COSMIC (Cohort Studies of Memory in an International Consortium): An international consortium to identify risk and protective factors and biomarkers of cognitive ageing and dementia in diverse ethnic and sociocultural groups

Perminder S Sachdev1,2*, Darren M Lipnicki1, Nicole A Kochan1, John D Crawford1, Kenneth Rockwood3, Shifu Xiao4, Juan Li5, Xia Li6, Carol Brayne7, Fiona E Matthews7, Blossom CM Stephan8, Richard B Lipton9,10, Mindy J Katz9, Karen Ritchie11,12,13, Isabelle Carrière11,12, Marie-Laure Ancelin11,12, Sudha Seshadri14, Rhoda Au14, Alexa S Beiser15, Linda CW Lam16, Candy HY Wong17, Ada WT Fung16, Ki Woong Kim18,19,20, Ji Won Han18, Tae Hui Kim18, Ronald C Petersen21, Rosebud O Roberts21, Michelle M Mielke21, Mary Ganguli22,23,24, Hiroko H Dodge25,26, Tiffany Hughes22,26, Karin J Anstey27, Nicolas Cherbuin27, Peter Butterworth27, Tze Pin Ng28, Qi Gao28, Simone Reppermund1, Henry Brodaty1,2, Kenichi Meguro29, Nicole Schupf30,31,32, Jennifer Manly30,31,33, Yaakov Stern30,31,33, Antonio Lobo34,35,36, Raúl Lopez-Antón35,37, Javier Santabárbara35,38 for COSMIC

Abstract

**Background:** A large number of longitudinal studies of population-based ageing cohorts are in progress internationally, but the insights from these studies into the risk and protective factors for cognitive ageing and conditions like mild cognitive impairment and dementia have been inconsistent. Some of the problems confounding this research can be reduced by harmonising and pooling data across studies. COSMIC (Cohort Studies of Memory in an International Consortium) aims to harmonise data from international cohort studies of cognitive ageing, in order to better understand the determinants of cognitive ageing and neurocognitive disorders.

**Methods/Design:** Longitudinal studies of cognitive ageing and dementia with at least 500 individuals aged 60 years or over are eligible and invited to be members of COSMIC. There are currently 17 member studies, from regions that include Asia, Australia, Europe, and North America. A Research Steering Committee has been established, two meetings of study leaders held, and a website developed. The initial attempts at harmonising key variables like neuropsychological test scores are in progress.

(Continued on next page)
Discussion: The challenges of international consortia like COSMIC include efficient communication among members, extended use of resources, and data harmonisation. Successful harmonisation will facilitate projects investigating rates of cognitive decline, risk and protective factors for mild cognitive impairment, and biomarkers of mild cognitive impairment and dementia. Extended implications of COSMIC could include standardised ways of collecting and reporting data, and a rich cognitive ageing database being made available to other researchers. COSMIC could potentially transform our understanding of the epidemiology of cognitive ageing, and have a world-wide impact on promoting successful ageing.

Keywords: Cohort studies, Cognitive ageing, Data harmonisation, Dementia, International consortium, Mild cognitive impairment

Background
The ageing of our populations, with the increasing prevalence of physical and cognitive disorders associated with age, poses a major burden on society [1]. Making an impact on this disability burden requires an understanding of the risk and protective factors for age-related cognitive decline, frailty and chronic disease. The optimal approach to study this involves the longitudinal examination of population-based ageing cohorts. There are many such studies currently ongoing internationally, but there is considerable inconsistency in the results produced [2] and further systematic examination of the existing evidence is required to determine findings which are robust.

Some of the variation in prevalence rates and risk factors identified across studies may be associated with regional and/or ethnic differences. For example, rates of non-amnestic mild cognitive impairment (MCI) are reported to be higher in blacks than whites from a similar geographical location, even when controlling for sex and education [3]. However, a significant proportion of the variance between studies is likely attributable to differences in methodology, including differences in the assessment tools and performance criteria used for diagnosing cognitive disorders. Indeed, small but theoretically valid changes to how objective cognitive impairment was operationally defined led to greatly elevated prevalence rates, from 4% to 70% [4]. Similarly, using different criteria for the diagnosis of dementia can result in vastly different prevalence figures [5].

There are a number of approaches for overcoming methodological differences and other sources of heterogeneity so that studies can be more accurately compared and true differences identified. These include the use of standardised protocols, meta-analysis, and harmonisation of data [6]. The use of standardised or even similar protocols is a rare feature of existing collaborations (the 10/66 Dementia Research Group is one exception [7]), and meta-analysis is limited to published results. In contrast, data harmonisation offers the potential to explore both existing and novel research questions by a cost-effective use of previously-collected data.

Harmonising data across studies to create a single, large database helps to minimise the influence of both study-level (e.g., methodology) and individual level (e.g., demographic) factors, while also enabling these to be explored as potential contributors to differences in results [8,9]. Other advantages include increased statistical power for detecting effects, and the inherent replication and enhanced generalisability associated with using heterogeneous samples and methodologies [8].

COSMIC (Cohort Studies of Memory in an International Consortium) is a recently established endeavour that aims to bring together cohort studies of cognitive ageing internationally in order to facilitate a better understanding of the determinants of cognitive ageing and neurocognitive disorders. The two main objectives of this project are to:

1. Harmonise shared, non-identifiable data from cohort studies that longitudinally examine change in cognitive function and the development of dementia in older individuals (60+ years).
2. Perform joint or mega-analyses using combined, harmonised data sets that yield collated results with enhanced statistical power, in addition to comparisons across geographical regions, ethnicities and sociocultural groups.

Other collaborations bringing together cohort studies of ageing include the genetics-focused CHARGE (Cohorts for Heart and Aging Research in Genomic Epidemiology) [10] and ENIGMA (Enhancing NeuroImaging Genetics through Meta-Analysis) [11]. Consortia with a particular interest in cognitive ageing include the UK-based HALCyon (Healthy Ageing across the Life Course) [12], the primarily Europe-based CHANCES (Consortium on Health and Ageing: Network of Cohorts in Europe and the United States) [13], the Australian-based DYNOPTA (Dynamic Analyses to Optimise Ageing) [14], and the IALSA (Integrative Analysis of Longitudinal Studies on Aging) network [15], which has member studies from Europe, North America and Australia. None of these consortia have any studies from Asia, where the current and
future number of people with dementia is estimated to be greater than that of Europe and the Americas combined [1]. COSMIC hopes to distinguish itself by being a truly international effort comprising studies with a clinical and biomedical focus from Asia, Europe, the Americas, and Oceania. COSMIC was established in 2012, with progress reported in 2013 [16].

**Methods/design**

**Membership**

Studies are eligible to participate in COSMIC if they meet the following membership criteria:

1. Are epidemiological, and therefore population-based.
2. Have a minimum sample size of 500.
3. Examine individuals aged 60 years and over.
4. Are longitudinal, with a minimum of two assessments.
5. Include assessment of cognitive function as an important, if not central, objective.
6. The outcome measures include dementia and/or cognitive impairment and/or cognitive decline.

Official enrolment in COSMIC involves a lead investigator having signed a memorandum of understanding that entails a willingness to share non-identifiable raw and/or processed data for joint or mega-analyses. Studies that, for institutional or other reasons, are unable to provide raw and/or processed data may participate in COSMIC as provisional members, if willing to provide results of in-house analyses conducted using COSMIC protocols. At the time of writing there are 14 officially enrolled and 3 provisional members of COSMIC. These studies, and their key demographic characteristics, are shown in Table 1. It is intended that the overall sample size and range of geographical regions and ethnicities represented be extended even further, and thus we ask that any study meeting the eligibility criteria consider contacting us to become a member of COSMIC. Studies from Africa, South America and Eastern Europe are particularly encouraged to join.

**Organisation**

COSMIC has a Research Steering Committee comprising one representative from each participating study, generally the lead investigator or a delegate. The primary functions of the Research Steering Committee are:

1. To develop guidelines for the inclusion and exclusion of studies.
2. To provide rules of participation and guidelines for the roles and responsibilities of the participating studies.
3. To approve Workgroups.
4. To select topics of interest.
5. To provide overall analytic strategies.
6. To develop rules for publication, including authorship.
7. To develop rules for the protection of intellectual property, when relevant.
8. To seek funds to support COSMIC.

**Meetings**

An initial meeting of many (now member) study leaders on July 16, 2012 in Vancouver supported the official establishment of COSMIC. Potential projects, both initial and more long-term, and the steps needed to progress these were among the topics discussed. A subsequent meeting comprising many of the Research Steering Committee members was held on July 15, 2013 in Boston.

**Website**

A website has been established that contains a description of COSMIC and summaries of the member studies (http://www.cheba.unsw.edu.au/group/cosmic). This website is intended to serve as an avenue for presenting and preserving COSMIC project protocols and results, and will potentially house data restricted by password to COSMIC members. The Sydney team are currently responsible for the development and maintenance of the COSMIC website.

**Ethics**

The overall COSMIC project has been approved by the Human Research Ethics Committee of the University of New South Wales, Sydney. Member studies are responsible for obtaining approval (if considered necessary) from their local institutional review board for the sharing of data. However, de-identified data are not considered Protected Health information by the National Institute of Health of the USA. A protocol for the de-identification of data has been developed.

**Discussion**

**Challenges**

General challenges facing large, international consortia have been previously described (e.g., by CHARGE [10]). These include a potential need for additional funding to prolong the use of study data beyond initial anticipations, and timely and effective communication among members across different countries.

More specific to COSMIC are challenges associated with harmonisation, many of which have also been previously described [9,35]. The major challenge of harmonisation stems from differences between studies in the measurement instruments used and/or differences in how questions from similar instruments are worded and responses provided and categorised, including the effect of language and culture. Attempts to maximise the number of studies...
### Table 1 COSMIC member studies

| Study                                                  | Country      | Sample size | Age range | Males (%) | Main races/ethnicities       | Start and end date   | Key reference(s)                                                                 |
|--------------------------------------------------------|--------------|-------------|-----------|-----------|------------------------------|----------------------|--------------------------------------------------------------------------------|
| Canadian Study of Health and Aging (CSHA)              | Canada       | 10263       | 65-102    | 43        | Caucasian                    | 1991-2002            | CSHA Working Group (1994) [17]                                                  |
| Chinese Longitudinal Ageing Study (CLAS)*              | China        | 3514        | 60+       | 44        | Chinese                      | 2010-                | Xiao et al. (2013) [18]                                                        |
| Cognitive Function and Ageing Studies (CFAS)*†         | UK           | 13004       | 65+       | 40        | Caucasian                    | 1991-                | Brayne et al. (2006) [19]                                                      |
| Einstein Aging Study (EAS)*†                           | USA          | 1956        | 66-104    | 39        | Caucasian/African American   | 1993-                | Katz et al. (2012) [3]                                                        |
| Etude Santé Psychologique Prévalence Risques et Traitement (ESPRIT)* | France       | 2268        | 65+       | 42        | Not recorded                 | 1999-                | Ritchie et al. (2010) [20]                                                     |
| Framingham Heart Study (FHS)*†                         | USA          | 15328†      | 5+        | 50        | Caucasian                    | 1948-                | Dawber & Kannel (1958) [21]; Feinleib et al. (1975) [22]; Splansky et al. (2007) [23] |
| Hong Kong Memory and Ageing Prospective Study (HK-MAPS)*| Hong Kong    | 787         | 60+       | 46        | Chinese                      | 2005-                | Wong et al. (2013) [24]                                                        |
| Korean Longitudinal Study on Cognitive Aging and Dementia (KLOSCAD) | South Korea | 6479        | 60+       | 44        | Korean                       | 2009-                | Kim et al. (2013) [25]                                                        |
| Mayo Clinic Study of Aging (MCSA)*†                    | USA          | 4000        | 50-89     | 50        | Caucasian                    | 2004-                | Roberts et al. (2008) [26]                                                     |
| Monongahela Valley Independent Elders Survey (MoVIES)*† | USA          | 1681        | 65+       | 42        | Caucasian                    | 1987-2002            | Ganguli et al. (2000) [27]                                                     |
| Personality and Total Health (PATH) Through Life Project† | Australia  | 2551        | 60-64     | 52        | Caucasian                    | 2001-                | Anstey et al. (2012) [28]                                                      |
| Singapore Longitudinal Ageing Studies (SLAS) I and II†  | Singapore    | 5748        | 54-98     | 37        | Chinese                      | 2003-                | Feng et al. (2010, 2013) [29,30]                                               |
| Sydney Memory and Ageing Study (Sydney MAS)*†          | Australia    | 1037        | 70+       | 45        | Caucasian                    | 2005-                | Sachdev et al. (2010) [31]                                                     |
| Tajiri Project                                         | Japan        | 1654        | 65+       | 42        | Japanese                     | 1998-2005            | Meguro et al. (2002) [32]                                                      |
| Washington Heights Inwood and Columbia Aging Project (WHICAP)* | USA          | 4577        | 63-103    | 32        | Hispanic/African American/Caucasian | 1989-                | Tang et al. (2001) [33]                                                        |
| ZARADEMP Project (ZARAgoa DEMenia DEPression Project)*  | Spain        | 4803        | 55+       | 42        | Caucasian                    | 1994-                | Lobo et al. (2005) [34]                                                        |

*Data for the first project have been made available.
†Provisional member.
‡Including 3 generations (Original cohort, Offspring, Grandchildren) and separate Omni cohort of 900 ethnic minority participants.
contributing to a final dataset can require that complex information from some studies be simplified (e.g., converted from a continuous measure to a categorical scale). There is a potential reduction in validity involved in simplifying data, but there are mechanisms by which this can be tested and/or quantified [9].

Meeting the objectives of COSMIC will require various data types to be harmonised, but data relating to cognitive outcomes such as impairment and decline are likely to be the most challenging (i.e., more so than demographic and health-related variables). COSMIC member studies have operationally defined cognitive outcomes in vastly different ways. For example, for the purposes of diagnosing MCI, cognitive impairment has been variously defined as abnormal scores on the memory items of two cognitive status instruments (Mini-Mental State Examination and Geriatric Mental State Schedule) in the Zaragoza Dementia Depression Project [36], and as a score on any measure from a comprehensive neuropsychological battery 1.5 or more standard deviations below published normative values in the Sydney Memory and Ageing Study [31]. Different studies have used different neuropsychological test batteries, but even when similar cognitive tests have been used it is often the case that different versions have been used or the tests have been administered in a non-standard way. An added complication is the need to reconcile differences in the data while giving appropriate consideration to relevant demographic effects, including those associated with gender and education.

First project
The aim of the first COSMIC project is to compare the baseline prevalence of MCI across the COSMIC member cohorts and the different regions and ethnicities represented by these. The project is currently underway, and is being coordinated by the Sydney team. A questionnaire was developed and promulgated, with the information provided guiding a subsequent request for data from the studies on:

1. Demographics.
2. Sample representativeness.
3. Neuropsychological test performance.
4. Functional test scores.
5. Memory/cognitive complain/concerns.
6. Criteria used for MCI.

The receipt of data was followed by communication with data managers and/or study leaders to clarify the nature of data (e.g., the particular neuropsychological test used or manner of administration) and/or to ask that further data be provided (e.g., the individual items from a functional test scale in addition to a total score originally provided). Data from 11 studies have been made available for this project (see Table 1), and there is a total sample size of more than 23,000 non-demented individuals aged 60 and older.

Some demographic variables have been harmonised. All studies provided age in years, and harmonising sex only required some recoding to a common scale (female = 0; male = 1). Education was less straightforward. A four-level categorical scale of the highest level of education achieved (Less than high school completion, High school completion, Technical or college diploma, University degree) was chosen as the most appropriate common measure, and to which various other categorical formats or years of formal education were transformed (see Additional file 1 for the protocol). Data were provided in the harmonised format by the studies themselves, or later transformed from the original variable by the project coordinators.

The next step will be to harmonise the data needed to make classifications of MCI. The participating studies have published widely varying rates of MCI, from as low as 3.2% for the Monongahela Valley Independent Elders Survey [37] to 34.8% for the Sydney Memory and Ageing Study [31]. Differences between the studies in how MCI diagnoses were made have undoubtedly contributed to the varying prevalence rates [4], and minimising this requires the harmonisation of data informing the four generally accepted criteria for MCI:

1. Absence of dementia.
2. No or minimal functional impairment.
3. Objective cognitive impairment.
4. Memory complaint or concern [38,39].

Future projects
A number of future projects utilising COSMIC data are currently planned, and aim to make comparisons across COSMIC cohorts, countries and ethnic groups of:

1. Risk and protective factors for MCI.
2. Rates of cognitive decline.
3. Biomarkers (e.g., blood, genetic and MRI-derived) of MCI and dementia.

Many of the existing member studies have relevant data to contribute to these projects. It is expected that additional projects will address more refined and specific topics addressing the overall objectives of COSMIC. This could include identifying and comparing rates of decline within particular cognitive domains, and establishing associations between untreated hypertension or non-traditional risk factors and cognitive decline. Projects like these will be enabled and facilitated by growing the COSMIC membership base to ensure that there are sufficient relevant data on variables not collected by all studies.
Extended Implications of COSMIC

The mechanisms for harmonising measures developed by COSMIC could produce standardised ways of collecting and reporting data that facilitate the comparability of longitudinal studies of ageing. This includes previous or existing studies, for which data could be reformatted and further analysed. It may also guide the choice of measures used or type of data collected by future studies, for which the capacity to directly compare results with those of many other cohorts would greatly enhance their interpretability and relevance.

There is also the potential for the COSMIC database to be made available to non-consortium researchers via the website, following consortia-based publications and with the approval of the Research Steering Committee. The scientific benefits of making large databases available to researchers worldwide are demonstrated by the more than 250 publications reported to have arisen from the sharing of ADNI (Alzheimer’s Disease Neuroimaging Initiative) data across the internet [40].

With these, and potentially further extended implications and uses of COSMIC data, member studies can be confident that their data are being fully utilised and that they are contributing to a truly global effort to understand and combat the problems associated with cognitive ageing, MCI and dementia.

Conclusion

The COSMIC project is a truly international effort to form the epidemiology of cognitive disorders associated with advanced age by identifying risk factors and biomarkers that are common as well as unique. It has the potential to transform our understanding of the epidemiology of cognitive ageing and have a world-wide impact on promoting successful ageing.

Additional file

Additional file 1: Protocol for harmonising education across COSMIC member studies participating in the first project.

Abbreviations

COSMIC: Cohort Studies of Memory in an International Consortium; MCI: Mild cognitive impairment.

Competing interests

The authors declare that they have no competing interests, except for Kenneth Rockwood: Founder and shareholder of DGI Clinical; Richard Lipton and Mindy Katz have received monies from Bristol Myers Squibb Inc.; Ronald Petersen is on the Data Monitoring Boards of Pfizer Inc. and Janssen Alzheimer Immunotherapy, and a consultant to GE Healthcare; Rosebud Roberts has received a grant from Abbott Laboratories; Yaakov Stern is on the Advisory Boards of Janssen LLC, Pfizer Inc., Alzheimer’s Association and AbbVie, and has received Research Support from Piramal Research.

Authors’ contributions

PS5 is the instigator and head of COSMIC, and together with DML drafted the manuscript. All authors contributed to their local study, contributed to critically revising the manuscript for important intellectual content, and approved the final version of the manuscript for submission.

Acknowledgements

Canadian Study of Health and Aging (CSHA): Kenneth Rockwood (study leader). Funding from the National Health Research Development Program of Health Canada (6605-3954-MC3S).

Chinese Longitudinal Ageing Study (CLAS): Shifu Xiao (study leader), Juan Li, Xia Li. The authors extend their thanks to the main investigators from across the different regions of China: Tao Wang, Muni Tang, Wei Chen, Feng Bao, Huai Wang, Yaping Wang, Ying Liu, Yaping Wang, Yefeng Yuan, Xiaoyun Zuo, Zhongming Chen, Xulai Zhang, Lijuan Cui, Wenyuan Wu, Mingyuan Zhang. Funding from a China Ministry of Science and Technology grant (2009BA11B03). Cognitive Function and Ageing Studies (CFAS): Carol Brayne (study leader), Fiona E Matthews, Blossom CM Stephen. Funding from major awards from the Medical Research Council and the Department of Health, UK. Einstein Aging Study (EAS): Richard B Lipton (study leader), Mindy J Katz (study leader). The authors acknowledge the contributions of Molly Zimmerman and Carol Derby. Funding from National Institute on Health/ National Institute on Aging grants: SP01 AG053949, R03 AG054574.

Etude Santé Psychologique Prévalence Risques et Traitement (ESPRI): Karen Ritchie (study leader), Isabelle Carrière, Marie-Laure Anselin (study leader). Funding from Novartis.

Framingham Heart Study (FHS): Sudha Seshadri (study leader), Rhoda Au, Alexa S Beiser. The authors acknowledge the contributions of Philip A. Wolf and Galit A. Weinstein, and the dedication of the FHS participants. Funding from the National Heart, Lung and Blood Institute’s Framingham Heart Study (Contract No. N01-HC-25195) and grants from the National Institute of Aging (AG08122, AG16495, AG033193), the National Institute of Neurological Disorders and Stroke (NS17950), and the National Heart, Lung and Blood Association (HL93029, U01HL 096917). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Neurological Disorders and Stroke, the National Heart Lung and Blood Institute, the National Institute of Aging or the National Institutes of Health.

Hong Kong Memory and Ageing Prospective Study (HK-MAPS): Linda CW Lam (study leader), Candy HY Wong, Ada WT Fung. The authors acknowledge the contributions of Grace T.Y. Leung, Wai Chi Chan, Department of Health of Hong Kong SAR, the participants and the social centers for their assistance in the assessment, and thank Novartis and Astra Zeneca for their sponsorship of souvenirs for the participants in the baseline study. The baseline study is funded in part by the Mr. Lai Seung Hung & Mrs. Lai Chan Pui Ngong Dementia in Hong Kong Research Fund, and by an educational fund from Eisai.

Korean Longitudinal Study on Cognitive Aging and Dementia (KOOSCAD): Ki Woong Kim (study leader), Ji Won Han, Tae Hui Kim. Funding from a Korean Health Technology R&D Project grant from the Ministry for Health, Welfare, & Family Affairs, Republic of Korea (Grant No. A092077).

Mayo Clinic Study of Aging (MCSA): Ronald C Petersen (study leader), Rosebud O Roberts, Michelle M Mielke. Funding from the National Institute on Aging: U01 AG067786, PS0 AG165574, R01 AG034676.

Monongahela Valley Independent Elders Survey (MoVES): Mary Gangulli (study leader), Hiroko H Dodge, Tiffany Hughes. The authors acknowledge the contributions of 1681 study participants from the Monongahela Valley and of multiple MoVES project personnel over the years. Funding from Grant # R01AG07562 from the National Institute on Aging, National Institutes of Health, United States Department of Health and Human Services.

Personality and Total Health (P4TH) Through Life Project: Kaarin J Arney (study leader), Nicolas Cherbuin, Peter Butterworth. The authors acknowledge the further study members Helen Christensen, Andrew MacKinnon, Simon Eastal, Project Managers Trish Jackson, Karen Maxwell, participants and the NHMRC. Funding from National Health and Medical Research Council of Australia grants 973302, 178085, 157125 and 1002160.

Singapore Longitudinal Ageing Studies (SLAS) I and II: Tze Pin Ng (study leader), Qi Gao. The authors gratefully thank the help and support of the following voluntary welfare organizations: Geylang East Home for the Aged, Presbyterian Community Services, Thye Hua Kwan Moral Society (Moral Neighbourhood Links), Yuhua Neighbourhood Link, Henderson Senior Citizens’ Home, NTUC Eldercare Co-op Ltd, Thong Kheng Seniors Activity Centre (Queenstown Centre) and Redhill Moral Seniors Activity Centre.
Funding from research grants (No. 03/121/17/214 and No. 08/121/19/567) from the Biomedical Research Council, Agency for Science, Technology and Research (A*STAR) in Singapore.

Sydney Memory and Ageing Study (MAS): Perimnder S Sachdev (study leader and consortium head), Darren M Lipnicke, Nicole A Kochan, John D Crawford, Simone Reppermund, Henry Brodaty (study leader). The authors acknowledge the contributions of members of the MAS Team: Allison Bowman, Kim Burns, Anthony Broe, Joula Dekker, Louise Dooley, Michele de Permenter, Sarah Fairjones, Janelle Fisher, Therese French, Cathy Foster, Emma Nugent-Cleary-Fox, Chien Gooi, Evelyn Harvey, Rebecca Helyer, Sharpley Hsieh, Laura Hughes, Sarah Jacek, Mary Johnston, Donna McCade, Samantha Meeth, Eveline Milne, Angharad Moir, Rios O’Grady, Kia Pfaflfi, Carine Pose, Laura Reuser, Amanda Rose, Peter Schoffield, Zeeshan Shahnawaz, Amanda Sharpley, Claire Thompson, Wiebke Queisser, and Sam Wong. Funding from a National Health & Medical Research Council of Australia Program Grant (ID 350833).

Tajiri Project: Kenichi MEGURO (study leader). The author acknowledges the contributions of Miari Kasa, Kei Nakamura, and Masahiro Nakatsuka. Washington Heights Inwood and Columbia Aging Project (WHICAP): Nicole Schupf (study leader), Jennifer Manly, Yaakov Stern. The authors acknowledge the contributions of Richard Mayeux, Principal Investigator of the WHICAP study, co-investigators Adam Brickman and Jose Luchsinger, and study team members Danuys Sanchez, Ming X. Tang and Howard Andrews. Funding from the National Institute of Health/National Institute on Aging: Grants: A1R01 AG027122, P01 AG072322. ZARADEMP Project (ZARAgoza Dementia DEPresion Project): Antonio Lobo (study leader), Raúl López-Anton, Javier Santabarba. The authors acknowledge the further study members Guillermo Marcos, Concepción De-la-Cámara, Pedro Saz, Tinro Ventura, Miguel Ángel Quintanilla, and Elena Lobo, and the contributions of the ZARADEMP Workgroup who participated in the study. Funding from the Fondo de Investigación Sanitaria, Instituto de Salud Carlos III, Spanish Ministry of Health, Madrid, Spain (grants 94/1562, 97/1321E, 98/0103, 01/0255, 03/0815, 06/0617, and 03/0128) and Pfizer Foundation, Madrid.

Author details
1Centre for Healthy Brain Ageing, University of New South Wales, Sydney, Australia. 12Department of Geriatric Behavioral Neurology, Tohoku University Graduate School of Medicine, Sendai, Japan. 13The Taub Institute for Research in Alzheimer’s Disease and the Aging Brain, Columbia University, New York, NY, USA. 14The Gertrude H. Sergievsky Center, Columbia University, New York, NY, USA. 15The Division of Epidemiology, Joseph P. Mailman School of Public Health, Columbia University, New York, NY, USA. 16Department of Neurology, The Chinese University of Hong Kong, Hong Kong, SAR, China. 17Department of Psychiatry, Universidad de Zaragoza, Zaragoza, Spain. 18Centro de Investigación Biomédica en Red de Salud Mental (CIBERSAM), Ministry of Science and Innovation, Madrid, Spain. 19Department of Psychology and Sociology, Universidad de Zaragoza, Zaragoza, Spain. 20Department of Preventive Medicine and Public Health, Universidad de Zaragoza, Zaragoza, Spain.

Received: 10 October 2013 Accepted: 31 October 2013 Published: 6 November 2013

References
1. Prince M, Bryce R, Albanese E, Wimo A, Ribeiro W, Ferri CP: The global prevalence of dementia: a systematic review and metaanalysis. Alzheimer’s Dement 2013, 9:63–75. e62.
2. Plassman BL, Williams JW Jr, Burke JR, Holsinger T, Benjamin S: Systematic review: factors associated with risk for and possible prevention of cognitive decline in later life. Ann Intern Med 2010, 153:182–193.
3. Katz MJ, Lipton RB, Hall CB, Zimmerman ME, Sanders AE, Vergheese J, Dickson DW, Derby CA: Age-specific and sex-specific prevalence and incidence of mild cognitive impairment, dementia, and Alzheimer dementia in blacks and whites: a report from the Einstein Aging Study. Alzheimer Dis Assoc Disord 2012, 26:S33–343.
4. Kochan NA, Slavin MJ, Brodaty H, Crawford JD, Troollar JN, Draper B, Sachdev PS: Effect of different impairment criteria on prevalence of “objective” mild cognitive impairment in a community sample. Am J Geriatr Psychiatry 2010, 18:711–722.
5. Erkinjuntti T, Ostbye T, Steenhuis R, Hachinski V: The effect of different diagnostic criteria on the prevalence of dementia. N Engl J Med 1997, 337:1667–1674.
6. Beer-Borst S, Morabia A, Herbergs S, Witek O, Bernstein MS, Galan P, Galasso R, Giampaoli S, Houterman S, McCrum E, et al: Obesity and other health determinants across Europe: the EUROLEIM project. J Epidemiol Community Health 2000, 54:424–430.
7. Prince M, Ferri CP, Acosta D, Albanese E, Ilgazka R, Dewey M, Gavrilova SI, Guerra M, Huang Y, Jacob KS, et al: The protocols for the 10/66 dementia research group population-based research programme. BMC Public Health 2007, 7:165.
8. Hofer SM, Piccinin AM: Integrative data analysis through coordination of measurement and analysis protocol across independent longitudinal studies. Psychol Methods 2009, 14:150–164.
9. Schaap LA, Peeters GM, Dennison EM, Zambon S, Nikolaus T, Sanchez-Martinez M, Musacchio E, van Schoor NM, Deeg DJ: European Project on OsteoArthritis (EPOSA): methodological challenges in harmonization of existing data from five European population-based cohorts on aging. BMC Musculoskelet Disord 2011, 12:272.
10. CHARGE (Cohorts for Heart and Aging Research in Genomic Epidemiology). [http://web.chargeconsortium.com]
11. ENIGMA (Enhancing NeuroImaging Genetics through Meta-Analysis). [http://enigma.mlnl.org/ucl.edu]
12. HALCyon (Healthy Ageing across the Life Course). [http://www.halcyon.ac.uk]
13. CHANCES (Consortium on Health and Ageing: Network of Cohorts in Europe and the United States). [http://www.chancesfp7.eu]
14. Anstey KJ, Byles JE, Luczcz MA, Mitchell P, Steel D, Booth H, Browning C, Butterworth P, Cumming RG, Healy J, et al: Cohort profile: The Dynamic Analyses to Optimize Ageing (DYNOPTA) project. Int J Epidemiol 2010, 39:449–51.
15. IALSA (Integrative Analysis of Longitudinal Studies on Aging). [http://web.uvic.ca/~life]
16. Sachdev P, Lipnicki D, Kochan N, Crawford J: COSMIC: Cohort Studies of Memory in an International Consortium [abstract]. Alzheimers Dement 2013, 9(Suppl 4):P611.
17. Canadian Study of Health and Aging Working Group: Canadian study of health and aging: study methods and prevalence of dementia. 
CMAJ 1994, 150:899–913.

18. Xiao S, Li J, Tang M, Chen W, Bae F, Wang H, Wang Y, Liu Y, Wang Y, Yuan Y, et al. Methodology of China’s national study on the evaluation, early recognition, and treatment of psychological problems in the elderly: the China Longitudinal Aging Study. Shanghai Archives of Psychiatry 2013, 25:91–97.

19. Brayne C, McCracken C, Matthews FE: Cohort profile: the Medical Research Council Cognitive Function and Ageing Study (CFAS). Int J Epidemiol 2006, 34:113–145.

20. Ritchie K, Carriere I, Ritchie CW, Ber C, Artero S, Ancelin ML: Designing prevention programmes to reduce incidence of dementia: prospective cohort study of modifiable risk factors. BMJ 2010, 341:c3885.

21. Davber TR, Kannel WB: An epidemiological study of heart disease: the Framingham study. Nutr Rev 1958, 16:1–4.

22. Feinleib M, Kannel WB, Garrison RJ, McNamara PM, Castelli WP: The Framingham Offspring Study. Design and preliminary data. Prev Med 1975, 4:518–525.

23. Splansky GL, Corey D, Yang Q, Atwood LD, Cupples LA, Benjamin EJ, D’Agostino RB Sr, Fox CS, Larson MG, Murabito JM, et al. The Third Generation Cohort of the National Heart, Lung, and Blood Institute’s Framingham Heart Study: design, recruitment, and initial examination. Am J Epidemiol 2007, 165:1328–1335.

24. Wong CH, Leung GT, Fung AW, Chan WC, Lam LC: Cognitive predictors for five-year conversion to community-dwelling Chinese older adults. Int Psychogeriatr 2013, 25:1125–1134.

25. Kim TH, Park JH, Lee JJ, Joo HJ, Kim BJ, Kim JL, Kim SG, Youn JC, Ryu SH, Lee DY, et al: Overview of the Korean Longitudinal Study on Cognitive Aging and Dementia (abstract). Alzheimer’s Dement 2013, 9(suppl 4):626–627.

26. Roberts RO, Geda YE, Knopman DS, Cha RH, Pankratz VS, Boeve BF, Ivnik RJ, Zunzunegui MV, Pedersen NL, Deeg DJ: Activities of daily living was a reliable and valid instrument for early recognition, and treatment of psychological problems in the elderly: the China Longitudinal Aging Study. Shanghai Archives of Psychiatry 2013, 25:91–97.

27. Ganguli M, Dodge HH, Chen P, DeKosky ST: Mild cognitive impairment, amnestic type: an epidemiologic study. Neurology 2004, 63:115–121.

28. Petersen RC: Mild cognitive impairment as a diagnostic entity. J Intern Med 2004, 256:183–194.

29. Winblad B, Palmer K, Kivipelto M, Jelic V, Fratiglioni L, Wahlund LO, Nordberg A, Backman L, Albert M, Almkvist O, et al. Mild cognitive impairment—beyond controversies, towards a consensus: report of the International Working Group on Mild Cognitive Impairment. J Intern Med 2004, 256:240–246.

30. Carrillo MC, Bain LJ, Frisoni GB, Weiner MW: Worldwide Alzheimer’s disease neuroimaging initiative. Alzheimers Dement 2012, 8:337–342.
Author/s:
Sachdev, PS; Lipnicki, DM; Kochan, NA; Crawford, JD; Rockwood, K; Xiao, S; Li, J; Li, X; Brayne, C; Matthews, FE; Stephan, BCM; Lipton, RB; Katz, MJ; Ritchie, K; Carriere, I; Ancelin, M-L; Seshadri, S; Au, R; Beiser, AS; Lam, LCW; Wong, CHY; Fung, AWT; Kim, KW; Han, JW; Kim, TH; Petersen, RC; Roberts, RO; Mielke, MM; Ganguli, M; Dodge, HH; Hughes, T; Anstey, KJ; Cherbuin, N; Butterworth, P; Ng, TP; Gao, Q; Reppermund, S; Brodaty, H; Meguro, K; Schupf, N; Manly, J; Stern, Y; Lobo, A; Lopez-Anton, R; Santabarbara, J

Title:
COSMIC (Cohort Studies of Memory in an International Consortium): An international consortium to identify risk and protective factors and biomarkers of cognitive ageing and dementia in diverse ethnic and sociocultural groups

Date:
2013-11-06

Citation:
Sachdev, P. S., Lipnicki, D. M., Kochan, N. A., Crawford, J. D., Rockwood, K., Xiao, S., Li, J., Li, X., Brayne, C., Matthews, F. E., Stephan, B. C. M., Lipton, R. B., Katz, M. J., Ritchie, K., Carriere, I., Ancelin, M. -L., Seshadri, S., Au, R., Beiser, A. S.,... Santabarbara, J. (2013). COSMIC (Cohort Studies of Memory in an International Consortium): An international consortium to identify risk and protective factors and biomarkers of cognitive ageing and dementia in diverse ethnic and sociocultural groups. BMC NEUROLOGY, 13 (1), https://doi.org/10.1186/1471-2377-13-165.

Persistent Link:
http://hdl.handle.net/11343/262169

File Description:
Published version