

Vascular cognitive impairment

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KNOWLEDGE VALORISATION

The general aim of this thesis was to gain more insight into predictors of cognitive functioning or cognitive impairment in individuals with manifest cardiovascular disease (CVD) and stroke. Thereby gaining a better understanding of the concept of the 'heart-brain connection' with regard to cognitive functioning. This valorisation paragraph describes the societal relevance, the possible economic implications, and the potential implementation opportunities of the results described in this thesis.

Mr. X is a 58-year-old married man who has been living with hypertension for eleven years now. His hypertension has been under control by medication use. Last year he experienced a minor heart attack. This experience shocked him and made him change his lifestyle for a while. He stopped smoking, tried to eat healthy, and went for a walk everyday. As time passed by, the fear of dying diminished and the desire to smoke became stronger. Today, Mr. X is smoking again, is eating fatty foods more often because they just taste good, and going out for a walk has become a burden. Recently, he noticed that he is no longer interested in reading the newspaper because he is unable to maintain his attention. Also at work he has difficulty concentrating. His wife is worried about him and wonders what is causing these changes. Also, she wishes he would live his life more healthy but does not want to withhold him from the things he enjoys in life.

This case describes a man who is experiencing cognitive problems after a minor heart attack and longstanding hypertension. His wife worries and wonders whether a change of lifestyle can help. Should Mrs. X tell the cardiologist or wait until she sees their general practitioner?

Societal relevance

Stroke and heart disease are major leading causes of death and disability in the elderly all over the world. Coronary heart disease is number one on the list of diseases with the highest disease burden (expressed in 'disability adjusted life years' which is the sum of lost life years and years of living with loss in quality of life), followed by stroke. In the Netherlands, around 1.4 million individuals are suffering from CVD, including stroke. Consequences of a cardiovascular event vary and can be of, not only physical, but also psychological, emotional, and/or cognitive origin. Many individuals are confronted with these cognitive difficulties. Frequently, these worsen over time and lead to significant cognitive impairment, or even develop into dementia in the long run. These cognitive consequences have a great influence on basic and instrumental activities of daily living, and on occupational, leisurely, and social aspects of people's daily lives.

In 2015, costs directly associated with cardiovascular care were 11.6 billion euro, which was 13.6 percent of the total Dutch healthcare costs (85.1 billion euro). Costs exist of expenses made by hospital visits, medication usage, and medical interventions. Costs of dementia care were 6.6 billion euros in 2015, which was 7.7 percent of the total Dutch healthcare costs. The number of individuals living with CVD or dementia is increasing with our aging society, thereby posing an enormous emotional burden on individuals and their families and an economic burden on our healthcare systems.

Therefore, there is a growing need to understand how CVD, including stroke is linked to cognitive impairment and dementia. In the general population there is little awareness of this 'heart-brain connection', its risk factors, and the risk for cognitive impairment and dementia. Therefore, it is also important to inform the public about this link. More awareness among patients and health care professionals may lead to earlier detection of cognitive deficits and (neuro)psychological symptoms. Indeed, our findings suggest that efforts at preventing CVD can have a significant public health implication by possible prevention of cognitive impairment and dementia.

Target audience

Findings presented in this thesis are relevant for individuals living with CVD and survivors of cardiovascular events, for health care professionals, and for researchers.

The most important target group is the one of the individuals living with CVD. They have to become more aware of how CVD affects cognition and how a healthy lifestyle influences their chances of developing dementia in the long run. They can possibly prevent cognitive impairment and dementia by adopting a healthy lifestyle. More "What's good for your heart is good for your brain" public awareness campaigns are needed and individuals with CVD should be encouraged to share cognitive complaints or worries with their cardiologist or general practitioner. These individuals will benefit from early detection, identification, and psycho-education by becoming more aware of the effect of lifestyle on brain health. Policy makers are another important target audience as they are the ones influencing public campaigns on cognition in CVD.

Obviously, the health care professionals, including neurologists, cardiologists, geriatricians, rehabilitation physicians, general practitioners, psychiatrists, (neuro)psychologists, and practice nurses play a very important role in this and are therefore another important target audience of the results of this thesis. These professionals are involved in the treatment

and after-care of the individuals who suffer from CVD or survived a cardiovascular event. It is important for the health care professional to be aware of the connection between life style, CVD, and cognitive impairment. Those who are aware of cognitive symptoms and/or complaints are more likely to ask their patient about these possible changes and identify patients at risk of cognitive decline, and may better recognize the cognitive symptoms and complaints. They then can give psycho-education, which plays an important role in care provided. Moreover, systematic CVD screening in offices outside the cardiologist's and a checklist for cognitive and emotional consequences (e.g. CLCE-24) in offices outside the (neuro)psychologist's could possibly be tackling this.

Findings in this thesis underline the importance of a more integrated multi-disciplinary approach and handling. Promising in this regard is the development of heart-brain clinics and specialized stroke after-care clinics, which have specific expertise regarding these symptoms. These clinics provide multidisciplinary evaluations to individuals who have had neuro(psycho)logical symptoms that may be attributable to a cardiovascular or cardiac aetiology. Such clinics can specifically look into those cognitive symptoms that are not easily recognized or not mentioned by the patient during anamnesis.

In addition, clinical researchers can use our findings for their own research. By showing the association between coronary heart disease and an increased risk of cognitive impairment or dementia, more mechanistic studies can focus on the underlying biological pathways and shared risks that link CHD and risk of cognitive impairment and dementia. By showing the temporal relationship between prevalent and incident CVD and cognitive functioning, we highlighted the important effect of CVD exposure duration. Other researchers can take this a step further by looking at the influence of medication usage during this exposure time period or by looking into the different CVDs separately. We showed that there is a window in time for prevention. Other researchers can use this information when selecting a target group of patients to study the effectiveness of a preventative measure, e.g. physical exercise or healthy diet. The results also underscore the importance of evaluating several cognitive domains as opposed to less precise measures such as clinical diagnoses or a global cognitive screening test. Future studies can then aid the development of more specific cognitive treatment programs. Our results regarding the relationship between stroke event-related and additional ageing-related brain damage and cognition might also be of interest to other traumatic brain injury patient populations.

Innovation and Products

We expand the existing knowledge of the heart-brain connection by showing the associations between myocardial infarction and angina pectoris and cognition and the temporal relationship of cognitive functioning with incident CVD. We were the first to look at incident CVD whereas former studies mostly look at prevalent CVD.

The main product of our findings regarding CVD and cognition is a deepening of our knowledge on the heart-brain connection. The new insights can be used in the clinical context of prevention and intervention. The findings underline the importance of a more intensive management of CVD risk factors because universal as well as selected prevention and control of already present risk factors can also prevent cognitive impairment and dementia. In addition, the importance of screening for cognitive changes and timely identification of people who are prone to develop cognitive impairment is underlined.

Another product resulting from this thesis is the large amount of data that was collected for the CASPER study including volumetric and visual imaging measures, elaborate neuropsychological and neuropsychiatric assessment, and other biomarker data (inflammatory markers and epigenetics) from 250 individuals who suffered a stroke. These data can and will be used for future studies and are part of the STROKOG consortium (<http://cheba.unsw.edu.au/group/strokog>), which has built a database with more than 12,000 stroke patients from across the world. Harmonization of these data will give way to more research, with currently ongoing projects focusing on a better understanding of the longitudinal trajectory of cognitive impairment after stroke, differences in prevalence of cognitive consequences, and risk and protective factors between different countries and ethnic groups. Also, participants of the CASPER study are approached for participation in the three-year follow-up, for which currently data is being collected.

Implementation

Findings of neuropsychological assessment and use of imaging markers resulting from this thesis are immediately applicable for clinicians and can be translated into clinical practice through incorporation in clinical guidelines. Raised awareness of, and psycho-education, on the connection between cardiovascular events, cognitive impairment, and possibly dementia may improve early recognition of symptoms. Cognitive functioning should be included in the checklist of all health care professionals who are treating these individuals. Vice versa, information on vascular risk factors should be gathered by the neuropsychologists, psychiatrist, or other psychological health care professionals at the

general practitioner's office. This could benefit identification of individuals who are at risk for cognitive impairment and could make earlier intervention or treatment possible.

Dissemination

New insights in this thesis have been disseminated in the academic community through publications in leading international scientific journals and presentations at international conferences. Individuals who participated in our studies were updated about the results and progress of the study through newsletters.

How could Mr. X have benefited from the results of this thesis?

Mr. X and his wife meet with the cardiologist for a yearly control visit. The cardiologist is aware of the influence CVD can have on cognition. When asking how Mr. X is feeling since his last visit, he asks specifically whether he has noticed any changes in his thinking processes, whether he noticed anything different in his concentration and attention, how things are going at work and whether there are changes in his leisure and social activities. Mr. X tells the cardiologist that he does not see the relevance of these questions. The cardiologist explains to the married couple how heart and brain are connected, and how research has shown the link between heart disease and cognitive changes. Mr. X realizes that the subtle changes in concentration and attention he noticed might be important to mention. The cardiologist explains how a healthy lifestyle influences CVD and that this is not just good for the heart, but also for the brain. It may even prevent cognitive impairment and dementia. Mr. X is quite concerned and realizes there is actually something he can do to reduce the chances of this happening to him. Mrs. X is relieved and feels empowered to consequently change their lifestyles by cooking healthy food, encouraging her husband to get more physical exercise, and supporting him to quite smoking again.