BMJ Open

Psychometric evaluation of the Holden Communication Scale (HCS) for persons with dementia

Benedicte Sørensen Strøm,[1] Knut Engedal,[2,3] Jūratė Šaltytė Benth,[4,5] Ellen-Karine Grov[6]

To cite: Strøm BS, Engedal K, Šaltytė Benth J, *et al*. Psychometric evaluation of the Holden Communication Scale (HCS) for persons with dementia. *BMJ Open* 2016;**6**: e013447. doi:10.1136/bmjopen-2016-013447

► Prepublication history for this paper is available online. To view these files please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2016-013447).

Received 13 July 2016
Revised 26 September 2016
Accepted 3 November 2016

For numbered affiliations see end of article.

Correspondence to
Benedicte Sørensen Strøm;
benedicte.strom@vid.no

ABSTRACT

Objective: To investigate the psychometric properties of the Holden Communication Scale (HCS) and the association between scores on HCS and cognitive function among persons with dementia.

Method: Internal consistency was assessed by the Cronbach's α coefficient and inter-item correlations. Test-retest was carried out to test the instrument's stability. An exploratory factor analysis with the principal components extraction method and oblimin rotation was performed to evaluate construct validity. Pearson's correlation coefficients were calculated to explore associations between the scores on the HCS and cognitive function.

Results: A total of 128 persons with moderate-to-severe cognitive impairment (mean Mini-Mental State Examination (MMSE) score 8.9 (SD 7.0)) participated. The mean age was 85.2 (SD 7.2) and 101 of the participants were women. The Cronbach's α of the HCS was 0.94 and test-retest reliability was r=0.71. The corrected item-total correlation ranged from 0.63 to 0.79 and factor analysis showed a 1-factor structure of the HCS, which explained 63% of the variance. However, a forced 3-factor structure explained 76% of the variance. The correlation between cognitive function as measured by the MMSE and ability to communicate as measured with HCS was found to be moderate for those with an MMSE score of 0–10 (−0.61) and low for persons with an MMSE score of 11–20 (−0.06).

Conclusions: The HCS is a reliable and valid scale for assessing communication ability in persons with moderate and severe cognitive impairment, and might have a 1-factor or 3-factor structure.

Strengths and limitations of this study

- Psychometric properties performed in a structured way.
- Relatively few participants.
- The inter-rater reliability of the HCS was not studied.

INTRODUCTION

Speech and language impairments among persons with dementia are well known and lead to difficulties in communication.[1] The impairments are suggested to be due to language (extralinguistic) rather than speech (linguistic) deficits. However, this will depend on the cause of dementia. Persons with Alzheimer's dementia have, first of all, language deficits which are expressed by difficulties finding words, recalling names and difficulties putting ideas into words,[2] whereas persons with vascular dementia often have speech deficits such as slurred speech or difficulties with spoken and written language.[1]

There is a close relationship between cognitive deficits and language impairments[2] and as the dementia progresses, the communication ability will gradually decline.[3] However, the need for belonging and companionship is a basic human need and does not change with increasing cognitive decline.[3 4] This need for belonging is fundamental to carry out person-centred care,[5] and we therefore have to learn how to communicate with people with dementia with moderate and severe cognitive impairment who have a communication deficit.

Valuable research has documented that behaviour and psychological symptoms in dementia (BPSD) could be an expression of communication.[6 7] However, limited attention has been given to how to examine the ability to communicate[8] and the association between the different aspects of communication and cognitive function in persons with severe dementia.

Reviews conducted by Strøm *et al*[8] and Egan *et al*[9] reported that several tools have been developed to assess different aspects of communication for persons with dementia. Most of those studies are focusing on the person's expression in terms of agitation and aggression rather than the ability to communicate. To the best of our knowledge, only two dementia-specific communication tools focusing on communication ability have been developed, the Threadgold Communication

Tool (TCT)[10] and the Holden Communication Scale (HCS).[11] A psychometric evaluation of the TCT revealed that this a is reliable and valid instrument, suitable for measuring communication among persons with dementia.[12] The HCS, which has been used in several studies, has never been validated. The overall aim of this study is therefore to investigate the psychometric properties of the English version of the HCS in a sample of persons with moderate-to-severe cognitive impairment living in nursing homes in Ireland. In addition, we wanted to evaluate the original three subgroups of the instrument, referred to by Holden and Woods.[11] We further wanted to investigate the association between the ability to communicate and cognitive function, as measured by the HCS and Mini-Mental State Examination (MMSE), respectively.

METHOD

Sample and procedure

A convenience sample of 128 persons over 65 years living in seven nursing homes in Ireland was recruited. The mean age of the residents was 85.2 (SD 7.2) and 101 (79%) were women. The recruitment process took place between January and March 2014. Persons with dementia, defined by an MMSE score of 0–20, were included in the study. Persons in the palliative phase and not expected to live longer than 6 months, and those with major depression or severe pain, were excluded. Data were collected prior to randomisation.

Measures

Nurses collected the demographic data from medical and nursing home records. Cognitive function and communication ability were assessed by means of the MMSE and the HCS at baseline of the RCT (n=128) and HCS was also assessed at 1-week follow-up (n=88 to measure test-retest reliability) by one and the same nurse in each of the seven nursing homes.

Nurses who knew the residents well over a long period of time received 2 hours training about how to carry out the assessments.

Mini-Mental State Examination

MMSE is an instrument used to assess cognitive performance which can be used as a surrogate for the Clinical Dementia Rating (CDR) for the staging of dementia.[13] The scale comprises 20 questions that cover orientation, memory, attention and calculation, recall and language. Each question is scored, and the summing up leaves a possibility of 30 points, with a higher score indicating a better cognitive performance.[14]

The HCS

The HCS is a proxy-based instrument initially developed to assess reality orientation approaches and reminiscence programmes. The Scale includes 12 items assessing conversation, awareness and knowledge, and communication. Each item contains five response options, ranging from 0 to 4, with a maximum score of 48. A higher score indicates more difficulties with communication.[11]

Statistical analysis

Data were analysed using the SPSS V.22.0. The distribution of data was assessed graphically by inspecting the histograms and no obvious deviations from normality were found. Inter-item Pearson correlations were calculated to explore if all items of the HCS measure the same underlying characteristics. The Cronbach's α coefficient and corrected item-total correlations were used to analyse internal consistency reliability. The criterion function for acceptable reliability was set to $\alpha \geq 0.7$.[15]

Test-retest reliability was assessed by calculating Pearson's correlation coefficient. The criterion for acceptance was set to at least 0.7. Bias was assessed by paired samples Student's t-test and 95% limits of agreement were calculated. Even though no a priori width for limits of agreement was specified, these might be useful in assessing the spread in the difference between test and retest measurements.

An exploratory factor analyses (FA) with a principal components extraction method was performed, including all 12 items of the HCS with the aim to explore the component structure and construct validity. Bartlett's test of sphericity (significance better than 0.05) and the Kaiser-Meyer-Olkin (KMO) (higher than 0.60) test were carried out prior to FA. Oblimin rotation was applied to allow for correlated factors. First, the number of components was defined by inspection of the scree plot and the Kaiser criterion (eigenvalue ≥1). Next, since the original version of the HCS divides the scale into three subgroups, an FA with three components was carried out. The concurrent validity was examined by calculating Pearson correlation coefficients between the HCS and MMSE, stratified into those with an MMSE score of 0–10 (severely impaired, n=67) and those with a score of 11–20 (moderately impaired, n=61). We did not measure the inter-rater reliability since the same nurse in each of the seven nursing homes scored the HCS on both occasions.

Informed consent was obtained from the next of kin since the persons with dementia were unable to sign the informed consent.

RESULTS

At baseline, the mean MMSE score was 8.9 (SD 7.0) and the mean HCS score was 22.3 (SD 12.0) among the 128 participants.

Internal consistency

The Cronbach's α for the total HCS score was 0.94. The inter-item correlations were all positive and above 0.37, with the majority of the correlation coefficients between 0.50 and 0.70. The highest correlations were between: *success in communication and attempts to communicate (0.79), speech and attempts to communicate (0.76), success in*

Table 1 Correlation matrix for the 12 items in Holden Communication Scale (HCS) (n=128)

	1	2	3	4	5	6	7	8	9	10	11	12
1. Response	1											
2. Interest in past events	0.64	1										
3. Pleasure	0.68	0.63	1									
4. Humour	0.70	0.70	0.71	1								
5. Names	0.50	0.60	0.37	0.54	1							
6. General orientation	0.46	0.58	0.44	0.52	0.64	1						
7. General knowledge	0.54	0.59	0.56	0.57	0.54	0.60	1					
8. Ability to join in games, etc	0.60	0.54	0.61	0.62	0.44	0.50	0.54	1				
9. Speech	0.70	0.61	0.51	0.62	0.56	0.43	0.58	0.59	1			
10. Attempts at communication	0.66	0.61	0.50	0.65	0.54	0.48	0.55	0.50	0.76	1		
11. Interest and response to objects	0.63	0.64	0.67	0.65	0.48	0.51	0.62	0.60	0.61	0.63	1	
12. Success in communication	0.70	0.61	0.54	0.59	0.55	0.46	0.56	0.55	0.73	0.79	0.69	1

communication and speech (0.73), humour and pleasure (0.71) and speech and response (0.70). The correlation between pleasure and remembering names (0.37) and remembering names and the ability to join in games (0.44) was low (table 1).

All corrected item-total correlations ranged from 0.63 to 0.79 (table 2).

Test-retest reliability

The total score on HCS between baseline and 1-week (table 3) did not differ significantly (22.6 (SD 12.5) and 22.2 (SD 12.1)), p=0.35 for paired samples Student's t-test. Assessing the individual items, a small bias was only revealed in *ability to join in games, etc*, (p=0.04). The 95% limits of agreement interval, which would contain the differences between test and retest ~95% of the time, were rather narrow for all items as well as total HCS score (table 3). This clearly indicates reliable measurements.

Table 2 Item performance for the Holden Communication Scale (HCS) (n=128)

Items	Mean	SD	Corrected item-total correlation	Cronbach's α if item deleted
Conversation				
1. Response	1.7	1.4	0.79	0.94
2. Interest in past events	2.2	1.2	0.78	0.94
3. Pleasure	1.5	1.0	0.71	0.94
4. Humour	1.9	1.2	0.79	0.94
Awareness and knowledge				
5. Names	2.1	1.2	0.66	0.94
6. General orientation	2.8	1.2	0.63	0.94
7. General knowledge	2.6	1.1	0.72	0.94
8. Ability to join in games, etc	2.1	1.3	0.69	0.94
Communication				
9. Speech	1.4	1.5	0.78	0.94
10. Attempts at communication	1.2	1.5	0.78	0.94
11. Interest and response to objects	1.6	1.3	0.78	0.94
12. Success in communication	1.4	1.4	0.79	0.94

Factor analysis

Bartlett's test of sphericity was statistically significant (p<0.001), and the KMO measure was 0.94, both implying satisfactory values. The FA using a criterion of eigenvalue ≥1 and inspection of the scree plot revealed a one-component structure accounting for 63% of the variance. A three-factor analysis was performed to assess the original three subgroups structure of the HCS.[11] The three factors explained 76% of the variance. Factor 1 had a Cronbach's α of 0.89 and accounted for 62.1% of the variance, while factor 2 had a Cronbach's α of 0.81 and factor 3 a Cronbach's α of 0.91, accounting for 7.3% and 6.6% of the variance, respectively. Most of the loadings on three factors were strong, and most of the items loaded substantially on only one factor. However, an inspection of the scree plot revealed a clear break after the first component (table 4).

Relationship between the ability to communicate and cognition function

The HCS correlated as expected with the MMSE, suggesting that lower levels of cognitive functioning were related to increased communication difficulties (−0.67). However, when dividing between moderate and severe cognitive decline, strong correlation was only found between severe cognitive decline and HCS (−0.61) and not between moderate cognitive decline and HCS (−0.06). Among those with severe cognitive impairment, the strongest correlation was found between cognitive dysfunction and *speech* (−0.59), whereas among those with moderate cognitive impairment *interest in past events (−0.30)* was found to be strongest.

Table 3 Test-retest reliability measures for the Holden Communication Scale (HCS) (n=88)

Scale	Baseline Test mean (SD)	1 week Retest mean (SD)	Bias and 95% limits of agreement	p Value
Conversation				
1. Response	1.68 (1.37)	1.65 (1.29)	0.03 (−0.11; 0.17)	0.63
2. Interest in past events	2.18 (1.16)	2.17 (1.17)	0.01 (−0.07; 0.09)	0.78
3. Pleasure	1.42 (0.99)	1.41 (0.94)	0.01 (−0.13; 0.15)	0.87
4. Humour	1.86 (1.21)	1.80 (1.19)	0.07 (−0.06; 0.19)	0.27
Awareness and knowledge				
5. Names	2.20 (1.22)	2.18 (1.17)	0.02 (−0.08; 0.13)	0.67
6. General orientation	2.74 (1.28)	2.78 (1.28)	0.05 (−0.12; 0.03)	0.25
7. General knowledge	2.60 (1.05)	2.59 (1.04)	0.01 (−0.09; 0.12)	0.83
8. Ability to join in games, etc	2.10 (1.37)	1.92 (1.24)	0.18 (0.01; 0.35)	0.04
Communication				
9. Speech	1.50 (1.52)	1.49 (1.53)	0.01 (−0.09; 0.12)	0.83
10. Attempts at communication	1.27 (1.48)	1.26 (1.44)	0.01 (−0.08; 0.11)	0.81
11. Interest and response to objects	1.51 (1.32)	1.47 (1.30)	0.05 (−0.08; 0.17)	0.47
12. Success in communication	1.50 (1.46)	1.44 (1.43)	0.06 (−0.04; 0.15)	0.23
Total score	22.6 (12.5)	22.1 (12.1)	0.38 (−0.42; 1.17)	0.35

Table 4 Three component structure of the Holden Communication Scale (HCS)

Holden	Component 1	Component 2	Component 3
3. Pleasure	**0.970**	0.051	0.041
8. Ability to join in games, etc	**0.689**	0.135	0.056
4. Humour	**0.615**	0.155	0.212
11. Interest and response to objects	**0.553**	0.095	0.307
2. Interest in past events	**0.407**	0.378	0.206
6. General orientation	0.156	**0.907**	0.152
5. Names	0.190	**0.792**	0.307
7. General knowledge	0.354	**0.503**	0.085
10. Attempts at communication	0.022	0.059	**0.896**
12. Success in communication	0.076	0.005	**0.858**
9. Speech	0.064	0.029	**0.841**
1. Response	0.479	0.056	**0.521**
Explained variance	62.1%	7.3%	6.6%
Cronbach's α	0.89	0.81	0.91

Bold formatting highlights the three components.

The correlation between cognitive dysfunction and humour was strongest for those with severe cognitive impairment (−0.56), whereas those with moderate cognitive impairment exhibited a low correlation (−0.06). There was little difference in the ability to express pleasure in persons with severe cognitive impairment and those with moderate cognitive impairment, −0.31 and −0.18, respectively (table 5).

DISCUSSION

To the best of our knowledge, this is the first study to investigate the psychometric properties of the English version of the HCS for persons with moderate-to-severe cognitive impairment living in Irish nursing homes.

Internal consistency

The Cronbach's α for the total HCS was 0.94, indicating a satisfactory internal consistency. However, a high Cronbach's α coefficient might indicate the need to assess if there are some items measuring the same construct.

The strong correlation between *attempts at communication* and *success in communication* (0.79) was not expected since the attempts to communicate do not necessarily follow the success in communication. Further, the strong correlation between speech and attempts at communication (0.76) and success in communication (0.73) was not expected either, since the speech ability depends on motor functioning, while communication is connected to language.[1] On the other side, the strong correlation between *speech* and *response* (0.70) was as expected. A person who is able to respond would certainly be expected to be able to express in terms of speech.

Although *pleasure* and *humour* are closely connected, we would not expect them to have such strong correlation (0.71). The experience of pleasure is subjective and considered one of the core dimensions of emotion.

Table 5 Pearson's correlations between HCS items and cognitive function (MMSE) (n=128)

Holden/MMSE	MMSE score 0–10 (n=67)	MMSE score 11–20 (n=61)
Conversation		
1. Response	−0.55	−0.10
2. Interest in past events	−0.49	−0.30
3. Pleasure	−0.31	−0.18
4. Humour	−0.56	−0.06
Awareness and knowledge		
5. Names	−0.30	−0.04
6. General orientation	−0.16	−0.22
7. General knowledge	−0.42	−0.10
8. Ability to join in games, etc	−0.46	−0.07
Communication		
9. Speech	−0.59	−0.13
10. Attempts at communication	−0.52	−0.09
11. Interest and response to objects	−0.47	−0.13
12. Success in communication	−0.52	−0.03
Total Holden	−0.61	−0.06

HCS, Holden Communication Scale; MMSE, Mini-Mental State Examination.

The experience is a positive feeling or sensation correlated with external circumstances such as having a good meal, performing exercises, enjoying art, literature and dancing,[16] sharing music,[17] showing real pleasure in situations or smiling.[11] Humour, on the other hand, is a complex phenomenon with no clear definition and has often been considered synonymous with 'joke', 'laughter' and 'wit'. However, it is important to distinguish these concepts from humour even if they are related since they do not contain the same conceptual phenomena. Humour can be described as a subjective, emotional response that comes from the recognition and expression of incongruity of a comic, absurd, or impulsive situation or remark, and enhances feelings of togetherness and closeness.[18] This could be such as enjoying comic situations or telling funny stories on one's own initiative[11] or be used as a tool in creating relationship and communication.[19]

As expected, the *ability to remember names* and express *pleasure* revealed low correlation (0.37). The ability to remember names is associated with semantic memory,[3] which has to do with long-term memory, while the ability to express pleasure is based on an experience and does not depend on memory. Further, the ability to join in games and remember names (0.44) was weakly correlated. This was not as expected since the ability to join in games would depend on a certain function of cognition, which again is connected with memory (table 1).

Some of the items, like humour and pleasure, were difficult to differentiate since a smile can be an indication for both humour as well as pleasure. Another challenge with the HCS is that some of the scoring values refer to expression as well as experience, such as in item 12: success in communication (clearly understood (0), uses gestures and sounds effectively (1), understanding restricted to a few people (2), becomes frustrated and angry (3) and makes no attempt (4)). Success in communication refers to the degree to which the person is clearly understood or not. However, value number 1 addresses if the person is using non-verbal communication, while value number 3 refers to the person's reaction. Such inconsistent naming of scoring values makes it difficult to get a clear opinion of what is assessed and thus could lead to misleading results.

The inter-item correlations were all positive and above 0.37, indicating that all items measure the same underlying aspect of communication and correlate with the total score (table 1).

Test-retest reliability

The test-retest analysis revealed no significant difference in the total score of HCS at baseline and after 1-week (paired sample Student's t-test; p=0.35). However, by inspecting each single item, a significant bias (p=0.04) was found for one item, *the ability to join in games, etc.* Despite the significantly different score for this item, the result indicates a good test-retest reliability for the HCS. We can therefore conclude that the nurses carried out the assessments in a consistent way (table 3).

Validity

The FA resulted in a one-component structure, explaining 63% of the variance and this was expected since the corrected item-total correlation was between 0.63 and 0.79 (table 2). However, Holden and Woods[11] who constructed the scale considered HCS to consist of three subscales: *conversation*, *awareness* and *knowledge*, and *communication*. On the basis of this suggestion, we forced a three-factor analysis. The three-factor solution explained a total of 76% of the variance, all loading above 0.4, with a sufficient Cronbach's α for each factor (table 4). In the original HCS, items 1–4 made up one subgroup (conversation), items 5–8 subgroup two (awareness and knowledge), and items 9–12 subgroup three (communication). As illustrated in table 4, the three-factor solution resulted in an almost equal distribution of items among the three subgroups, however, with a different structure than the original HCS. In the present study, item 1 was connected to factor 3, whereas items 8 and 11 were connected to factor 1.

Although item 1 loaded almost the same on factors 1 and 3 (loadings 0.48 and 0.52, respectively), after looking more closely we suggest that the response in this setting might be understood as being involved in conversation. Item number 1 could be connected to items 9, 10 and 12, all of which have to do with verbal communication. The same language pattern is proposed for item 11 (interest and response to objects), which is connected to non-verbal communication and therefore subscale 1. However, item 2 (interest in past events), which loaded almost the same on factors 1 and 2 (loadings

0.40 and 38, respectively), is clearly connected to aspects of communication that require memory. It would therefore be preferable to move this item to factor 2.

Although a one-component structure was revealed, the forced three-factor analysis indicates that a three-factor solution is stronger than the one-component structure.[20] On this basis, we therefore suggest that the scale be divided into three subscales: subscale 1, non-verbal communication; subscale 2, knowledge/understanding; and subscale 3, verbal communication. This would also be obvious when considering the face validity.

The correlation between cognitive function and the ability to communicate

This study demonstrated a moderate negative correlation between cognitive function, as measured with the MMSE, and the ability to communicate (−0.67), suggesting that lower levels of cognitive functioning were related to increased communication difficulties. This test gives evidence of good clinical validity of the HCS. Although a strong correlation was found among those with severe cognitive impairment (−0.61), a low negative correlation was found among those with moderate cognitive impairment (−0.06). On the basis of these findings, we might question the validity of using the HCS among those at the moderate stage of dementia.

The strong correlation between cognitive dysfunction and the item *speech* among those with severe cognitive impairment (−0.59) was considerably lower for those with moderate cognitive impairment (−0.13), and is consistent with previous research reporting the speech ability to decline as part of the dementia process.[21]

The correlation between cognitive function and the item *humour* was strongest among those with severe cognitive impairment (−0.56) and low among those with moderate cognitive impairment (−0.06). This finding is supported by previous research where an altered sense of humour in persons with dementia is reported[22] and that appropriateness of humour depends on cognitive function.[23] However, little difference in the ability to express pleasure was reported between the groups, −0.31 and −0.18, respectively. Cohen-Mansfield *et al*[24] gives support to this finding: persons with severe dementia are still capable of showing pleasure.

The strength of this study is the presentation of the psychometric properties performed in a structured way. However, a weakness is that it is based on relatively few participants, as well as the fact that the participants had moderate-to-severe cognitive decline and were mainly women. Another weakness is the fact that the same nurse was completing both the MMSE and the HCS, which could influence the ratings. Another weakness is related to the fact that we did not study the inter-rater reliability of the HCS. However, since the same nurse did the assessments on both occasions, we consider this bias to be small. Transferring the results from this study to all stages of dementia might therefore be a challenge.

CONCLUSION

The psychometric evaluation reveals HCS to be a reliable and valid instrument, suitable for assessing communication in persons with dementia. The analyses demonstrate high internal consistency and test-retest reliability. Further, there is a moderate correlation between communication ability and cognitive function among persons with severe cognitive decline, whereas this correlation is low among those with moderate cognitive decline.

A one-structure solution was found, where all items loaded satisfactorily. However, a forced three-factor analysis revealed a different distribution of the items, compared with the original subgrouping by Holden and Woods, with a higher explained variance.

The findings of the study may help clinicians to detect the ability to communicate in persons with dementia. Focusing on ability rather than limitations presents an important clinical perspective in the communication with persons having dementia.

Author affiliations
[1]VID Specialized University, Center for Diakonia and Professional Practice, Oslo, Norway
[2]Norwegian Advisory Unit for Aging and Health, Vestfold Hospital HF, Tønsberg, Norway
[3]Department of Geriatrics, Oslo University Hospital, Tønsberg, Norway
[4]Institute of Clinical Medicine, Campus Ahus, University of Oslo, Lørenskog, Norway
[5]HØKH, Research Centre, Akershus University Hospital, Lørenskog, Norway
[6]Oslo and Akershus University College of Applied Sciences, Oslo, Norway

Acknowledgements The authors would like to thank Sister Morag Collins SJC for her detailed proof reading.

Contributors BSS, KE and E-KG contributed to the design of the study, accountability and approval of the published version. BSS was involved in drafting of the work. KE, E-KG and JŠB revised the work.

Competing interests None declared.

Patient consent Obtained.

Ethics approval The study was approved by the Regional committees for medical and health research ethics of Norway (REC) under registration number IRB 0000 1870. No ethical approval was needed in Ireland, except from the board of management in each nursing home.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement The data will be available at NSD after the study has been completed.

REFERENCES

1. Klimova B, Kuca K. Speech and language impairments in dementia. *J Appl Biomed* 2016;14:97–103.
2. Kempler D, Goral M. Language and dementia: neuropsychological aspects. *Annu Rev Appl Linguist* 2008;28:73–90.
3. Engedal K, Haugen PK, Brækhus A. *Demens: fakta og utfordringer: en lærebok*. Tønsberg: Aldring og helse, 2009.
4. Edvardsson D, Winblad B, Sandman PO. Person-centred care of people with severe Alzheimer's disease: current status and ways forward. *Lancet Neurol* 2008;7:362–7.

5. Kitwood T. *Dementia reconsidered: the person comes first*. Buckingham: Open University Press, 1997.
6. Bergh S, Selbæk G. The prevalence and the course of neuropsychiatric symptoms in patients with dementia. *Norsk Epidemiologi* 2012;22:225–32.
7. Selbæk G, Engedal K, Bergh S. The prevalence and course of neuropsychiatric symptoms in nursing home patients with dementia: a systematic review. *J Am Med Dir Assoc* 2013;14:161–9.
8. Strøm BS, Ytrehus S, Grov EK. Sensory stimulation for persons with dementia: a review of the literature. *J Clin Nurs* 2016;25:1805–34.
9. Egan M, Bérubé D, Racine G, *et al*. Methods to enhance verbal communication between individuals with Alzheimer's disease and their formal and informal caregivers: a systematic review. *Int J Alzheimers Dis* 2010;2010:pii:906818.
10. Sonas aPc. Sonas Workshop Booklet, 2011.
11. Holden UP, Woods RT. *Positive approaches to dementia care*. Edinburgh: Churchill Livingstone, 1995.
12. Strøm BS, Engedal K, Grov E-K. A psychometric evaluation of the Threadgold Communication Tool for persons with dementia. *Dement Geriatr Cogn Dis Extra* 2016;6:150–60.
13. Perneczky R, Wagenpfeil S, Komossa K, *et al*. Mapping scores onto stages: Mini-Mental State Examination and Clinical Dementia Rating. *Am J Geriatr Psychiatry* 2006;14:139–44.
14. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975;12:189–98. [Published Online First: 1975/11/01].
15. Hardy MA, Bryman A. *Handbook of data analysis*. London: Sage Publications, 2004.
16. Persaud ML. *Pleasure in the daily lives of people living with advanced dementia in a long-term care facility: a multiple case study approach*. Canada: University of Toronto, 2009.
17. Myskja A. Integrated music in nursing homes: an approach to dementia care: PhD dissertation under the auspices of the Grieg Academy, GAMUT, University of Bergen, November 2011: (doktoravhandling). *Universitetet i Bergen*. Griegakademiet, Bergen, 2011.
18. Tanay MA, Roberts J, Ream E. Humour in adult cancer care: a concept analysis. *J Adv Nurs* 2013;69:2131–40.
19. Person M, Hanssen I. Joy, happiness, and humor in dementia care: a qualitative study. *Creat Nurs* 2015;21:47–52.
20. Pett MA, Lackey NR, Sullivan JJ. *Making sense of factor analysis: the use of factor analysis for instrument development in health care research*. SAGE Publications, 2003.
21. Rongve A, Soennesyn H, Skogseth R, *et al*. Cognitive decline in dementia with Lewy bodies: a 5-year prospective cohort study. *BMJ Open* 2016;6:e010357.
22. Clark CN, Nicholas JM, Gordon E, *et al*. Altered sense of humor in dementia. *J Alzheimers Dis* 2015;49:111–19.
23. Takeda M, Hashimoto R, Kudo T, *et al*. Laughter and humor as complementary and alternative medicines for dementia patients. *BMC Complement Altern Med* 2010;10:1–7.
24. Cohen-Mansfield J, Marx MS, Freedman LS, *et al*. What affects pleasure in persons with advanced stage dementia? *J Psychiatr Res* 2012;46:402–6.

BMJ Open

Psychometric evaluation of the Holden Communication Scale (HCS) for persons with dementia

Benedicte Sørensen Strøm, Knut Engedal, Jurate Saltyte Benth and Ellen-Karine Grov

BMJ Open 2016 6:
doi: 10.1136/bmjopen-2016-013447