Key Words
Walking test, elderly people, standardisation.

Standardisation of a Three-metre Walking Test for Elderly People

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Summary There is evidence that distance-limited timed walking tests are useful indicators of functional mobility in elderly people. However, since there is little consensus on how such tests should be conducted, the test parameters have been reviewed and a standard procedure for administering them to older people is suggested. Particular attention is paid to reducing any fear of falling people may experience while performing the test. To this end subjects walk along a corridor which is carefully set up to provide support if they feel unsteady.

In addition, evidence from a pilot community study is presented which demonstrates that it may be possible to conduct this test in only about 50% of homes in inner-city areas.

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Introduction

Lack of clear guidance about how to carry out a test may be an inhibiting factor in the adoption of objective measures in rehabilitation. In this paper we address this issue with respect to timed walking tests. Sixteen years ago Guyatt *et al* (1984) observed that the procedure for conducting these tests had 'never been standardised'. He was referring primarily to time-limited tests but the situation is similar for those which are distance-limited. Although Wade (1992, pages 78, 167) subsequently outlined a standard procedure, references to it are rare.

Indeed, apart from a few authors (Connelly *et al*, 1996; Wolf *et al*, 1999), test procedures are rarely reported in enough detail for them to be replicated. There does not appear to be any consensus about administering or scoring this useful test.

Standardisation is especially necessary when very old people are the test subjects as variability in almost all abilities is greater among them than among younger people. Therefore, if results are to have any meaning beyond the individual person, the possible sources of variation in test administration within and between subjects should be reduced to a minimum.

The main purpose of this paper is to suggest a standard procedure for administering a three-metre walking test to elderly people, in particular for those over 75 years old. Recording the time taken to walk a measured distance allows walking speed to be calculated expressed as m/sec or as ms^{-1}. But first we summarise evidence for the usefulness of this test as an indicator of functional mobility. We also report a pilot survey into the feasibility of conducting the test in people's homes.

Usefulness of Walking Tests

The relative re-test reliability of stop-watch timed short walking tests (ie less than 10 metres in length) is discussed elsewhere (Simpson and Worsfold, 2001). Here we examine some of the evidence, based on tests of various lengths, to support the interpretation of walking time or gait speed as an indicator of functional mobility. Slower walking times are associated with increases in disability, postural instability and risk of falling. Walking time discriminates the effect of stroke and reflects improvement during rehabilitation among stroke sufferers (Goldie *et al*, 1996).

Guralnik *et al* (1994) found slower walking speeds to be associated with higher levels of self-reported disability and greater risk of mortality and of nursing home admission. Among both community dwelling elderly people and nursing home residents, Cress *et al* (1995) observed walking speed to be a strong independent predictor of summary scores on the physical function dimension of the Sickness Impact Profile. At discharge from a geriatric rehabilitation ward, Friedman *et al* (1988) reported that a

discharge walking speed of 0.15 m/sec separated people who required long-term nursing care from those deemed able to live alone or in a rest home.

A decrease in gait speed is associated with a reduction in the ability to undertake activities of daily living (ADL) (Judge *et al*, 1996; Potter *et al*, 1995). The latter found patients with walking speeds less than 0.25 m/sec were more likely to be dependent in one or more ADL measured by the Barthel index than those who walked more quickly.

Guralnik *et al* (1995, 2000) showed that walking speed predicts subsequent disability. In their sample, 80% of elderly people who could manage 0.77 m/sec or more over a distance of 2.4 m were free of disability four years later. In contrast 36% of those who achieved only 0.42 m/sec or less were free of disability at follow-up.

Slow walking speeds are correlated with postural instability ($r = 0.87$, $P = 0.001$) as measured by the Berg balance scale (Willems and Vandervoort, 1996).

Retrospective studies have shown that slow walking speed among older people discriminates between those who have fallen and those who have not (Woo *et al*, 1995; Wolfson *et al*, 1995; Piotrowski and Cole, 1994).

In a prospective study among frail elderly people in care, 64% of those who fell took more than 19 seconds to walk 6 metres (0.32 m/sec) compared with the non-fallers among whom only 35% took so long (Lipsitz *et al*, 1991).

In other prospective studies slow walking speed was a significant predictor of which participants would fall and was found to be associated with increased risk of hip fracture, non-syncopal falls and recurrent falls (Dargent-Molina *et al*, 1996; Luukinen *et al*, 1995; Nevitt *et al*, 1989).

Test Parameters

There are several parameters of timed walking tests that can vary:

- Distance walked.
- Floor surface.
- Start and finish procedures.
- Use of walking aids.
- Footwear.
- Reducing fear of falling.
- Instructions.
- Timing method.
- Scoring method.

We describe these variations, then suggest a preferred method. For the most part we restrict this discussion to very short tests of 10 metres or less.

Distance Walked

One problem with using a walkway 10 metres or more in length is that there may not be enough space to set it up, especially in people's homes, so a turn is sometimes incorporated at 5 metres. Van Herk (1998) examined the effect of turning on the time needed to complete the test. On average, the walk with a turn was 3.2 seconds longer, but it varied considerably between individuals. Shorter straight walks should avoid this problem. However, a pilot study of the feasibility of conducting very short tests in small inner-city homes indicated that it may be possible to set out the test in only just under 50% of such situations (see panel opposite).

Another danger in selecting a long distance for a walking test with this client group is that frail people who are otherwise willing and able to participate may be unable to complete the test or can do so only if allowed to take rests. Lamb *et al* (1995) had to help some participants even over 3.05 metres (10 ft). Friedman *et al* (1988) chose a 2-metre walkway because the majority of their 'poorly mobile sick patients could not traverse a longer distance without pausing'. Allowing pauses means that walking time and speed cannot be measured although 'time to complete the test' may be of use. Under 10 metres, chosen test distances vary between 5 and 2 metres.

Interestingly, Finlay (1993) concluded there was no advantage in testing elderly people over distances longer than ten metres. She found only minor differences when comparing walking speed over four different distances: 10 metres (1.2 m/sec), 30 metres (1.22 m/sec), 50 metres (1.25 m/sec) and 100 metres (1.27 m/sec) but she did not test them over shorter distances.

In clinical practice, probably the most sensible choice is the distance elderly people feel they need to be able to manage with ease in their place of residence; the minimum functionally significant distance. Lamb *et al* (1995) suggest three metres as being the minimal requirement for indoor mobility, but Bassey *et al* (1992) suggest six metres as it

Is it possible to conduct a stop-watch timed three-metre walking test in people's homes?

For a test to be really useful clinically it must be possible for it to be conducted in peoples' own homes as well as in institutional settings and hospitals. In other words it must not require too much space, need heavy equipment that is difficult to carry, or be in some way unacceptable to the occupants.

Hackney is one of the poorest inner city boroughs in the UK where, in several districts, homes tend to be small. It was reasoned that if few homes in Hackney could accommodate this test then it would be unlikely that it could be widely used by community therapists working in similar parts of the country. The purpose of this survey was to:

- Establish in how many homes there would be enough space to conduct the test.
- Identify any other factors that could hinder successful completion of the test.

Methods

Members of the City and Hackney Community Physiotherapy Team and their physiotherapy assistants agreed to collaborate in the project. During one week, members of the team assessed the home of every patient they visited regardless of whether or not they would actually use the test with them.

The home was examined to ascertain whether enough space could be found for a person to stand up from a chair, walk 3 metres at their normal pace, turn, and sit down in another chair. In effect a clear walkway of about 4 to 5 metres is required. Each collaborator recorded all data and comments on a single record sheet by inserting a tick, digit or comment in the appropriate column: identification code; house/flat/maisonette; possible/impossible [to carry out the test]; other comments. The data were analysed using a hand-held calculator. For each set of data the percentage of 'impossibles' out of the total number of homes for which visits were recorded was calculated, then the overall percentage calculated.

Results and Discussion

Five physiotherapists (three full-time, two part-time in domiciliary work) and three assistants collaborated. Data were collected in 74 homes (22 houses, 47 flats, 5 maisonettes). Staff estimated that the 3-metre timed walking test could be conducted in 35 of the 74 homes (47%). There was a wide variation between staff, the highest estimate of impossible being 84% of homes and the lowest 29%; the median estimate was 36% impossible. The variation could be partly attributable to the district visited as some residents are more affluent than others and their homes are more spacious; and partly to the experience of the staff member visiting. More experienced staff tended to rate a higher percentage of homes as 'possible'.

Even so, not all the 'walkways' identified were hazard-free. Several could be constructed only if they passed through a narrow doorway. At some flats or sheltered housing complexes it would be possible to use the outside passage but not all elderly people liked the idea of 'performing' in public, and therapists were concerned that patients would not be able to give their best performance in these circumstances. Often the proposed inside walkways were very narrow or cluttered.

Furthermore, in order to time the walk with a stopwatch, vertical markers (eg strips of masking tape) have to be placed on the wall near to the floor so that the timing can be started when the tip of the first foot passes the first marker and stopped when the heel of the last foot passes the second marker. In many homes it would be necessary to move furniture or objects in order to clear wall space to fix the markers used to time the beginning and end of the test. In others it would be difficult to position them, as the required distance could be achieved only by walking diagonally across a room, well away from a wall. Staff were also concerned that some people might not like the idea of makers being placed on their walls or furniture.

Conclusions

The outcome of this survey suggests that in areas comparable to east London it would be possible to find the space to conduct a 3-metre timed walking test in about half of all homes. But even then, lack of width and/or length mean that, in many more homes, timing the test would be very difficult.

is the usual distance from one room to another in a small house. Given that measuring over the shorter distance reaches very satisfactory levels of reliability (Simpson and Worsfold, 2001) and that three metres may be achievable in most peoples' homes, we chose this distance for the standard test. In clinical practice a longer distance may have to be tested, in addition to depending on a patient's needs.

Floor Surface

The type of floor surface is specified for the sub-tasks of the Emory functional ambulation profile (Wolf *et al*, 1999) but this is often omitted from reports. Willmott (1986) found that subjects walked faster on carpeted surfaces so this would be the ideal. However, carpet pile can vary considerably, so to allow for the test to be standardised a smooth surface was chosen.

Start and Finish Procedures

If the subject is timed from a standing start the walking time measured and the gait speed calculated are compounded with both the subject's time to react to the command and the time taken to reach usual, comfortable walking speed. The solution is to provide a pre-test, or warm-up, path before the test stretch itself. Similarly a post-test path discourages people from slowing down ahead of the final marker. Opinions vary about the length of warm-up path. A long warm-up path considerably increases the total distance walked, reducing the acceptability of the test and precipitating fatigue. Most researchers quote distances of 0.5 to 1.5 metres. Rather confusingly Wolf *et al* (1999) refer to a 10-metre walk but then mention that the time taken to cover only the middle 6 metres was measured, so they were using a 2-metre warm-up path. Hendry *et al* (1990) found 1 metre before the start of timing ample for elderly inpatients to reach their final walking speed. Given the already slow speeds of most elderly people we opted for 0.5 metres.

Use of Walking Aids

Surprisingly, it is not always made clear if subjects are allowed to use their normal walking devices or not, as the use of a device is associated with slower speeds (Bassey *et al*, 1992; Friedman *et al*, 1988). In practice it must be the subjects' choice whether they use them or not, and either way this must be recorded.

Footwear

It is not often made clear in study reports, but we assume that most participants are shod. Dobbs *et al* (1993) calculated a 5% increase in speed when subjects are shod compared to walking barefoot. Some researchers recommend thin hard soles for greater stability (Robbins *et al*, 1992) but they may not be comfortable.

Reducing Fear of Falling

Up to 50% of community dwelling older people admit to being afraid of falling (Walker and Howland, 1991; Tinetti *et al*, 1994) and similar levels have been reported among patients in geriatric medical wards (Simpson *et al*, 1997). But little account has been taken of the effect it might have on test performance. Maki *et al* (1991) however, who studied postural sway among elderly people, suggested that, during balance testing, people with deteriorated postural control may feel anxious about their balance problems so that their test results might be compounded with performance anxiety. If performance uncontaminated by fear is required, then steps must be taken to reduce apprehension.

Instructions

If the test is of 'usual performance' rather than 'best possible performance', oral encouragement, which improves performance (Guyatt *et al*, 1984) is not given during the test. Nor should feedback about the time taken be given afterwards. Instructions should make clear to subjects whether they are to walk at their normal comfortable pace or as fast as possible. Most studies use the latter.

Timing Method

Clinicians as well as the majority of researchers use a stopwatch as a timer, which has the advantage of being portable, easy to use and inexpensive. Other methods include infra-red beams with photocell sensors (Willems and Vandervoort, 1996; Friedman *et al*, 1988) and the ultrasonic timer. The small hand-held ultrasonic timer device used by Potter *et al* (1995) times walks longer than 2 metres and has the virtues of simplicity and accuracy.

Scoring Method

When three alternative scoring methods were compared -- the mean of two or more trials, best performance out of n trials, or just the first trial – taking the mean score maximised the retest stability of results (Connelly *et al*, 1996). But more trials may increase the risk of fatigue among frail elderly people as well as needing longer time to run the test. Furthermore, there appears to be risk of a learning effect over three trials, even when the elderly subjects have been up and about before testing (Simpson and Worsfold, 2001).

Relative walking speed which corrects for subjects' height is sometimes calculated (Friedman *et al*, 1988). However, among older people no great advantage in predictive value over uncorrected walking speed was found.

Standard Test Procedure

Accepting the argument that physical performance may be affected by anxiety about falling, we took steps to reduce this anxiety to a minimum. We made the assumption that the proximity of sturdy handholds, which people know they may grasp safely if they feel unsteady, reduces fear of falling.

Preparation

A 3-metre walkway or 'corridor' is constructed along a wall in a smooth-floored area. Approximately 1 metre away and parallel to it, tables and exercise plinths or other sturdy items of furniture are arranged to offer support continuously for 4 metres. Narrow 15-centimetre vertical strips are fixed on the wall at floor level and 3 metres apart within the corridor. We prefer this to sticking a line on the floor which, in our experience, can distract patients. Chairs are positioned at each end, but at least 0.5 m from the markers to allow for acceleration and deceleration effects. These chairs are of a height to suit the person and facilitate easy standing up.

Subjects sit on one of the chairs wearing their usual comfortable footwear or something suitable which has been provided. Thick-soled trainers are avoided so far as possible.

Steps are taken to avoid distractions, such as other people passing close by, especially if a subject suffers from dementia.

Subjects should have been active before taking the test, walking about or otherwise exercising, and not tested 'cold' – on the other hand, they should not feel tired.

Initial Instructions

While sitting at the end of the 'corridor' the participant is given standard instructions: 'Soon you are going to stand up. When you are standing I shall say "Go". Then you are going to walk down to the chair facing you [indicate] at a comfortable pace without rushing. Do not stop until you have reached the other chair. You can use your walking aid or hold the wall or the furniture if you wish. Are you clear about what you are going to do?'

Starting Position

If necessary subjects are helped to stand up. They can hold the supports if they wish or use their walking aids. They may be reminded to walk at a comfortable pace, without rushing and without stopping, until they reach the opposite chair.

Instructions

Once the person is upright and steady the command 'Go' is given calmly, not in a way to imply the need for speed.

Warnings and Encouragement

During the walk no oral encouragement is given although occasionally the command 'Keep going' is given if subjects seem about to stop or be distracted. Afterwards their efforts are rewarded with 'Well done'.

Feedback about the actual time taken is not given.

Timing

Stop-watches, which time to at least 0.01 seconds, should be checked for accuracy regularly. Ordinary wrist watches with second hands are not suitable.

The tester, carrying the stopwatch, walks quietly at the side of subjects as they pass the first marker, then continues slightly behind them until close to the final marker when he moves forward opposite it. The tester avoids conveying any sense of pressure on the patient to hurry. Timing begins when the tip of the first foot crosses the first vertical strip, and stops when the heel of the last foot crosses the second vertical strip.

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Scoring

Simpson and Worsfold (2001) found satisfactorily consistent performance among elderly people making three trials of the test in one session under the above conditions (intraclass correlation coefficient 0.97). Therefore, for clinical purposes at least, one trial alone is sufficient. Subsequent trials, however, should be made under the same circumstances and preferably at the same time of day.

Recording the Result

Results are recorded in seconds to the nearest 0.1 second. We recommend that testing is done at regular intervals, eg twice or more each week, and that results are displayed on a graph. In this way trends towards improvement, deterioration or stability can easily be detected.

The observer also records his name, where the test is conducted, the time of day at which it is done and any other observations or comments relevant to the person's performance or the conduct of the test.

Discussion

We have described a standard version of the 3-metre walking test which is clinically useful. It is fairly quick to administer, especially if a corridor is already set up and only one trial is made. If suitable sturdy furniture is available, no special equipment apart from a stop-watch is required. Conducting the test need not disrupt the flow of care during a rehabilitation session, especially if subjects are already practising walking in the corridor.

As the rehabilitation of elderly people is taking place more and more in the community, tests which tell clinicians something about their patients' abilities and which can be carried out in their own homes need to be identified. On the whole the 3-metre walk fulfils these requirements. There are however drawbacks to its practical use at home which have been alluded to above. The pilot study reported in the panel on page 129 found that even 3 metres may be too long for some small, cluttered homes and it may be impossible to find a suitable surface on which to fix the markers for starting and stopping timing. On the other hand, there may be space enough but in an uncluttered environment it may be difficult to find suitable items of furniture to form the corridor. This restriction must also apply to the popular timed up-and-go test which also requires a measured 3-metre path.

With respect to agreeing rehabilitation goals with older patients, the emphasis is likely to be on achieving the required functional distance in their homes so that they perceive themselves to be safe when doing so and score 'confident' on the chosen measure of self-efficacy or balance confidence (Tinetti *et al*, 1994; Simpson *et al*, 1998). Nevertheless, in a study of 154 patients on geriatric medical wards (Simpson *et al*, 1997) gait speed over 3 metres correlated negatively and highly significantly with balance confidence, $r = -0.672$ ($P = 0.0001$), so it is reasonable to assume that improvements in speed will be associated with increases in confidence.

As with all measurements, once a rehabilitation department has decided to adopt a certain measure for use with particular patients, then a departmental protocol is drawn up. Then all staff follow this protocol when conducting the test (Simpson, 1998). Sessions to check between tester consistency should be held at regular intervals and especially when new staff join the team. Guidance on the selection and use of tests and measurements has already been drawn up (CSP, 1994).

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Key Messages

- The standardised procedure for administering the three-metre walking test with elderly people will make it easier for clinicians to use this test, although restricted space may make it difficult to do so in some people's homes.
- Following the standardised procedure should reduce between-observer variability.
- Testing on a 'corridor' of sturdy handholds should increase the likelihood that the patient's performance will not be contaminated by fear.
- Decreased time to complete this test is likely to reveal concomitant improvement in functional mobility and can be used to identify change that may be attributable to rehabilitation interventions.