STROKOG (stroke and cognition consortium): An international consortium to examine the epidemiology, diagnosis, and treatment of neurocognitive disorders in relation to cerebrovascular disease

Perminder S. Sachdev a, b, * , 1, Jessica W. Lo a, John D. Crawford a, Lisa Mellon c, Anne Hickey c, 
David Williams d, Régis Bordet e, Anne-Marie Mendyk e, Patrick Gelé f, Dominique Deplanque f, 
Hee-Joon Bae e, g, h, Jae-Sung Lim i, Amy Brodtmann j, Emilio Werden i, Toby Cumming j, 
Sebastian Köhler k, Frans R. J. Verhey k, Yan-Hong Dong a, b, l, m, n, Hui Hui Tan l, m, n, 
Christopher Chen l, m, Xu Xin l, m, Raj N. Kalaria o, Louise M. Allan o, Rufus O. Akinyemi p, 
Adesola Ogguniyi p, q, a, Aleksandra Klimkowicz-Mrowiec r, Martin Dichgans s, t, u, 
Frank A. Wollenweber s, Vera Zietemann s, Michael Hoffmann v, David W. Desmond w, 
Thomas Linden x, y, z, Christian Blomstrand x, Björn Fagerberg z, Ingmar Skoog a, 
Olivier Godefroy b, bb, Mélanie Barbay b, bb, Martine Rousssel b, bb, Byung-Chul Lee f, Kyung-Ho Yu i, 
Joanna Wardlaw c, cc, Stephen J. Makin dd, Fergus N. Dougal cc, Francesca M. Chappell cc, 
Velandai K. Srikantan ee, ff, Amanda G. Thrift i, lee, Geoffrey A. Donnan i, Nagaendran Kandiah eg, 
Russell J. Chandler gg, Xuling Lin gg, Charlotte Cordonnier e, Solene Moulic e, Costanza Rossi e, 
Behnam Sabayan bh, David J. Stott ii, J. Wouter Jukema ji, Susanna Melkas kk, Hanna Jokinen kk, 
Tim Erkinjuntti kk, Vincent C. T. Mok ll, mm, Adrian Wong ll, mm, Bonnie Y. K. Lam ll, mm, 
Didier Leys e, Hilde Hénon e, Stéphanie Bombois e, Darren M. Lipnicki a, Nicole A. Kochan a

"Centre for Healthy Brain Ageing (CHeBA), University of New South Wales, Sydney, Australia 
"Dementia Collaborative Research Centre, University of New South Wales, Sydney, Australia 
"Department of Psychology, Royal College of Surgeons in Ireland, Dublin, Ireland 
"Department of Stroke and Geriatric Medicine, Royal College of Surgeons in Ireland, Dublin, Ireland 
"University of Lille, Inserm, CHU Lille, U1171 - Degenerative & Vascular Cognitive Disorders, Lille, France 
"University of Lille, Inserm, CHU Lille, CIC 1403 - Centre d’investigation clinique, Lille, France 
"Department of Neurology, Seoul National University Bundang Hospital, Seongnam, Republic of Korea 
"Clinical Neuroscience Center, Seoul National University Bundang Hospital, Seongnam, Republic of Korea 
"Department of Neurology, Hallym University Sacred Heart Hospital, Anyang, Republic of Korea 
"Florey Institute for Neuroscience and Mental Health, University of Melbourne, Melbourne, Australia 
"School for Mental Health and Neuroscience, Maastricht University, Maastricht, The Netherlands 
"Department of Pharmacology, Yong Loo Lin School of Medicine, National University of Singapore, Singapore 
"Department of Medicine (Neurology Division), Yong Loo Lin School of Medicine, National University of Singapore, Singapore 
"Neurovascular Research Group, Institute of Neuroscience, Newcastle University, Newcastle upon Tyne, UK 
"Neuroscience and Ageing Research Unit, Institute for Advanced Medical Research and Training College of Medicine, University of Ibadan, Ibadan, Nigeria 
"Department of Medicine, College of Medicine, University of Ibadan, Ibadan, Nigeria 
"Department of Neurology, Jagiellonian University Medical College, Krakow, Poland

Authors’ contributions: P.S.S. is the instigator and head of STROKOG and together with J.W.L. and D.M.L. 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.

The authors declare that they have no competing interests.

*Corresponding author. Tel.: 612 9382 3763; Fax: 612 9382 3774. E-mail address: p.sachdev@unsw.edu.au
Abstract

Introduction: The Stroke and Cognition consortium (STROKOG) aims to facilitate a better understanding of the determinants of vascular contributions to cognitive disorders and help improve the diagnosis and treatment of vascular cognitive disorders (VCD).

Methods: Longitudinal studies with ≥75 participants who had suffered or were at risk of stroke or TIA and which evaluated cognitive function were invited to join STROKOG. The consortium will facilitate projects investigating rates and patterns of cognitive decline, risk factors for VCD, and biomarkers of vascular dementia.

Results: Currently, STROKOG includes 25 (21 published) studies, with 12,092 participants from five continents. The duration of follow-up ranges from 3 months to 21 years.

Discussion: Although data harmonization will be a key challenge, STROKOG is in a unique position to reuse and combine international cohort data and fully explore patient level characteristics and outcomes. STROKOG could potentially transform our understanding of VCD and have a worldwide impact on promoting better vascular cognitive outcomes.

© 2016 The Authors. Published by Elsevier Inc. on behalf of the Alzheimer’s Association. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Keywords: Cohort studies; Vascular dementia; Post-stroke dementia; Vascular cognitive disorder; Small vessel disease; Data harmonization; International consortium

1. Introduction

Vascular cognitive disorders (VCDs) are a heterogeneous group of neurocognitive disorders with the salient feature being that cognitive decline is primarily attributable to cerebrovascular disease. The term VCD has a chequered history, and it includes not only vascular dementia (VaD; e.g., post-stroke and multi-infarct dementia), but also cognitive impairment of vascular origin that does not meet the criteria for dementia. VaD is common and is generally considered to be the second most common form of dementia, after Alzheimer’s disease (AD) [1].

The prevalence and incidence of VCD varies depending on the diagnostic criteria applied and the populations studied. In 11 population-based European studies conducted in the 1990s, the age-standardized prevalence of VaD was estimated to be 1.6% compared to 4.4% for AD [2]; the prevalence of VaD was 0.3% in the age group 65–69 years and 5.2% in those aged 90 and above, and VaD accounted for 15.8% of all dementias in these studies [2]. The Canadian Study of Health and Aging used a broader concept termed vascular cognitive impairment (VCI) which consisted of three subgroups: VCI with no dementia, VaD, and AD with a vascular component. The authors estimated that approximately 5% of people over the age of 65 years had VCI, with 2.4% having VCI with no dementia, 0.9% having mixed (vascular and neurodegenerative) dementia and 1.5% having VaD [3]. Various clinical studies have shown that the prevalence of dementia is much greater in post-stroke patients, with 6 to 32% being reported as having dementia three months after stroke [3–8]. A systematic review reported that dementia is 3.5 to 5.6 fold more frequent in patients with stroke than in stroke-free controls [9]. Because risk factors for stroke are modifiable, and its incidence has been
shown to change with public health intervention, stroke may be regarded as a powerful and modifiable risk factor for dementia [10].

Poststroke dementia has emerged as an important subset of VCD primarily because of the large impact stroke has on the risk of VCD. The cognitive consequences of stroke as well as the associated burden of increased functional dependency, institutionalization, and mortality rates are increasingly being recognized [11]. However, many aspects of poststroke dementia are uncertain [5], and the precise impact of a stroke on pre-existing cognitive impairment has been disputed. Patients with stroke usually have a complex combination of large and small vessel disease in the brain; in older patients in particular, nonvascular pathology such as AD may also be present [12]. Some studies found that up to 10% of stroke patients have cognitive impairment that could be classified as dementia before their first stroke [4,5,8], a finding that may be attributable to previous silent infarcts, noninfarct small vessel disease or AD pathology, or a combination of these. An American case-control longitudinal study reported that a stroke doubles the risk of dementia, that this excess risk diminishes with time, and that it does not apply to those >85 years [13]. According to a recent systematic review and meta-analysis, about one-tenth of patients develop new dementia soon after first stroke, and over one-third are demented after a recurrent stroke [8].

Although older age and low levels of education have consistently emerged as key predictors of worse cognitive outcome soon after stroke [8,14], studies have shown inconsistent findings in relation to other risk factors, which include cerebrovascular disease risk factors such as diabetes mellitus and atrial fibrillation, prior pathology, stroke features, and infarct characteristics [8,9,15].

Making better use of existing data to improve stroke and dementia prevention and treatment is a priority for many governments and funders. The Joint Program for Neurodegeneration (JPND) thus recently funded several initiatives to improve data usage. Metacohorts is one of these initiatives focused on vascular contributions to dementia and the group identified over 90 studies, including over 600,000 subjects worldwide that included data relevant to vascular effects on neurodegeneration including cognitive consequences of stroke [16].

Stroke and Cognition consortium (STROKOG) is a recently established consortium of prospective post-stroke/TIA studies from around the world, including, at the time of writing, 25 studies with up to 12,092 patients from 16 countries and 25 institutions worldwide. By harmonizing data and conducting individual participant data (IPD) meta-analyses on studies from around the world, STROKOG aims to better understand the longitudinal course of poststroke cognitive impairment and investigate differences in the prevalence of VCD as well as risk and protective factors between different countries and ethnic groups. In IPD meta-analysis, the original research data are sought directly from the researchers responsible for each study rather than extracting summary (aggregate) data from study publications or from investigators. The original data can then be re-analyzed centrally and combined, if appropriate, in meta-analyses. There are various advantages of conducting IPD meta-analyses over standard meta-analysis, such as the ability to investigate patient level characteristics, adjust for the same confounding factors across studies, address new research questions, and reduce publication bias [17,18]. By harmonizing and conducting analyses on a rich collection of individual participant data, STROKOG can examine risk factors on the patient level and apply standardized methods of statistical analyses and dementia diagnosis that could produce more accurate prevalence estimates and more detailed information on the risk factors for VCD and the impact stroke has on cognitive decline. It is anticipated that the findings of STROKOG will help guide and optimize preventative strategies and health policy worldwide. STROKOG was officially established at the VASCOG (Society for the Study of Vascular Cognitive and Behavioral Disorders) 2015 meeting in Tokyo, Japan.

2. Methods

2.1. Membership

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

1. Prospectively recruited patients with stroke, TIA, or high-stroke risk (such as patients with atrial fibrillation, hypertension, genetic disorders such as CADASIL and so forth).
2. Are longitudinal, with a minimum of two waves of assessments conducted or planned.
3. Have a minimum sample size of 75.
4. The major outcome measures include dementia and/or cognitive impairment and/or cognitive decline.

Official enrollment requires the study lead investigator to sign a memorandum of understanding (MoU) which specifies a willingness to share nonidentifiable data for joint analyses. Studies that have restrictions on data use and data sharing may also participate in STROKOG by conducting in-house analyses using STROKOG protocols and providing summary data for pooling.

At the time of writing, there are 24 officially enrolled member studies of STROKOG and one unofficial member study which plan to obtain participants’ permission to share data before signing the MoU. These studies and their key demographic characteristics are shown in Table 1. Supplementary Table S1 shows some salient findings from each member study. They represent 16 different countries, including one lower middle income country from across five continents (Africa, Asia, Australia, Europe, and North America). In total, there are 12,092 participants, and for most studies, patients were recruited consecutively as they were admitted to hospital with a recent stroke.
Approximately half of the studies admitted participants with a recent TIA, and those with a previous stroke were typically not excluded. The longest follow-up duration of the studies is 21 years and the median is 3 years. Table 2 shows the list of neuropsychological tests used in each study.

2.2. Organization

The STROKOG Research Steering Committee (RSC) consists of a representative from each of the contributing studies, generally the lead investigator or a delegate. The primary functions of the RSC are to

1. Develop guidelines for the inclusion and exclusion of studies.
2. Provide rules of participation and guidelines for the roles and responsibilities of the participating studies.
3. Approve Work Groups (see research projects below).
4. Select topics of interest.
5. Provide overall analytic strategies.
6. Develop rules for publication, including authorship.
7. Develop rules for the protection of intellectual property, when relevant.
8. Seek funds to support STROKOG.

2.3. Meetings

An initial meeting of many study leaders at the VASCOG 2015 conference in Tokyo on 16 September 2015 supported the official establishment of STROKOG. The proposed structure of the consortium, including the functions of the RSC and proposed projects were discussed. A second international meeting was held at VASCOG 2016 in Amsterdam on 14 October 2016. Preliminary findings from the first project were presented and potential projects were discussed.

2.4. Website

A website that contains a description of STROKOG and summaries of the member studies has been established (https://cheba.unsw.edu.au/group/strokog). The website is intended to serve as an avenue for presenting and preserving STROKOG project protocols and results.

2.5. Ethics

The overall STROKOG project has been approved by the Human Research Ethics Committee (HREC) of the University of New South Wales (UNSW), Sydney (reference number: HC14359). Member studies are responsible for obtaining approval (if necessary) from their local institutional review board for the sharing of data. Although de-identified data are not considered Protected Health Information by the National Institutes of Health of the United States, ethics review boards differ in their approach to this matter. A protocol for the de-identification of data has been developed. Additionally, each new project presented to STROKOG must be approved by an institutional review board and the HREC of UNSW informed about the project.

2.6. Research projects and data

The Sydney team will initiate the first project, collate study data and conduct the initial data harmonization and IPD meta-analyses across the different studies. STROKOG will follow guidelines for rigorous and effective harmonization [58] as well as for IPD meta-analyses and reporting [17,59]. Original data sets supplied by members and the harmonized data sets, which will include derived data, will be held by the Sydney team on a secure database at the University of New South Wales. A STROKOG RSC member can propose a research project, which need to undergo an approval process by the RSC. If the prospective proposer of a project is not a member of the RSC or affiliated with a member study, the proposal can still go ahead if it is sponsored by a member of the RSC. A student may similarly request data for a research project if sponsored by a member of the RSC. Once approved, the proposer will be advised to form a Work Group for the specific project, with a clearly identified project leader. Other members of the consortium may volunteer to be part of the Work Group if they have a clear interest and expertise in the research project. The Work Group will address and be responsible for the planning, analysis, and publication of the approved project. Data held by STROKOG will be released to the Work Group; newly joined and existing member studies will be requested to provide additional de-identified data. Each cohort can opt-in or opt-out of participation; opting-in represents a commitment to collaborate on the project. The central STROKOG data repository at UNSW, Sydney, will hold a copy of the data sets used for each project. The STROKOG data will not be used or accessed for any purpose other than contributing to an approved STROKOG project.

3. Discussion

3.1. Challenges

Large international consortia face general challenges that include efficient communication among personnel involved with studies across different countries and a need for additional funding to enable the further use of previously collected data. Such challenges have been previously described by other consortia (e.g., by CHARGE [60]).

Challenges more specific to STROKOG are those associated with data harmonization, many of which have also been previously described [61,62]. Neuropsychological test data are likely to be the most challenging set of data to be harmonized across studies due to heterogeneity in test instruments, administration, and criteria for defining impairment; however, the Sydney team has had experience harmonizing large data sets from diverse
| Study                                              | Country       | Period       | Sample size | Follow-up schedule | Cognitive assessments | MRI assessments | Dementia criteria                  | Key reference(s)                  |
|---------------------------------------------------|---------------|--------------|-------------|--------------------|----------------------|----------------|-----------------------------------|-----------------------------------|
| Action on Secondary Prevention Interventions and Rehabilitation in Stroke (ASPIRE-S) | Ireland       | 2011–2012    | 256         | 6m                 | 6 mo                 | No             | NA                                | Mellon et al. (2015) [19]         |
| Bundang VCI cohort (Bundang-VCI)                   | Korea         | 2007–ongoing | 918         | 3m, 1y, 2y, 3y;    | 3 mo, 1 y, 2 y, 3 y | Initial, 1–3 y | DSM-IV                            | Lim et al. (2014) [20]             |
| Clinical Biological and Pharmacological Factors Influencing Stroke Outcome (BIOSTROKE) | France        | 2005–2015    | 477         | 3m, 5y             | 5 y                  | Initial, 5 y   | NA                                | Ducroquet et al. (2013) [21]       |
| Cognition and Affect after Stroke: Prospective Evaluation of Risks (CASPER) | Netherlands   | 2013–2016    | 250         | 3m, 9m, 15m        | 3 mo, 9 mo, 15 mo    | 3 mo           | DSM-V, NINCDS-ADRDA, NINDS-AIREN | Douven et al. (2016) [22]          |
| Cognition and Neocortical Volume After Stroke (CANVAS) | Australia     | 2014–2018    | 135         | 1m, 3m, 1y, 3y;   | 3 mo, 1 y, 3 y      | Initial, 3 mo, 1 y, 3 y | DSM, NINDS-AIREN                   | Brodtmann et al. (2014) [23]       |
| Cognitive Function After Stroke (CogFAST-UK)       | UK            | 2002–2012    | 355         | 3m; 1–8y (annually)| 3 mo; 1–8 y (annually)| 3 mo, 2 y    | Yes                               | Allan et al. (2011) [12]           |
| Cognitive Function After Stroke Nigeria (CogFAST-Nigeria) | Nigeria       | 2010–ongoing | 217         | 3m                  | 3 mo                 | 3 mo           | DSM-IV, AHA/ASA                    | Akinyemi et al. (2014) [24]        |
| Cognitive Outcome After Stroke (COAST)             | Singapore     | 2009–2017    | 400 (planned)| 3–6m, 1y, 3–4y, 5y | 3–6 mo, 1 y, 3–4 y, 5 y, 6 y, 7 y | Initial (small subset only) | DSM-IV                            | Dong et al. (2012) [25]            |
| Cracow Stroke Database (Cracow)                    | Poland        | 2000–2001    | 250         | 3m, 12m            | 3 mo, 12 mo         | No             | DSM-IV                            | Klimkowicz et al. (2004, 2006) [26,27] |
| Determinants of Dementia After Stroke (DEDEMAS)    | Germany       | 2011–2019    | 600 (planned)| 3m, 6m, 1y, 2y, 3y | 6 mo, 1 y, 3 y, 5 y; (TICS only: 3 mo, 2 y, 4 y) | Initial, 6 mo; 3 y, 5 y | DSM-V                             | Wollenweber et al. (2013) [28]      |
| Durban Stroke Data Bank (DSDB)                     | South Africa  | 1992–1998    | 1000        | 3m, 6m, 12m        | Initial, 3, 6, 13 mo | 3 mo–10 y (annually) | No                                | Modified DSM-III-R                 |
| Epidemiologic study of the risk of dementia after stroke (Epi USA) | USA           | 1988–1999    | 585         | Initial, 3m–10y (annually) | 3 mo–10 y (annually) | No | Modified DSM-III-R | Desmond et al. (2000, 2002) [7,31] |
| Göteborg 70 + Stroke Study (Göteborg Neuro70+)     | Sweden        | 1993–1994    | 243         | 3m, 12m, 18m       | 18 mo                | Subset         | DSM-III-R                          | Linden et al. (2004, 2007) [32,33] |
| Groupe de Réflexion pour l’Evaluation COGinitive VASCulaire study (GRECOG-VASC) | France        | 2010–2015    | 360         | 6m                  | 6 mo                 | 6 mo          | VASCOG                            | Godefroy et al. (2012) [34]         |
| Helsinki Stroke Aging Memory (SAM)                 | Finland       | 1993–2015    | 486         | 3m, 15m, 21y       | 3 mo                 | Initial       | DSM                               | Jokinen et al. (2015) [35]; Oksala et al. (2009) [36] |

(Continued)
### Table 1

**STROKOG member studies (Continued)**

| Study                                      | Country          | Period        | Sample size* | Follow-up schedule | Cognitive assessments | MRI assessments | Dementia criteria | Key reference(s) |
|--------------------------------------------|------------------|---------------|--------------|---------------------|-----------------------|-----------------|------------------|------------------|
| Maastricht Cognitive Disorders After Stroke (CODAS) | Netherlands      | 2000–2003     | 194          | 1m, 6m, 1y, 2y      | 1 mo, 6 mo, 1 y, 2 y  | No              | DSM-III, DSM-III-R, DSM-IV, ICD-10, NINDS-AIREN, ADDTC | Rasquin et al. (2005) [37] |
| Mild Stroke Study II (MSS–II)              | UK               | 2010–2015     | 264          | 1–3m, 1y, 3y        | Initial, 1–3 mo, 1 y  | ACER, MoCA equivalent, NART | Heye et al. (2015; 2016) [38,39], Valdes Hernandez et al. (2015) [40] |
| Korean-Vascular Cognitive Impairment Harmonization Standards Study (K-VCIHS) | Korea            | 2007–2008     | 620          | 3m                  | Initial               | DSM-IV          | Yu et al. (2013) [41] |
| North East Melbourne Stroke Incidence Study (NEMESIS) | Australia        | 1998–2003     | 99           | 3m, 1y, 2y          | 3m, 1 y, 2 y          | No              | Yes              | Srikanth et al. (2003; 2004; Study) [42–44] |
| National Neurosciences Institute study (NNI Singapore) | Singapore         | 2011–2017     | 506          | 3–6m, 1y up to 5y   | 3–6 mo, 1 y up to 5 y | Initial         | Yes              | Kandiah et al. (2011; 2014, 2016) [45–47] |
| Prognosis of Intracerebral Hemorrhage (PITCH) | France            | 2004–ongoing  | 562          | 6 mo, 1 y, 2 y, 3 y, 4.5 y, 6 y, 8 y, 10 y | 1 y, 2 y, 3 y, 4.5 y, 6 y, 8 y, 10 y | Initial, 6 mo; 1 y, 2 y, 3 y, 4.5 y, 6 y, 8 y, 10 y | Yes             | Cordonnier et al. (2010) [48]; Moulin et al. (2016) [49] |
| Prospective Study of Pravastatin in the Elderly at Risk (PROSPER) | Scotland, Ireland, Netherlands | 1997–2001 | 649          | 9 mo, 1.5 y, 2.5 y, up to 3 y | Initial, 9 mo, 1.5 y, 2.5 y, study end | Initial, study end | NA              | Shepherd et al. (2002) [50] |
| Stroke Registry Investigating Cognitive Decline (STRIDE) | Hong Kong        | 2009–2015     | 1013         | 3–6 mo, 1 y, 2 y, 3 y, 4 y, 5 y | 3–6 mo               | Initial         | DSM-IV          | Yang et al. (2015) [51]; Liu et al. (2015) [52]; Wang et al. (2015a, 2015b) [53,54]; Møk et al. (2016) [55] |
| Study of Factors Influencing Post-Stroke Dementia (STROKDEM) | France            | 2011–2018     | 1100 (planned) | 6 mo, 1 y, 3 y, 5 y | 6 mo, 1 y, 3 y, 5 y | Initial, 6 mo, 3 y, 5 y | Yes             | NA              |
| Sydney Stroke Study (SSS)                   | Australia        | 1997–2005     | 351          | 3–6 mo, 1 y, 3 y, 5 y | 3–6 mo, 1 y, 3 y, 5 y | 3–6 mo, 1 y, 3 y, 5 y | Consensus diagnosis | Sachdev et al. (2004; 2014) [56,57] |

Abbreviations: m, month after index stroke; y, years after index stroke; ACER, Addenbrooke’s Cognitive Examination; ADDTC, Alzheimer’s Disease Diagnostic and Treatment Centers; DSM, Diagnostic and Statistical Manual of Mental Disorders; ICD-10, *International Statistical Classification of Diseases, 10th Revision*; MoCA, The Montreal Cognitive Assessment; NART, National Adult Reading Test performance in established dementia; NINCDS-ADRDA, National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer’s Disease and Related Disorders Association; NINDS-AIREN, National Institute of Neurological Disorders and Stroke-Association Internationale pour la Recherche et l’Enseignement en Neurosciences; TICS, Telephone Interview for Cognitive Status; VASCOG, International Society for Vascular Behavioral and Cognitive Disorders.

*Sample size denotes enrollment number (not follow-up) and does not include healthy control subjects. The studies which recruited control subjects were: CANVAS (n = 40), CogFAST-Nigeria (n = 74), Epi USA (n = 249), NEMESIS (n = 99), PROSPER and SSS (n = 129).

1 Some studies also obtained PET scans from a subgroup of their participants: GRECOG-VASC (amyloid for 100 patients with poststroke cognitive deficit), STROKDEM (at 1 year), DEDEMAS (amyloid/FDG for incident dementia cases), CANVAS (amyloid at 3 years), STRIDE (PiB, n = 50) and DSDB (SPECT, n = 36).

1 ASPIRE-S is an unofficial member that is planning to obtain participants’ permission to share data outside of Ireland before signing the MoU.

1 For the GRECOG-VASC study, only the 200 first patients from the Amiens center are included for STROKOG and the VASCOG criteria was used except for the threshold of cognitive impairment which was set at the 5th percentile.

1 PROSPER shares data at the summary level and not individual participant data.
| Study         | Cognitive domain                                      |
|--------------|-------------------------------------------------------|
| **ASPIRE-S** | NA                                                    |
| **BIOSTROKE**| Trail Making Test A                                   |
|              | Zazzo Test                                            |
|              | Digit symbol coding                                   |
|              | Bell’s Test                                           |
| **Bundang-VCI**| Trail Making Test A                                   |
|              | Digit symbol coding                                   |
| **CASPER**   | Trail Making Test A                                   |
|              | Digit Span Forward                                    |
|              | Digit Symbol Coding                                   |
|              | Start Cancellation Task                              |
| **CANVAS**   | Trail Making Test A                                   |
|              | Digit Span Forward                                    |
|              | Symbol Digit Modalities Test                          |
|              | Cogstate Detection Test and Identification Test        |
|              | Star Cancellation Task                                |
| **CogFAST-UK**| Trail Making Test A                                   |
|              | Simple Reaction Time                                  |
|              | Choice Reaction Time                                  |
|              | Number Vigilance task                                 |
|              | Digit Span forward                                    |
| **CogFAST-Nigeria**| Choice Reaction Time                                |
|              | Word-List Learning Test (10-item)                    |
|              | Delayed recall of stick design                       |
| **COAST**    | Digit Span Forward                                    |
|              | Visual Memory Span Forward                            |
|              | Auditory Detection Test                               |
|              | Symbol Digit Modalities Test                          |
|              | Digit cancellation task                               |
| **DREDEMAS** | Trail Making Test A                                   |
|              | Digit Symbol Coding                                   |
| **DSDB**     | Trail Making Test A                                   |

(Continued)
### Table 2

Cognitive measures used by the STROKOG member studies to diagnose dementia (Continued)

| Study                  | Attention/processing speed          | Memory               | Language                                      | Construction (visuospatial)                  | Executive function/abstract reasoning         |
|------------------------|-------------------------------------|----------------------|-----------------------------------------------|----------------------------------------------|-----------------------------------------------|
| **Epi USA**            | - Target finding for shapes and letters | - Selective Reminding Test | - Boston Naming Test | - Copying geometric figures | - Similarities test subtest  |
|                        |                                     | - Benton Recognition Test | - Verbal fluency, category | - Benton Matching Test | - Identities and oddities  |
|                        |                                     |                      | - Complex Ideation and Repetition subtests of BDAE |                              | - Verbal fluency, letter  |
| **Göteborg Neuro70+**  | NA                                  | NA                   | NA                                            | NA                                          | NA                                            |
|                        | - Trail Making Test A               | - FCSRT              | - Boston Naming Test | - Rey Complex Figure Test: Copy | - Trail Making Test B  |
|                        | - Digit Symbol Coding               | - Door Visual Recognition Test | - Verbal fluency, category (animals) | - Figure copying test | - Verbal fluency, letter (PVR)  |
|                        | - Simple Reaction Time              | - Rey Complex Figure Test: Recall | - Block Design | - Clock-Drawing Test | - Strategic index (FCSRT)  |
|                        | - Digit Tapping                     |                      | - Reading, writing, arithmetic operations     | - Poppelreuter | - Inventory of Behavioral Dysexecutive Disorders  |
|                        | - Albert cancellation test          |                      |                                               |                              | - Trail Making Test B  |
| **SAM**                | - Trail Making Test A               | - Logical memory     | - Boston Naming Test | - Block Design | - Digit Span backward  |
|                        | - Stroop color naming               | - Visual Reproduction | - Verbal fluency, category (animals) | - Figure copying test | - Verbal fluency, letter (K)  |
|                        | - Digit Span Forward                | - Full Object Memory Evaluation | - Token Test | - Clock-Drawing Test | - Stroop Test  |
|                        | - Bell’s Test                       |                      | - Boston Diagnostic Aphasia Exam (overall speech evaluation) | - Poppelreuter | - Wisconsin Card Sorting Test  |
| **CODAS**              | - Concept Shifting Test Parts A and B | - RAVLT (15-Word, Dutch) | - Verbal fluency, category (animals, professions) | - GIT Vocabulary | - Similarities  |
|                        | - Letter Digit Substitution Test    |                      | - GIT Analogies                               |                              | - Comprehension  |
|                        | - Stroop color naming and reading test |                      |                                               |                              |  |
| **MSS–II**            | NA                                  | NA                   | NA                                            | NA                                          | NA                                            |
| **K-VCIHS**            | - Trail Making Test A               | - Seoul Verbal Learning Test | - Boston Naming Test | - Rey Complex Figure Test: Copy | - Trail Making Test B  |
|                        | - Digit Symbol Coding               |                       | - Verbal fluency, category | - Recomplex | - COWAT  |
|                        |                                     |                      |                                               | Figure Test: Copy |  |
| **NEMESIS**            | - KSNAP Mental Status               | - Rivermead Behavioral Memory Test | - Rey Complex Figure Test: Copy | - Picture Completion | - KSNAP 4 letter word test  |
|                        | - Digit Span Forward                | - RAVLT              | - Block Design                               | - KSNAP Gestalt closure | - Similarities  |
|                        | - KSNAP Symbol Coding               | - Rey Complex Figure Test: Recall | - Clock drawing (Sutherland) |                              | - Digit Span backward  |
|                        | - KSNAP Number Recall               | - Word Recall        |                                               |                              | - Verbal fluency, letter (FAS)  |
|                        |                                     |                      |                                               |                              | - Frontal assessment battery  |
| **NNI Singapore**      | - Trail Making Test A               | - FCSRT              | - Verbal fluency, category | - Rey Complex Figure Test: Copy | - Trail Making Test B  |
|                        | - Digit Span Forward                | - Rey Complex Figure Test: Recall | - Token Test | - Praxis score | - Verbal fluency, letter  |
| **PITCH**             | - Trail Making Test A               | - Picture Learning test: immediate and delayed memory | - Rey Complex Figure Test: Copy | - Praxis score | - Card Sorting Test  |
|                        | - Digit Span Forward                | - Doors and People test | - Token Test |                              | - Digit Span backward  |
| **PROSPER**           | - Letter Digit Substitution Test    | - Picture Learning test: immediate and delayed memory | - Rey Complex Figure Test: Copy | - Praxis score | - Stroop Test  |
| **STRIDE**            | NA                                  | NA                   | NA                                            | NA                                          | NA                                            |

(Continued)
Table 2
Cognitive measures used by the STROKOG member studies to diagnose dementia (Continued)

| Study          | Attention/processing speed               | Memory                  | Language                                | Construction (visuospatial)             | Executive function/abstract reasoning |
|---------------|------------------------------------------|-------------------------|-----------------------------------------|------------------------------------------|----------------------------------------|
| STROKDEM      | - Trail Making Test A                     | - FCSRT                 | - Verbal fluency, category              | - VOSP                                   | - Trail Making Test B                  |
|               | - Zazzo Test                              |                         | - Token Test                            | - VOSP Complex Figure Test: Copy         | - Trail Making Test B                  |
|               | - Digit Symbol Coding                     |                         | - Boston Naming Test                    | - Praxis score                           | - Stroop Test                          |
|               | - Bell’s Test                             |                         | - Sentence repetition                   | - Block design                           |                                        |
|               |                                         | - Visual Reproduction I & II | - Visual fluency, category (animals)    | - Simple copying                        |                                        |
|               | - Choice Reaction                         | - Visual memory recall   | - Token Test                            | - Picture completion                     |                                        |
| SSS           | - Trail Making Test A                     | - Logical Memory I & II  |                                         |                                          |                                        |
|               | - Digit Span Forward                      |                         |                                         |                                          |                                        |
|               | - Mental Control                          |                         |                                         |                                          |                                        |
|               | - Symbol Digit Modalities Test            |                         |                                         |                                          |                                        |
|               | - Choice Reaction                         | - Visual memory recall   |                                         |                                          |                                        |
|               | - Time                                    |                         |                                         |                                          |                                        |

Abbreviations: BADS, behavioral assessment of the dysexecutive syndrome; BDAE, Boston Diagnostic Aphasia Examination; CAMCOG, Cambridge Cognitive Examination; CERAD, Consortium to Establish a Registry for Alzheimer’s Disease; COWAT, Controlled Oral Word Association Test; CSID, Community Screening Interview for Dementia; FCSRT, Free and Cued Selective Reminding Test; GIT, Groninger Intelligence Test; HCFD, higher cortical function deficits; KSNAP, Kaufman short neuropsychological assessment procedure; RAVLT, Rey Auditory Verbal Learning Test; VOSP, visual object and space perception battery.

NOTE. The assignment of a neuropsychological test to a particular cognitive domain is based on convention and previous work such as for COSMIC [17] and may not be how a study has assigned the test.

*ASPIRE-S, MSS-II, Göteborg Neuro70+ and STRIDE did not conduct detailed neuropsychological test batteries, instead, the following tests were used to diagnose dementia in each study: ASPIRE-S: MoCA (The Montreal Cognitive Assessment); Göteborg Neuro70+: Cognitive symptom ratings and items from ADAS-Cog (The Alzheimer’s Disease Assessment Scale-Cognition); MSS-II: NART (National Adult Reading Test performance in established dementia) was conducted for pre-morbid cognitive ability; specific additional tests for current cognition were not performed outside of ACER (Addenbrooke’s Cognitive Examination) and MOCA (equivalent); STRIDE: The Mini–Mental Status Examination (MMSE) and MoCA.

*Cracow study conducted neuropsychological tests under the five domains but these data were lost and not available.

3.2. Advantages

The benefits of being able to reuse, combine, and compare data from multiple cohorts are obvious, and this approach has been recommended by the Lancet REWARD Campaign [64]. Cohort studies focused on stroke and cognition are expensive, labor-intensive, and very demanding of researchers’ and participants’ time. Multiple factors may limit the study sample size and duration. There already exists a wealth of data from previous or current studies that are underutilized and can be put to further use. Standard meta-analysis is one way of analyzing the combined cohorts of existing studies, but it is limited to published results and specific research questions. STROKOG’s approach in harmonizing individual participant data from various studies is an economical use of previously collected data to explore both existing and novel research questions. According to the Cochrane Methods group, IPD meta-analyses are considered the “gold standard” of systematic review [65]. In IPD meta-analyses, individual participant data from all studies can be modeled simultaneously while accounting for the clustering of participants within studies [17]. It allows detailed participant-level exploration of cognitive disorders in relation to the individuals’ characteristics. Additionally, statistical analysis can be standardized across studies where more appropriate or advanced methods can be used; baseline and potential confounding factors can be adjusted for consistency across studies; results for missing or poorly acquired outcomes can be reported, thereby reducing bias within study reporting; results for specific subgroups of participants can be obtained across studies; unpublished data can be included, thereby addressing publication bias [17]. Having access to a rich collection of individual participant-level data from international studies, STROKOG is in a unique position to apply IPD meta-analyses techniques and fully explore and examine patient studies, for example, for the COSMIC consortium [63]. There exists much heterogeneity in measurement instruments used by different studies. Even when studies have used similar tests, different versions of tests were used, and tests might have been administered in nonstandard ways. Owing to differences in culture and language, questions and responses may have been worded differently. There is no consensus on how each neuropsychological test should be allocated to a specific cognitive domain as such tests are generally multifactorial. Table 2 shows the list of tests used in the studies under five cognitive domains; each test was assigned to a cognitive domain based on convention and previous work such as for COSMIC [63]. Demographic effects such as age, gender, and education need to be accounted for. Furthermore, adequate normative data may or may not be available in all regions or for all ethnocultural groups; not all studies included nondemented stroke-free controls whose test scores may be used to derive adjusted scores and to define cognitive impairment.
level characteristics and outcomes, which in turn could lead to facilitating a better understanding of various aspects of post-stroke cognitive impairment.

A consortium such as STROKOG has the added benefit of informing new researchers of the need to standardize their measures and methods so that they are in step with other researchers in the same field. This is particularly important for stroke and dementia, as many researchers from low and middle income countries have recently become interested in this topic and are mounting studies that would benefit from comparability with existing studies. New studies therefore would have the benefit of validated measures and better comparability. There is also the potential for the STROKOG database to be made available to nonconsortium researchers following consortium-based publications and with the approval of the RSC and the ethics review board. The scientific benefits of making large databases available to researchers worldwide have been demonstrated by the more than 250 publications that have resulted from the sharing of ADNI (Alzheimer’s Disease Neuroimaging Initiative) data [66].

The research community that STROKOG proposes to create is likely to pay other dividends. It is expected that the productivity of the group will increase over time in quality and quantity; junior researchers will be supported, new ideas and lines of investigation will be generated and scientific interchange and collaboration will be facilitated. The benefits will therefore extend beyond the harmonizing and pooling of data.

3.3. Specific projects

The first project aims to describe the prevalence and profile of poststroke cognitive impairment, measured between 1 and 6 months after a stroke or TIA, in diverse geographical and ethnic-cultural settings as represented by the STROKOG member cohorts. The project is currently underway and is being coordinated by the Sydney team. A project proposal was approved by the RSC, and the following data are currently being requested:

1. Demographics.
2. Stroke-related variables.
3. Medical history/risk factors.
4. Functional assessments and screening tests.
5. Neuropsychological test data.
6. Neurological assessments and psychiatric examinations.
7. Cognitive disorder diagnosis.

A number of projects utilizing STROKOG data have been proposed for the future, and they aim to examine across STROKOG cohorts

1. Rates of cognitive decline in post-stroke patients.
2. Determinants of cognitive impairment.
3. Determinants of cognitive decline.
4. Effect of methodologic differences in the collection and interpretation of cognitive data on the estimation of prevalence of cognitive deficit.
5. Specific risk factors such as atrial fibrillation, congestive heart failure, diabetes, and homocysteine.
6. Depression and apathy in relation to cerebrovascular disease.
7. Relative contributions of Alzheimer’s and vascular pathologies to dementia.
8. Precise and reliable quantitation and localization of white-matter hyperintensities, microbleeds, lacunes and micro-infarcts and examination of their relationship to cognition.

While many of the existing member studies have relevant data to contribute to the more general topics (such as 1 to 4 noted above), the more specific topics (5 to 8) will be best addressed by growing the STROKOG membership base. Therefore, we encourage any investigators with a study meeting the eligibility criteria to contact STROKOG and become a member of the consortium.

4. Conclusion

STROKOG is a truly international consortium of studies with a focus on cognitive disorders associated with cerebrovascular disease. It has the potential to transform our understanding of the epidemiology and natural course of VCD and have a worldwide impact on promoting better cognitive outcomes in the setting of cerebrovascular disease.

Acknowledgments

ASPIRE-S: The authors acknowledge the ASPIRE-S Steering Group members: Professor Hannah McGee, Royal College of Surgeons in Ireland; Professor Emer Shelley, Royal College of Surgeons in Ireland; Professor Peter Kelly, Mater Misericordiae University Hospital, Dublin; Dr Eamon Dolan, Connolly Hospital, Dublin. BIOSTROKE and STROKDEM: French Health Ministry, the VasCog FHU, the ‘Fondation Coeur et Arteres’. CANVAS: CANVAS researchers wish to acknowledge support from the NHMRC (APP1020526 and APP1094974), Sidney and Fiona Myer Foundation and the Collie Trust. CASPHER: The CASPER project team consists of Ms. Syenna Schievink, Ms Elles Douven, Dr Sebastian Köhler, Dr Pauline Aalten, Dr Julie Staals, Professor Robert van Oostenbrugge, and Professor Frans Verhey. COAST: The authors thank all participants for their involvement, the research team from NUHS Memory Ageing and Cognition Centre for data collection. CogFAST-UK: The authors are very grateful to the patients, families, clinical staff and previous co-investigators for their co-operation and help with the execution of the study. CogFAST-Nigeria: The authors are very grateful to the patients, families and clinical staff for their co-operation and help with the execution of the study. DSDB: The Durban Cerebrovascular Group, Department of Surgery and Neurology, University of Kwa-Zulu Natal and Entabeni Hospital Stroke Center, Durban, South Africa. GRECOG-VASC: French Health Ministry. MSS-II: MMS2 acknowledges the Wellcome Trust, Row Fogo Charitable
Trust; Fergus Doughty is supported by the Stroke Association and Garfield Weston Foundation. NEMESIS: The National Health and Medical Research Council of Australia (NHMRC). PITCH: Charlotte Cordonnier is a member of the Institut Universitaire de France.

The funding provided for the study is as follows: STROKOG: The Dementia Momentum fund from the Centre of Healthy Brain Ageing (CHeBA), UNSW Medicine, University of New South Wales and Vincent Fairfax Family Foundation. ASPIRE-S: Irish Health Research Board (HRB; grant number 1404/7400). CASPER and CODAS: Maastricht University, Health Foundation Limburg, and the Adriana van Rinsum-Ponsen Stichting. The sponsors had no role in the design of the study and collection, analysis, and interpretation of data, and in writing the manuscript. COAST: National Medical Research Council (NMRC/CG/NUHS/2010) and National University Health System National Clinician Scientist Program (NUHS NCSP). Y.D. was a recipient of the NUHS NCSP award during this study. CogFAST-UK: R.N.K. was supported by grants from the Newcastle Centre for Brain Ageing and Vitality (BBSRC, EPSRC, ESRC and MRC, LLHW; G0700718). The original CogFAST-UK research programmes were supported by the UK Medical Research Council (MRC, G0500247 and G0817621). CogFAST-Nigeria: R.O.A. was supported by a fellowship from the International Brain Research Organization (IBRO) Paris, France and by an ORS Award from the Newcastle University, UK. DEDEMAS: Vascular Dementia Research Foundation. Flutemetamol (18F) was provided by GE Healthcare. Epi USA: National Institutes of Health (grants R01-NS26179 and P01-AG07232). GRECOG-VASC: French Health Ministry. MSS-II: Wellcome Trust number WT088134/Z/09/A. Row Fogo Trust. NEMESIS: NHMRC, Victorian Health Promotion Foundation, Austin Hospital Medical Research Foundation, Perpetual Trustees, National Stroke Foundation, Foundation for High Blood Pressure Research. NNI: National Neuroscience Institute, Singapore. PROSPER: The original PROSPER clinical trial was founded by an investigator initiated grant from Bristol-Myers Squibb, USA. However, the company had no involvement in the formulation of hypotheses, analysis of the data or in any aspect of the preparation of this manuscript. SAM: Helsinki University Central Hospital, Helsinki. STRIDE: Health and Health Services Research Fund (0708041) of the Food and Health Bureau of the Government of the HKSAR, the Lui Che Woo Institute of Innovative Medicine, and Therese Pei Fong Chow Research Centre for Prevention of Dementia (in memory of Donald H K Chow). SSS: National Health and Medical Research Council.

Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.dadm.2016.10.006.

RESEARCH IN CONTEXT

1. Systematic review: The authors performed a review of published studies of poststroke cognitive impairment and dementia using PubMed and invited all eligible studies to participate. Unpublished studies were identified through correspondence with members of the Society for Vascular Cognitive and Behavioral Disorders (VASCOG).

2. Interpretation: The STROKOG consortium brings together international longitudinal cohort studies of cognitive decline and dementia following stroke or TIA. By harmonizing data and conducting individual participant meta-analyses, STROKOG aims to better understand the determinants and manifestations of vascular contributions to cognitive disorders and help improve the diagnosis and treatment of vascular cognitive impairment.

3. Future directions: STROKOG will conduct individual projects investigating research topics such as the prevalence of VCD, rates of cognitive decline, determinants of cognitive impairment and the frequency of depression in relation to cerebrovascular disease. STROKOG invites other longitudinal studies on stroke/TIA patients and cognitive impairment to join, contribute to the database and participate in collaborative research.

References

[1] Román GC. Managing Vascular Dementia. London: Science Press; 2003.
[2] Lobo A, Launer LJ, Fratiglioni L, Andersen K, Di Carlo A, Breteler MM, et al. Prevalence of dementia and major subtypes in Europe: A collaborative study of population-based cohorts. Neurologie Diseases in the Elderly Research Group. Neurology 2000;54:S4–9.
[3] Rockwood K, Wentzel C, Hachinski V, Hogan DB, MacDonald K, McDowell I. Prevalence and outcomes of vascular cognitive impairment. Neurology 2000;54:447–51.
[4] Pohjolasaara T, Erkinjuntti T, Ylikoski R, Hietanen M, Vataja R, Kaste M. Clinical determinants of poststroke dementia. Stroke 1998; 29:75–81.
[5] Sachdev PS, Brodaty H, Valenzuela MJ, Lorentz L, Looi JCL, Berman K, et al. Clinical determinants of dementia and mild cognitive impairment following ischaemic stroke: the Sydney Stroke Study. Dementia Geriatr Cogn Disord 2006;21:275–83.
[6] Makin S, Turpin S, Dennis M, Wardlaw J. Cognitive impairment after lacunar stroke: systematic review and meta-analysis of incidence, prevalence and comparison with other stroke sub-types. J Neurol Neurosurg Psychiatry 2013;84:993–990.
[7] Desmond DW, Moroney JT, Paik MC, Sano M, Mohr JP, Aboumatar S, et al. Frequency and clinical determinants of dementia after ischemic stroke. Neurology 2000;54:1124–31.
[8] Pendlebury ST, Rothwell PM. Prevalence, incidence, and factors associated with pre-stroke and post-stroke dementia: a systematic review and meta-analysis. Lancet Neurol 2009;8:1006–18.

[9] Savva GM, Stephan BC, the Alzheimer’s Society Vascular Dementia Systematic Review Group. Epidemiological studies of the effect of stroke on incident dementia: A systematic review. Stroke 2010;41:e41–6.

[10] Sposato LA, Kapral MK, Fang J, Gill SS, Hackam DG, Cipriano LE, et al. Declining incidence of stroke and dementia: coincidence or prevention opportunity? JAMA Neurol 2015;72:1529–31.

[11] Pendlebury ST. Stroke-related dementia: rates, risk factors and implications for future research. Maturitas 2009;64:165–71.

[12] Allan L, Rowan EN, Firbank MJ, Thomas AJ, Parry SW, Polvikoski TM, et al. Long term incidence of dementia, predictors of mortality and pathological diagnosis in older stroke survivors. Brain 2011;134:3713–24.

[13] Ivan CS, Seshadri S, Beiser A, Au R, Kase CS, Kelly-Hayes M, et al. Dementia after stroke: the Framingham Study. Stroke 2004;35:1264–8.

[14] Gottesman RF, Hills AE. Predictors and assessment of cognitive dysfunction resulting from ischaemic stroke. Lancet Neurol 2010;9:985–905.

[15] Gorelick PB, S cuteri A, Black SE, Decarli C, Greenberg SM, Iadecola C. Vascular contributions to cognitive impairment and dementia: a statement for healthcare professionals from the American heart association/american stroke association. Stroke 2011;42:2672–713.

[16] METACOHORTS Consortium. METACOHORTS for the study of vascular disease and its contribution to cognitive decline and neurodegeneration: An initiative of the Joint Programme for Neurodegenerative Disease Research. Alzheimers Dement 2016; http://dx.doi.org/10.1016/j.jalz.2016.06.004 [Epub ahead of print].

[17] Riley RD, Lambert PC, Abo-Zaid G. Meta-analysis of individual participant data: rationale, conduct, and reporting. BMJ 2010;340:521–5.

[18] Lyman GH, Kuderer NM. The strengths and limitations of meta-analyses based on aggregate data. BMC Med Res Methodol 2005;5:14.

[19] Mellon L, Brewer L, Hall P, Horgan F, Williams D, Hickey A, et al. Cognitive impairment six months after ischaemic stroke: a profile from the ASPIRE-S study. BMC Neurol 2015.

[20] Lim JS, Kim N, Jang MU, Han MK, Kim S, Baek MJ, et al. Cortical hubs and subcortical cholinergic pathways as neural substrates of post-stroke dementia. Stroke 2014;45:1069–76.

[21] Ducroquet A, L eys D, Saab A, Richard F, Cordonnier C, Girot M, et al. Influence of chronic ethanol consumption on the neurological severity in patients with acute cerebral ischemia. Stroke 2013;44:2324–6.

[22] Douven E, Schievink SH, Verhey FR, van Oostenvrugge JR, Aalten P, Staals J, et al. The Cognition and Affect after Stroke – A Prospective Evaluation of Risks (CASPER) study: rationale and design. BMC Neurol 2016;16:65.

[23] Brodmann A, Werden E, Pardoe H, Li Q, Jackson G, Cowie T, et al. Charting cognitive and volumetric trajectories after stroke: protocol for the Cognition And Neocortical Volume After Stroke (CANVAS) study. Int J Stroke 2014;9:824–8.

[24] Akinremi AO, Allan L, Owolabi MO, Akinremi JO, Ogbole G, A jani A, et al. Profile and determinants of vascular cognitive impairment in African stroke survivors: The CogFAST – Nigeria Study. J Neurol Sci 2014;346:241–9.

[25] Dong Y, Venkatasubramanian N, Poon-Lap Chan BP, Sharma VK, Slavin MJ, Collinson SL, et al. Brief screening tests during acute admission in patients with mild stroke are predictive of vascular cognitive impairment 6-months after stroke. J Neurol Neurosurg Psychiatry 2012;83:580–5.

[26] Klimkowicz A, Dziedzic T, Polczyk R, Pera J, S lówik A, Szczudlik A. Factors associated with pre-stroke dementia: the cracow stroke database. J Neurol 2004;251:599–603.

[27] Klimkowicz-Mrowiec A, Dziedzic T, S lówik A, Szczudlik A. Predictors of poststroke dementia: results of a hospital-based study in Poland. Dement Geriatr Cogn Disord 2006;21:328–34.
Cordonnier C, Leys D, Dumont F, Deramecourt V, Bordet R, Pasquier F, et al. What are the causes of pre-existing dementia in patients with intracerebral haemorrhages? Brain 2010; 133:3281–9.

Moulin S, Labreuche J, Bombois S, Rossi C, Boulouis G, Hénon H, et al. Dementia risk after spontaneous intracerebral haemorrhage: a prospective cohort study. Lancet Neurol 2016;15:820–9.

Shepherd J, Blauw GI, Murphy MB, Bollen EL, Buckley BM, Cobbe SM, et al. Pravastatin in elderly individuals at risk of vascular disease (PROSPER): a randomised controlled trial. Lancet 2002; 360:1623–30.

Yang J, Wong A, Wang Z, Liu W, Au L, Xiong Y, et al. Risk factors for incident dementia after stroke and transient ischemic attack. Alzheimers Dement 2015;11:16–23.

Liu W, Wong A, Au L, Yang J, Wang Z, Leung EY, et al. Influence of amyloid-β on cognitive decline after stroke/transient ischemic attack: three-year longitudinal study. Stroke 2015;46:3074–80.

Wang Z, Wong A, Liu W, Yang J, Chu WC, Au L, et al. Cerebral microbleeds and cognitive function in ischemic stroke or transient ischemic attack patients. Dement Geriatr Cogn Disord 2015;40:130–6.

Mok VC, Lam BY, Wang Z, Liu W, Au L, Leung EY, et al. Delayed-onset dementia after stroke or transient ischemic attack. Alzheimers Dement 2016;12:1167–76.

Sachdev PS, Brodaty H, Valenzuela MJ, Lorentz L, Looi JC, Wen W, et al. The neuropsychological profile of vascular cognitive impairment in stroke and TIA patients. Neurology 2004;62:912–9.

Sachdev PS, Lipnicki DM, Crawford JD, Wen W, Brodaty H. Progression of cognitive impairment in stroke/TIA patients over 3 years. J Neurol Neurosurg Psychiatry 2014;85:1324–30.

Fortier I, Raina P, Van den Heuvel ER, Griffith LE, Craig C, Saliba M, et al. Maelstrom Research guidelines for rigorous retrospective data harmonization. Int J Epidemiol 2016. pii: dys075. [Epub ahead of print].

Stewart GB, Altman DG, Askie LM, Duley L, Simmonds MC, Stewart LA. Statistical analysis of individual participant data meta-analyses: a comparison of methods and recommendations for practice. PLoS One 2012;7:e46042.

Psaty BM, O’Donnell CJ, Guddason V, Lunetta KL, Folsom AR, Rotter JI, et al. Cohorts for Heart and Aging Research in Genomic Epidemiology (CHARGE) Consortium: Design of prospective meta-analyses of genome-wide association studies from five cohorts. Circ Cardiovasc Genet 2009;2:73–80.

Schaap LA, Peeters GM, Dennison EM, Zambon S, Nikolaus T, Sanchez-Martinez M, et al. 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.

Pluijm SM, Bardage C, Nikula S, Blumstein T, Jylha M, Minicuci N, et al. A harmonized measure of activities of daily living was a reliable and valid instrument for comparing disability in older people across countries. J Clin Epidemiol 2005;58:1015–23.

Sachdev PS, Lipnicki DM, Kochan NA, Crawford JD, Thalamuthu A, Andrews G, et al. The prevalence of mild cognitive impairment in diverse geographical and ethnocultural regions: The COSMIC Collaboration. PLoS One 2015;10:e0142388.

REWARD. The Lancet. Available at: http://www.thelancet.com/campaigns/efficiency/statement. Accessed June 01, 2016.

Cochrane Methods: IPD Meta-analysis. The Cochrane collaboration. Available at: http://methods.cochrane.org/ipdma/. Accessed August 22, 2016.

Carrillo MC, Bain JJ, Frisoni GB, Weiner MW. Worldwide Alzheimer's disease neuroimaging initiative. Alzheimers Dement 2012; 8:337–42.
Author/s:
Sachdev, PS; Lo, JW; Crawford, JD; Mellon, L; Hickey, A; Williams, D; Bordet, R; Mendyk, A-M; Gelé, P; Deplanque, D; Bae, H-J; Lim, J-S; Brodtmann, A; Werden, E; Cumming, T; Köhler, S; Verhey, FRJ; Dong, Y-H; Tan, HH; Chen, C; Xin, X; Kalaria, RN; Allan, LM; Akinyemi, RO; Ogunniyi, A; Klimkowicz-Mrowiec, A; Dichgans, M; Wollenweber, FA; Zietemann, V; Hoffmann, M; Desmond, DW; Linden, T; Blomstrand, C; Fagerberg, B; Skoog, I; Godefroy, O; Barbay, M; Roussel, M; Lee, B-C; Yu, K-H; Wardlaw, J; Makin, SJ; Doubal, FN; Chappell, FM; Srikanth, VK; Thrift, AG; Donnan, GA; Kandiah, N; Chander, RJ; Lin, X; Cordonnier, C; Moulin, S; Rossi, C; Sabayan, B; Stott, DJ; Jukema, JW; Melkas, S; Jokinen, H; Erkinjuntti, T; Mok, VCT; Wong, A; Lam, BYK; Leys, D; Hénon, H; Bombois, S; Lipnicki, DM; Kochan, NA; STROKOG

Title:
STROKOG (stroke and cognition consortium): An international consortium to examine the epidemiology, diagnosis, and treatment of neurocognitive disorders in relation to cerebrovascular disease.

Date:
2017

Citation:
Sachdev, P. S., Lo, J. W., Crawford, J. D., Mellon, L., Hickey, A., Williams, D., Bordet, R., Mendyk, A. -M., Gelé, P., Deplanque, D., Bae, H. -J., Lim, J. -S., Brodtmann, A., Werden, E., Cumming, T., Köhler, S., Verhey, F. R. J., Dong, Y. -H., Tan, H. H. ,... STROKOG (2017). STROKOG (stroke and cognition consortium): An international consortium to examine the epidemiology, diagnosis, and treatment of neurocognitive disorders in relation to cerebrovascular disease.. Alzheimers Dement (Amst), 7 (1), pp.11-23.
https://doi.org/10.1016/j.dadm.2016.10.006.

Persistent Link:
http://hdl.handle.net/11343/257536