The DSQIID is a valid, reliable and easy to use tool that could help both have drawbacks. A questionnaire that not standardise the cut-off thresholds for dementia for 49 according to modified ICD–10 criteria (World Health Organization, 1992). We named the questionnaire the Dementia Screening Questionnaire for Individuals with Intellectual Disabilities (DSQIID) because although the questionnaire was only tested among adults with Down’s syndrome, we believe that it can be used equally effectively among all adults with intellectual disabilities. The project received approval from the Welsh Multi-centre Research Ethics Committee and we obtained written consent from each carer who completed the questionnaire.

The DSQIID is an observer-rated questionnaire, which is completed by carers of people with Down’s syndrome who have known the individual for some time. The DSQIID is divided into three parts (see data supplement to online version of this paper). The first asks about the ‘best’ ability the person has or has had. The second contains 43 questions about behaviour or symptoms that are usually associated with dementia in adults with Down’s syndrome. Each item is scored on a four-point scale: ‘always has been the case’; ‘always, but worse’; ‘new symptoms’; and ‘does not apply’. We adopted this scoring system to overcome the floor effect of the existing dementia screening scales, which only score current behaviour and not changes in behaviour (because in the general population the pre-existence of these skills is assumed). Items with a response of ‘always been the case’ or ‘does not apply’ are scored 0, those with ‘always but worse’ or ‘new symptom’ are scored 1.

Part 3 of the DSQIID contains 10 questions, all of which are comparative; for Alzheimer’s dementia is relatively common among adults with Down’s syndrome and tends to manifest relatively early. As in the general population, increasing age and genetic predisposition act as risk factors (Aylward et al., 1997; Deb et al., 2000). Autopsy and neuroimaging studies (Deb et al., 1992) have shown an almost universal presence of Alzheimer’s neuropathology among adults with Down’s syndrome over the age of 45 years. Clinically, however, dementia is not universally manifested in this population (Mann, 1988; Prasher, 1995). One of the reasons for this discrepancy is the difficulty in diagnosing dementia among people with Down’s syndrome in particular, and intellectual disabilities in general – especially during the early stage of dementia. Unfortunately, screening methods used for the detection of dementia among the general population are not suitable for people with intellectual disabilities because of floor effects. Moreover, we cannot standardise the cut-off thresholds for people with intellectual disabilities because those people vary considerably in their cognitive abilities. For the same reasons direct neuropsychological tests, including the Mini-Mental State Examination (MMSE; Folstein et al., 1975), are not useful for this population. Therefore, an observer-rated screening instrument which is primarily based on the reporting of behavioural changes following the onset of dementia is desirable (Deb & Braganza, 1999).

The two dementia screening instruments that are currently in wide use among people with intellectual disabilities, namely the Dementia Scale for Down Syndrome (DSDS; Gedye, 1995) and the Dementia Questionnaire for Persons with Mental Retardation (DMR; Evenhuis, 1992, 1996), both have drawbacks. A questionnaire that is valid, reliable and easy to use could help to screen for dementia among people with Down’s syndrome, which will help in timely diagnosis and treatment. We therefore developed a behavioural rating scale, incorporating carers’ perspectives at the outset, for use by carers to screen for dementia in people with intellectual disabilities.
example, ‘speaks (signs) less’ and ‘seems generally more tired’. A response of ‘yes’ is scored 1 and a response of ‘no’ is scored 0. Scores from parts 2 and 3 are added to provide a total score. The 53 items of the DSQIID cover areas such as loss of memory, confusion, loss of skills, social withdrawal, behavioural changes, psychological symptoms, physical symptoms, sleep disturbance and speech abnormalities.

Questionnaire evaluation

Sample selection

Initially S.D. contacted colleagues in the UK requesting them to identify adults with Down’s syndrome with and without dementia who might be suitable for inclusion in the study. M.H. publicised the study among her contacts who are primarily carers in Wales. S.B. approached those carers of adults with Down’s syndrome on the Leicestershire register who had agreed to take part in research. The Leicestershire register holds information on over 3000 people with intellectual disabilities in the county. The adults with Down’s syndrome who were included in the study had a range of intellectual disabilities.

Carers who expressed an interest were sent an information sheet, a written consent form, the DSQIID and a stamped addressed envelope. They were asked to return the completed DSQIID along with the completed consent form. We also asked the first carer to inform us of any other carer of the person with Down’s syndrome who was willing to complete a DSQIID for that person – this was done to assess interrater reliability. Where appropriate, we immediately sent the same pack to the second carer, and thereby managed to gather data from 41 second carers of adults with Down’s syndrome. We also sent the DSQIID again to the same carers immediately after we had received their completed first questionnaire. By this means we gathered test–retest data for 52 adults with Down’s syndrome.

Inclusion criteria and matching

We did not match the groups with and without dementia for age and gender but subsequent analysis showed that those with dementia were significantly older than those without, which was expected. There was no significant difference in gender distribution between the groups. We did not match the two groups according to other possible confounders, such as hypothyroidism and depression, but on subsequent data analysis we did not find any significant intergroup differences in these variables (see Table 1).

Data analysis

We entered all data anonymously and analysed them using SPSS version 13 for Windows (Field, 2005).

RESULTS

Demographic data

We gathered data using the DSQIID on 193 adults with Down’s syndrome from 28 centres in the UK. Local clinicians examined 117 of these adults and confirmed a diagnosis of dementia among 49 and the absence of dementia among 68 according to the modified ICD–10 criteria for the diagnosis of dementia among adults with intellectual disabilities (Aylward et al, 1997). Because some adults with Down’s syndrome were recruited through carers and nursing staff, 76 were not examined by a clinician and therefore we do not have a dementia diagnosis for these participants.

We used receiver operating characteristic (ROC) analysis only on data from those who were examined by a clinician. We excluded 1 person with Down’s syndrome from the ROC analysis because he had a mixed diagnosis of cerebrovascular events and dementia. We used data from all participants to analyse test–retest and interrater reliability.

The age of the whole cohort ranged from 23 to 77 years (mean 55 years, s.d.=7.6); 51% were male. The age of the 49 adults with dementia ranged from 44 to 77 years (mean 56 years, s.d.=7). The age range of 68 adults without dementia was 23–63 years (mean 44 years, s.d.=10). Eighteen adults without dementia were over age 50. Independent-sample t-test showed that those with dementia were significantly older than those without (P<0.001); 54% of those with dementia and 37% of those without were female. Although it was not possible to gather IQ scores from a cohort recruited from multiple centres, 35% had fluent speech, 37% could use short sentences, 15% speak a few words, 7% used sign language and 6% had no speech. Similarly, 13% lived totally independently, 6% lived independently but needed a lot of help, 35% were cared for by others and needed some help, and 46% were cared for by others and needed a lot of help for self-care. Therefore, it could be assumed that a proportion had severe and profound intellectual disabilities.

Comparative data for the adults with and without a diagnosis of dementia on the presence of depression, epilepsy, visual or hearing problems, and the use of anti-epileptics, antidepressants and thyroxine are presented in Table 1. A significantly higher proportion of adults with dementia had hearing (P=0.014) and visual (P=0.044) problems.

Psychometric properties

Feasibility

We sought comments from experts on the initial draft, and updated the questionnaire in the light of comments received. We piloted the draft questionnaire among six carers of adults with Down’s syndrome and dementia to identify any practical difficulties before wider use in field-testing. Any ambiguity in the questions, difficulty in understanding wording and other practical issues related to the design of the DSQIID were rectified.

Content validity

We checked whether carers were consistently missing any particular item or providing the same answer. We also checked
for possible floor or ceiling effects from the spread of overall scores from all carers. When preparing the questions we took into account interpretability, ambiguity, carers’ reading level, avoidance of double-barrelled questions, jargon, value-laden words, positive and negative wording, and the length of items.

### Construct validity

An initial principal component analysis using ‘varimax rotation’ created 13 factors (Field, 2005), which captured about 80% of the total variance. Subsequent scree plot analysis revealed that between four and five factors would be more appropriate but clinical grouping of items revealed that a four-factor structure was most appropriate for the DSQIID. Therefore, we carried out a forced four-factor analysis with four factors which included over 57% of the overall variance (Table 2). We excluded from the factor analysis the last 10 items of the DSQIID that were rated on a two-point scale as either ‘yes’ or ‘no’ as opposed to other items that were rated on a four-point scoring system (see data supplement to online version of this paper).

Factor 1 has most items involving symptoms of memory deficit and confusion; factor 2 includes primarily symptoms relating to frontal lobe dysfunction such as apathy and feelings of insecurity; factor 3 comprises primarily sleep and confusion-related items; and factor 4 symptoms associated with behavioural problems. Apart from some minor overlap, the factors appear to reflect different clinical symptoms. About 41% of the variance is owing to factor 1, whereas the remaining three factors contribute less than 17% of the variance. The first new variable contains the maximum amount of variation, whereas the remaining variables are orthogonal to the first and are independent of the first principal component. It is for this reason that the latter three factors contribute less to the variance as any common associations with first component items are ignored. This means that the items comprising factor 1, such as memory impairment and confusion, are only somewhat more important than the items in other factors.

### Internal consistency

Cronbach’s $\alpha$ for all 53 items in the DSQIID is 0.91.

### Criterion-related validity

We assessed criterion-related validity by comparing the total score on the DSQIID with the clinicians’ diagnosis of the presence or absence of dementia among 117

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**Table 2** Factor analysis of the 43 DSQIID items.

<table>
<thead>
<tr>
<th>Initial eigenvalues</th>
<th>Memory/ confusion</th>
<th>Feelings of insecurity</th>
<th>Sleep problems</th>
<th>Behaviour problems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.71</td>
<td>3.0</td>
<td>2.12</td>
<td>2.1</td>
</tr>
<tr>
<td>% Variance</td>
<td>41.17</td>
<td>6.93</td>
<td>4.93</td>
<td>4.76</td>
</tr>
</tbody>
</table>

DSQIID, Dementia Screening Questionnaire for Individuals with Intellectual Disabilities.
adults with Down’s syndrome. We used a ROC method to calculate the best fit between specificity and sensitivity. Out of 49 adults who had a clinical diagnosis of dementia, 4 scored less than 20 on the DSQIID. Out of 68 adults with Down’s syndrome who did not have a clinical diagnosis of dementia, 2 scored more than 20 on the DSQIID. Therefore, use of an overall score of 20 as a screening cut-off provided a specificity of 0.97, a sensitivity of 0.92, a positive likelihood ratio of 31 and a negative likelihood ratio of 0.08. Hence with a cut-off score of 20 a positive diagnosis of dementia is 31 times more likely in a person with dementia than in one without. Similarly, a negative diagnosis of dementia is 0.08 times more likely or 13 times less likely in a person with dementia than without. We therefore recommend 20 as the cut-off for the total score when using the DSQIID for screening for dementia among adults with Down’s syndrome. However, it is possible that there might be a different cut-off score for people with severe and profound intellectual disabilities whom we were unable to test separately. We therefore recommend the serial use of DSQIID over a period of time, particularly for people with severe and profound intellectual disabilities.

Reliability

The intraclass correlation for test–retest reliability (n=52) is 0.95, with a two-tailed level of significance of P<0.01 (80% power). The intraclass correlation for inter-rater reliability (n=41) is 0.9, and the two-tailed level of significance is P<0.01 (80% power).

DISCUSSION

Development of DSQIID

Our approach in developing the DSQIID is somewhat unique in that, for the first time, we have adopted a ‘bottom up’ approach and incorporated the views of carers of adults with Down’s syndrome regarding the symptoms of dementia. The strategy has ensured that the DSQIID has good face and content validity. It also puts carers’ views, to the forefront.

The DSQIID is easy to use, takes approximately 10–15 min to complete and can be completed either at home or in a clinic. The questions are simple and easy to understand, and the scoring system is simple and unambiguous. The screening cut-off is constant rather than variable, unlike the DSDS. The same cut-off score applies to adults with all levels of intellectual disabilities, unlike the DMR. We were not able to gather data on the level of intellectual disabilities among the whole study population but have included adults with all degrees of intellectual disabilities. Moreover, the original qualitative study used for the design of the DSQIID included adults with Down’s syndrome with mild, moderate and severe intellectual disabilities (Deb et al, 2007). We have found that adults with Down’s syndrome and severe intellectual disabilities showed a different manifestation of dementia in the early stage of the disease (primarily loss of skills) compared with those with mild-to-moderate intellectual disabilities (primarily memory deficit) (Deb et al, 2007). However, the end-stage symptoms of dementia are likely to be similar in both groups.

Other findings

Although we did not match those with and without dementia at the outset of the study, data analysis showed that, as expected, the dementia group was significantly older. The gender distribution of the two groups is similar. The two most common differential diagnoses of dementia are depression and hypothyroidism but there were no significant differences between the two groups on these variables. However, both hypothyroidism and depression may coexist with dementia and both are treatable conditions. There was a higher rate of hearing and visual problems among the group with dementia but the implication of these findings is not clear. Perhaps those with sensory deficits are more likely to develop dementia or this group might have been erroneously diagnosed because of their poor sensory skills.

We believe that for the DSQIID to be most effective the carers completing it should have known the person with intellectual disabilities for at least 6 months, and should have witnessed the change in behaviour since before the onset of dementia. Although we did not use this criterion for the field-testing, we believe that the carer should report only those behaviours that have existed for at least 6 months.

Limitations

It was not possible to test whether a different cut-off score for screening dementia should be applied for people with severe and profound intellectual disabilities. Moreover, sensitivity of the DSQIID can only be tested in a prospective study.

Inclusion of more adults with a clinical diagnosis of dementia might have improved the accuracy of the results.

Strengths

In order to avoid the floor effect, as can be seen with the MMSE, we have employed a scoring system by which only recent changes in behaviour are scored rather than all behaviours. This is a major strength of the DSQIID, which allows its use in a cross-sectional context. However, it is probably best to use the DSQIID at regular intervals over a period of time to identify the change in score. A further strength of the DSQIID relates to its robust psychometric properties, which existing scales often do not possess. Previous studies have included only a small number of people with dementia when validating scales (Evenhuis, 1992; Gedye, 1995), whereas in this study the number of people with dementia is much higher, and is very close to the 50 suggested by Streiner & Norman (1999). Moreover, the scores for test–retest and inter-rater reliability and internal consistency indicate that the DSQIID is very robust compared with existing scales.

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REFERENCES


DATA SUPPLEMENT: DEMENTIA SCREENING QUESTIONNAIRE FOR INDIVIDUALS WITH INTELLECTUAL DISABILITIES (DSQIID)

NAME:

ADDRESS:

DATE OF BIRTH:

DATE OF COMPLETION OF DSQIID:

☐ FEMALE  ☐ MALE

PHYSICAL DISABILITY:

☐ None
☐ Problems with vision/blind
☐ Problems with hearing/deaf
☐ Other – please specify

OTHER MEDICAL CONDITIONS:

☐ None
☐ Present – please specify

PSYCHOLOGICAL CONDITIONS:

☐ None
☐ Present – please specify

CURRENT MEDICATION (please specify):


PART 1: LEVEL OF ‘BEST’ ABILITY

Please indicate the level of ‘best’ ability the person has, or has had, by ☐ the appropriate boxes.

SPEECH:

☐ Could speak fluently and understandably
☐ Could make short sentences
☐ Could speak only a few words
☐ Could not speak much but used sign language
☐ Could not speak and did not use sign language

DAILY LIVING SKILLS (e.g. dressing, washing, eating):

☐ Could live independently with minor help
☐ Could live independently but needed a lot of help with self-help skills
☐ Could not live independently and needed minor help with self-help skills
☐ Could not live independently and needed a lot of help with self-help skills

CURRENT ACCOMMODATION:

☐ On his/her own
☐ With relatives
☐ In a shared, staffed house
☐ In a group home with full-time staff
☐ In a nursing home with full nursing care
☐ Other

OTHER INFORMATION:


PART 2

Please complete the following questions by ☐ the appropriate box.

Example: Question 1) Cannot wash and/or bathe without help.

If the person has always needed help with washing and bathing in his or her adult life, please ☐ ‘Always been the case’.

If the person’s previous skills in this area seem to have deteriorated, ☐ ‘Always, but seems worse’.

If the person had the skill in their adult life and has recently lost this skill, please ☐ ‘New symptom’.

Finally, if the question does not apply to the person (in this case, if the person can wash without help and this has not changed), please ☐ ‘Does not apply’.

Always Always New Does Does not apply
Always been the case but worse sym- not apply

Cannot wash and/or bathe without help ☐ ☐ ☐ ☐
Cannot dress without help ☐ ☐ ☐ ☐
Dresses inappropriately (e.g. back to front, incomplete) ☐ ☐ ☐ ☐
Undresses inappropriately (e.g. in public) ☐ ☐ ☐ ☐
Needs help eating ☐ ☐ ☐ ☐
Needs help using the bathroom ☐ ☐ ☐ ☐
Incontinent (including accidental accidents) ☐ ☐ ☐ ☐
Does not initiate conversation ☐ ☐ ☐ ☐
Cannot find words ☐ ☐ ☐ ☐
Cannot follow simple instructions ☐ ☐ ☐ ☐
Cannot follow more than one instruction at a time ☐ ☐ ☐ ☐
Stops in the middle of a task ☐ ☐ ☐ ☐
Cannot read ☐ ☐ ☐ ☐
Cannot write (including printing own name) ☐ ☐ ☐ ☐
Changed sleep pattern (sleeping more or sleeping less) ☐ ☐ ☐ ☐
Wakes frequently at night ☐ ☐ ☐ ☐
Confused at night ☐ ☐ ☐ ☐
Sleeps during the day ☐ ☐ ☐ ☐

PART 3

Finally, please answer the following questions by ticking ‘Yes’ or ‘No’.

Always Always New Does not apply
Always been the case but worse sym- not apply

Wanders at night ☐ ☐ ☐ ☐
Cannot find way in familiar surroundings ☐ ☐ ☐ ☐
Wanders ☐ ☐ ☐ ☐
Loses track of time (time of day, day of the week, seasons) ☐ ☐ ☐ ☐
Not confident walking over small cracks, lines on the ground or uneven surfaces ☐ ☐ ☐ ☐
Unsteady walk, loses balance ☐ ☐ ☐ ☐
Cannot walk unaided ☐ ☐ ☐ ☐
Cannot recognise familiar person (staff/relatives) ☐ ☐ ☐ ☐
Cannot remember names of familiar persons ☐ ☐ ☐ ☐
Cannot remember recent events ☐ ☐ ☐ ☐
Withdraws from social activities ☐ ☐ ☐ ☐
Withdraws from persons ☐ ☐ ☐ ☐
Loss of interest in hobbies and activities ☐ ☐ ☐ ☐
Seems to go into own world ☐ ☐ ☐ ☐
Obsessive or repetitive behaviour (e.g. empyres cupboards repeatedly) ☐ ☐ ☐ ☐
Hides or hoards objects ☐ ☐ ☐ ☐
Losses objects ☐ ☐ ☐ ☐
Puts familiar things into wrong places ☐ ☐ ☐ ☐
Does not know what to do with familiar objects ☐ ☐ ☐ ☐
Appears insecure ☐ ☐ ☐ ☐
Appears anxious or nervous ☐ ☐ ☐ ☐
Appears depressed ☐ ☐ ☐ ☐
Shows aggression (verbal or physical) ☐ ☐ ☐ ☐
Fits/epilepsy ☐ ☐ ☐ ☐
Talks to self ☐ ☐ ☐ ☐

Thank you for completing this questionnaire.

If you have any further comments please use the space provided here.

DATA SUPPLEMENT TO BRITISH JOURNAL OF PSYCHIATRY (2007), 190, 440-444
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Shoumitro Deb, Monika Hare, Lindsay Prior and Sabyasachi Bhaumik
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Supplementary Material
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