



Archived at the Flinders Academic Commons:

<http://dspace.flinders.edu.au/dspace/>

This is the authors' version of an article published in *Geriatrics & Gerontology International*. The original publication is available by subscription at:

<http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291447-0594>

doi: 10.1111/ggi.12339

Please cite this article as:

Yang, Y., Xiao, L. D., Deng, L., Wang, Y., Li, M. and Ullah, S. (2014), Nurse-led cognitive screening model for older adults in primary care. *Geriatrics & Gerontology International*.

Copyright (2014) Wiley. All rights reserved. **Please note** that any alterations made during the publishing process may not appear in this version.

In addition, authors may also transmit, print and share copies with colleagues, provided that there is no systematic distribution of the submitted version, e.g. posting on a listserve, network or automated delivery.

The title of the paper: A nurse-led cognitive screening model for older adults in primary care

Running title: Cognitive screening in primary care

If you cite this article in your paper, please use the information in the following:

Yang, Y., Xiao, L. D., Deng, L., Wang, Y., Li, M. and Ullah, S. (2014), Nurse-led cognitive screening model for older adults in primary care. *Geriatrics & Gerontology International*. doi: 10.1111/ggi.12339

The full names of the authors: Yanni Yang; Lily Dongxia Xiao; Lanlan Deng; Yanjiang Wang; Min Li; Shahid Ullah

The addresses of the institution: School of Nursing, Third Military Medical University, #30 Gaotanyan Street, Shapingba District, Chongqing, China, 400038.

Corresponding author: Address correspondence to Associate Professor Yang Yanni, Third Military Medical University, School of Nursing, #30 Gaotanyan Street, Shapingba District, Chongqing, China, 400038. +86-23-68752367. Fax: +86-23-68752367. E-mail address: yangyan9787@sina.com

Each author's contribution to the paper: All authors have contributed significantly. Associate Professor Yang as first author and Corresponding author designed and drafted the article; Dr Xiao assisted the development of key concepts of this study. Ms Deng collected, analysed and interpreted data; Dr Xiao, Professor Wang, Professor Li and Dr Ullah revised it for critically important intellectual content. All the authors have reviewed this manuscript and agree with the content.

Lily Dongxia Xiao, School of Nursing & Midwifery, Flinders University, Adelaide, Australia; Yanjiang Wang, Department of Neurology and Center for Clinical Neuroscience, Daping Hospital, Third Military Medical University, Chongqing, China; Min Li, School of Psychology, Third Military Medical University, Chongqing, China; Shahid Ullah, Flinders Centre for Epidemiology and Biostatistics, Faculty of Health Sciences, Flinders University, Adelaide, Australia

A nurse-led cognitive screening model for older adults in primary care

Abstract

Aim: The potential value of enabling health professionals to implement cognitive screenings for older adults with subjective memory complaints in primary care in low- and middle-income countries has remained largely unknown. This study aimed to establish a nurse-led cognitive screening model for community-dwelling older adults with these complaints from seven communities in Chongqing, China and report the findings of this model.

Methods: Screenings took place from July 2012 to June 2013. Cognitive screening was incorporated into the annual health assessment for older adults with subjective memory complaints in a primary care setting. Two community nurses were trained to implement the screening in their daily practice using the Mini-Mental State Examination and Montreal Cognitive Assessment.

Results: Of 733 older adults, 495 (67.5%) reported having subjective memory complaints. Of the 249 individuals who participated in the cognitive screening, 102 (41%) had mild cognitive impairment, while 32 (12.9%) had cognitive impairment. Eighty subjects (78.4%) with mild cognitive impairment agreed to participate in a memory support program. Subjects with cognitive impairment were referred to specialists for further examination and diagnosis; only one reported that he had seen a specialist and had been diagnosed with dementia.

Conclusions: Incorporating cognitive screening into the annual health assessment for older adults with subjective memory complaints was feasible, though referral rates from primary care providers remained unchanged. This study highlights the urgent need for simple screenings as well as community-based support services in primary care for older adults with cognitive or mild cognitive impairments.

Keywords: cognitive impairment; dementia; memory disorders; older adults; primary care

Introduction

Global demographic transitions in low- and middle-income countries (LAMICs) predict an increase in Alzheimer's disease and related disorders among older adults [1]. Early detection and intervention for cognitive impairment (CI) are important to achieve timely diagnosis of dementia, access to dementia services, and improve quality of life for these individuals and their family caregivers [2]. Incorporating cognitive screening into physical assessments for older adults in primary care can also improve general practitioners' (GPs) dementia-care behaviors [3]. However, barriers to screening, including a shortage of GPs, limited resources, and insufficient training [3, 4], might be more prominent in LAMICs where primary healthcare systems are often underdeveloped.

Community Health Services Centers (CHSCs) were initiated in China in 1998 via China's Urban Health Care Reform [5]. CHSCs function as the primary institutions offering basic medical and public health services [5]. A CHSC is comprised of 3–6 stations for every 30,000 to 100,000 residents, depending on the size of a region, with each station serving approximately 10,000 [6]. Although cognitive screening has been an elective item in the annual health checklist for older adults receiving government-funded primary care in China since 2009, it has not been implemented because of the above-mentioned barriers and a lack of awareness of what constitutes early cognitive impairment [5, 6].

In the absence of cognitive screening, encouraging help-seeking among older adults with subjective memory complaints (SMC) is strongly recommended [7]. While the relationship between SMC and current cognitive abilities is weak, SMC is strongly associated with future cognitive decline [8]. Recent studies have linked SMC with brain-imaging evidence, suggesting that people with SMC are at an increased risk of developing dementia [9]. However, studies have shown that older adults with SMC and their physicians often ignore early signs of cognitive decline, viewing these as part of normal aging [2]. Consequently, a window of opportunity for administering effective pharmacological or other interventions to diagnose and treat preventable dementia caused by idiopathic normal pressure hydrocephalus (INPH), infectious disorders, subdural hematoma, or metabolic encephalopathies is lost.

Most studies on community-based cognitive screening in China have focused on the development of screening tools [10, 11]. Little is known about enabling health professionals to implement cognitive screenings or the potential value of primary-care screenings for older adults with SMC in LAMICs. Studies on routine screening in primary care strongly suggest that nurses undertake cognitive screening in these settings [12] and emphasize collaborations between primary-care services and specialists [2]. Positive effects of nurse-led cognitive screenings have been reported in high-income countries [13], but the effects of such screenings in LAMICs need clarifying.

To tackle barriers to the implementation of cognitive screening in primary care, we conducted a study titled “Nurse-led and Community-based Memory Support Program” for older adults with memory complaints. This program included two phases: establishment of cognitive screenings in primary care, and interventions for older adults with mild cognitive impairment (MCI). This article reports on the first phase of

establishing a nurse-led cognitive screening for community-dwelling older adults with SMC.

Methods

Setting and study population

The study was conducted in the Tongjiaqiao CHSC in Chongqing, China. Chongqing has a population of 28.85 million and the proportion of its population aged 60 or over was 17.42% in 2010, the highest among China's 31 regions [14]. Tongjiaqiao CHSC was established in 2010 and provides services to seven communities with a total population of 48,000. This study involved a convenient sample of older adults living in these communities from July 2012 to June 2013, who were recruited as part of a larger study for older adults with SMC. Inclusion criteria were (1) being aged ≥ 60 years, (2) having SMC, (3) being a local permanent resident, and (4) being willing to participate in the study. Exclusion criteria were (1) having severe chronic diseases (e.g., heart or respiratory failure), (2) having enduring mental illness, (3) having diagnosed dementia, and (4) being unable to comply with the assessment. All participants gave their written informed consent. The study was approved by the Medical Ethics Committee of the Third Military Medical University.

Procedure

This study was jointly conducted by the Third Military Medical University and Tongjiaqiao CHSC; furthermore, it was approved and supported by the district health bureau. A multidisciplinary team worked together to discuss the plan and implement the screening process, which included a nursing specialist, nursing researcher, psychologist,

and neuropsychologist from the university, as well as two each of nurses, medical staff, and administrative staff from the CHSC. The nursing specialist and nursing researcher specialized in dementia care designed the screening plan and helped the community staff implement it. The two community health care nurses were trained by the nursing researcher to conduct the cognitive assessments. The three nurses interviewed participants face-to-face in a private room, where distractions could be minimized, to collect basic demographic data (e.g., social demographics, history of diseases, putative associated factors) and conduct the cognitive screening. CHSC staff developed and distributed posters/notices to encourage participation in the cognitive screening, and organized two educational lectures for local residents on the prevention of dementia. All health care professionals involved in the annual health check at the CHSC were encouraged to ask, “Do you think you are suffering from memory impairment in comparison to a year ago?”[15]. Those who answered “yes” were recommended for cognitive screening.

Cognitive assessment

The Chinese version of the Mini-Mental State Examination (MMSE) [16, 17] and Beijing version of the Montreal Cognitive Assessment (MoCA) [11, 18] were combined to screen for MCI and CI [10]. The MMSE has excellent reliability and validity [17, 19], but is insensitive to MCI. The MoCA has also shown good reliability and validity, indicating its suitability for use in our study assessment [11].

CI was identified via the MMSE at education level cutoffs of 17/18 points for illiterate individuals, 20/21 for those with six or fewer years of education, and 24/25 for individuals with more than six years of education. With the cutoffs, the sensitivity and

specificity of the MMSE for dementia were 85.2% and 92.7%, respectively [19]. MCI was identified with the MoCA at education level cutoffs of 13/14, 19/20, and 24/25, respectively. The sensitivity of the MoCA was 83.8% for all cognitive impairments, 80.5% for MCI, and 96.9% for dementia, while its specificity for identifying normal cognition was 82.5% with these cutoffs [11], suggesting its validity as a screening tool for cognitive impairment with our study population.

Assessment training

A previous study reported that research staff without a health care background could administer cognitive assessments after adequate training [20]. Using a slightly revised training method, a nursing researcher who was familiar with the assessments trained two community nurses to administer them. First, a two-hour training session on theoretical knowledge was conducted, including techniques for assessing and interpreting scoring and acceptable responses for the assessments. Thereafter, the two assessments were administered to five participants with MCI. The community nurses observed while the nursing researcher interviewed and assessed the first participant, and then took turns conducting the remaining assessments. All three assessors rated each participant, and were blind to each other's scoring. They then reviewed the scoring and discussed any differences. After the training period, a pilot study to test inter-rater reliability was performed. The sample consisted of seven participants with MCI, who were each rated independently by the three assessors. The nursing researcher observed as the community nurses alternated in conducting the assessments.

Statistical analysis

Analysis was undertaken using SPSS 19.0 (SPSS Inc., Chicago, IL). Continuous variables are presented as mean (SD) and ranges, unless otherwise specified.

Categorical data are presented as absolute values and percentages. To determine if groups had an effect on the participants' characteristics, data were analyzed by ANOVA, with Bonferroni adjustments for multiple comparisons at each time point ($p < 0.05$ was considered significant). Chi-squared tests were used to test for statistical significance of categories, as appropriate.

To determine inter-rater reliability, intra-class correlation coefficients (ICCs) were calculated for scores on the MMSE and MoCA as rated independently by the three nurses. The Landis–Koch [21] classification of ICC values was adopted to rate the level of agreement: 0.00–0.20, slight; 0.21–0.40, fair; 0.41–0.60, moderate; 0.61–0.80, substantial; 0.81–1.00, almost perfect. A negative ICC value indicates that the variation between raters is relatively small as compared with that within raters, thereby confirming a lack of inter-rater reliability.

Multivariate linear regression models were used to assess the strength of relationships between covariates (age, education, marital, and smoking status) and MMSE and MoCA scores. A stepwise procedure was used in the multivariate models.

Results

Inter-rater reliability of assessments

The ICC for independent rater scores on the MMSE and MoCA demonstrated good outcomes (MMSE: ICC = 0.96, 95% confidence interval [CI] = 0.85–0.99; MoCA: ICC = 0.95, 95% CI = 0.82–0.99) (Table 1). The average time they each took to assess a participant was 19.4 ± 1.7 , 20.0 ± 1.8 , and 20.0 ± 1.7 minutes, respectively.

Screening flow and total sample findings

Of the 1,879 participants who completed the health check, only 733 (39%) were asked the SMC question, which elicited such complaints from 495 (67.5%) people (Figure 1). Of 249 participants with SMC who completed the cognitive screening, 239 (96%) did so because of a health care professional's concerns about their memory, while only 10 (4%) were motivated to seek help for SMC by the posters. The average MMSE and MoCA scores were 26.2 ± 3.0 and 22.3 ± 4.2 , respectively. MCI was detected in 102 (41%) participants (80 or 78.4% of whom agreed to attend a memory support program), while cognitive impairment was found in 32 (12.9%), who were then referred to specialists for further examination and diagnosis. However, only one reported that he had seen a specialist and was diagnosed with dementia. Another responded that he could not afford to see a specialist.

Of the 256 (51.7%) with question-elicited SMC who did not complete the cognitive screening, 16 (6.3%) could not because of vision and/or hearing problems, 27 (10.5%) thought it was unnecessary, 37 (14.5%) viewed it as time-consuming, 5 (2%) felt it would not help to improve their memory, 48 (18.8%) chose not to disclose their reason for refusing, and 123 (48%) did not keep their appointments.

Demographics of cognitive screening participants

About 61.8% of these 249 individuals were female (Table 2). The average age was 67.6 years (range: 60–87), and average formal education was 9.2 years (range: 0–19). The majority (84.3%) was married and 91.6% lived with family members.

At least one chronic disease was reported by 158 (63.5%) participants. The most commonly identified were hypertension (47.4%) and diabetes (22.9%), with 53 (21.3%)

participants having more than two diseases. Thirty-seven (14.9%) had a history of brain injury, 10 (4.0%) of stroke or cerebral infarction, and 7 (2.8%) of dementia.

Participant groups differed significantly by age and marital status, but not in other socio-demographic and clinical factors. On average, participants with CI were significantly older than those with normal cognition or MCI ($p < 0.01$). A significantly higher proportion with MCI were widows/widowers compared to those with normal cognition ($p < 0.05$).

Multiple regression analysis

Table 3 highlights the factors that were significantly related to change in MMSE and MoCA scores in stepwise multiple regressions. Only two factors (age, education level) were significantly associated with MMSE scores, whereas four (age, education, marital status, smoking status) with MoCA scores.

Discussion

Cognitive screening in primary care enables early diagnosis of dementia, but its practicality, especially with cognitively impaired individuals in LAMICs, remains controversial [4, 22]. The feasibility of incorporating cognitive screening into annual health assessments for older adults in primary care was verified in this study. The findings also indicated that as members of a multidisciplinary team, nurses can contribute to early detection of dementia in primary care settings serving large populations and with limited resources in LAMICs, as in resource-rich high-income countries with less dense populations [12]. However, cognitive screening alone might be insufficient, due to underdeveloped dementia care services in the public health care

systems of LAMICs. The low adherence to referrals (only one participant) and high adherence to memory support (78.4% of participants with MCI) in our study revealed the urgent need for such care. In China, financial burden is still a major concern for individuals with memory loss to seek medical diagnosis and treatment in China [23]. Low adherence to referrals may indicate the inability to afford getting a diagnosis. As the ultimate goal of the screening is to provide timely diagnoses and interventions, supporting these with cognitive decline to access specialists for differential diagnosis and treatment is far more important. This has been incorporated into our phase two study by the means of building collaborations between primary care and specialist services in dementia care.

Although they were all encouraged to do so, the health care professionals in our study asked only 39% of patients the SMC question. Only 10 individuals sought further help for their SMC, and 51.7% with SMC chose not to attend our screening. This indicated a low concern among older adults as well as health care professionals regarding memory problems. Three possible explanations for this include (1) lay people's and health care professionals' false beliefs that nothing can be done for people with dementia, even when some forms are preventable and treatable, could be a main factor preventing people from seeking formal medical help [25]; (2) low public awareness of dementia and its contributors [25, 26]—Sheng et al. (2008) noted most dementia patients in Hong Kong sought medical attention at a late stage; and (3) stigma attached to dementia [25]—Begum et al. [27] argued that people were more likely to seek help if they did not view presenting their complaints to their GP negatively and believed their problem had a biomedical cause.

Because of the general low concern about memory problems, our pilot study suggests that education and training in dementia care for health professionals in primary care settings are imperative, so they can take more proactive approaches toward memory screening when conducting annual health assessments for older adults. Their commitment to patient education on dementia could be strengthened, thereby improving help-seeking behaviors in individuals with SMC.

The screening identified demographic risk factors for cognitive impairment in a small convenience sample. Research has identified modifiable risk factors for dementia (e.g., physical inactivity, smoking, alcohol addiction). Risk factors for vascular disorders have also been found to contribute toward Alzheimer's [28]. Therefore, early detection might lead to greater awareness of risk factors for cognitive impairment and enable early intervention for these factors. Although the average age was lower than 70 in our study, 63.8% had at least one chronic disease that could lead to the development of dementia. This finding highlights the importance of strengthening primary-care competence in recognizing and managing memory disorders. Regular cognitive assessment along with compliance with treatment regimens may delay the onset of vascular dementia.

The groups differed significantly in terms of age and marital status might be explained by the small convenience sample, an early stage of cognitive impairment, and/or the relatively young average age of the sample. Deng et al. [29] (2012) found that the death of a spouse was significantly associated with a higher risk of cognitive impairment. Findings from our study confirmed the previous studies evidenced by the higher proportion of people with CI among the widow/widower group .

We found that 41% of participants screened positively for MCI and 12.9% for CI, considerably higher than previously reported prevalence rates (e.g., 20.1% in a population-based study, utilizing the education level MoCA cutoffs [11]; a 7.0% CI rate in another, with the education level MMSE cutoffs [30]). This finding implies greater prevalence of MCI and CI among older Chinese adults with SMC than among those without.

This research had several limitations. First, the findings were restricted to one CHSC and a convenience sample, and thus may be less applicable to other countries or dependent older adults. Second, as part of a larger study, all the participants were screened using both the MMSE and MoCA, when in fact it is not necessary to use the MoCA for those whose MMSE scores are abnormal. This may have had an impact on screening efficiency. Third, although we developed a multidisciplinary team to implement the screening process, the lack of sufficient funding precluded the use of formal neuropsychological tests to diagnose dementia and MCI. In addition, we were unable to differentiate other mental disorders such as depression or mental developmental retardation from cognitive impairment in the screening phase. In the phase two, interventions for older adults with mild cognitive impairment (MCI), we have incorporated differential diagnoses in practice. For example, we have used the Geriatric Depression Scale Short-Form (GDS-15) to differentiate depression from cognitive impairment that will be reported in another paper.

Conclusion

Although it did not cover all the older adults served by the CHSC, results showed that this cognitive screening model was feasible and accepted by both the

CHSC and participants. This marks an important first step in heightening public awareness of dementia and CI, which is crucial for early diagnosis and management. This study also confirmed that it was possible to develop acceptable, practical, and cost-effective cognitive screenings at the primary-care level.

Acknowledgements

The study was funded by Shapingba District Health Bureau, Chongqing Municipal Government in China (project No. 201201). The authors would like to thank Tao Hui and Wu Kaiping at Shapingba District Health Bureau, Chongqing and Li Jie, Cao Jinyu, Qian Chunmei at Tongjiaqiao CHSC, Chongqing for assisting in the program. The study was also supported by a grant from the State Scholarship Fund of China Scholarship Council.

Disclosure statement

All of the authors declare no financial or other potential conflict of interest.

References

1. Llibre Rodriguez JJ, Ferri CP, Acosta D, et al. Prevalence of dementia in Latin America, India, and China: A population-based cross-sectional survey. *Lancet* 2008; 372: 464-474.
2. Alzheimer's Disease International. World Alzheimer Report 2011: The benefits of early diagnosis and intervention [monograph on the Internet]. London: Alzheimer's Disease International; 2011 [cited 2012 May 16]. Available from: <http://www.alz.co.uk/research/WorldAlzheimerReport2011.pdf>.
3. Borson S, Scanlan J, Hummel J, Gibbs K, Lessig M, Zuhr E. Implementing Routine Cognitive Screening of Older Adults in Primary Care: Process and Impact on Physician Behavior. *J Gen Intern Med* 2007; 22: 811-817.
4. Iracleous P, Nie J X, Tracy C S, et al. Primary care physicians' attitudes towards cognitive screening: Findings from a national postal survey. *Int J Geriatr Psychiatry* 2010; 25: 23-29.
5. Pan X, Dib H H, Wang X, Zhang H. Service utilization in community health centers in China: A comparison analysis with local hospitals. *BMC Health Serv Res* 2006; 6: 93.
6. Yang J, Guo A, Wang Y, et al. Human resource staffing and service functions of community health services organizations in China. *Ann Fam Med* 2008; 6: 421-427.
7. Department of Health of UK. Living well with dementia: a national dementia strategy,

- Department of Health of UK, 2009.
8. Reid L M, MacLulich A M J. Subjective Memory Complaints and Cognitive Impairment in Older People. *Dement Geriatr Cogn Disord* 2006; 22: 471-485.
 9. Merrill D A, Siddarth P, Saito N Y, et al. Self-reported memory impairment and brain PET of amyloid and tau in middle-aged and older adults without dementia. *Int Psychogeriatr* 2012; 24: 1076-1084.
 10. Cao L, Hai S, Lin X, et al. Comparison of the Saint Louis University Mental Status Examination, the Mini-Mental State Examination, and the Montreal Cognitive Assessment in Detection of Cognitive Impairment in Chinese Elderly from the Geriatric Department. *J Am Med Dir Assoc* 2012; 13: 626-629.
 11. Lu J, Li D, Li F, et al. Montreal cognitive assessment in detecting cognitive impairment in Chinese elderly individuals: A population-based study. *J Geriatr Psychiatry Neurol* 2012; 24: 184-190.
 12. Lee L, Hillier L M, Stolee P, et al. Enhancing dementia care: A primary care-based memory clinic. *J Am Geriatr Soc* 2010; 58: 2197-2204.
 13. Elliott A F, Horgas A L, Marsiske M. Nurses' role in identifying mild cognitive impairment in older adults. *Geriatr Nurs* 2008; 29: 38-47.
 14. National Bureau of Statistics of China. Tabulation on the 2010 population census of the People Republic of China, National Bureau of Statistics of China, 2012.
 15. Park M H, Min J Y, Min H Y, Lee H J, Lee D H, Song M S. Subjective memory complaints and clinical characteristics in elderly Koreans: A questionnaire survey. *Int J Nurs Stud* 2007; 44: 1400-1405.
 16. Folstein M F, Folstein S E, McHugh P R. "Mini-Mental State": A practical method for grading the cognitive state of patients for the clinician. *J Psychiatric Research* 1975; 12: 189-198.
 17. Katzan R, Zhang M, Ouang-Ya-Qu, et al. A Chinese version of the mini-mental state examination: Impact of illiteracy in a Shanghai dementia survey. *J Clin Epidemiol* 1988; 41: 971-978.
 18. Nasreddine Z S, Phillips N A, Be'dirian V, et al. The Montreal Cognitive Assessment, MoCA: A brief screening tool for mild cognitive impairment. *J Am Geriatr Soc* 2005; 53: 695-699.
 19. Zhang M, Katzman R, Salmon D, et al. The prevalence of dementia and Alzheimer's disease in Shanghai, China: impact of age, gender, and education. *Ann Neurol* 1990; 27: 428-437.
 20. Edwards M, Feighther J, Goldsmith C H. Inter-rater reliability of assessments administered by individuals with and without a background in health care. *Occup Ther J Res* 1995; 15: 103-110.
 21. Landis J R, Koch G G. The measurement of observer agreement for categorical data. *Biometrics* 1977; 33: 159-174.
 22. Ashford J W, Borson S, O'Hara R, et al. Should older adults be screened for dementia? It is important to screen for evidence of dementia! *Alzheimer's & Dementia* 2007; 3: 75-80.
 23. Wang J, Xiao L D, He G P, De Bellis A. Family caregiver challenges in dementia care in a country with undeveloped dementia services. *Journal of advanced nursing* 2013; doi: 10.1111/jan.12299.
 24. Xiao L D, Wang J, He G-P, Bellis A D, Verbeeck J, Kyriazopoulos H. Family caregiver challenges in dementia care in Australia and China: a critical perspective. *BMC Geriatr* 2014; doi: 10.1186/1471-2318-14-6.
 25. Alzheimer's Disease International. World Alzheimer Report 2012: Overcoming the stigma of dementia [monograph on the Internet]. London: Alzheimer's Disease International; 2012 [cited 2013 Jun 12]. Available from: http://www.alz.org/documents_custom/world_report_2012_final.pdf.
 26. Sheng B, Law C B, Yeung K M. Characteristics and diagnostic profile of patients seeking dementia care in a memory clinic in Hong Kong. *Int Psychogeriatr* 2008; 21: 392-400.
 27. Begum A, Whitley R, Banerjee S, Matthews D, Stewart R, Morgan C. Help-seeking response to subjective memory complaints in older adults: Toward a conceptual model. *Gerontologist* 2012; 53: 462-473.
 28. Luchsinger J A, Reitz C, Honig L S, Tang M-X, Shea S, Mayeux R. Aggregation of vascular risk factors and risk of incident Alzheimer disease. *Neurology* 2005; 65: 545-551.
 29. Deng J, Lian Y, Shen C, et al. Adverse life event and risk of cognitive impairment: a 5-year prospective longitudinal study in Chongqing, China. *Eur J Neurol* 2012; 19: 631-637.
 30. Cui G H, Yao Y H, Xu R F, et al. Cognitive impairment using education-based cutoff points for CMMSE scores in elderly Chinese people of agricultural and rural Shanghai China. *Acta Neurol*

Scand 2011; 124: 361-367.

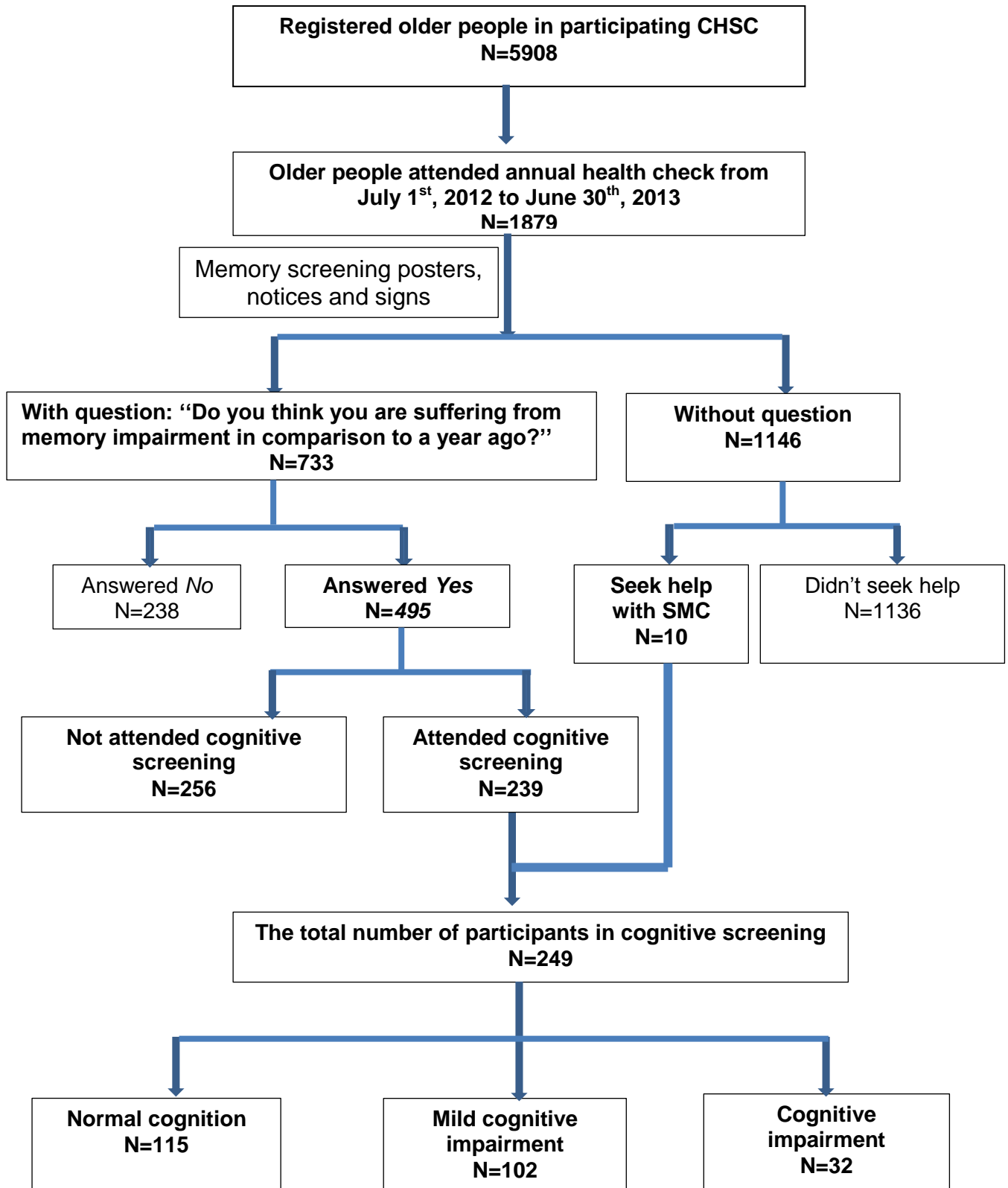


Figure 1 Cognitive screen flow chart

Table 1 Intra-rater reliability for independence score on MMSE and MoCA

Assessment	Rater	Mean \pm SD	ICC single	95% CI
MMSE	1	25.00 \pm 2.83	0.96	0.85,0.99
	2	25.43 \pm 3.16		
	3	24.86 \pm 3.08		
MoCA	1	20.43 \pm 3.69	0.95	0.82,0.99
	2	20.29 \pm 4.15		
	3	21.00 \pm 3.56		

MMSE=Mini-Mental State Examination; MoCA= Montreal Cognitive Assessment

Table 2 Demographic characteristics of the participants in cognitive screening (n=249)

Variable	Full sample (n=249)	Mean (SD) or N (% of total)			Statistic	P
		Normal (n=115)	MCI (n=102)	CI (n=32)		
Age ^a	67.59±5.96	66.35±5.47	67.63±5.93	72.97±5.83	F=12.14	.000*
Years of education	9.15±4.06	9.22±3.82	9.24±3.97	8.56±5.11	F=0.377	.686
Gender						
Male	95(38.2)	46(40.0)	37(36.3)	12(37.5)	$\chi^2=0.325$	.850
Female	154(61.8)	69(60.0)	65(63.7)	20(62.5)		
Unmarried ^b					$\chi^2=8.118$	.017*
No	210(84.3)	105(91.3)	79(77.5)	26(81.3)		
Yes	39(15.7)	10(8.7)	23(22.5)	6(18.8)		
Live alone					$\chi^2=1.587$	.452
No	228(91.6)	108(93.9)	91(89.2)	29(90.6)		
Yes	21(8.4)	7(6.1)	11(10.8)	3(9.4)		
Physical inactivity ^c					$\chi^2=0.982$	.612
No	194(77.9)	92(80.0)	79(77.5)	23(71.9)		
Yes	55(22.1)	23(20.0)	23(22.5)	9 (28.1)		
Smoking ^d					$\chi^2=0.259$	.879
No	187(75.1)	88(76.5)	75(73.5)	24 (75.0)		
Yes	62(24.9)	27(23.5)	27(26.5)	8(25.0)		
Drinking alcohol ^e					$\chi^2=0.14$	.932
No	221(88.8)	102(88.7)	90(88.2)	29(90.6)		
Yes	28(11.2)	13(11.3)	12(11.8)	3(9.4)		
Diabetes mellitus					$\chi^2=4.578$	.101
No	192(77.1)	90(78.3)	82(80.4)	20(62.5)		
Yes	57(22.9)	25(21.7)	20(19.6)	12(37.5)		

Hypertension					$\chi^2=0.501$	.778
No	131(52.6)	61(53.0)	55(53.9)	15(46.7)		
Yes	118(47.4)	54(47.0)	47(46.1)	17(53.1)		
Heart disease					$\chi^2=0.04$	.98
No	216(86.7)	100(87)	88(86.3)	28(87.5)		
Yes	33(13.3)	15(13)	14(13.7)	4(12.5)		
History of brain injury					$\chi^2=0.738$	.692
No	212(85.1)	100(87.0)	86(84.3)	26(81.3)		
Yes	37(14.9)	15(13.0)	16(15.7)	6(18.8)		

Notes: MCI: screened positive for mild cognitive impairment; CI: screened positive for cognitive impairment.

^aPost hoc Bonferroni test indicate dementia group significantly different from other 2 groups (CI > Normal and MCI, $p < 0.01$)

^bPost hoc Bonferroni test indicate dementia group significantly different between Normal and MCI groups

^cPhysical inactivity: physical activities < 2 time/ week and < 30 minutes/time = Yes

^dSmoking: > 5 cigarettes/day and > 5 years = Yes

^eDrinking alcohol : > 2 times/week and > 5 year = Yes

* $p < 0.05$

Table 3 Factors associated with MMSE and MoCA score in stepwise multiple regression

	MMSE scores			MoCA scores		
	Standardized β	95%CI	P	Standardized β	95%CI	P
Age	-0.368	-0.240,-0.133	<0.001	-0.326	-0.297,-0.159	<0.001
Education	0.420	0.233,0.392	<0.001	0.57	0.49,0.682	<0.001
Unmarried		—		-0.135	-2.684,-0.396	<0.01
Smoking ^a		—		-0.106	-1.926,-0.105	0.03
Adjusted R-square		0.281			0.457	

Notes: only significant variable are reported; MMSE, Mini-Mental State Examination; MoCA, Montreal Cognitive Assessment

^aSmoking: >5 cigarettes/day and >5 years