Findings from the National Memory Screening Day Program

Peter J. Bayley, PhD,[a,b] Jennifer Y. Kong, BA,[a] Marta Mendiondo, PhD,[c] Laura C. Lazzeroni, PhD,[b] Soo Borson, MD,[d,e] Herman Buschke, MD,[f] Margaret Dean, RN,[g,h] Howard Fillit, MD,[i] Lori Frank, PhD,[j] Frederick A. Schmitt, PhD,[c] Susan Peschin, MS,[k,l] Sanford Finkel, MD,[m] Melissa Austen, BS,[l] Carol Steinberg, BA,[l] and John Wesson Ashford, MD, PhD[a,b]

OBJECTIVES: To report experience with a large, nationwide public memory screening program.

DESIGN: Descriptive study of community-dwelling elderly adults.

SETTING: Local community sites (48 sites agreed to provide data) throughout the United States participating in National Memory Screening Day in November 2010.

PARTICIPANTS: Of 4,369 reported participants, 3,064 had complete data records and are included in this report.

MEASUREMENTS: Participants completed a questionnaire that included basic demographic information and a question about subjective memory concerns. Each site selected one of seven validated cognitive screening tests: Mini-Cog, General Practitioner assessment of Cognition, Memory Impairment Screen, Kokmen Short Test of Mental Status, Mini-Mental State Examination, Montreal Cognitive Assessment, Saint Louis University Mental Status Examination.

RESULTS: Overall, 11.7% failed one of the seven screening tests. As expected, failure rates were higher in older and less-educated participants (*P*'s < .05). Subjective memory concerns were associated with a 40% greater failure rate for persons of similar age and education but no memory concerns (odds ratio = 1.4, 95% confidence interval = 1.07–1.78), although only 11.9% of those who reported memory concerns (75% of all participants) had detectible memory problems.

CONCLUSION: Screening for cognitive impairment in community settings yielded results consistent with expected effects of age and education. The event attracted a large proportion of individuals with memory concerns; 88.1% were told that they did not have memory problems detectible with the tests used. Further studies are needed to assess how participants respond to and use screening information, whether this information ultimately influences decision-making or outcomes, and whether memory screening programs outside healthcare settings have public health value. **J Am Geriatr Soc 63:309–314, 2015.**

Key words: memory screening; Alzheimer's disease; dementia; subjective memory

From the [a]War Related Illness and Injury Study Center, Veteran Affairs Palo Alto Health Care System, Palo Alto, California; [b]Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, California; [c]Sanders-Brown Center, University of Kentucky Medical Center, Lexington, Kentucky; [d]Department of Psychiatry and Behavioral Sciences, School of Medicine, University of Washington, Seattle, Washington; [e]Department of Psychosocial and Community Health, School of Nursing, University of Washington, Seattle, Washington; [f]Department of Neurology and Neuroscience, Albert Einstein College of Medicine, Bronx, New York; [g]School of Nursing, Health Sciences Center, Texas Tech University, Lubbock, Texas; [h]Geriatric Division, Department of Internal Medicine, School of Medicine, Texas Tech University, Amarillo, Texas; [i]The Alzheimer's Drug Discovery, New York City, New York; [j]Research Integration and Evaluation, Patient-Centered Outcomes Research Institute, Washington, District of Columbia; [k]Alliance for Aging Research, Washington, District of Columbia; [l]Alzheimer's Foundation of America, New York City, New York; and [m]Council for Jewish Elderly, The Leonard Schanfield Research Institute, Chicago, Illinois.

Address correspondence to Peter J. Bayley, VA Palo Alto Health Care System, 3801 Miranda Avenue (151Y), Palo Alto, CA 94304.
E-mail: Peter.Bayley@va.gov

DOI: 10.1111/jgs.13234

Detecting cognitive impairment is the first step in determining whether an individual needs further assessment for significant memory disorder or dementia. Alzheimer's disease (AD) is by far the most common cause of dementia and accounts for approximately two-thirds of cases.[1] In response to underrecognition of memory problems, dementia, and AD,[2] the Alzheimer's Foundation of America (AFA, a U.S. nonprofit organization) holds an annual National Memory Screening Day (NMSD) each November in collaboration with national and local organizations across the United States. NMSD was developed after an earlier study demonstrated the acceptability of large-scale community memory screening[3] for clinically important cognitive disorders. On NMSD, sites nationwide offer free screenings to the public. The ongoing success of NMSD parallels an increased public awareness of AD and interest in cognitive screening. The recent change to the

0002-8614/15/$15.00

Medicare "Annual Wellness Visit," which since 2011 has included the detection of cognitive impairment, also reflects this interest.

Screening for cognitive impairment and dementia is controversial.[4–8] Validated screening tests for cognitive impairment demonstrate reasonable performance in some studies,[9] yet dementia continues to go unrecognized in clinical settings, where diagnosis and intervention will necessarily begin. Although evidence that early detection improves outcomes on the population level is being developed,[5] its benefits are still contested.[10]

The current study first determined what proportion of participants failed the memory screening test on NMSD. Epidemiological estimates of dementia in elderly populations range from 3% to 14%,[1] but participants in NMSD were self-selected, and it was not clear how screening results would compare with results in epidemiological sample populations.

The relationship between age, education, and performance on the screening tests was then examined. Older age and lower educational attainment are associated with poorer cognitive performance in healthy adults[11] and are risk factors for dementia.[12,13] Finding the expected pattern of results in the data would suggest that the screening process was valid.

Correspondence between subjective memory concerns and test performance was examined next. One of the potential benefits of memory screening is that it provides objective information to people who are worried about their memory. Accordingly, whether subjective memory concerns in this population were related to whether an individual would pass or fail the memory screen was explored.

METHODS

The institutional review board of Stanford University approved data collection.

Participants

Two thousand three hundred thirty-four sites participated in NMSD 2010 (e.g., Alzheimer's agencies, pharmacies, hospitals, community centers), and an estimated 60,000 individuals were screened. Of these sites, 48 agreed to provide data to the AFA and sent information on 4,396 individuals (Table 1). A mean of 55 ± 34 participants were seen at each site (range 5–159). Men were significantly older (Mann–Whitney *U*, $P = .04$) and more educated (Mann-Whitney U, $P < .001$) than women (Table 1).

Materials

On arrival at the screening site, each participant was given a voluntary participant survey (VPS) to complete anonymously. This 29-item questionnaire included questions on demographic characteristics, medical history, reasons for attending the screening, preferences for where to conduct memory screening (e.g., doctor's office, senior center), concerns and beliefs about memory, and their current activities to help reduce the risk of dementia.

Table 1. Demographic Characteristics of Participants

Characteristic	n (%)
Sex	
Male	1,257 (28.8)
Female	3,109 (71.2)
Age	
<35	40 (0.9)
Male	14
35–44	57 (1.3)
Male	20
45–54	190 (4.4)
Male	51
55–64	604 (13.8)
Male	153
65–74	1,330 (30.5)
Male	367
75–84	1,524 (34.9)
Male	464
>85	617 (14.1)
Male	185
Race	
White	3,757 (87.4)
Black	320 (7.4)
Other	221 (5.1)
Hispanic	188 (4.3)
Education	
Elementary	197 (4.5)
High school	1,666 (39.0)
> High School	356 (8.3)
Bachelor's degree	865 (20.2)
Postbachelor's	1,192 (27.9)

Each site used one of eight well-validated dementia screening tests, three of which AFA's Memory Screening Advisory Board identified for use on NMSD (Mini-Cog,[14] General Practitioner assessment of Cognition (GPCOG),[15] and Memory Impairment Screen (MIS)[16]). These tools met the criteria for screening instruments. They were validated; easy to administer; no cost (because of the generous permission of the copyright holders); relatively free of education, race, or cultural bias; and took 5 minutes or less to administer. Sites chose the remaining five most-commonly used screening tests, which included the Kokmen Short Test of Mental Status (STMS),[17] the Mini-Mental State Examination (MMSE),[18] the Montreal Cognitive Assessment (MoCA),[19] and the Saint Louis University Mental Status Examination (SLUMS)[20]on an ad hoc basis (Table 2). A few sites used the clock drawing test,[21] which was excluded from data analysis because of the wide variety of scoring procedures.

After a qualified healthcare professional (e.g., physician, nurse, nurse practitioner, social worker, pharmacist, neurologist, psychologist, geriatrician, physician assistant) administered the screening test, he or she tallied the score and completed the "Letter to Healthcare Professional," which was customized to the individual and included spaces for the name of the participant, the organization that hosted the event, the screening test used, the score, the range of scores that indicates a need for further assessment, and the examiner's name and contact information. The letter was reviewed with the participant, who was asked to give it to his or her healthcare professional at

Table 2. Tests Used on National Memory Screening Day 2010

Test	Participants Tested, n	Score Range	Description	Score
General Practitioner assessment of Cognition[a]	1,396	Stage 1: 0–9 Stage 2: 0–6	Two stages consisting of nine items, including a clock drawing test, followed by six informant items if scores on stage 1 are 5–8	Stage 1: 0–4 Stage 2: 0–3
Mini-Cog[a]	686	0–5	Three-item recall and clock drawing test; scores combined with an algorithm to yield a dementia screen score	0–2
Memory Impairment Screen[a]	249	0–8	Four-item delayed free and cued recall	0–4
Mini-Mental State Examination	452	0–30	17 Items, including orientation, immediate recall, short-term verbal memory, calculation, language, construct ability	<25
Kokmen Short Test of Mental Status	71	0–38	Eight Items: orientation, attention, immediate recall, calculation, abstraction, construction, information, delayed recall	<30
Montreal Cognitive Assessment	201	0–30	30 Items, including visuospatial and executive, naming, memory, attention, language, abstraction, delayed recall, orientation	<26
Saint Louis University Mental Status Examination	9	0–30	11 Items, including orientation, memory, attention, executive function	<21 (high school education)

[a]Screening test suggested by Alzheimer's Foundation of America for use on National Memory Screening Day 2010. Site preference determined which screening test was used.

their next visit. The screener emphasized that the screening was not a clinical evaluation and that the results did not represent a diagnosis.

Procedure

A private room or area was set up for each screener, and testing adhered to a standard format. Each site was responsible for organizing time and location of screenings, selecting qualified healthcare professionals to administer the tests, selecting the screening test, distributing and collecting all required forms, publicizing the event, emphasizing to participants the confidentiality of the screening and that it was not a medical diagnosis, encouraging participants with screening scores below cutoff to follow up with a healthcare professional, and distributing additional educational materials.

RESULTS

Complete screening results were reported from 3,064 participants at 48 reporting sites. After omitting questions that did not necessarily require a response, 36% of participants completed all 29 items on the VPS. The number of missing items varied (mean 1.46 ± 1.82 missing items per participant, range 0–14). An independent-samples *t*-test showed that individuals who failed the screening had significantly more missing items (n = 357, mean 2.30 ± 2.59) than those who passed (n = 2,707, mean 1.38 ± 1.69) ($t(3062) = –8.90$, $P < .001$).

Screening Results

The three tests that the AFA recommended (GPCOG (45%), Mini-Cog (23%), MIS (8% of screenings)) were among the most frequently used screening tests. The remaining screenings used the MMSE (14%), MoCA (7%), STMS (2%), or SLUMS (1%). Overall, 11.7% of participants failed the screening. A one-way analysis of variance revealed no significant difference in failure rates (Mini-Cog (14.7%), STMS (12.7%), MMSE (11.5%), MIS (11.5%), GPCOG (10.7%), MoCA (10.5%), and SLUMS (0.0%)) between the seven screening tests ($F(6,3063) = 1.66$, $P > .05$).

Screening Outcome

The outcome of the screening (pass/fail) was analyzed using logistic regression (Stata version 12, Stata Corp., College Station, TX) with age, education, and subjective memory concerns as predictors. Age was initially entered using seven levels and education with five. Preliminary analyses indicated that screening outcome did not vary significantly between the four youngest age groups (from <35 to 74, $P = .34$) or the three highest levels of education (> high school to graduate degree, $P = .72$), so the five youngest age groups and the three highest education groups were combined. A gradually increasing rate of screening failure was found with increasing age, becoming statistically significant for age groups older than 74 (Figure 1). Screening failure was greater with lower level of education. A significant interaction between age and education was also found ($P = .03$), revealing a proportionally greater negative effect of the combined effect of older age and less education (Figure 1).

Subjective memory concerns were next considered using responses to the VPS question, "Are you concerned about your memory? Y/N." Data for this question were available from 2,772 participants; 2,067 (74.6%) responded that they were concerned, but only 11.9% of these failed the screening. Of the 705 participants who were not concerned about their memory, 8.2% failed the screening. For an individual with memory concerns, the odds of failure was 1.4 times as great as the odds for an individual of the same age and

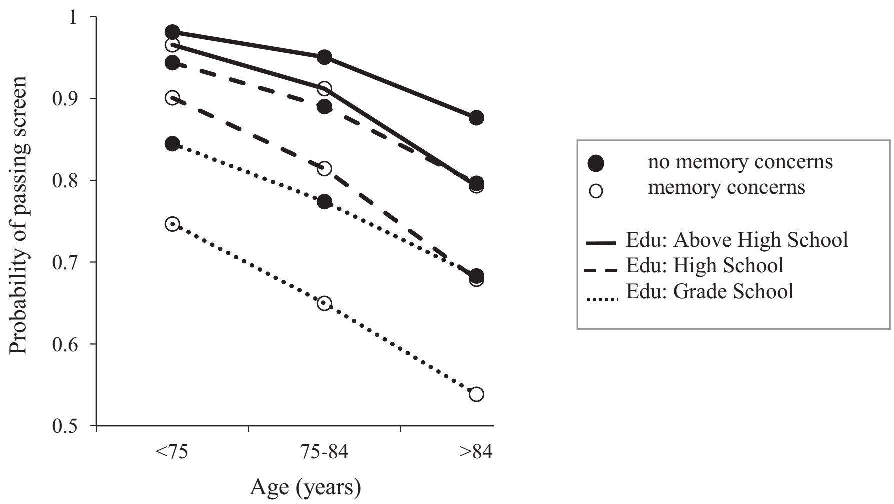

Figure 1. Effects of age, education (Edu), and subjective memory complaints on probability of passing the memory screening test.

educational achievement who lacked such concerns (odds ratio (OR) = 1.4, 95% confidence interval (CI) = 1.07–1.78). Thus, memory concerns added independent information for predicting screening success beyond that from the main and interactive effects of age and education ($P < .001$). No significant interactions were found between memory concerns and age ($P = .79$) or education ($P = .16$).

DISCUSSION

Overall, 11.7% of the sample of 3,064 who were analyzed failed the screening test, indicating that further testing for memory problems was warranted. Data were available for 2,772 participants regarding their memory concerns, and 74.5% expressed concern; 11.9% of these failed the screen. As expected, a gradual increase in screening failure rates was found with increasing age and decreasing educational attainment. Analysis of participants' subjective memory concerns suggested that individuals had some awareness of cognitive impairment independent of age and education, although 65.7% of individuals who expressed concern about their memory passed the screening test, suggesting the participation of substantial numbers of "worried well" or people with cognitive difficulties too mild to detect with the tools used.

The preliminary analysis of missing data addressed the issue of feasibility of collecting data in this setting. Failure to complete the questionnaire was related to cognitive impairment as measured by the screening test. These findings underline the inherent difficulty of using self-report instruments. One solution would be to use computerized data collection. AFA is currently exploring this possibility for future NMSDs, the format of which has not changed substantially since 2010.

There was interest in knowing what proportion of NMSD participants failed the memory screen. Overall screening failure rate was 11.7%. Because the screening cutoff scores were selected to indicate the possibility of dementia, the screening failure rate can be taken as an approximate estimate of dementia prevalence in the sample. Perhaps surprisingly, this failure rate is similar to dementia prevalence rates that epidemiological studies of the U.S. population report (13–14%[1,22]). One of the aims of NMSD is to reach individuals in the community who may have undiagnosed dementia. This could have resulted in a greater frequency of dementia in the sample than found in epidemiological samples, but this was not found. One explanation is that individuals with moderate to severe cognitive impairment had already received a medical diagnosis of dementia and had no need to participate in NMSD. Alternatively, such individuals may not have wanted to take part in screening because they did not wish to be "detected" or because they were unable to remember to attend the program.

To what extent screening outcome (pass/fail) was associated with age and education was next asked. Older age is associated with lower levels of cognitive performance.[23] Age is also the main risk factor for neurodegenerative disorders such as AD that affect cognition, and older age is a major risk factor for progression to dementia.[12] Consistent with these observations, the study found an increase with age in failure on the screening tests that plateaued in individuals younger than 74. Likewise, lower education is associated with worse neuropsychological test performance[11] and greater risk of dementia.[24] Consistent with these observations, a decrease in failure on the memory screen with increasing education was found that plateaued above high school education. The confirmation that age and education influenced the screening outcome in the expected directions suggests that the screening process and testing were valid. Furthermore, the interaction found between age and education suggests that these factors are not entirely independent and may exert a compounding effect on the risk of screen failure.

Subjective memory concerns predicted screening outcome beyond that of age or education. These results are consistent with those of other studies showing that subjective memory concerns are associated with objective cognitive status in early dementia and that healthcare professionals may take them into account in determining whether follow-up is warranted.[25]

These results have several potential limitations. First, because individual consent was not obtained, data were collected anonymously. Birth date was not collected, and age was reported in broad 10-year categories. Second, apart from the data collected on NMSD, no health information was available. It was therefore not possible to confirm participant health status or perform any follow-up. Third, the sample was not randomly selected from the community and may have been biased toward those with memory concerns, memory problems, or both. Bias was also introduced from those who failed screening who were found to have significantly more missing data than those who passed screening.

Taking these limitations into consideration, to improve validity, future events should include input from third-party individuals who are aware of participants' levels of daily function when possible. Longitudinal screening data from successive NMSDs could be collected by assigning unique identification numbers to participants. This would provide a means of tracking decline in scores over time to determine whether screening led to appropriate support, education, or other services and, ultimately, to better health outcomes. Such a tracking system is particularly well suited to computerized testing, which would also help improve data collection rates and test standardization.

The question of screening for memory problems, dementia, and AD has recently become a high-profile controversy, largely as a result of the lack of data demonstrating improvement in outcomes for individuals whose dementia is detected using screening. Although NMSD has no outcome data, most individuals who were concerned about their memories passed the test (54–96%, depending on age and education, Figure 1). As such, the majority of individuals with such concerns were provided with some assurance that their memory difficulties were not of significant concern at the time of taking the test, although further outcome studies, with cost-worthiness analyses,[26] are needed to determine the value of a memory screening program. Medicare now requires "detection of any cognitive impairment" as part of the annual wellness visit. How to operationalize the detection of cognitive impairment is being debated. As such, NMSD provides a useful example of how cognitive screens could be operationalized in a healthcare setting. The choice of specific screening tests would ultimately depend on many factors, including availability of norms and ease of administration.

These results are consistent with expectations for age, education, and subjective memory complaints. The results also support the feasibility of a national-level screening event, although currently available data do not indicate whether this approach, which does not assume follow-up, would be more or less cost-effective than brief evaluation in a clinician's office, where there should be inherently greater likelihood of appropriate follow-up. This needs further research.[5,27] A voluntary screening event may therefore be a viable way to enhance public health through identification of potential cognitive impairment appropriate for subsequent clinical evaluation. Additional studies are urgently needed to determine whether there is a benefit to individuals with positive or negative results in such a program. Furthermore, a broader public health analysis is needed to determine the overall costs and worth of memory screening. Developing screening protocols that give more-precise information, including computerized testing, providing mechanisms for improved communication with clinicians about the memory screening results, establishing recommendations for cost-effective additional clinical evaluations, and confidential means of long-term follow-up of individuals would all be useful directions.

ACKNOWLEDGMENTS

The authors would like to thank the staff and volunteers at each screening site, without whom this event would not be possible, and all of the participants and their families for participating.

This work was supported by the AFA. Major sponsors of NMSD 2010 were Forest Laboratories, Inc. and Novartis Pharmaceuticals.

Conflict of Interest: No conflict of interest is reported. The views expressed in this article are those of Dr. Frank and do not necessarily reflect those of the Patient-Centered Outcomes Research Institute. Peter J. Bayley, Marta Mendiondo, Soo Borson, and Sanford Finkel are members of the AFA Memory Screening Advisory Board. Peter J. Bayley received an honorarium from AFA for participating in a workgroup on screening for cognitive impairment organized by AFA and the America's Drug Discovery Foundation. Lori Frank was employed by MedImmune, LLC/AstraZeneca until January 2012. Frederick A. Schmitt has received funding for research from National Institutes of Health NIH grants. Susan Peschin was Vice President of Public Policy for the AFA from 2007 to 2011. J. Wesson Ashford is a director of the AFA Memory Screening Advisory Board.

Author Contributions: Bayley: statistical analysis, drafting manuscript. Kong: data analysis, drafting manuscript. Mendiondo: data input, data coding, statistical analyses and interpretation. Lazzeroni: data analysis and interpretation. Borson: study concept and design, data interpretation, editing manuscript. Buschke, Dean, Schmitt, Finkel: study design. Frank: study concept and design, editing manuscript. Peschin: provision of details of NMSD procedures. Austen Steinberg: study design, data collection. Ashford: study concept and design, data interpretation, drafting manuscript. All authors read and approved the final manuscript.

Sponsor's Role: None.

REFERENCES

1. Alzheimer's Association. Alzheimer's disease facts and figures. Alzheimers Dement 2010;6:158–194.
2. Ashford J, Borson S, O'Hara R et al. Should older adults be screened for dementia? It is important to screen for evidence of dementia. Alzheimers Dement 2007;3:75–80.
3. Lawrence JM, Davidoff DA, Katt-Lloyd D et al. Is large-scale community memory screening feasible? Experience from a regional memory-screening day. J Am Geriatr Soc 2003;51:1072–1078.
4. Lin JS, O'Connor E, Rossom RC et al. Screening for cognitive impairment in older adults: A systematic review for the U.S. Preventive Services Task Force. Ann Intern Med 2013;159:601–612.
5. Borson S, Frank L, Bayley PJ et al. Improving dementia care: The role of screening and detection of cognitive impairment. Alzheimers Dement 2013;9:151–159.
6. Lundquist TS, Ready RE. Screening for Alzheimer's disease: Inspiration and ideas from breast cancer strategies. J Appl Gerontol 2013;32:1–12.

7. Le Couteur DG, Doust J, Creasey H et al. Political drive to screen for pre-dementia: Not evidence based and ignores the harms of diagnosis. BMJ 2013;347:f5125.
8. Silverberg NB, Ryan LM, Carrillo MC et al. Assessment of cognition in early dementia. Alzheimers Dement 2011;7:e60–e76.
9. Moyer VA. Screening for cognitive impairment in older adults: U.S. Preventive Services Task Force Recommendation Statement. Ann Intern Med 2014;160:791–797.
10. Brayne C, Fox C, Boustani M. Dementia screening in primary care: Is it time? JAMA 2007;298:2409–2411.
11. Ganguli M, Snitz BE, Lee CW et al. Age and education effects and norms on a cognitive test battery from a population-based cohort: The Monongahela-Youghiogheny Healthy Aging Team. Aging Ment Health 2010;14:100–107.
12. Panza F, D'Introno A, Colacicco AM et al. Current epidemiology of mild cognitive impairment and other predementia syndromes. Am J Geriatr Psychiatry 2005;13:633–644.
13. Butler SM, Ashford JW, Snowdon DA. Age, education, and changes in the Mini-Mental State Exam scores of older women: Findings from the Nun Study. J Am Geriatr Soc 1996;44:675–681.
14. Borson S, Scanlan J, Brush M et al. The Mini-Cog: A cognitive 'vital signs' measure for dementia screening in multi-lingual elderly. Int J Geriatr Psychiatry 2000;15:1021–1027.
15. Brodaty H, Pond D, Kemp NM et al. The GPCOG: A new screening test for dementia designed for general practice. J Am Geriatr Soc 2002;50:530–534.
16. Buschke H, Kuslansky G, Katz M et al. Screening for dementia with the memory impairment screen. Neurology 1999;52:231–238.
17. Kokmen E, Naessens JM, Offord KP. A short test of mental status: Description and preliminary results. Mayo Clin Proc 1987;62:281–288.
18. 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;12:189–198.
19. Nasreddine ZS, Phillips NA, Bedirian V et al. The Montreal Cognitive Assessment, MoCA: A brief screening tool for mild cognitive impairment. J Am Geriatr Soc 2005;53:695–699.
20. Tariq SH, Tumosa N, Chibnall JT et al. Comparison of the Saint Louis University Mental Status Examination and the Mini-Mental State Examination for detecting dementia and mild neurocognitive disorder—a pilot study. Am J Geriatr Psychiatry 2006;14:900–910.
21. Sunderland T, Hill JL, Mellow AM et al. Clock drawing in Alzheimer's disease. A novel measure of dementia severity. J Am Geriatr Soc 1989;37:725–729.
22. Plassman BL, Langa KM, Fisher GG et al. Prevalence of cognitive impairment without dementia in the United States. Ann Intern Med 2008;148:427–434.
23. Salthouse TA. When does age-related cognitive decline begin? Neurobiol Aging 2009;30:507–514.
24. Evans DA, Hebert LE, Beckett LA et al. Education and other measures of socioeconomic status and risk of incident Alzheimer disease in a defined population of older persons. Arch Neurol 1997;54:1399–1405.
25. Amariglio RE, Townsend MK, Grodstein F et al. Specific subjective memory complaints in older persons may indicate poor cognitive function. J Am Geriatr Soc 2011;59:1612–1617.
26. Ashford JW. Screening for memory disorder, dementia, and Alzheimer's disease. Aging Health 2008;4:399–432.
27. McCarten RJ, Anderson P, Kuskowski MA et al. Finding dementia in primary care: The results of a clinical demonstration project. J Am Geriatr Soc 2012;60:210–217.