Journal of Aging Research & Clinical Practice© Volume 1, Number 2, 2012

### IS MEASURING GRIP STRENGTH ACCEPTABLE TO OLDER PEOPLE? THE SOUTHAMPTON GRIP STRENGTH STUDY

H.C. Roberts<sup>1,2</sup>, J. Sparkes<sup>3</sup>, H. Syddall<sup>2</sup>, J. Butchart<sup>3</sup>, J. Ritchie<sup>3</sup>, C. Cooper<sup>2</sup>, A.A. Sayer<sup>1,2</sup>

**Abstract:** *Objectives:* To evaluate the acceptability of grip strength measurement among older people in different healthcare settings. *Design:* A cross-sectional study with quantitative and qualitative data collection. *Setting:* Four healthcare settings in one town in southern England. *Participants:* 101 community hospital rehabilitation inpatients, 47 community physiotherapy referrals, 57 patients attending a Parkinson's clinic at the hospital and 100 residents in care homes. *Measurements:* Grip strength, Barthel score, Mini Mental State Examination and outline questions on the grip measurement process were assessed on all participants. In-depth semi-structured interviews ascertained the views of a sub-sample of 20 participants on grip strength measurement. *Results:* The instructions were easily understood, most participants did not find the measurement painful or tiring, and almost all were prepared to repeat the assessment. Participants felt that this could be a useful and acceptable routine assessment, which some thought could be an opportunity to improve their health, while others were uncertain whether it would be helpful to be told that they were becoming weaker. Participants were generally accepting of medical assessments and felt that grip measurement was easy, unless there was a problem with an individual's hand. *Conclusions:* This is the first study to demonstrate that grip strength measurement is acceptable to older people undergoing rehabilitation, living with a chronic neurological condition or resident in care homes. The high level of acceptability found among older people in different healthcare settings in this study supports the use of grip strength measurement in routine clinical practice.

Key words: Grip strength, acceptability, older people, measurement.

#### Introduction

Grip strength is frequently measured in research studies and low grip strength is known to be associated with increased falls (1), longer length of hospital stay (2, 3), increased disability (4), poor nutrition (5), poor healthrelated quality of life (6) and increased mortality (7, 8). Grip strength was recently recommended for use in clinical settings for the assessment of sarcopenia (9), and the Jamar hand dynamometer (Lafayette Instrument Company, USA) is accepted as the gold standard by which other dynamometers are evaluated (10). A standardised protocol is recommended (11) and the measurement properties of the Jamar include high testretest reproducibility over 12 weeks among community dwelling volunteers (mean age 75 years) (12) and excellent (r=0.98) inter-rater reliability (13). The feasibility of its use with older people has been shown in day centre and care home settings (14-16). However little is known about the acceptability of grip strength measurement to older people, particularly those undergoing rehabilitation, living with a chronic neurological condition or resident in care homes, for whom it may be most relevant but possibly most arduous.

Two studies have assessed the acceptability of grip strength measurement in adults. Helliwell (17) broadly assessed the acceptability of three dynamometers by asking 26 patients (mean age 63 years) with arthritis 'if you had to squeeze these devices each day as part of your assessment, which one would you prefer?' There is no information on the reasons for their preference, or on their views of grip strength measurement as part of routine clinical care. Harding evaluated grip strength in patients with chronic pain (18). Acceptability was measured by participant refusal rate and all 431 subjects (mean age 50 years) were able to complete the grip strength measurement. Neither study evaluated the Jamar dynamometer.

This study aimed to evaluate the views of older people in four healthcare settings on the acceptability of grip strength measurement with a Jamar dynamometer.

<sup>1.</sup> Academic Geriatric Medicine; 2. MRC Lifecourse Epidemiology Unit, University of Southampton; 3. Medicine for Older People Southampton University Hospitals NHS Trust, Southampton UK

Corresponding Author: Helen Roberts, University of Southampton, Southampton, Hants United Kingdom, hcr@soton.ac.uk

#### Methods

#### Study design

A cross-sectional study of older people recruited from four healthcare settings in one town in southern England between 2008 and 2010. The study received full ethical approval.

#### **Participants**

305 participants were recruited from a community hospital rehabilitation ward (n = 101), people referred for community physiotherapy (n = 47), a Parkinson's disease (PD) clinic at the community hospital (n = 57), and five nursing homes (n = 100). Interviews were conducted with a purposive sub-group of 20 participants aiming to represent men and women from each setting, which comprised six rehabilitation inpatients, two community physiotherapy referrals, eight PD patients and four residents from one nursing home. Participants were eligible for interview if they had a mini mental state examination (MMSE) score of 24 points or more. Interviews were held within one week of grip strength measurement to maximise recall, with final participant selection dependent on researcher availability within that time frame.

#### Data collection

Grip strength was measured using a Jamar dynamometer squeezed three times with each hand using a standardised protocol (19). Participants were asked a few minutes later whether the grip strength measurement had caused them any pain, if it was tiring, and if they would be prepared to repeat the assessment. Physical and cognitive function were assessed using the Barthel score (20) and the MMSE (21).

The interviews followed a semi-structured schedule (Figure 1) but could deviate from the schedule and include additional questions to explore issues raised during earlier interviews, using a grounded theory approach (22). The interviews were audio-taped and lasted 10-15 minutes; participants were anonymised throughout the recording. Interviews were conducted until no new information emerged (data saturation).

#### Data analysis

The acceptability of grip strength measurement was described by gender and setting using frequency and percentage distributions and differences in acceptability between settings within gender groups, and between genders within settings, were compared using Fisher's exact test. The characteristics of study participants who were interviewed were contrasted with those not interviewed by using means and standard deviations or

medians and inter-quartile ranges and were formally compared using a 2-sample t-test or Mann-Whitney ranksum test.

The audiotapes were transcribed verbatim. The texts were read, coded and evaluated for themes by two researchers (HR and JS) independently and then together, looking for commonality and differences within and between the care settings. The coding framework that was developed was grounded in the data rather than decided a priori.

Thank you for agreeing to talk to me about the handgrip testing that was performed  $\chi$  days ago. This interview is to discover how you found the testing of your hand strength but is not about the other questions you were asked. All the interviews will be anonymised but please say if you do not want anything recorded. • Can you tell me a little about what the research project involved.

- Did you understand the instructions given to you?
- How did you find using the grip tester?
- Was it comfortable? Did you find it tiring? Did it get easier after the first attempt?
- Do you think you could have done any better? Would you be prepared to perform this test regularly at the clinic or general practice? \* If not, why not?
- What did you think the grip tester was testing? Why?

Thank you for your help. Do you have any questions about the research or what we have spoken about today? Are you happy for me to use our conversation in the research?

Figure 1. Grip strength interview schedule

#### Results

Grip strength measurement was highly acceptable in all four healthcare settings (Table 1). Most inpatients did not find it tiring (92% men, 91% women) or painful (89% men, 92% women). More than 96% of community physiotherapy referrals did not find grip strength measurement tiring and none experienced pain. Ninetyfour percent of male PD patients and all female PD patients did not find the assessment tiring, and only a few female PD patients (13%) found it painful. 79% of the nursing home residents did not find the assessment tiring, and none of the male residents and only 10% of the female residents found it painful. Finally all of the male inpatients, male and female community physiotherapy referrals and male and female PD patients would repeat the assessment, as would 97% female inpatients and male nursing home residents, and 90% female nursing home residents.

The interview group was representative of the larger study group with regard to age, maximum grip strength, physical and cognitive function as shown in Table 2. The qualitative data analysis developed five main themes: understanding the instructions; the Jamar dynamometer itself; aspects of participants' involvement with grip strength measurement; routine use of grip strength measurement; and acceptability of grip strength measurement overall. These themes are presented using direct quotes selected to illustrate the commonality and diversity of views.

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	Hospital rehabilitation inpatients		Community rehabilitation referrals		Parkinson's disease clinic patients		Nursing Home residents		P value <sup>1</sup>
Number (%)	Male (N=37)	Female (N=64)	Male (N=24)	Female (N=23)	Male (N=34)	Female (N=23)	Male (N=35)	Female (N=65)	
Did not find assessment	34 (92)	57 (91)	22 (96)	23 (100)	32 (94)	23 (100)	27 (79)	49 (79)	M: 0.18 F: 0.04
P value <sup>2</sup>	P=1.00		P=1.00		P=0.38		P=1.00		
Did not find assessment	33 (89)	58 (92)	23 (100)	23 (100)	34 (100)	20 (87)	34 (100)	56 (90)	M: 0.03 F: 0.35
P value <sup>2</sup>	<i>P</i> =0.72		P=1.00		P=0.06		P=0.09		
Would repeat the assessment	37 (100)	61 (97)	23 (100)	23 (100)	34 (100)	23 (100)	33 (97)	56 (90)	M: 0.71 F: 0.03
P value <sup>2</sup>	P=0.53		P=1.00		P=1.00		P=0.05		

 Table 1

 Acceptability of grip strength assessment to all study participants

N: number; %: percentage; Data for all three items missing for 1 female inpatient, 1 male community referral, and 1 male and 3 female nursing home residents; P value<sup>1</sup> for differences between settings by gender calculated using Fisher's exact test; P value<sup>2</sup> for differences between gender within settings calculated using Fisher's exact test;

# Table 2 Comparison of the interview group with remaining study participants: age, maximum grip strength, physical and cognitive function

Mean (SD)		Male		Female			
	Not interviewed (N=120)		Interviewed (N=10)	Not interviewed (N=165)		Interviewed (N=10)	
Age (years)	79.6 (8.3)	D 0 (7	80.8 (12.3)	83.6 (8.2)	<b>D</b> 0 (2)	82.3 (5.0)	
P value	2F F (11 0)	P=0.67	27 = (1 ())	12.0 (7.7)	P=0.62	14 ( (0 ()	
strength	25.5 (11.8)		27.7 (16.6)	12.8 (7.7)		14.6 (9.6)	
P value		P=0.58			P=0.48		
Barthel score <sup>a</sup>	81 (45, 97.75)		78 (60, 96.5)	68 (40.5, 90)		77.5 (40.5, 97.25)	
P value		P=1.00			P=0.49		
MMSE <sup>a</sup>	25 (17, 29)		26 (24.75, 27.5)	25 (17, 28)		25 (22, 28.5)	
P value		P=0.26			P=0.39		

SD: standard deviation; N: number; MMSE: mini men tal state examination; Data for MMSE missing for 1 male who was not interviewed; P value for differences between groups calculated using 2-sample t-test or Mann Whitney rank-sum test; Median and inter-quartile range (IQR)

#### Understanding the instructions

Eight participants commented on their ease of understanding the instructions about grip assessment and taking part in the study. They all found it quite straightforward:

Well, just a grip test to find out whether there is a correlation between strength of grip and muscle weakness or Parkinson's or various diseases.... I had to squeeze a machine as hard as I could with both hands, well one at a time really. 14(PD)

#### The Jamar dynamometer itself

Seven participants commented positively on the shape of the Jamar, recognizing that it was designed for ease of grip:

*The grip seemed to be quite a central arrangement. It suited my hand anyway.* 4(*inpatient*)

Two of the nursing home patients were unable to grip

the dynamometer because of its size, and six participants commented that the Jamar was rather heavy, even though it was supported by the researcher. Four did not find it heavy at all, but there was recognition some others might do so.

Well, actually the doctor was holding the thing so all I had to do was just grip. I think it would have been rather heavy if I had been doing it on my own. 2( inpatient)

Eight participants commented on the lack of compressibility of the Jamar and four thought that more feedback on their performance might have enabled them to achieve a higher grip strength.

Yes, if I had a dial it would at least have told me if I was doing anything or not 'cause I was darned if I could tell otherwise. 2(inpatient) IS MEASURING GRIP STRENGTH ACCEPTABLE TO OLDER PEOPLE? THE SOUTHAMPTON GRIP STRENGTH STUDY

### Aspects of Participants' involvement with grip strength measurement

#### Effort expended

Ten participants commented that they had tried their best with the grip strength assessment:

Only just. Only just, I had to make a lot of effort. 20(nursing home)

Three patients commented that they could only have managed another couple of attempts in total:

Oh I did it one or a few times I think. Two or three times.... I could have done it more I think. 16(community physiotherapy)

#### Grip strength and assessment order

Opinion was divided on the impact of assessment order on grip strength. Two participants felt that their first attempt was the best

Well, ... at the beginning it was a bit easier, more strength, than the one at the end. There was a bit of time in between. And I had already done it once. 10(PD)

However others felt that their later attempts were better:

When you get to the third time when it is the last time, you put most effort in. 9(PD)

Still others felt that their efforts had been constant throughout their attempts:

*I* don't know if it changed or not because *I* did it the same way each time. 5 (inpatient)

#### Grip strength and hand dominance

Most participants felt that their dominant hand was the stronger, one man thought his non-dominant hand had been better, but another felt his grip was fairly equal with both hands:

I wouldn't like to say because when I was working I was a bricklayer you see, so I used a trowel in my left hand and I picked up the bricks in my right hand. 7 (inpatient)

### Discomfort associated with grip strength measurement

No participants felt that the measurement had been painful but there was recognition from three participants that it could be tiring:

Well, it was enough for those particular muscles to start feeling the strain, I think, because you do have to put as much into it as you can, therefore it does tire you if you keep on doing it. 3 (inpatient)

Interestingly this view was not shared by other inpatients or any of the nursing home residents:

No, I didn't do it long enough or often enough for that. 19(nursing home)

#### Routine use of grip strength measurement

#### Rationale for grip strength measurement

16 participants replied to the question about the rationale for grip strength measurement but only two people associated grip strength with general weakness:

Well I suppose it's for older people, a strength test. 21 (community physiotherapy)

Everyone else felt that strength in their arms and legs were separate and eight participants felt that grip assessment was specifically related to their hands and/or

specific functional tasks:

Your hand muscles. I can't see that it would do much for your biceps. 14(PD)

If I could hold onto my sticks I should think. 5(inpatient)

#### Utility of routine grip strength measurement

All of the participants felt that this would be a useful and acceptable routine assessment:

*A routine test. Yes, I would have thought it seems like quite a sensible idea, a practical idea.* 4(*inpatient*)

I think people would just take it in their stride. 10(PD)

However location of the assessment was important for one participant:

*Yes, but it would be easier if it was brought to our house, I think. 5( inpatient)* 

Several people commented that the assessment could be an opportunity to try to improve their health:

Yes, yes, I would want to know if I was getting weaker.... Well I would try to do more exercise and try and live a healthier lifestyle, I guess. 14(PD)

However two participants did not think there would be much scope for improvement:

I don't know. When you get older, I don't know, do you? I mean you don't get your same strength back when you get older, do you? 21(community physiotherapy)

Two participants commented that they would know that they were getting weaker, but another felt that this may not be the case:

*I think you would probably realise it yourself but you would probably want confirmation of what you think.* 9(PD)

Two participants felt that there could be therapeutic aspects to the grip strength assessment itself, and two people commented on the use of serial measurements for comparison:

*Yes, quite happy, yes. Because it would be good to get a comparison I expect.* 12(*PD*)

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## Negative aspects of routine grip strength measurement

Only two people (both with a chronic progressive condition) commented specifically on aspects of routine screening that might worry them:

To be told whether they are getting stronger or not. Well it would be encouraging if they were told they were fairly strong I suppose. But whether it would be helpful to be told that you were a lot weaker than last time, I don't know. 12(PD)

#### Passive acceptance of medical assessments

Six participants expressed their views on medical assessments, and all were accepting of them even if they did not understand exactly why or what was being done:

No idea. I've long ago given up wondering why. I just do it and that's that. No idea. Like going around to the surgery, I only go around there if I'm summoned, not otherwise. 2(inpatient)

*Ah, doctors, they test your blood all the time, it's a sort of addiction.* 19(*nursing home*)

### Acceptability of grip strength assessment overall

Ten participants commented that this was an easy test to do:

*No hardship to test it, only takes a few minutes.* 19(*nursing home*)

The only potential problems envisaged were local issues with participant's hand:

I think most people would be good at it, don't you? Unless they had arthritis in their wrist or something like that. 21(community physiotherapy)

#### Discussion

This is the first study to demonstrate in detail that grip strength measurement is acceptable to older people undergoing rehabilitation, living with a chronic neurological condition or resident in care homes. The vast majority of participants did not find the measurement painful or tiring, and were prepared to repeat the assessment. The instructions were easily understood and the Jamar dynamometer suited most people, although several people commented that it was bulky and would have been heavy if not supported by the researcher. Participants variably felt that their first or third attempts were strongest, or that their grip strength was constant; most felt that their dominant hand was the stronger and some commented that the lack of compressibility of the handle prevented feedback on their performance.

Only one person associated low grip strength with

general muscle weakness, and most people felt that grip measurement was specifically related to hand muscle strength or functional tasks involving their hands. Participants felt that this could be a useful and acceptable routine assessment, which some thought could be an opportunity to improve their health, although two people with a chronic progressive condition were uncertain whether it would be helpful to be told that they were becoming weaker. The participants were generally accepting of medical assessments and felt that grip strength measurement was easy, unless there was a problem with an individual's hand.

This study had some limitations. Firstly, practical constraints dictated that the interview group was partly dictated by interviewer availability; however, analyses demonstrated that this sub-group were broadly representative of the whole study group in terms of age, grip strength, and physical and cognitive function. A second limitation was that most interview participants were interviewed several days after the grip strength measurement but the PD participants were interviewed straight away. This may have produced a bias in participants' clarity of recall but saturation of the data was achieved with this number of interviews.

This study also had many strengths. Firstly, the study sample included hospital inpatients undergoing rehabilitation and nursing home residents who are likely to have lower grip strength than community dwelling older people and may find it more difficult to participate in research studies concerning grip strength. Secondly, indepth interviews were conducted which allowed a greater understanding of the participants' views than a selection of closed response quantitative questions. Thirdly, the study was conducted by an experienced research team with expertise in interviewing older people in different health and social care settings. Finally, grip strength was measured according to a standard protocol and inter- and intra-observer variation studies were conducted to ensure reliability and comparability of measurement between and within observers.

It is important to establish the acceptability of measurements prior to their introduction to routine clinical practice. Acceptability may be gauged in different ways. For example, a study of cognitive screening of older veterans used their consent to be screened as a measure of acceptability (23) while another study validating an outcome scale in PD patients used the degree of completeness of the questionnaire as an indicator of acceptability (24). A study of preference between two handheld indirect calorimeters used four questions with responses provided on a 5-point Likert scale to assess acceptability (25). The experience and views of participants are crucial to demonstration of acceptability yet a systematic review of nonpharmacological interventions to reduce wandering in dementia identified 11 studies where none of the

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acceptability papers reported the patients' views (26).

Demonstration of the reproducibility, feasibility and acceptability of grip strength measurement is essential if it is to be used in clinical practice. The high level of acceptability found among older people in different healthcare settings in this study supports the use of grip strength measurement in routine clinical practice.'

Acknowledgement: The authors would like to thank Sergio Salomone, research nurse, for his help with recruiting the nursing home residents

Conflict of interest: The study was supported by a grant from BUPA Giving.

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