1-1-2012

Lifestyle and late life cognitive health: Sufficient evidence to act now?

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10.1017/S1041610211002912

This article has been published in a revised form as Barber, B., Ames, D., Ellis, K., Martins, R. N., Masters, C., & Szoeke, C. (2012). Lifestyle and late life cognitive health: Sufficient evidence to act now?. International Psychogeriatrics, 24(5), 683-688.

International Psychogeriatrics (2012), 24:5, 683–688 © International Psychogeriatric Association 2012
doi:10.1017/S1041610211002912

GUEST EDITORIAL

Lifestyle and late life cognitive health: sufficient evidence to act now?

Introduction

Cures for the various diseases that give rise to dementia remain elusive and are likely to remain so for the foreseeable future. Our current capacity to slow disease progression or to manage symptoms is far from satisfactory. Pharmacological interventions have made only a modest impact to date, and carry risks as well as possible benefits (Ritchie, 2007)

As a consequence of this situation, many people with dementia and their carers pursue a variety of complementary and alternative therapies, for which there is minimal or no evidence of efficacy (Livingston and Cooper, 2010). In the absence of effective treatments for dementia it is natural to explore other approaches to this disorder.

A number of researchers have focused on a variety of lifestyle factors to determine whether they have the potential to delay the age of onset of neuropathologically-based cognitive symptoms, including those of Alzheimer's disease (AD), vascular dementia (VaD), and other neurodegenerative diseases. Delaying the onset of cognitive decline and dementia is a worthy goal, but the language of this approach includes the words "protective" and "preventive," betraying an optimism that may be an essential foundation for ongoing research.

The idea that the way our lives are lived may have implications for health in later life is not new. Population studies examining aging were initiated as early as the 1960s (Saczynski *et al.*, 2006) and many studies undertaken since that time have provided the opportunity to evaluate the potential of a variety of factors to impact on late life health in general and on cognition and dementia in particular (Purandare, 2010).

To determine the potential for lifestyle factors to be examined using trial methods that meet the highest criteria for evidence, we and other collaborators prepared a report reviewing studies that evaluated the effects of physical activity, social engagement, and cognitive activity on later life cognitive function. The full text of this report, which was funded by Australia's Commonwealth Scientific, Industrial Research Organization (CSIRO) is attached to the electronic version of this editorial as supplementary material at www.journals.cambridge.org and can be downloaded by anyone with electronic access to *International Psychogeriatrics.* In accord with many other such reviews, the results encourage further investigation, as they include remarkably consistent data associating later life cognitive status with physical activity, social engagement, and cognitive activity.

Physical activity

The studies examined included a total of 39,512 participants. Setting aside for the moment the fact that across the cohort studies there was substantial variation with respect to inclusion/exclusion criteria, follow-up periods, the modeling of predictor variables, choice of outcome measures, and the modeling of associations between physical activity and cognitive decline, there was a remarkable consistency in results favoring physical activity as a beneficial modulator of late life cognitive function. For example, in one study people were dichotomized to Active versus Sedentary on the basis of midlife leisure physical activity (Rovio *et al.*, 2005). At 20.9 years follow-up after controlling for age, sex, education, locomotor symptoms, and time to follow-up, the odds ratio for all cause dementia for midlife Active versus Sedentary people was 0.45 (95% CI, 0.24–0.85) and the odds ratio for AD for Active versus Sedentary was 0.34 (95% CI, 0.15–0.74). In the same cohort, physical activity associated with occupation and commuting did not yield a similar protective effect suggesting that physical activity effects are subject to psychosocial factors (Rovio *et al.*, 2007). All 12 epidemiological studies included in the review reported reduced odds for the onset of both all-cause dementia and AD. Whether dichotomized, expressed as tertiles or quartiles, or as the number of different physical activities in which participants engaged, higher levels of physical activity were associated with reduced risk.

Physical activity is the lifestyle factor that best lends itself to evaluation using randomized methods. One such study found that, for people at risk for AD, 150 min/week × 24 weeks of moderate intensity walking (or equivalent), at 18 months follow-up yielded sustained highly significant improvement from baseline on both cognitive (ADAS-Cog) and global impairment (Clinical

Dementia Rating Scale) total scores and on a wordlist delayed recall task (Lautenschlager *et al.*, 2008). Other randomized studies of older people with mild cognitive impairment (MCI) showed no effects on global cognitive measures, but did report effects on measures including Stroop tasks, verbal learning, verbal fluency, and the Trails B (van Uffelen *et al.*, 2008; Baker *et al.*, 2010). These two studies observed better outcomes for women than for men, suggesting that the sex of participants may be a significant variable in the development of physical activity agendas and programs.

Social engagement

Population studies examining the role of social engagement as a factor in later life cognitive health collectively produce an extensive list of variables. As was the case with cohort studies of physical activities, analyses were adjusted for many variables to address a broad range of potential confounds in generating results. Even so, the studies collectively use a great diversity of constructs in modeling social engagement, giving rise to skepticism about their value in some, but more importantly leading to the conclusion that, compared to physical activity, there are major barriers confronting attempts to operationalize social engagement in randomized studies. Certainly, there are ethical hurdles to be overcome and it seems likely that there could be significant problems with compliance.

Being married (inclusive of both formal conjugal relationships and simple cohabitation) was used as the reference in demonstrating that having never married, being divorced, being widowed, and living alone were associated with a striking increase in risk of all-cause dementia and AD (Helmer *et al.*, 1999; Fratiglioni *et al.*, 2000). Frequent unsatisfactory contact with children was observed to double the risk of all-cause dementia although unsatisfactory relationships with children with less frequent contact yielded a cognitive benefit, perhaps by stimulating socio-affective cognitive abilities (Fratiglioni *et al.,* 2000)!

Socially engaging leisure, recreational and productive activities gained through social networks, social ties, and social supports that link individuals to others are associated with reduced all-cause dementia risk (Fabrigoule *et al.*, 1995; Wang *et al.*, 2002; Niti *et al.*, 2008). Conversely, reduced social engagement (Bassuk *et al.,* 1999) and loneliness (Wilson *et al.,* 2007) increase the odds of cognitive decline. Social network activities identified collectively by studies are diverse and include going to church, to the cinema, to restaurants, attending sports events, joining excursions and trips, playing games, visiting family and friends, caring for children, membership of clubs for older people, gardening, knitting, and doing odd jobs.

This diversity of activities represented in the cohort studies gives rise to some points for discussion. For example, there is evidence that increasing the number of socially engaging activities in later life provides substantial cognitive benefit, especially if they also engage physical and cognitive functions (Bosma *et al.,* 2002).This supports the idea that, although lifespan engagement shows robust effects, initiating activities in later life is far from futile. Similarly, it is evident that frequency has a modifying effect such that weekly social activity yields greater benefit than less frequent activity (Wang *et al.,* 2002) and that health outcomes of socially engaging cognitive and physical activities are incremental in association with frequency of activity–days/week (Verghese *et al.,* 2003).

Other factors emerge in the literature indicating that there are lifespan social engagement predictors of later-life cognitive health. Low levels of non-occupational intellectual and physical activities between the ages of 20 and 60 years are highly predictive of AD onset (OR 3.85 (2.65–5.85) (Friedland *et al.*, 2001). Midlife social and intellectual activities are protective, whereas higher levels of television viewing in midlife are associated with an increased risk of AD (Lindstrom *et al.*, 2005).

Some studies of social engagement include solitary leisure activities, such as knitting and gardening. These may be categorized as productive activity for which no definitive conceptual model associating productive activity, leisure, and social engagement has yet been developed. While the inclusion of solitary activities in the study of the protective potential of social engagement may appear to be at odds with our understanding of social engagement, it is easy to conceive frequently solitary acts such as knitting as having an end product destined to be of use to others, and therefore, arguably constituting a socially engaging act. Definitions aside, the emergence of productive activity as bestowing a benefit on the producer allows some speculation about the nature and value of engagement and how it accords with assumptions and preconceptions about the aspirations, goals, and expectations of older people.

Cognitive interventions

Cognitive training and rehabilitation are not precisely differentiated, but the reports reviewed revealed a trend indicating that training was applied

more frequently, but not exclusively, to people without diagnosed cognitive conditions beyond "subjective memory complaints" or "age-associated cognitive decline," and rehabilitation was applied to participants with a diagnosis of MCI or AD.

Cognitive training

Most cognitive training studies employ randomized methods. Outcomes show that it produces better performance on neuropsychological tests for both cognitively healthy older people (Ball *et al.*, 2002) and people with mild to moderate AD (Farina *et al.*, 2006). While improvements are apparent in the specific domains of memory, processing speed, and reasoning, there is very limited evidence that the improvements translate to a greater ability to manage the demands of daily life. However, a study that also addressed emotional status and independent living functions reported improvement in those domains (Oswald *et al.*, 2006).

The intervention programs operationalized in the studies were, in some cases, strikingly different with respect to focus, content, delivery, and duration, suggesting that cognitive training has substantial variability in approaches. While the potential for adaptability in cognitive training models is useful, the theoretical framework within which these adaptations were made was not consistently well described.

The evidence for an effect of cognitive training suggests that there is a potential role for its application in the context of a multi-domain trial of interventions that include physical and social components. As with those domains, inclusion of a cognitive training component will involve detailed background investigation to plan and describe outcomes and to determine the procedures that will yield those outcomes.

Cognitive rehabilitation

All rehabilitation studies used some form of randomization. Cognitive rehabilitation interventions yielded improvements in memory, executive functions and emotional and behavioral status. There are inconsistent outcomes for memory, psychosocial, and independent living effects of cognitive rehabilitation.

The outcomes of the rehabilitation programs reviewed were differentiated from those of the training programs in that they focused more on "real life" functional outcomes in addition to specific memory, reasoning, and executive functions. These included prospective memory related to self-management of personal affairs (Kinsella *et al.*, 2009) and real life tasks related, for example, to money management (Levine *et al.*, 2007). In conjunction with these measures, two studies in particular placed emphasis on an educative role for the program. This approach explicitly differentiates between training aimed at skill development and education aimed at developing higher order knowledge that supports self-management – a body of knowledge that may be defined as supervisory knowledge. The cognitive rehabilitation studies also placed more emphasis on neuropsychiatric, socialization, and orientation outcomes, raising the possibility that both cognitive training and rehabilitation programs that provide self-management education may yield more sustainable and transferable effects than programs that focus only on specific cognitive tasks and functions.

The results of these cognitive interventions indicate that cognitive decline in older people, whether simply "age-associated", subjectively experienced or disease-related, is responsive to interventions. This, together with evidence from studies evaluating the effects of social engagement which include variables with a high cognitive component, clearly supports the view that arresting cognitive decline in older people is a realistic goal.

Health practice aspires to employ treatment strategies based on evidence. While there is a strong tendency to be dismissive of any approaches that are not supported by the highest levels of evidence (Flicker *et al.*, 2011), it is now clear that there are ethical barriers to the investigation of some modifiable lifestyle factors using randomization methods (e.g. smoking) and there are unmodifiable social factors (e.g. marital status, family structures) about which there is substantial epidemiological evidence but which have no potential for evaluation via randomized studies.

Changing policies

It is important that those factors that can be investigated in randomized studies are so investigated and that some consensus is developed as to how we should respond to lower order, "best available" evidence. The reaching of retirement age of the advance guard of the baby-boomer generation carries with it two decades of concentration on the threat and burden of the expanding older population. More recently the idea that threat and burden can be reconstrued as opportunity and asset has encouraged a more positive approach. In Australia, federal and state governments have formed committees charged with the task of canvassing widely to develop a more comprehensive understanding of the economic potential of older Australians and of increasing participation rates of older Australians across a broad spectrum of domains and functions. It is clear that there is some

urgency underlying this process, driven by well-established concerns but also by the understanding that established stereotypes of the older retiree are no longer universally valid.

In part, this change in stereotypic assumptions is likely to have come about on the basis of the very large body of epidemiological evidence that there are factors predictive of better aging, and rather than waiting for higher levels of evidence, governments and other community leaders have been persuaded that current best evidence is a sufficient basis on which to initiate changes in policy aimed at nurturing better health in older age and providing opportunities for older people to remain engaged and productive. Given this climate, it would be counterproductive to insist on maintaining the status quo until we have devised ways of improving the quality of evidence.

Changing habits

While anti-smoking campaigns have resulted in a reduction in tobacco smoking, they have not succeeded simply on the basis that smoking is strongly predictive of disease. Laws have been implemented to prohibit smoking in many settings and high tax imposts and severe advertising constraints have been implemented in many countries. In addition, the documented effects of passive smoking have led to some vilification of smokers as being anti-social. It appears to require a multi-layered set of pressures to modify behaviors, even when the detrimental effects of those behaviors are evident.

With increasing evidence that higher levels of physical activity, social engagement, and cognitive activity predict better late life cognitive health, there is a case for developing public health policies that encourage change in participation rates. However, greater participation in those evidently modifiable domains involves significant change that can only be effected by individuals. Anecdotally, doctors find that many patients are remarkably resistant to sustaining even simple medication regimes and minimal lifestyle changes (such as walking for 30 minutes three times per week) even when immediate benefits have been experienced at first hand. This raises two questions:

1. Can similar levels of pressure used in "quit smoking" campaigns be brought to bear on individuals to make significant lifestyle changes? It seems unlikely. The negative characterization of smokers and smoking does not translate easily into a campaign vilifying sedentary and socially disengaged behaviors predictive of cognitive impairment, dementia, or obesity. It may be possible to increase taxes on foods high in saturated fat or to manipulate dietary habits using differential taxation levels (as has been done with alcohol in some countries), and it may be possible to reduce consumption of fast foods by combined taxation and advertising constraints. However such actions, particularly in capitalist democracies, are likely to meet sturdy opposition. Pressure to engage in physical and social activities may fare better but there is no persuasive cause for optimism.
2. Is it possible to bring about lifestyle changes by using incentives other than better late life health? There is evidence to show that a volunteer program introduced for older people, not as a health program, but as an opportunity to continue to learn, to respond to challenges, to fulfill new responsibilities, to meet goals, to acquire new competencies and roles, to help young school children, and to be productive may prove more acceptable (Barron *et al.*, 2009). The program has the aim of improving educational outcomes particularly for students who for a range of reasons might be seen as at risk. As a health program it is expensive. As a program to improve social capital, economic modeling shows it to yield a national cost benefit (Frick *et al.,* 2004).

While researchers may argue the quality of current evidence for life-style factors to mediate the incidence, prevalence, and age of onset of dementia and related disorders in older people, governments are responding to the perceived economic challenges associated with the retiring baby-boomer generation as a matter of some urgency.

Conclusion

The extent to which people are physically, socially, and cognitively engaged appears to be associated with later life cognitive health. There is evidence that high levels of midlife engagement contribute to maintenance of cognitive functions and reduce the odds of all-cause dementia, AD and VaD. There is also evidence that, in later life, changes in lifestyle resulting in higher levels of engagement can slow or even reverse the process of declining functions. We should be utilizing this knowledge to improve the current and future cognitive health of aging populations right now.

Conflict of interest

All authors except Dr. Barber are investigators on the Australian Imaging Biomarkers and Lifestyle study of Ageing which has received funding from CSIRO, the Science Industry Endowment Fund,

the National Health, and Medical Research Council and Pfizer.

Description of authors' roles

Dr. Barber was the lead author on both the guest editorial and the online supplementary report, but all authors contributed significantly to their preparation and revision.

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