View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Queensland University of Technology ePrints Archive

COVER SHEET

This is the author-version of article published as:

Sullivan, Karen and Finch, Sue and O'Conor, Frances (2003) A confidence interval analysis of three studies using the Alzheimer's Disease Knowledge test. *Aging & Mental Health* **7(3):pp. 176-181.**

Accessed from http://eprints.qut.edu.au

© 2003 Taylor & Francis

A confidence interval analysis of three studies using the Alzheimer's Disease Knowledge test.

Karen Sullivan, PhD[1], Sue Finch[2] & Frances O'Conor[1]

1 = Queensland University of Technology, Queensland, Australia

2 = Latrobe University, Melbourne, Australia

Correspondence concerning this article should be addressed to Karen Sullivan at the School of Psychology and Counselling, Queensland University of Technology, Carseldine campus, Carseldine Queensland 4034, Australia. Electronic mail should be sent to ka.sullivan@qut.edu.au. Telephone: + 61 7 3864 4609

Abstract

It has been suggested that community awareness of Alzheimer's Disease (AD) has increased over recent years (Fox, 1989). This claim has been difficult to evaluate given the lack of systematic research in this area however, despite some recent attempts at monitoring changes in knowledge about AD (e.g., Karlin & Dalley, 1998). To address the question of change in awareness about AD, the present study compared results from three studies that have investigated the level of AD knowledge among undergraduate students, using confidence intervals. Consistent with previous findings (Karlin & Dalley, 1998), the results of this study suggest that more recent cohorts of undergraduate students are more knowledgeable about some aspects of AD, although to an extent that is much less marked than previously thought. Importantly, there are also a number of areas in which there appears to have been little or no change in community awareness about AD, and these are highlighted as issues that may need to be specifically addressed as part of future carer education programs.

Keywords: community awareness, public education, dementia, aging

Previous research has shown that carer knowledge of dementia has important implications for the wellbeing of those who care for AD patients, and indirectly for patients themselves (Cahill & Shapiro, 1997; Graham et al., 1997a, 1997b). In recognition of the importance of education in dementia care, Dieckmann and colleagues developed the Alzheimer's Disease Knowledge Test (ADK; Dieckmann, Zarit, Zarit & Gatz, 1988). The ADK was developed to "assess the level of knowledge of AD of caregivers, mental health professionals, nursing home staff, and other individuals who interact with dementia patients, and to establish educational objectives, stimulate group discussion, clarify common misconceptions, and evaluate support groups and other educational programs" (Dieckmann et al., 1988, p.402).

Since it's inception the ADK has been used in two studies for these purposes (e.g., Karlin & Dalley, 1998; Sullivan & O'Conor, 2001). Karlin and Dalley (1998) recently attempted to determine whether speculation about increasing awareness about AD (Fox, 1989) might be borne out by a comparison of AD knowledge among undergraduate students tested in 1995 and 1988 (during development of the ADK; Dieckmann et al., 1988). Sullivan and O'Conor (2001) used the ADK in a repeated-measures design to determine the most effective way of educating people about AD, using educational materials from the Alzheimer's Association of Australia.

The primary purpose of this study was to expand on the work of Karlin and Dalley (1998). Specifically, to monitor levels of public awareness about AD by analysing the results of three ADK studies (Dieckmann et al., 1988, Karlin & Dalley, 1998; Sullivan & O'Conor, 2001). The inclusion of three studies in this comparison is a 50% increase in the number of studies used in the comparison conducted by Karlin and Dalley. However, more importantly, we have attempted to address two apparent limitations of the study reported by Karlin and Dalley (1998), and we demonstrate an

alternative way of presenting data that better addresses the question of whether community awareness about AD has changed.

In attempting to assess the effectiveness of AD public awareness campaigns, Karlin and Dalley (1998) compared ADK data they collected from students in 1995 with data reported previously by Dieckmann et al. in 1988. For each of the 20 ADK items, one sample chi-square tests were conducted. Data from the 1988 study was used to calculate expected frequencies and data from the 1995 sample was used as observed frequencies. Hence the 1988 data were used to estimate theoretical frequencies that assumed no change from 1988 to 1995. Karlin and Dalley interpreted statistically significant results as indicating an increase in knowledge about AD in the sample tested in 1995. That is, they reported an increase in AD knowledge over a 7-year period on eight out of 20 ADK items. This result appeared to be consistent with speculation about increases in public awareness about AD (Fox, 1989).

As noted by Karlin and Dalley (1998) however, the interpretation of their results was complicated by potential sample size issues. Specifically, the 1988 study included 29 subjects, whereas their own 1995 sample included 417 subjects. To “correct” for this difference in sample size calculated, Karlin and Dalley (SF – is there a word missing or are the words in the wrong order?) the expected frequencies "by using the percentage for each 1988 response and multiplying by the current studies [sic] subject number" (Karlin & Dalley, 1998, p. 215). In drawing conclusions, Karlin and Dalley (1998) again noted limitations due to sample size and described their conclusions as "tentative" (Karlin & Dalley, 1998, p. 216). However, the appropriateness of the sample size correction used by Karlin and Dalley (1998) depends to a large extent on the match between samples and the target population, not only the differences in sample size, and this is not explicitly stated by the authors.

Further, the use of data from the 1988 study to estimate expected frequencies for the 1995 group takes no account of sampling variability. This is an important issue given that estimates of population characteristics from small samples may vary markedly, and we felt this was a limitation that needed to be addressed.

The second apparent limitation we felt needed to be addressed related to sample comparability. Although Karlin and Dalley state that "the sample was selected purposively according to the needs of comparing present information with 1988 findings (p. 212)", it is difficult to determine whether the sampling strategy used was effective. To illustrate this point, Table 1 reports the sample characteristics of groups tested in 1988, 1995, and 1999. The 1999 data was taken from a third ADK study (Sullivan & O'Conor, 2001), and is included in this Table since we have incorporated results from this study in subsequent data analyses. There are two points to note from Table 1. First, it is difficult to assess the comparability of the Dieckmann et al., (1988) sample with other samples given the lack of detail provided about this group. In addition, without specific tests of the characteristics of these samples or more descriptive information, it is difficult to know precisely how comparable Karlin and Dalley's sample is with that of Dieckmann and colleagues' (1988). Second, to the extent that it is possible to make comments about the similarity of samples based on visual analysis of descriptive statistics, there are more apparent similarities between the two groups of subjects tested most recently (i.e., Karlin & Dalley; Sullivan and O'Conor, 2001).

Insert Table 1 about here

The aim of the current study was therefore to continue efforts to monitor changes in the level of knowledge of AD amongst undergraduate students, using an analytical technique that addresses some of the limitations of the study conducted by Karlin and Dalley (1998). The most appropriate method to achieve this aim would be a meta-analysis (e.g., Hunter & Schmidt, 1990). A meta-analysis would provide an overall estimate of the level of AD knowledge, and would allow an investigation of the extent to which variations in knowledge over time arose from sampling variability. However, given the small number of studies to date and concerns about the comparability of the samples involved, we chose to adopt a simpler approach. First, we calculated 95% confidence intervals for the results from the three published ADK studies listed in Table 1. This provides estimates of the proportion of correct responses in each of the three time periods, and hence provides some much needed Australian normative data for ADK. Second we calculated 95% confidence intervals to examine differences in proportion of correct responses for the two most recent studies.

Method

Subjects

As mentioned previously, Table 1 shows sample characteristics of the ADK comparison studies used in this analysis. There are clearly more similarities between the samples tested by Sullivan and O'Conor and Karlin and Dalley, than between other pairs of studies.

Materials

The Alzheimer's Disease Knowledge Test (ADK) is an established measure of AD knowledge with known psychometric properties (Dieckmann et al., 1988). The ADK is a twenty-item multiple-choice instrument with alpha coefficients ranging from .71 to .92 giving it acceptable internal consistency. Response alternatives consist of a correct response, three distracter responses, and an "I don't know" option. Question stems are presented in the form of incomplete sentences. To illustrate the nature of items on the ADK, a sample item is shown in Table 2. The first 10 ADK items cover areas such as epidemiology, aetiology, symptomatology and assessment. The second half of the questionnaire covers issues relating to treatment, management, and community support options for people with AD and their carers.

Insert Table 2 about here

Results

Data from three published studies on the ADK were gathered in preparation for analysis. The proportion of correct and incorrect responses for each item was calculated (Dieckmann et al., 1988; Karlin & Dalley, 1998; Sullivan & O'Conor, 2001). Given that Sullivan and O'Conor (2001) used a repeated-measures design to assess the effect of instruction in AD on ADK scores, only pre-education results were used in this analysis. In addition, two ADK items (11 and 19) were excluded from analysis, since data from these items was not collected in one study for reasons explained elsewhere (Sullivan & O'Conor, 2001).

Ninety-five percent confidence intervals (CI) for the proportion of correct ADK responses were then calculated for each data set. That is, for each ADK item,

three CIs were calculated (i.e., one CI for each of three data sets per ADK item). Each interval provides an estimate of the proportion of correct responses in the population sampled. We chose to calculate separate confidence intervals (rather than taking an independent samples approach) for several reasons. First, as discussed, the comparability of the three samples is questionable. Second, the width of the interval depends, in part, on sample size, therefore we are able to highlight the sampling variability in small samples. Further, our approach is consistent with recent recommendations of the American Psychological Association's Task Force on Statistical Inference (Wilkinson & Task Force, 1999) to reduce the reliance on hypothesis testing, to provide confidence intervals, and to choose methods of analysis that are simple, parsimonious and communicate findings clearly. Finally, our results could readily be integrated into future meta-analyses.

Figure 1 depicts these results. Confidence intervals for each item in Figure 1 were plotted in reverse chronological order so that the first CI in each set depicts results from Sullivan and O'Conor (2001; solid line), followed by data from Karlin & Dalley (1998; dotted line), and Dieckmann et al., (1988; dashed line). The order of ADK items on the Y-axis was plotted in order of difficulty, using results from Sullivan and O'Conor (2001) with easier items appearing at the top (see Figure 1).

The use of confidence intervals to compare these results is an alternative method to that used by Karlin and Dalley (1998). The confidence interval approach avoids the need to "adjust" for unequal samples (cf. Karlin & Dalley, 1998), and illustrates limitations associated with corrections of this type. For example, Figure 1 clearly illustrates the effect of different sample sizes on the length of confidence intervals around the proportion of correct responses. That is, the length of confidence intervals for the data set with the smallest sample size, depicted with dotted lines (n =

29; Dieckmann et al., 1988) is consistently longer than the length of confidence intervals for other data sets. This result shows the lack of precision in population estimates based on the Dieckmann et al. 1988 data, and that there is substantial overlap in the estimates based on Dieckmann et al. and Karlin and Dalley. Therefore, given the lack of precision in the 1988 results and potential differences in sample characteristics of the Dieckmann et al. sample relative to the other samples, subsequent comparisons were restricted to the two most recent data sets (i.e., Sullivan & O'Conor, 2001 and Karlin & Dalley, 1998).

To compare AD knowledge between the remaining samples (Karlin & Dalley, 1998 and Sullivan & O'Conor, 2001), we first considered the overall response levels. Inspection of Figure 1 shows that subjects in the Sullivan and O'Conor sample answered ten out of 18 items correctly at a better-than-chance rate. These are items where the confidence interval excludes a proportion correct of .20. (As participants had five response choices, the probability of guessing the correct response is .20.) Three items (9, 17 & 18) were answered correctly at a high level, defined as correct for approximately 70% of participants. Twelve items were answered at the better-than-chance rate in the 1995 sample. However, in the 1995 sample only one item had a correct response rate around 70%.

A visual inspection of Figure 1 was undertaken to assess the extent of overlap between CIs and facilitate the comparison between the 1995 and 1999 samples. It is important to note that the separate confidence intervals calculated for these samples do not directly estimate population differences. To estimate differences between the 1995 and 1999 groups, 95% confidence intervals for the differences in proportions of correct responses were calculated. Computational details are not provided here, but have been summarised below.

For items in Figure 1 where confidence intervals are clearly overlapping (items 1, 2, 4, 5, 6, 10, 12, 14, 16 & 17), differences in proportion correct are close to zero. Where the confidence intervals are clearly non-overlapping (items 8, 9, 13 & 20) the average difference between the proportion of correct responses was .22. For close or just overlapping confidence intervals (items 3, 7, 15 & 18), the difference between the proportion of correct responses averaged .11. The 95% confidence intervals for the difference between the 1995 and 1999 groups for non-overlapping or close-to-non-overlapping items excluded zero. However, given the large sample sizes involved, we chose to interpret the clearly non-overlapping cases as representing non-trivial differences between the results obtained in 1995 and 1999. That is, we identified non-trivial differences between 1995 and 1999 samples on four out of 18 ADK items.

Two of the four items (9 & 20) for which clear differences were observed, were more likely to be answered correctly by subjects in the Sullivan and O'Conor sample (2001) than those in the sample tested by Karlin and Dalley (1998). For example, for item 9, the 95% confidence interval for the 1995 sample was .44 to .54 compared with .68 to .84 for the 1999 sample. On item 20, the 1999 group responded at a better than chance level, while the 1995 group did not exceed better-than-chance levels. On items 8 and 13 however, the 1995 group answered correctly more often than the 1999 group.

Discussion

The aim of this study was to extend recent comparisons of Alzheimer's disease knowledge in undergraduate university students, using confidence intervals for three ADK studies. Specifically, this study was intended to address two important

limitations of a previous study in this area (Karlin & Dalley, 1998), which involved sample size and sample comparability. Results of this study are discussed in three sections, relating to the appropriateness of the statistical method used by Karlin and Dalley (1998), the meaning of their results when reanalysed using the alternative method we proposed, and the results of our analysis of data from three ADK studies.

To explore the appropriateness of the method used by Karlin and Dalley, and investigate potential sampling variability effects, we used confidence intervals to reanalyse their data. As noted previously, the appropriateness of the correction for sample size used by Karlin and Dalley (1998), depends to a large extent on whether there is reasonable grounds to expect that comparison samples have been drawn from the same population. However, this is not at all apparent from descriptive information provided (see Table 1).

As expected, the results of our analysis showed a strong negative relationship between sample size and the length of confidence intervals associated with the proportion of correct responses on the ADK. That is, the relative length of confidence intervals associated with the Dieckmann et al., 1988 data (n = 29), suggests that Karlin and Dalley's use of these data to estimate expected frequencies for their analysis is problematic. Karlin and Dalley’s (1998) approach therefore fails to acknowledge the great variability in population estimates based on such small samples, and this variability is vividly apparent from the length of the confidence intervals for 1988 data shown in Figure 1.

Based their results, Karlin and Dalley (1998) concluded there was a moderate increase in community awareness about Alzheimer's Disease (i.e., higher ADK scores on 40% of items) from 1988 to 1995. However our reanalysis of this data using a confidence interval approach, shows that confidence intervals for all ADK items from

the 1988 and 1995 overlap (see Figure 1). This suggests there is no difference between these two groups in levels of AD knowledge; a finding that is contrary to speculation about increasing community awareness about AD (Fox, 1989).

In our three-study comparison, confidence intervals were also used to make comparisons between studies. However, these comparisons were primarily limited to comparisons between the two most recent studies, for the reasons mentioned previously (i.e. relatively wide confidence intervals associated with the 1988; the sample characteristics of the 1988 sample were not sufficiently described and appear dissimilar to the other two studies). Limiting comparisons to results from the two most recent studies, and using a conservative criterion to identify non-trivial differences between samples (i.e., average difference between the proportion of correct responses of .22), a mixed pattern of results was found. Specifically, we found convincing evidence of change on 4 out of 18 ADK items, though this change was inconsistent. That is, it appears that the 1999 cohort of uninstructed psychology undergraduate students performed better on two ADK items than the 1995 cohort. However, the 1995 cohort performed better on two ADK items than the 1999 cohort. Items on which the 1999 sample appears to have done better relate to AD symptomatology and support services. Items on which the 1999 sample did worse than the 1995 sample relate to strategies that might be used to manage difficult behaviour (item 13) and differential diagnosis (item 8).

Clearly there is a need for longitudinal studies to monitor the level of community awareness about Alzheimer's disease, and Karlin and Dalley (1998) also made this point. Failing this, cross-sectional studies in which samples are matched as closely as possible on important demographic variables need to be conducted to address the question of how knowledge changes over time. Results of these studies

could be analysed using the confidence interval approach demonstrated in this study, which as noted previously, has the additional benefit that results can be readily incorporated into future meta-analyses. In addition, if further cross-sectional studies are conducted, it may be important to ensure matching on variables that would allow for identification of potential cultural differences, given that samples compared in this study came from North America (Dieckmann et al., 1988; Karlin & Dalley, 1998) and Australia (Sullivan & O'Conor, 2001) respectively, as well as using groups with a wider age range. Future studies are also needed to explore AD knowledge in samples that reflect important target populations, such as older adults and AD carers (Dieckmann et al., 1988).

The results of this study clearly have implications for future public education programs and the management of individual dementia carer education. Overall, there was no change in the number of ADK items answered correctly by participants tested in 1999 and 1995 (around 56% of items), and a mixed pattern of results on items on which non-trivial sample differences were found. Whilst, the 1999 sample showed some increase in AD knowledge (2 items), there is clearly a great deal of room for targeted educational programs. In addition, although ten out of 18 ADK items elicited correct responses at better-than-chance rates in the sample tested most recently (Sullivan & O'Conor, 2001) only three out of 18 items were correctly answered by around 70% of participants. Based on these results, awareness of issues relating to prevalence, aetiology, diagnosis and management remains poor. Importantly, a recent study has demonstrated that this information can be "taught" to subjects (Sullivan & O'Conor, 2001), however retention over a long-term interval has yet to be demonstrated.

This study has also generated much needed Australian normative data on the proportion of correct responses for the ADK. Prior to publication of this paper, there were no Australian normative data for the ADK. The generation of Australian norms data for the ADK should have a number of useful applications. For example, data generated in this study could provide a benchmark for future evaluations of the effectiveness of Australian AD public education campaigns.

In conclusion, this study attempted to address some of the limitations of Karlin and Dalley's research by comparing ADK scores from different samples to assess changes in community awareness about AD. Limitations were addressed by using two approximately matched samples and using a more appropriate statistical method. Even with these improvements however, cautious interpretation of findings is warranted until results are replicated using a longitudinal design. Finally, given the positive benefits of education on levels of depression in AD carers and the positive association between education and quality of care, the need to improve awareness about AD is clear. Although some gains in understanding are apparent, the success of some public education programs, as measured by improved ADK scores, may be less than initially estimated in some areas. These results highlight the continued need for public education interventions, specifically targeting issues of epidemiology and management of problem behaviours associated with AD. Until these programs are developed, individual carers will need to be provided with targeted information that addresses these issues.

References

Cahill, S., & Shapiro, M. (1997). “At first I thought it was age”: Family carers’ recognition and general practitioners diagnosis of dementia. New Doctor, 19-23.

Dieckmann, L., Zarit, S., Zarit, J., & Gatz, M. (1988). The Alzheimer's Disease Knowledge test. The Gerontologist, 28 (3), 402-407.

Graham, C., Ballard, C., & Sham, P. (1997a). Carers' knowledge of dementia and their expressed concerns. International Journal of Geriatric Psychiatry, 12, 470-473.

Graham, C., Ballard, C., & Sham, P. (1997b). Carers' knowledge of dementia, their coping strategies and morbidity. International Journal of Geriatric Psychiatry, 12, 931-936.

Fox, P. (1989). From senility to Alzheimer's disease: The rise of the Alzheimer's disease movement. Millbank Quarterly, 67, 55 - 99.

Hunter, J.E. & Schmidt, F.L. (1990). Methods of meta-analysis : correcting error and bias in research findings. Newbury Park : Sage Publications.

Karlin, N., & Dalley, M. (1998). Alzheimer's disease knowledge: a comparison study. Journal of Clinical Geropsychology, 4 (3), 211-217.

Sullivan, K. A., & O'Conor, F. (2001). Providing education about Alzheimer's disease. Aging and Mental Health, 5 (1), 5-13.

Wilkinson, L. & Task Force on Statistical Inference, APA Board of Scientific Affairs (1999). Statistical Methods in Psychology Journals: Guidelines and Explanations. American Psychologist, 54, 594-604.

Table 1.

Sample characteristics and sample size for ADK comparison studies.

Study	Year data collected	n	Student type	% female	Age**
Sullivan & O'Conor, 2001	1999	100	Psychology u/g*	79	M = 27 (17 - 56)
Karlin & Dalley, 1998	1995	417	Psychology u/g	75	M = 22 (18 - 55)
Dieckmann et al., 1988	1988	29	Gerontology u/g	Not reported	Not reported

Notes: * u/g refers to undergraduate university student.

** Age range shown in brackets.

Table 2.

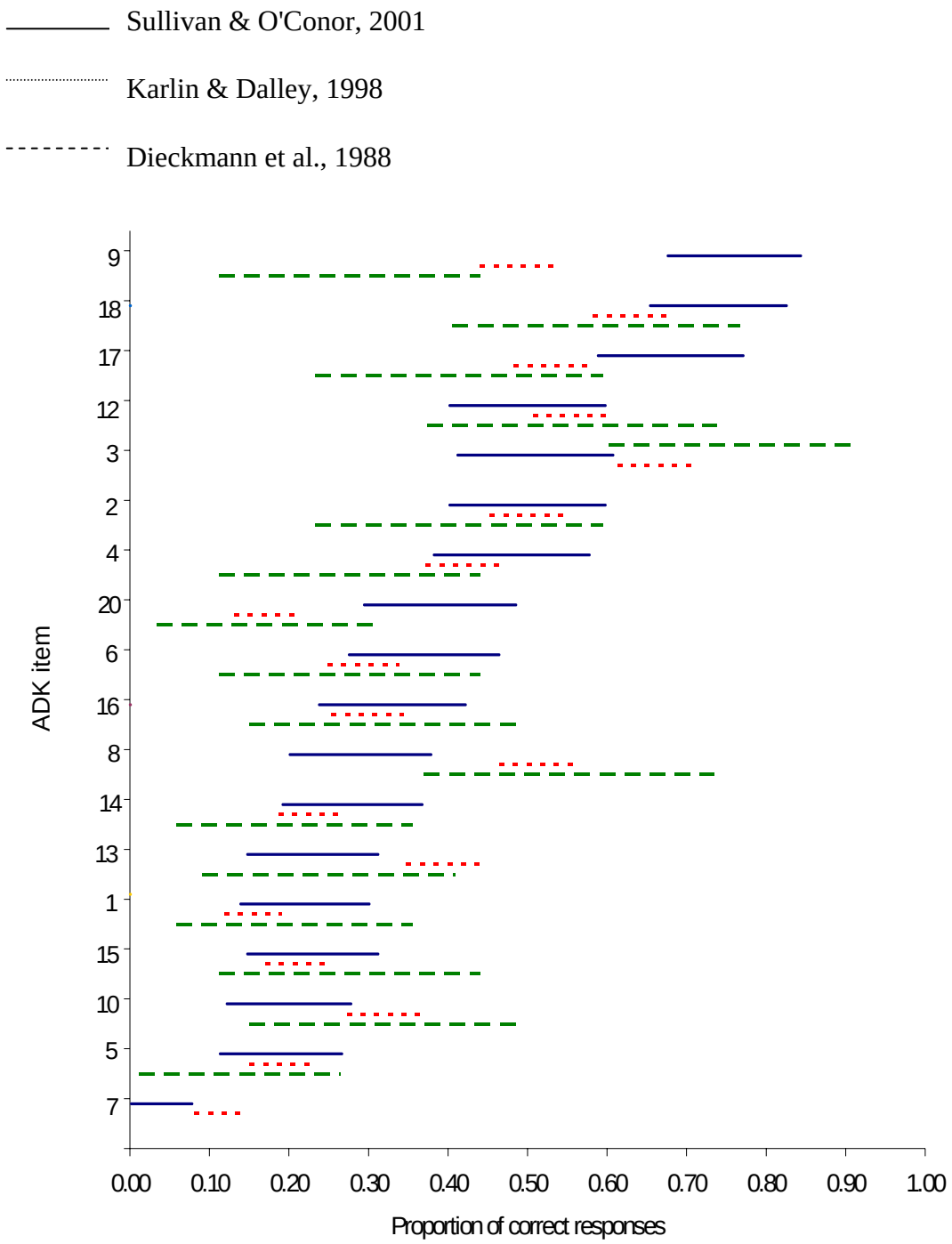
Example of item from Alzheimer's Disease Knowledge Test (ADK; Dieckmann et al., 1988).

10. Although the rate of progression of Alzheimer's disease is variable, the average life expectancy after onset is:

(a) 6 months - 1 year
(b) 1-5 years
(c) 6-12 years
(d) 15-20 years
(e) I don't know

Figure Caption

Figure 1. Ninety-five percent confidence intervals for correct ADK responses from three data sets (solid line = Sullivan & O'Conor, 2001; n = 100; dotted line = Karlin & Dalley, 1998, n = 417; dashed line = Dieckmann et al., 1988, n = 29). ADK items are plotted in order of difficulty, with easier items appearing at the top of the Y-axis. Note, confidence intervals for the Dieckmann et al., 1988 data set are not show for item 7, as there was no variation in responses to this item (all respondents to this item answered incorrectly). Also, there are no data points for items 11 and 19, since data for these items was not collected in all three studies.


Sullivan & O'Conor, 2001
Karlin & Dalley, 1998
Dieckmann et al., 1988
ADK item
9
18
17
12
3
2
4
20
6
16
8
14
13
1
15
10
5
7
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Proportion of correct responses