Introduction

Assistive devices are growing in importance within health and social care as they are thought to promote function independence [1–3] increase self-efficacy [4] and quality of life.[5,6] The devices market was valued at USD 12.37 billion in 2012 and is expected to reach an estimated value of USD 19.68 billion in 2019.[7] This is hardly surprising since the use of devices increases with age.[8,9] In addition, there is evidence that the right prescription of assistive devices could deliver cost saving for health and social care providers.[10–12] Nevertheless, despite the reported benefits, there appear to remain a number of barriers to the ensuring that assistive technology is successfully adopted and used. In fact, 29.3% of all devices are abandoned.[13] These barriers can include lack of knowledge about the device, involvement in the process of selecting it, attitudes towards the technology and lack of fit of the assistive technology between service users and their environment.[14] Interestingly, a Canadian study suggests that the medias views of older adults could lower the use of assistive devices.[15] As a consequence, the service user’s independence is reduced and there are cost implications for the health and social care providers.[16] One possible solution is collaborative shared decision-making and person-centred practice.[17,18]

Customization of measurements plays a vital role in order to ensure the successful fit of the assistive device to the person.[19,20] It is essential if the device is to match the needs of the person.[21] If a device is to be customized it needs to be measured and assessed within the persons chosen environment since the actual dimensions of a piece of furniture can affect the individual’s ability to use it. For example, evidence suggests that when a chair seat is lower than knee height, a longer time is taken to rise from sit to stand, and an older occupant needs to use faster and larger trunk flexion movements.[22,23] In this case, a device such as a chair raiser can facilitate transfers in and out of a chair. Therapists and service users use measurements of furniture to ascertain the correct fitting of assistive devices to be provided. However, significant differences may occur between therapists and older adults’ perceptions in relation to the best height of a chair.[24] One of the factors that play a role in this could be that the optimum seat height for ease of rising is not necessarily the same as the optimum seat height required for comfort. Therefore,
seat height chosen to maximize the ease of rising may be slightly higher than that chosen for comfort.[25] There may also be difference between how service users and therapists take measurements, or in how measurements are taken among therapists. Nevertheless, currently no guidance indicates how much of a difference would be clinically significant.[26]

Therapists measure for assistive devices either by conducting a home visit with or without the patient.[27] In clinical practice, it is also becoming common for family members or service users to measure key items of furniture on behalf of therapists because of time limitations.[28] However, very little is known about the medium therapists use to facilitate the process of information exchange regarding taking measurements to ensure best fit of assistive devices. This is particularly important if service users want to self-assess for the provision of devices.

When service users feel informed, they are more likely to be satisfied with their devices, engage with them, and retain them.[4] Written guidance could achieve the aim of informing patients, but both the content and layout of guidance should empower service users to make informed decisions about their own care. If the guidance, however, does not adhere to recommended quality standards in relation to its content, layout and readability, then it may not result in the right decision being made by service users. Furthermore, we do not know the extent to which written guidance facilitates the principles of shared decision making and empowerment. Within occupational therapy and physiotherapy little attention has been paid to the effect and quality of information guidance on professional practice.

The overall goal of our research is to develop national guidance for service users to enable them to self-assess for provision of minor assistive devices that facilitate bed, chair, stairs, toilet and bath transfers. The pieces of furniture were chosen as they are the most frequently requested items for information by members of the public as recorded by the Disabled Living Foundation (UK) which is an independent consumer advice centre for provision of assistive technology (Figure 1). Also, Williamson and Fried[29] have shown that among 230 older adults, 14% had difficulty getting in or out of bed, 14% in or out of a chair and 13% ascending/descending stairs. The aim of this paper is to ascertain what guidance is currently available for measurement of home furniture and assess its readability and content.

Is the guidance fit for purpose?

An online descriptive national survey involving health and social care settings in England was carried out to determine what guidance is currently available for measurement of home furniture and also to gather this guidance. An online search for documents using a Google search engine was also carried out to ascertain whether any guidance was available online. The keywords that were used for the online search were measurement, occupational therapy, furniture measurement, height (i.e., bed, chair, toilet, stairs and bath), home visit, measurement, hip fracture measurement in combinations.

An online survey was considered to be easier for clinicians to drop-off documents rather than posting via a traditional postal service. In addition, we were of the opinion that an online survey would enhance our response rate when compared to a postal survey as suggested by Lazar and Preece.[30] Available web-based survey platforms such as survey monkey and Bristol surveys were decided against as we wanted to have direct communication with our respondents,[31] and at the same time accommodate file transfer to facilitate the upload of the available guidance. We were sensitive to the fact that occupational therapists have been slow to integrate technology within professional practice and wanted to ensure that the system was not difficult to operate.[32] There is also evidence that internet-based surveys provide an attractive alternative to postal and telephone surveys for health professionals.[33]

NHS settings were targeted, where occupational therapists who are involved in the provision of minor assistive devices work. These were identified by searching through the online NHS service directories page[3] and social care settings where therapists work through the online A–Z list of local councils[5].

To maximize response rates, we followed Dillman et al.’s[34] guidelines as suggested by Monroe et al. [35] who emphasized the importance of personalization. Therefore, individual emails were sent to each participant by including personalized survey links along with two reminder emails including a statement which specified how long it would take to complete the survey.[36] The survey was one page in length and questions were either closed or of a Likert scale type. Questions were related to the quality of the guidance in terms of currency, development, evaluation and accessibility (Table 1). The survey questions were developed from best available guidance.[37–39] To ensure content validity of the survey and coherence of the survey questions, a group of experts were asked to comment on the survey.

Descriptive statistics (i.e., frequencies and percentages) were used to analyse the collected data. The readability of the collected guidance leaflets was measured using the SMOG formula (simplified measure of goobledygook) which was formulated by McLaughlin[40] who uses vocabulary difficulty and sentence length to predict the difficulty level of a text.[41] It has been suggested by the national voice for life-long learning as it gives the readability score rather than the high school level. One hundred words from the beginning, middle and end of the document were entered into the SMOG calculator. If the document was short in

![Figure 1. Percentage of downloads for requests for information on furniture.](Image)

Table 1. Outline of survey questions.

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>What area of practice are you working in?</td>
</tr>
<tr>
<td>Are you currently using written guidance for provision of minor assistive devices/technology used in bath, toilet, bed, chair and stair transfers?</td>
</tr>
<tr>
<td>When was your guidance written?</td>
</tr>
<tr>
<td>How was the guidance developed?</td>
</tr>
<tr>
<td>Who was involved?</td>
</tr>
<tr>
<td>Has it been evaluated?</td>
</tr>
<tr>
<td>Is the guidance fit for purpose?</td>
</tr>
</tbody>
</table>
text, we manually applied the SMOG formula to the text instead of using the website application to work out the readability score.

All of the identified pieces of guidance were sent to two occupational therapists. The therapists read each document independently and included the guidance if this made reference to how to measure bed, chair, toilet, bath and/or stairs. The two therapists discussed and debated aspects of measurement although they did not exclude documents if they perceived the measurement process was flawed. The guidance was then examined using a template to determine how and what measurements are taken and other factors that were related to the measurement. Extracted information included how measurements are taken, either of furniture height only and or with the person present. We also extracted relevant additional factors related to the measurement, such as environmental factors, type of furniture and suggested height of furniture. These were then placed under each relevant table. We then further synthesized the data to ascertain similarities and differences between the content of the guidance (Table 2).

### Results

From a total of 325 responses, 274 were not utilizing any guidance. The highest response rate from a single clinical area (Table 3) was physical disability in the community,[42] acute physical,[42] social services,[39] physical rehabilitation,[37] acute mental health [28] and neurology.[20] Not all the questions from the survey were completed by the participants (Table 4). Guidance was developed specifically for persons in acute care, or in the community with no guidance developed for use in other specialties. Eight guidance leaflets were written in 2008, one document within 2011.

**Table 2. Synthesis of Measurement Guidance Leaflets.**

<table>
<thead>
<tr>
<th>Furniture</th>
<th>Furniture height</th>
<th>Person present</th>
<th>Aspects about the furniture</th>
<th>Environment</th>
<th>Additional measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed</td>
<td>Measure the height from the floor to the top of the mattress when depressed as though someone were sitting on the edge of the bed (Guidance 1)</td>
<td>Measure the height from the floor to the top of the mattress when depressed with the patient sitting on the edge of the bed (Guidance 2, 3, 5, 6)</td>
<td>Is the bed single or double (Guidance 7)</td>
<td>Location of bed upstairs/downstairs (Guidance 5)</td>
<td></td>
</tr>
<tr>
<td>Toilet</td>
<td>Measure the distance from the floor to the rim of the toilet bowl (Guidance 6) Measure the distance from the floor to the toilet seat (Guidance 2, 3) Height of the toilet (with seat up) (Guidance 5)</td>
<td>With patient seated, measure the floor to back of knee (popliteal fossa). (Guidance 6, 8) Measure the distance between the floor and the back of the thigh, just behind the knee (Guidance 9)</td>
<td>Type of aids used to assist by the toilet? (Guidance 5)</td>
<td>Location of toilet upstairs/downstairs (Guidance 5)</td>
<td></td>
</tr>
<tr>
<td>Chair</td>
<td>For chairs measure the height from the floor to the top of the seat when it is depressed as if someone were sitting in the chair (Guidance 1, 5, 10)</td>
<td>With the patient seated, knees and ankles at 90°. Measure from the floor to the back of the knee (popliteal fossa) (Guidance 6, 10, 11, 12, 13) Feet flat on the floor (Guidance 10, 11, 12) Before you measure ensure the person is seated in a midline position with feet supported and ankles, knees and hips at approximately 90 degrees. Check their pelvis is level as this could affect seat height measurement (Guidance 10)</td>
<td>Type of chair legs: casters, wooden blocks, size of blocks, straight (Guidance 3, 5) Style of Chair: Armchair (Guidance 3, 5)</td>
<td>Add 2° for patients following hip replacement (Guidance 6) Add 2°/5cm each side, to allow for comfort when measuring seat width (Guidance 10)</td>
<td></td>
</tr>
<tr>
<td>Bath</td>
<td>No relevant information</td>
<td>Person present</td>
<td>They should be placed at height consistent with the measurement taken from the person (floor to ulna styloid when arm is down by side) (Guidance 14) Handrails should be positioned to follow the pitch of the staircase, at a height to suit the user’s needs but which shall be between 900 mm and 1000 mm measured vertically from the pitch line of the steps (Guidance 13)</td>
<td>Aspects regarding stair rail Usually a second stair rail is fitted parallel to the existing rail. (14, 15) Where space allows, the handrail should be allowed to continue past the top step by up to 300 mm (16)</td>
<td></td>
</tr>
</tbody>
</table>
Four of the guidance leaflets reported to have been evaluated and six of them had not been evaluated. Four of the documents had been reviewed in 2004, with one guidance reviewed in 2011. In relation to accessibility to service users (nine respondents), three persons rated the guidance to not be accessible at all, whilst three others rated it to be of some use to service users. In relation to how the guidance had been developed, four of the documents were devised by therapists with the remaining four guidance documents having no author. In regard to therapists’ perceptions of the guidance, three (out of seven) therapists rated it as being very much fit for purpose, one very good, and two fairly good. Four (out of 10) perceived the guidance as very easy to use, one good and two fairly easy to use.

**Readability**

The readability analysis revealed that eight of the guidance leaflets were aimed at National Adult Literacy standard 3 (age 9–11), which means that adults should be able to read short, straightforward texts on familiar topics accurately and independently (learning observatory 2015). The remaining 5 guidance leaflets were aimed at individuals with skills beyond level 3 and who could read a broadsheet newspaper.

**Measurement of home furniture**

Two guidance documents were received via the post and 13 guidance documents were uploaded. Thirty documents were found online. In total, 15 guidance documents met the inclusion criteria (4 documents from the national survey and 11 documents from the online search). None of the guidance made reference to any published research in the area of measurement and how the guidance was developed as per the inclusion criteria.

**Furniture height**

Among the guidance leaflets, there was some agreement in relation to furniture height for the bed and chair. For measuring the height of the toilet there was agreement that the measurement should start on the floor but there were subtle differences as to where the measurement should be taken from and to (i.e., toilet bowl,[6] toilet seat,[2,3] seat up [5]). No guidance was available for bath and/or for stair rail height. The guidance did make specific reference to the “make up” of the furniture, e.g., the type of chair, bed and/or whether adaptive devices were present.

**Person present**

The measurement of the person (i.e., popliteal height) was viewed as an important measurement for provision of chair, toilet, and bed devices. All but one of the guidance leaflets agreed that the measurement should occur from the floor to the “back of the knee” with one guidance (Guidance 9) only stating that it occurs “just behind the knee”. Footwear was only mentioned in relation to measuring a chair. In relation to the measurement of toilets and chairs, it was suggested that an additional 2 inches (5 cm) should be added for persons with a hip replacement. However, one document suggested that the additional measurement should be 2.5 cm (Guidance 8).

**Discussion**

Health literacy is defined as the ability to “access, understand, evaluate, and communicate information as a way to promote, maintain, and improve health in various settings over the life-course”.[42] Guidance is only effective if service users can read and understand the information provided. One means of determining the quality of provided guidance is to use the International Patient Decision Aid Standard (IPDAS). The IPDAS was formulated after an online Delphi Process with an international group of collaborators to assess the quality of decision aids.[43] Three of the 9 rating scales are based around, conflict of interest, structure and lay out, and reliability.

The findings from our research found that guidance was not always updated or attributed to an author or accessible to an author. However, what was of interest is that despite these limitations some therapists rated guidance as being very much fit for purpose, i.e., one very good, two fairly good. Four (out of 10) perceived the guidance as very much easy to use, one good and two fairly easy to use. This could suggest that therapists are not aware
of how quality guidance should be devised and also supports a
better education campaign about the importance of guidance. A
positive factor of the research was that the readability of eight of
the documents was aimed at National Adult Literacy standard
tree (Guidance leaflets 9–11), although the remaining five guid-
ance leaflets were aimed at individuals with skills beyond level
tree. The average reading age in the UK population is nine years
old. It should be noted, however, that the expectation of a
person reaching level three in the literacy standards is able to
read “short, straightforward texts on familiar topics accurately and
independently”. The process of measurement may not be familiar
and therefore developers of guidance should take this into
account, e.g., within the measurement guidance in our study ter-
minology such as “midline”, “depressed” and or “ninety degrees”
may not be understood by service users and carers. Our research
suggests that more needs to be done if we are to ensure service
users have access to high quality information within the measure-
ment process for devices.

The data from the national survey found that 84% of trusts
were not using any guidance. This could mean that therapists are
undertaking unnecessary home visits to take measurements for
devices and/or that the measurements that are being submitted
are not accurate or consistent. We do not know the effect that
measurement error has on function and further work is needed to
determine this, as well as its effect on patient safety. In addition,
information is needed to enable service users to contribute to
shared decision making and facilitate self-assessment.[17]

This research is unable to comment on the accuracy of informa-
tion as suggested by the IPDAS, although we can comment on
similarities and differences. Our research found that in relation
to bed, chair and toilet height to fit the person, the measurement
that was used for the person was from the floor to the back of the
knee which is sometimes referred to as popliteal height. However,
the reliability and validity of this measurement has been ques-
tioned.[44]

Measurement of bed height is particularly important in relation
to falls management and functional independence. One strategy in
fall prevention is to keep beds in a low position.[45] The analysis
of the guidance revealed that the content related to the measure-
ment of bed height to fit the person was consistent. Likewise the
same measurements are used in a research paper by Capezuti
et al.[46] The findings from our study found some consistency
between the different guidance leaflets. For both the measure-
ment of the furniture and to fit the person, guidance emphasized
that mattresses should be depressed. However no further guidance
is given as to whether this included duvet covers or where the
person should sit. Nevertheless, Tzeng et al. [45] suggest the measure-
ment should be from the floor to the “middle of the bed”.

Accurate measurement of chair height is important as the seat
height influences the performance of older adults.[46] When a
chair seat is lower than knee height, a longer time is taken to rise
to standing and the older occupant needs to use faster and larger
trunk flexion movements to rise.[22,23] Less effort is needed to
rise from a high chair although research by Chen et al. [25] found
that older adults felt it was less safe to rise and sit at lower and
higher seat heights. It has been established that a seat height
equivalent to knee height is most easy to rise from.[22,23] Within
the chair guidance, specific reference was made to the positioning
and angle of knees, hips and ankles. Rationale for this is probably
because of the 90°–90°–90° position which is regarded as the best
ergonomic seated position.[47] It is related to the view that the
aim should be able to achieve symmetry on both sides of the
body to avoid obliquity, rotation and posterior pelvic tilt [48]
which may account for the reference made to the assignment of
the pelvis in one guidance. However, the optimum seat height for
comfort is not necessarily the same as the height required for ease
of rising. A chair chosen for optimum comfort would allow the
user to rest the feet squarely on the floor and would ensure that
there was no pressure under the thighs that could limit blood cir-
culation. In addition, the seat height chosen to maximize the ease
of rising would be slightly higher than that chosen for comfort.[25]
In relation to the measurement of the chair seat height only with
no person sitting on it, the measurement leaflets from our study
are different from those used in studies by Weiner et al. [49] and
Kirvesoja et al.[24]

Our research found that only one guidance made reference to
measurements to fit a stair rail specifically for a service user. We
found no published research to substantiate the measurement
guidance for a stair rail. It is important that attention to building
regulations should be adhered to. An interesting stair formula for
the calculation of a stair rail for service users is suggested by
Ishihara et al.[50] Whilst it looks promising, this formula remains
untested in practice.

Few guidance leaflets made reference to toileting which was
surprising since toileting is an essential activity of daily living. In
our study, there was subtle difference in relation to the measure-
ment of the toilet height. However, there were no identified stud-
ies about prescription of toileting devices for older adults or their
usage by health care professionals. Studies of users’ perceptions of
toileting devices have not been published either. Although one
paper was found that made reference to measurement of toi-
let,[46] this paper spent little time discussing optimal toilet height.

Unfortunately, our research found no guidance that made refer-
ence to the measurement of the bath. Despite research outlining
the importance of bathing to service users,[51] bathing is often
given a low priority by health care professionals as it is not
regarded as an essential activity of daily living.

Conclusion
This research is unable to comment on the accuracy of informa-
tion gathered, although we can comment on identified similarities and
differences. Our research suggests that there are both different
techniques and ways of presenting measurement information
within a given guidance. There is need to ensure that information
within guidance is not only evidence based but is accurate as well.
Thus, our research has highlighted the need to confirm and agree
measurement techniques for home furniture in the provision of
assistive devices. This will then allow guidance to be tested for
accuracy and ensure the best fit of devices. Moreover it could in
turn enable service users to self-assess and consequently reduce
the need for therapists to perform measurements of furniture and
spend their time more efficiently.

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Disclosure statement
The authors report no conflicts of interest.

Notes
1. see http://www.nhs.uk/servicesdirectories/Pages/ServiceSearch.
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