with QUEST Service score (P<0.001) and QUEST Total score (P<0.05).

Correlations between ATUFS and QUEST scores

To analyze the relationship between the subjects' experiences with AT and their satisfaction with it we performed a Pearson's correlation analysis for data from ATUFS 1.1 (MD and HD versions) and the QUEST scales.

Within current MD users there were strong correlations (0.001<P<0.007) among all items of ATUFS, except for items #10 and #11, and QUEST total and device scales. Among current HD users there were strong correlations (P<0.001) between all the ATUFS items and both QUEST total and QUEST device scores; ATUFS items #17.7 and #17.9 were also weakly correlated (P<0.05) with QUEST Service score.

Among ex-MD users there were high negative correlations (0.000<P<0.01) between ATUFS sub-items #17.7, 17.9, 17.10, 17.11, 17.12, 17.14, 17.16, and 17.18, and both QUEST total and QUEST device scores. In addition, ATUFS sub-items #17.10, 17.11, and 17.18 were weakly correlated (0.002<P<0.013) with QUEST service score. There were no negative correlations between ATUFS sub-items #17.1 to 17.21 and the QUEST scores in former HD users.

Discussion

We found that overall 17.9% of our sample had abandoned their device; this is lower than the generally accepted 30% abandonment rate.[10, 15, 16, 18, 21] The abandonment seemed to be motivated almost exclusively by negative reasons as displayed in Table II. Only the MD users found that they no longer needed to use AT because their health/physical condition got better, and for a very low percentage (item #17.5, high importance 13.3%). This suggests the appropriate use of "abandonment" (with a negative emphasis) rather than, *e.g.*, "discontinuance" in reference to AT non-use. Users who received a HD were more likely to abandon their AT (22.4%) than people who received a MD (14.4%). We found that a higher percentage of HD users had never used the device issued to them and those who had used it had used it for a significantly shorter period than those who had abandoned a MD. The most commonly given reason for not using a HD was that the design of the device was inappropriate (58%). Reasons for abandoning MDs were more various and none was highly important to the majority of ex-users. However, summing the frequencies of the two mutually exclusive health-related reasons (items #17.4 and #17.5) indicated that for 52% of MD users (N.=31) health reasons were a very important factor in their abandonment of their device. In summary, it seems that a personal factor (health) was a more important factor in non-use of MDs than technology- and service-related factors, in spite of the fact that satisfaction with AT service delivery was rather low. Conversely, among ex-HD users the main reasons given for abandonment or lack of use were the AT assessment process and the features of the device. Similar findings have been reported by Phillips and Zhao,[15] Bynum and Rogers,[9] Cushman and Scherer,[10] and Verza *et al*.,[21] all of whom cited poor device performance, changes in user needs or functional capacity, and alternative solutions as reasons for abandonment.

Analysis of the QUEST scores from ex-HD users produced unexpected results. Although former HD users reported low satisfaction with their device and the associated service, former MD users reported similar levels of satisfaction to MD users who were still using their device. A possible explanation for this difference is that MD users were more likely than HD users to have abandoned their device for health reasons (positive or negative change in health) than because of factors related to the device or the AT service. This means that unlike the former HD users, whose reasons for abandonment tended to be directly related to the device characteristics, their abandonment may not have been related to their judgment of the device. The QUEST scores indicated that all groups of users except current HD users were relatively unsatisfied with the AT service. This suggests that HD users were less likely to abandon their device if the assessment and issuing procedure and follow-up service were perceived as a satisfactory pathway.

We did not investigate the ULHS's AT assessment processes, but Federici and Borsci [19, 20] reported that the user experience of an AT is influenced by the quality of the service they received in relation to the device. In the Umbria Region HD users can obtain a HD through two different pathways: through the ULHS's AT service or through commercial centers operated by HD manufacturers (*e.g.*, Maico, Amplifon, etc.). Users who follow the latter pathway are entitled to have the cost of their HD refunded by the ULHS, although post-delivery support and follow-up are provided by the commercial centers. The differences in satisfaction with the AT service may be related to the use of different pathways. Furthermore, given that both current and ex-MD users expressed a lack of satisfaction with their AT service similar to that of former HD users, we suggest that current HD users — who reported higher satisfaction with the support and follow-up they received in relation to their device — are more likely to have bought their device from a commercial center. HD users who obtained their device from a commercial center reported better initial and post-delivery service than users who received their AT from the ULHS's service. Two factors may account for the influence of quality of service on user satisfaction and non-acceptance.[19-21] First, greater satisfaction with the ULHS's AT service (QUEST Service score) was negatively associated with number of visits required to obtain the AT device (questionnaire part B, item V1). Second, duration of use before abandonment and satisfaction with the service did not predict abandonment, suggesting that it might instead be related to the characteristics of the device issued (AT assessment process [36]) or to failure of the device to meet user needs and expectations (matching person and technology [4]). Corroboration for these suggestions comes from the fact that 40% of recorded ex-users reported that they had never used the device issued to them and the majority of the remainder had abandoned their device with 7 months of issue.

Data on the utility of the AT (ATUFS-MD and -HD, items #7-15) showed that the most valued functions

were enhanced quality of life (item #7) and help in the home environment (item #10). Current HD users were more satisfied (ATUFS and QUEST scores) than current MD users. The QUEST data suggest that this difference in satisfaction was due to a difference in satisfaction with the service received in relation to one's device. This is further evidence to suggest that the type of service provision, rather than device characteristics, determines overall satisfaction.

Limitations of the study

This study has several limitations. One relates to the representativeness of the sample. Although the research is based on the largest survey ever conducted on AT abandonment in Italy, the sample was not selected to be representative of the population using the ULHS's AT service in terms of demographic and clinical variables. Second, unlike Federici and Borsci,[19, 20] we did not investigate the AT assessment processes of each ULHS's AT service, although this aspect of service delivery has been shown to affect the outcome of AT issue.[13, 19, 20, 36] Third, we did not control for the effect of the choice of device provider (commercial center vs. ULHS) on the outcome of AT issue; we did not collect data on whether users had received their device from the ULHS's AT service or from a commercial center. Finally, the study was restricted to only two types of devices (mobility and hearing devices); including other classes of AT might have affected the global percentage of abandonment.

Conclusions

The goal of this study was to investigate the extent and reasons for AT abandonment among Italian ULHS users. At the time of the survey 134 (17.9%) out of 749 respondents declared that they were not using their AT device and 40% of this group reported that they had never used the device issued to them. Our data suggests that abandonment may be the result of issuing of an inappropriate device, or unmet user needs and expectations. These findings are in line with data gathered in 2009 by Federici and Borsci.[19, 20] Finally, we would also like to highlight the economic leakage caused by AT abandonment in the Umbria Region. In 2013, the Umbria Region spent € 18,787,797.37 on AT; assuming an estimated AT abandonment rate of 17.9%, the economic leakage was around € 3,363,015.73. If we consider that the population of Umbria is roughly 900,000 inhabitants, this is a relevant sum, especially in light of the Italian public spending policies since 2007.

Federici and Borsci [49] demonstrated that the AT delivery systems in the Umbria Region Local Health Service, which is oriented to a more "person-centered" (i.e., individualized and holistic) approach, involving users in decisions about the support they receive,[6, 29, 45] have fewer functional problems, more satisfied users, and a lower AT abandonment rate. Conversely, in AT delivery with systems which are less focused on optimizing the process — i.e., reducing the costs, time, and professionals' efforts — the number of problems that a user could experience interacting with service is higher, user satisfaction is lower, and the AT abandonment rate is higher. Given that, we also found a correlation between user evaluation of ULHS (i.e., user satisfaction with AT delivery system) and QUEST scores (user satisfaction with AT in use): our findings suggest relevant indications for the ULHS management. A spending review focusing only on the efficiency (minimization of the time and costs of the process) of the health care systems and neglecting their effectiveness (quality of both process and solution provided to the patient) would be non-economic in the long-term and, therefore, not truly efficient.

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