

**Applying an Economic Framework to the Benefits for Aboriginal People of
'Healthy Country, Healthy People' and Government Failure in Addressing the
Global Noncommunicable Disease Pandemic**

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SUMMARY

Two national policy concerns are the loss of environmental services and the higher level of chronic or noncommunicable disease born by Aboriginal people relative to non-Indigenous Australians. This difference in health outcomes is the result of the higher level of psychosocial stress born by the Aboriginal population, with the socioeconomic determinants of health and loss of control through invasion and colonization being important additional stressors. These stressors act as primary-causative agents leading to disruption of the homeostatic system and to risky behavioural choices.

The initial intention of the thesis is to demonstrate the positive interrelationship between the above two policy issues according to the nexus between healthy country, healthy people, through involvement by Aboriginal people in traditional land management, or caring-for-country. This demonstration was carried out using two quantitative economic analyses of the probable cost savings in primary health care through involvement in caring-for-country. These analyses were for an Aboriginal community in tropical west Arnhem Land in the Northern Territory's 'top end', and for an Aboriginal community in the Northern Territory central Australian desert.

In addition to the private good benefits enjoyed by those participating in caring-for-country, the analyses shows the possibility of substantial cost savings in primary health care. A number of other public good social benefits, including biosequestration of greenhouse gases, maintenance of biodiversity, and mitigation of dust storms, which is a vector of airborne particulate matter and of disease. Such public good benefits occur as cost free by-products, or externalities. That is, these public good benefits can occur at no cost to society as a whole. As Aboriginal people receive minimal benefit from these public goods, they are likely to be under supplied, which might be corrected through use of appropriate incentives.

Much of government engagement in prevention and mitigation of noncommunicable disease is focused on risky behavioural choices and curative health interventions. While such interventions can be helpful, they do not address the primary stressors, which have negative health impacts beyond risky choices. Having a nonmedical origin they can be addressed through the application of nonmedical primary-preventative health interventions. For Aboriginal people in remote to very remote Australia, participation in caring-for-country provides an opportunity to assert control over their lives and the mitigation of those psychosocial stressors, which are primary-causative agents affecting negative health outcomes.

At a higher level of abstraction, caring-for-country exemplifies a cost-effective nonmedical primary-preventative health intervention, when such preventative actions might be applicable to the mitigation of the global noncommunicable disease pandemic. Nonmedical primary-preventative health interventions are likely to increase disability-free survival, with depressed morbidity leading to reduced health costs, increased social welfare and an extended tax base. Contrary to these benefits, primary-preventative health funding by government appears to be underfunded relative to curative health funding. Such government policy imbalance can constitute government policy failure. The processes by which economically optimal nonmedical primary preventative health interventions might be assessed and applied are considered, according to the likely multidisciplinary and multijurisdictional nature of such interventions.

Acknowledgements

Four of the papers on which the thesis is based were developed while holding a joint Senior Economist position with the Centre for Remote Health, Alice Springs; and Desert Knowledge Cooperative Research Centre, Alice Springs. This position was respectively, under the joint supervision of Professor John Wakerman and Dr Jocelyn Davies. I am grateful to them for their input and support and to both institutions for the opportunities provided.

Important to the progress and completion of the thesis has been the guidance, critique, commentary and general support provided by my supervisors. Given their global distribution, much contact was by email with occasional hosting by Professor Dean Carson, Professor of Rural and Remote Research, Flinders University Rural Clinical School Flinders University, Charles Darwin University, in Sweden. Opportunistic airport meetings took place in Alice Springs and Perth with Associate Professor Michael Dockery, Principal Research Fellow, CRC for Remote Economic Participation, Curtin University. And, on a more accessible basis, lunch meetings were held in Alice Springs with Professor Rolf Gerritsen, Professorial Research Fellow, Northern Institute, Charles Darwin University and Associate Professor Melissa Linderman, Centre for Remote Health/Flinders University, I am grateful to my supervisors for their concern and guidance, critical reviewing and constructive feedback on the original journal papers and work submitted in the thesis. Finally, I acknowledge Professor Dean Carson and Associate Professor Melissa Lindeman for their guidance in ensuring final submission of the thesis.

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Statement of Original Authorship

The thesis consists of nine Chapters. Seven of these chapters include/comprise peer reviewed journal articles, the first published in 2008 and the last published in April 2016. Three of seven articles are under joint authorship (two published in 2008 and the third published in 2011). The articles are included in the thesis in their final, published form. The introductory and concluding chapters, Chapter 1 and Chapter 8 do not include peer reviewed articles but explain the context, development and significance of the peer reviewed articles that form the main body of the thesis.

I held a joint appointment as senior economist, with the Centre for Remote Health, Flinders University; and with the Livelihoods inLandTM Project, Desert Knowledge Cooperative Research Centre, located in Alice Springs, from February 2007 to March 2012. My candidacy for Doctor of Philosophy commenced in October 2012. The material contained in the PhD was written over the period commencing February 2007.

Declaration of Original Authorship

I hereby declare that the work herein, now submitted as a thesis for the degree of Doctor of Philosophy with Flinders University, is the result of my own investigations, and all references to ideas and work of other researchers have been specifically acknowledged. I hereby certify that the work embodied in this thesis has not already been accepted in substance for any degree, and is not being currently submitted in candidature for any other degree.

.....

Date: 07 / April /2017

David Campbell

Collaborating authors

Of the seven peer-reviewed journal articles incorporated herein, I was sole author for four of the journal articles and the lead author for the remaining three journal articles. Other writers from other universities in Australia and the Commonwealth Scientific and Industrial Research Organisation, collaborated with me on three of the papers. These authors are profiled below in alphabetical order in recognition of their contributions to the overall research from which this thesis is derived.

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Contribution

Six of the eight chapters forming the thesis contain reprints of published peer reviewed articles that I authored. While three of these papers were co-authored, I was the senior author, and wrote the first and final drafts for the other four papers. All of the collaborating authors, as listed above, provided input in the construction, content and final draft submitted to the respective journals. The input provided by each co-author, according to each of the articles/chapters, is detailed in the following.

Author contributions to original articles incorporated in this thesis

Chapter	Incorporated article and its application to this thesis	Conception and design of the study	Collection, analysis and interpretation of data	Writing of the article including conclusion
Two	Campbell D, Davies J, & Wakerman J. 2008. 'Facilitating complementary inputs and scoping economies in the joint supply of health and environmental services in Aboriginal central Australia'.	Campbell	Campbell	Editing and commentary provided by co-authors, with most input from Davies. First and final draft including the conclusion by Campbell.
Four	Campbell D, Burgess C. P, Garnett S. T, Wakerman J. 2011. 'Potential primary health care savings for chronic disease care associated with Australian Aboriginal involvement in land management'.	Garnett put the research team together following earlier discussion with Campbell in regard to material contained in Chapter 2. This following his role in the Sustainable Northern Landscape project, western Arnhem Land (Garnett, Sithole 2007).	Biomedical data provided by Burgess. Economic modelling and quantitative analysis by Campbell.	I initiated the first draft. Burgess restructured and rewrote to fit health journal, especially in regard to his biomedical data (Burgess et al. 2008, 2009et al.). Garnet Wakerman provided an ongoing review of subsequent drafts. Garnett provided comment throughout. Campbell wrote the final draft, including the conclusion.

Chapter	Incorporated article and its application to this thesis	Conception and design of the study	Collection, analysis and interpretation of data	Writing of the article including conclusion
Five	Campbell D, Stafford Smith M, Davies J, Kuipers P, Wakerman J, McGregor M. 2008. 'Responding to the health impacts of climate change in the Australian desert'.	Campbell.	Campbell, Stafford Smith.	I initiated, researched and wrote the first draft, Stafford Smith provided the 'Responses' section including table 1. All co-authors read and provided comment. I wrote the final draft, including the conclusion.

Terminology

As the main body of the thesis consists of articles published from 2008 through 2016, there is a change in terminology as a result of a developing understanding of the enquiry being undertaken. For example, the use of the term ‘noncommunicable disease’ instead of the term ‘chronic disease’, is introduced in Chapter 7, and is then used in the introduction and concluding Chapter 1 and Chapter 8. This terminology is consistent with that used by the World Health Organization (e.g., World Health Organization 2013).

Noncommunicable disease is used in reference to a pathological condition, or disease, that cannot be transmitted from one to another person or animal – when a pathological condition is an impairment of the normal state or condition. Chronic disease is used in reference to those impairments lasting three months or more, which cannot be prevented by vaccination or cured by medication. The World Health Organization (2008), in its use of noncommunicable disease is primarily concerned with cardiovascular, diabetes, cancer, and chronic respiratory diseases (p. 9).

In other instances, changes in the terms used occur as a result of differences in their use in the references cited. Such variation can be due to differences in the make-up of the people who reside in a region, as occurs with differences between the Northern Territory, where Aboriginal people are the indigenous residents, and Queensland, where the indigenous residents include Aboriginal people and Torres Strait Islander people. The term ‘Aboriginal’ is used in relation to those people who are indigenous to the Australian mainland and Tasmania. The term ‘Indigenous’ is used in reference to Aboriginal and Torres Strait Islander people, such that the term ‘Aboriginal and Torres Strait Islander people’ can also apply. Alternatively, Indigenous may be used in a reference to people in, for example, publications by the Australian Bureau of Statistics in relation to Australia’s Aboriginal and Torres Strait Islander people. Aboriginal may be applied when citing a Canadian publication, when the term is in reference to Canada’s Indigenous people, or alternatively, Canada’s First people. Indigenous is also used in relation to ‘First’ people worldwide who have undergone colonisation. The context in which these respective terms are used will define the appropriate meaning.

‘Country’ is used in reference to those lands to which Indigenous people have a traditional attachment. ‘For many Aboriginal people country is the basis of their identity, their law and their relations with others. As well as being crucial to people’s day-to-day existence, country

has immense spiritual significance' (Bowman, 2015, p. 261). Such relationships are based on the laws, customs and ways of life that Indigenous people have inherited from their ancestors and ancestral beings (Rose 1992). The term 'caring-for-country' is used according to those interrelated activities by Aboriginal and other Indigenous peoples involving '...the objective of promoting ecological and human health' (Burgess, et al., 2008).

Awareness of the interrelationship for Indigenous people of healthy country, healthy people has a long history of use among Indigenous people worldwide. Use of the term healthy country, healthy people concerns the interrelationship, or nexus, between 'healthy country, healthy people' through involvement by Indigenous people in traditional land management practices. Traditional cultural practices on country includes the use of land management practices such as removal of unwanted plant species, and the use of cool weather burning to assist hunting and keeping country healthy (Altman, 2009; Garnett, Sithole 2007; Bird, et al., 2005).

The term 'nonmedical primary-preventative health' is introduced in the body of the thesis in Chapter 7, and in Chapters 1 and 8. Use of this term is in reference to those actions, policies and interventions that apply to the prevention and mitigation of those 'first' identifiable causative agents affecting homeostasis; when disruption of homeostasis as a result of exogenous variables can lead to noncommunicable or chronic disease, and to cognitive disorders. It has been considered necessary to use such a descriptive term because of the different applications in which the term 'primary' is used within the health literature. The term 'primordial' is sometimes used in the health literature in relation to the circumstances being dealt with here. As with the use of primary, however, primordial has also been used across a wide range of different health circumstances, while the term can also have derogative connotations. Use of the highly descriptive term, nonmedical primary-preventative health, is used to minimise any ambiguity as to what is being referred to.

Risky causative factors affecting noncommunicable disease include the socioeconomic and psychosocial determinants of health; the term 'psychosocial stressors' is used in the latter stages of the thesis in relation to these factors. Psychosocial stressors consist of those psychological and socioeconomic factors that can, but need not, initiate a stress response, when such a response has a negative health effect. People will differ in their stress response according to perceived and actual history of stressful events, their genetic status, personal characteristics, impact of psychological and socioeconomic determinants of health, and perceived lack of mastery and control. References such as Schneiderman et al.

(2005) and Chrousos (2009) provide useful background regarding this wording in preference the socioeconomic determinants of health.

The term ‘capital’ applies to when the item referred to provides a flow of services in time. The term is applicable to physical items, as would apply to a hospital and the equipment contained within it, and to non-material items, as would apply to information – although the body of the book, journal, compact disk or thesis, in which information is set out, consists of material.

The term ‘human capital’ refers to the flow of services provided by an individual or group of people in time. Human capital is enhanced through increased knowledge, skills and enhanced life years. As discussed in the following, human capital can be enhanced through investment in nonmedical primary-preventative health interventions, when this results in an increase in the number of quality productive life years; thus leading to a possible increase in the flow of services in time. It is useful to note that what is meant by human capital differs from what is intended by the term ‘social capital’, when the term ‘social capital’ is in relation to the nature of the social structures (Muntaner, 2004). Regarding the use of other economic terms in the thesis, reference is made to table 2.1, Chapter 2.

Complementary economies are a result of a technical relationship between two or more consumer or production inputs. Complementarity, for example, occurs with a sweetener, such as sugar, being added to coffee by a coffee consumer, or from a production perspective, by the addition of a sweetener to coffee by the barista making the coffee. In both cases, the sweetener is not an economic substitute, but is a technical requirement to sweeten the taste of the coffee. The combination of nonmedical primary-preventative health and curative health can fulfill the same technical complementary relationship in the same way, with shortfalls in one being made up by the other. The criteria and conditions in which complementarity economies exist or occur, are further discussed in chapters 2, 4, 6 and 7.

An economic framework, consisting of interlinked economic principles, is used to assess a broad based range of expected private good benefits and public good social benefits that are supplied by the private action of Aboriginal people in caring-for-country (e.g., see Australian Department of the Environment and Energy 2012). The use of a partial economic analysis has led to the occasional use of the term ‘partial economic framework’.

Much of the public good social benefit through involvement of Aboriginal people in caring-for-country relates to the biosequestration of greenhouse gases, much of which occurs as a result of anthropomorphic gases, including carbon dioxide. Biosequestration is when atmospheric carbon gases are tied up in plant growth, with long term biosequestration being in tree growth. The term 'anthropomorphic climate change' is in relation to human induced greenhouse gases, such as with the gases released by livestock and the burning of carbon based energy sources.

Terminology of multidisciplinary, multijurisdictional and multifunctionality are used in Chapter 4 and Chapter 7. Multifunctionality relates to consideration or recognition of the multiple benefits or outcomes that can occur as a result of a particular activity or resource use. Land, and land management is a case in point, with commodity production, environmental services and conservation being relevant considerations. Traditional Aboriginal land management through caring-for-country is a multifunctional (or multiple functions) activity that involves consideration of commodity production, cultural inheritance, health, environmental services and conservation. Such considerations are likely to be the concern of multiple jurisdictions involving private (including volunteer), government, and organisations, often involving multiple disciplines (see Armbruster 2008; Abler 2004).

Publications and Conference Presentations Associated with Thesis Content

Journal Publications

- Campbell, D. (2016) Economies through application of nonmedical primary preventative health: Lessons from the healthy country, healthy people experience of Australia's Aboriginal people. *International Journal of Environmental Research and Public Health*, 13, 400.
- Campbell, D. (2015). Aboriginal involvement in caring-for-country: an economic case study in primary preventative health. *Australasian Psychiatry*, 23(6): 623-625.
- Campbell, D. (2013). Economic rationality in choosing between short-term bad health choices and long-term good health choices. *International Journal of Environmental Research and Public Health*, 10:5971-5988.
- Campbell, D. (2011). Application of an integrated multidisciplinary economic welfare approach to improved wellbeing through Aboriginal caring-for-country. *The Rangeland Journal*, 33: 365-372.
- Campbell, D., Burgess, C.P., Garnett, S.T., & Wakerman, J. (2011). Potential primary health care savings for chronic disease care associated with Australian Aboriginal involvement in land management. *Health Policy*, 11: 83-89.
- Campbell, D., Davies, J., & Wakerman, J. (2008). Facilitating complementary inputs and scoping economies in the joint supply of health and environmental services in Aboriginal central Australia. *Rural and Remote Health Journal* (online), 8: 1010, 'www.rrh.org.au'
- Campbell, D., Stafford Smith, Davies, J., Kuipers, P., Wakerman, J., & McGregor, M. (2008). Responding to the health impacts of climate change in the Australian desert. *Rural and Remote Health Journal*, 8: 1008. 'www.rrh.org.au'
- Davies, J., Campbell, D., Campbell, M., Douglas J., Hueneke, H., LaFlamme, M., Pearson, D., Preuss, K., Walker, J., & Walsh, F. (2011). Attention to four key principles can promote health outcomes from desert Aboriginal land management. *The Rangeland Journal*, 33: 417-43.

Gador -White, A.P., Wakerman, J., Campbell, D., Lenthal, S., Struber, J., Hope, A., & Watson, C. (2014). Cost of best-practice primary care management of chronic disease in a remote Aboriginal community. *Medical Journal of Australia* 2000 : 663-666.

Working papers

Campbell, D. (2012). Economic Assessment in Mitigating the Impact of the Psychosocial Determinants as an Impediment to Self-Investment in Education, Cooperative Research Centre for Remote Economic Participation, Working Paper CW006, Ninti One Limited. Centre for Remote Health, Alice Springs.

Campbell, D., Davies J., & Wakerman, J. (2007). Realising Economies in the Joint Supply of Health and Environmental Services in Aboriginal Central Australia. Desert Knowledge CRC, Working Paper 11, Alice Springs.

Davies , J., Campbell, D., Campbell, M., Douglas, J., Hueneke, H., LaFlamme, M., Pearson, D., Preuss, K., Walker, J., & Walsh, F. (2010). Livelihoods inLandTM: Promoting Health and Wellbeing Outcomes from Desert Aboriginal Land Management, DKCRC Report 78. Desert Knowledge Research Centre, Alice Springs.

Conference presentations

Campbell, D. (2015). Aboriginal involvement in caring-for-country: an economic case study in primary preventative health, CRANaplus conference, Alice Springs, 16 October.

Campbell, D. (2015). Aboriginal involvement in caring-for-country: outlining an economic case study in preventative health. Creating Futures 2015 conference, Cairns, 11-14 May.

Campbell, D. (2014). The public and private good benefits in addressing the chronic disease pandemic among Indigenous peoples: Application of a multidisciplinary multijurisdictional economic welfare approach. The Muster: Global Community Engaged Medical Education, 27-30 October, Uluru, Northern Territory.

Campbell, D. (2014). Enhancing the development, monitoring and control of Indigenous health policy through the integration of the psychosocial determinants & social wellbeing. The Muster: Global Community Engaged Medical Education, 27-30 October, Uluru, Northern Territory.

- Campbell, D. (2014). Enhancing the development, monitoring and control of Indigenous health policy through the integration of the psychosocial determinants & social wellbeing. The Muster: Global Community Engaged Medical Education, 27-30 October, Uluru, Northern Territory.
- Campbell, D. (2013). Exploring the likely effect of distal exogenous variables on stress, resulting behavioural lifestyle choices and health risks to guide policy responses aimed at mitigating chronic disease. Presentation at the Urban North Symposium, Charles Darwin University, October 9, Darwin.
- Campbell, D. (2013). Healthy people, healthy country: What's new in health and health reform? 51st CARPA conference, November 2013, Alice Springs.
- Campbell, D. (2013). Improved health outcomes through improved behavioural choice: What's new in health and health reform? 51st CARPA conference, November 2013, Alice Springs.
- Campbell, D. (2011). Potential primary health care savings for chronic disease care associated with Australian Aboriginal involvement in land management. *CRH Seminar Series*, 17 February 2011.
- Campbell, D. (2011). Cost savings through real work: The national social benefits of Aboriginal participation in caring-for-country. Presentation at Olive Pink Gardens, Alice Springs, 20 August 2011, *CSIRO for Science*. crc-rep.com/publications/crc-rep-0013.
- Campbell, D. (2010). Savings in chronic disease costs with caring-for-country'. *Australian Health Inequalities Program Symposium*, Close the Gap Session, 27-28 April, Adelaide.
- Campbell, D. (2010). Is the gap in Aboriginal health the result of rational choice?, Paper presented at the 31st Australian Health Economics conference, Sydney.
- Campbell D. 2009. Health outcomes in the Australian desert through a wide angled lens, Crana Plus Conference, 14-17 Oct., Alice Springs.
- Campbell D. (2008). Scoping and complementary economies in closing the gap in health

outcomes for Aboriginal people in the Australian desert. Desert Knowledge Symposium and Business Showcase, Alice Springs Thursday 6th November 2008

Campbell, D., Burgess, P., Garnett S., Wakerman J. (2008). A partial economic assessment of the health benefits from caring for country in Arnhem Land, AIATSIS Native Title Conference, Perth Convention Exhibition Centre, 4-5 June.

Campbell D. 2008. Coping and complementary economies in closing the gap in health outcomes for Aboriginal people in the Australian desert. Desert knowledge Symposium and Business Showcase, 6th September, Alice springs.

Davies, J., LaFlamme M., Campbell, D. (2008). Health of people and land through sustainable Aboriginal livelihoods in rangeland Australia. XXI International GrasslandCongress, VIII International Rangeland Congress, 29 June to 5 July, Hohot, Inner Mongolia, China.

CHAPTER 1

FROM CHASING RABBITS IN WESTERN VICTORIA TO A PHD IN CENTRAL AUSTRALIA

Abstract

This chapter provides a brief summary of the background to my enrolment in a Doctor of Philosophy degree. This includes development of thinking in regard to the disadvantage suffered by Australia's Aboriginal people; the academic training and life experiences that made it possible for me to take on the issues and questions addressed in the thesis; and the opportunity to engage in these questions and issues according to the nexus between healthy country, healthy people.

As later shown, these results are firstly used as an example of a nonmedical primary-preventative health intervention in achieving improved health outcomes within resource constraints, for Australia's Aboriginal people, and for Indigenous people worldwide. And secondly, these results are then used to demonstrate the possible cost effectiveness of nonmedical primary-preventative health in addressing the global noncommunicable disease pandemic.

1.1 PREAMBLE

Taking on a PhD requires a commitment over a number of years. For those who are younger, the present value of expected monetary and non-monetary returns on such an investment over a lifetime might explain this commitment. For those in my age bracket, when undertaking a PhD can take up a large proportion of a remaining life, consideration of such a commitment, especially for an economist, could be considered to be irrational. In which case, a lump sum return is likely to have had an important influence. The lump sum return in this case is at least in part, in response to a desire to make a difference in relation to the circumstance of Aboriginal people, and, as it turns out, how we might go about addressing the global noncommunicable disease pandemic – given the apparent failure by national and international bodies to engage with those primary-causative factors in affecting noncommunicable disease, in spite of the existing understanding of their role.

While self-analysis holds risks, questions of fairness and equity relating to the circumstance of Australia's first people has influenced my values. This originated as a child in the late 1940s early 1950s living on a farm in western Victoria. At the time I became aware of and was sometimes mystified by unexplained attitudes to and treatment of Aboriginal people. Also relevant were environmental questions, with the observed damage caused by rabbits, prior to the introduction of myxomatosis, driving home this awareness. These issues, which were part of the public debate in the 1960s, had an influence on the course work undertaken when I undertook a degree at Eastern Michigan University in September 1968.

Motivation, without capacity and opportunity, is insufficient. A number of people, both in Australia and in the United States, have been important to my obtaining the necessary education, professional experience and opportunity. Most significant was my mother who, in wanting her son to be a farmer, funded me through Longerenong Agricultural College, where economics was my best subject.

1.2 INTRODUCTION

The intention in the following is to assess Aboriginal and environmental health in remote to very remote Australia, according to the healthy country healthy people nexus. And then, to extend the results of this assessment as a case study in which the possible application of nonmedical primary-preventative health to the noncommunicable disease pandemic is exemplified. The first part of the intended objective is covered in chapters 2 through 6, with the second part of the intended objective addressed in Chapter 7.

Aside from the introductory and concluding chapters, chapters 1 and 8, the body of the thesis consists of seven internationally, peer-reviewed papers, written and published over nine years to May 2016. In this time, there were two additional internationally peer reviewed published papers, three working papers and sixteen conference presentations that are complements to this work. The thesis is a culmination of a lifetime of interest, training, and professional and personal experience.

1.3 DEVELOPMENT OF INTEREST AND CAPABILITIES

Following graduation from Longerenong Agricultural College, I worked as a cadet land valuer, which engaged my economic interests. Bored by the clerical nature

of the job, I left this position and took up a cadet soil conservation officer position in north-western Victoria. In desiring to affect rather than carry out policy, in September 1968, I headed off to Eastern Michigan University with enough finance for one semester. On conclusion of the first semester I applied for an academic scholarship but was awarded an athletic scholarship, with the advantage of a living allowance. With conservation in mind, my studies were focused on economics and biology.

In 1971 I took up a Rockefeller Environmental Fellowship in the School of Natural Resources, University of Michigan. It was here, among my fellow graduate students, that I was introduced to the ‘healthy country, healthy people’ concept. While aware of this as a broad concept that connected indigenous people with country, I had little understanding of what this meant for Indigenous people.

My Masters involved course work and the thesis, ‘Inclusion of Stochastic, Density Independent Events in Biologic and Bioeconomic Models’ (Campbell 1978). This would have been one of the earliest bioeconomic papers that did not depend on the assumption that stock recruitment into the following year can be forecast according to relative stock density. On receiving an A for the thesis, I was offered the opportunity of doing a PhD in the North African Sahel. I did not take up the offer, instead returning to Australia in 1979.

On returning to Australia, my research focus was in fisheries economics, starting with employment as a research assistant in 1979 at the Centre for Applied Social Survey Research, Flinders University. A product of this was an economic assessment of the expected cost and returns of a lobster pot buy-back (Campbell 1980). On leaving Flinders in October 1982, I took up a position in the Fisheries Section, Bureau of Agricultural Economics (BAE). Much of this period in BAE involved the application of input controls versus individual transferable [catch] quota (ITQ) to the Southern Bluefin Fishery.

The institutional change brought about through ITQ led to a multiple increase in the value of the Australian Southern Bluefin Tuna catch – although the national allowable catch had been substantially reduced (Campbell et al. 2000). In addition to stock protection, the introduction of ITQ’s established an institutional structure in which imperfect possession of open or shared access to natural resources is overcome – as with the control of anthropomorphic greenhouse gases, which, as discussed in the following, is an important consideration in relation to the application of healthy country, healthy people.

In March 1983, I took leave of absence from the BAE to take up the position of fisheries economist and manager Fisheries Management Section, Fisheries Branch, Northern Territory Primary Industries. This work included three papers on the possible wider application of ITQ in fisheries (Campbell, 1985; Campbell, 1984a, 1984b). Globally, these three papers were among the earliest publications on the application of ITQ systems in general and fisheries in particular.

In March 1996, I returned to the BAE, by which time it had become the Australian Bureau of Agriculture and Resource Economics (ABARE). Here, my most important work was the research report 'Resource Rent in Fisheries' (Campbell, Haynes, 1990). This research report was in response to confusion in the literature regarding use of the term 'rent. This was especially so, as, following Tullock (1967) and Buchanan (1980), a number of authors erroneously used the term 'rent seeking behaviour' in relation to seeking unearned profits through market interference. A necessary requirement to achieving a rent return is the existence of an efficient market.

The consultancy David Campbell & Associates Fisheries Economists, or DCafe, was formed on my retiring from the Commonwealth Public Service in August 1999. This included involvement in the National Recreational Fisheries Survey (Campbell & Murphy, 2005; Lyle et al., 2003). My retirement from the public service also provided my first opportunity on leaving the United States of America, to engage with issues relating to the circumstance of Aboriginal Australians and the 'healthy country, healthy people' concept. This research was funded by the Fisheries Research Development Corporation. Participation in this project involved development of a method by-which the value of fish resources to Australia's indigenous people might be estimated (Campbell 1999; 2002).

This initial work was extended to the broader question of compensation for loss of Indigenous rights and interests, past and present, under the Native Title Act 1993, as amended (Campbell, 2000; 2001; 2002). My understanding of healthy country, healthy people was expanded by this work as it required recognition of the cultural importance and, therefore the value, of place. Because of the limitation of cultural value to a specific site, the use of market value as a measure of compensation value, as proposed by the Australian Institute of Valuers (Sheehan, 1998), is inappropriate, as it makes no allowance for the cultural value placed on country by the traditional owners¹.

¹The first judicial decision, by the Federal Court in relation to the valuation of compensation for loss of rights and interest was in 2016: Griffiths v Northern Territory of Australia (No 3) [2016] FCA Timber Creek. Aside from interest due, the largest component in assessing the loss of rights and interests for purpose of compensation under the Act, was for loss 'for non-economic intangible loss or soaltium' (Ato, et al 2016).

The consultancy David Campbell & Associates Fisheries Economists, or DCafe, was formed on my retiring from the Commonwealth Public Service in August 1999. This included involvement in the National Recreational Fisheries Survey (Campbell & Murphy, 2005; Lyle et al., 2003). My retirement from the public service also provided my first opportunity on leaving the United States of America, to engage with issues relating to the circumstance of Aboriginal Australians and the 'healthy country, healthy people' concept. This research was funded by the Fisheries Research Development Corporation. Participation in this project involved development of a method by-which the value of fish resources to Australia's indigenous people might be estimated (Campbell 1999; 2002).

In February 2007, I took up the joint position of Senior Economist, with the Centre for Remote Health and Desert Knowledge Cooperative Research Centre, Alice Springs. The working paper 'Realising Economies in the Joint Supply of Environmental Services in Aboriginal Australia' Native Title Act 1993 (Campbell, et al., 2007), was the first product in this position. My initial thinking and understanding of the issues covered in the thesis are set out in this paper. This includes recognition of those factors affecting the high incidence of noncommunicable disease among Aboriginal people as compared with non-Indigenous people. The following thesis Chapter (Chapter 2) is based on this work (Campbell et al. 2008a).

Three more research articles (Campbell et al 2008b; Campbell et al 2011; Campbell 2011), included in the thesis, were published during this time. A working paper dealing with behavioural choice (Campbell (2012) was completed following my retirement from the Cooperative Research Centre for Remote Economic Participation (which Desert Knowledge Cooperative Research Centre became following its refunding) and the Centre for Remote Health, in March 2012.

On returning to the Centre for Remote health as a PhD student in October 2012, I worked on transposing the behavioural choice working paper (Campbell 2012) into journal article (Campbell 2013). Important to my returning to do a PhD, was my concern that the research I had carried out prior to my retirement was incomplete. As discussed in the thesis, maintenance of the nexus between healthy country, healthy people, through caring-for-country, is important to a wide range of social benefits. These included the biosequestration of greenhouse gases, in addition to the mitigation of risky behavioural choice, and the private benefits enjoyed by Aboriginal people. Caring-for-country is, recognised as

an example of nonmedical primary-preventative health. And at a higher level of abstraction, exemplifies the application of nonmedical primary-preventative health to the prevention and mitigation of the global noncommunicable disease pandemic.

My professional experience with BAE/ABARE has been important to my integration of natural and social systems within economic theory. While a policy perspective exists throughout the thesis, a particular policy focus is applied in Chapter 7.

1.4 POLICY ISSUES

1.4.1 A History of Disenfranchisement

A history of disenfranchisement from country and culture for Aboriginal and Torres Strait Islander people started with the arrival of the First Fleet in 1788, and continues with an ongoing history of colonization. Loss of country for Australia's Aboriginal people and the related negative health impacts do not appear to have necessarily been the result of colonial policy. That is, terra nullius was not necessarily a result of policies developed by the Crown nor the Colonial Office, but was in large measure a convenient approach undertaken by the settlers. The colonisation of South Australia provides an example of this relationship. This summary is based on Reynolds, (1992).

Captain Cook saw few Native people along the east coast of Australia and concluded that Australia's inhabitants were few and moved around without any fixed location. Governor Phillip and the first settlers quickly realized this was not the case with Native people existing in clans or tribal groups living in specific locations, from which they took their name. Contrary to this recognition, the occupants of the Colony of New South Wales conveniently held to the initial supposition inferring terra nullius.

The difference in attitudes between the Colonial Office and the settlers is exemplified with the settlement of South Australia. The attitudes to the settlement of South Australia might be considered as starting with the Royal Proclamation of 1763, in which land not ceded or purchased from Native people in the North America British colonies was to be retained by the Native people. Though not applied to the Sydney settlement, this position was applied in the 1833 *Letter Patent* in which the South Australian colony was to be established. This action was soon followed, however, by the *South Australia Act* 1834, proclaimed late at night in an almost empty House of Commons, set out that the Colony of South Australia was to be established on 'waste and unoccupied lands ... fit for the purposes of colonisation'.

While the Colonial Office endeavored to establish the colony according to the 1833 *Letter Patent*, the private company promoting the South Australian settlement was able to manipulate circumstances in their own interest, with no acknowledgement of Native Title, and no intention to negotiate access to land or for compensation to be paid. Accordingly, Reynolds titled the two chapters covering this sequence as the ‘First Land Rights Movement’ (chapter IV) and ‘Land Rights Frustrated 1834-1838’ (chapter V).

The impact of ‘... dispossession of Aboriginal people from their traditional country is discussed in Chapters 2 through 7. This involves the loss of access to traditional food and medicines, of cultural connection with country and personal and group identity, with the psychological impacts leading to an increasing incidence of noncommunicable disease among Australia’s indigenous people. The psychosocial stressors include failure to meet cultural responsibilities to country, the breakdown of customary community governance structures, the loss of personal and group identity, and loss of control over living as individuals and as members of a community’ (Campbell 2011, p. 367). Loss of control is an important factor affecting psychosocial stress and leading to the disruption of the homeostatic system and participation in risky health behaviours.

One approach, as is shown in the following, is for those Aboriginal communities who have been able to maintain some form of physical and cultural contact with country, or have the opportunity to reestablish such cultural contact and life circumstance, is through their participation in traditional land management practices, or caring-for country.

The intention in the following is to consider the environmental benefits and probable cost savings in primary health care, through caring-for-country, according to the healthy country healthy people nexus. And to use these results as a case study to exemplifying the possible application of nonmedical primary-preventative health to the global noncommunicable disease pandemic.

The first part of the objective is covered in chapters 2 through 5, which is extended to addressing the global noncommunicable disease pandemic in Chapter 7. Important to the capacity of Aboriginal people to participate in caring-for-country is individual capacity to assert volitional control and willpower; a capacity that is eroded by the highly stressful circumstances in which Aboriginal people live, as is discussed in Chapter 6. These results are then used to exemplify the possibilities of a rebalancing of health investment towards

nonmedical preventative health interventions in addressing the global noncommunicable health pandemic in Chapter 7.

An important aspect touched upon with the introduction of the Barker Syndrome in Chapter 6, is epigenetic inheritance, which is the intergenerational transmission of parental phenotypic responses to environmental change – even when offspring do not experience the challenges themselves’ (Harper 2005, p. 340). Aside from the Barker syndrome, epigenetic inheritance is not discussed in the thesis. Epigenetic factors may, however, have an important impact on early life and later life outcomes (Bonduriansky, Day 2009; Harper 2005), and be an important consideration when accounting for expected social benefits when considering the integration of nonmedical primary-preventative health and curative health.

Remarking on the circumstance of Australia’s Aboriginal and Torres Strait Islander people Commissioner Calma (Commissioner for Aboriginal and Torres Strait Islander Social Justice) called for a national commitment to be made to achieving equity for Aboriginal and Torres Strait Islander people within 25 years (Calma (2005)

In 2008, Rudd and Roxon (2008), respectively as Prime Minister and as Minister of Health, made a funding commitment of \$1.8 billion to the Council of Australian Governments, in response to this request. In the following year, the Council extended this initial intention to a commitment of \$4.6 billion over four years (Council of Australian Governments 2009). In so doing they set out the following performance objectives:

- close the life expectancy gap within a generation (by 2031);
- halve the gap in mortality rates for Indigenous children within a decade (by 2018);
- ensure access to early childhood education for all Indigenous four year olds in remote communities within five years (by 2013). This target was not met, and was modified by the Council of Australian Governments in 2015 to 95% Aboriginal and Torres Strait Islander for all four-year-olds to be enrolled in early childhood education by 2025;
- halve the gap in reading, writing and numeracy achievements for children within a decade (by 2018);

Each year, the Prime Minister provides an annual report against the seven performance criteria. While some overall progress has been made, none of the required performance criteria are being met. This leaves open the question of what alterations or additions might be made to progress these objectives. Although the following does not directly respond to the criteria set by the Council of Australian Governments, the following indicates a possible culturally acceptable approach in-which Aboriginal people might take greater control over the issues affecting their lives.

1.4.2 Economic Philosophy: Welfare or Extra-Welfare

The following analysis is focused on the health and environmental benefits of 'healthy country, healthy people' according to engagement by Aboriginal people in traditional land management, or caring-for-country, in remote, to very remote Australia. The quantitative analysis is in regard to the primary health care cost savings through caring-for-country. The broader policy discussion is in a far broader economic policy context. An important consideration of this work is whether it fits within a welfare or extra-welfare framework. From a sociologist's perspective, this discussion might be seen in terms of individualism (welfare) or a structuralist² (extra-welfare) perspective (e.g., see Mayhew 1980).

Care is required in entering this discussion given the extremes that might be applied. The first of two possible examples of boundary extremes is with the allocation of resources to meet health needs being left to the individual client through the market according to revealed preference. Such choice is constrained by personal budget, which makes no allowance for personal psychosocial opportunity cost, individual circumstance, or forgone national production and ongoing health cost. The tendency in this case can be to assess national benefits according to objective wellbeing measures . Alternatively, there are those who propose health to be provided according to need, with the possibility being to assess national benefits according to subjective wellbeing measures rather than gross national

² The term 'structural' [can be] used to refer to interventions that work by altering the context within which health is produced or reproduced. Structural interventions locate the source of public-health problems or factors in the social, economic and political environments that shape and constrain individual, community, and social health outcomes' (Blankenship et al 2000).

product. The welfare, extra-welfare discussion is extensively covered by Hurley (2014; 2000), with the contents of McIntyre and Mooney (2007) providing a review that relate to the economics of health equity, an important element to the extra-welfare discussions.

Market and nonmarket factors are recognized as playing an important role in affecting the psychosocial stressors, when these include socioeconomic and social wellbeing factors. Accordingly, the coverage provided would be described as best fitting extra-welfarism. For Aboriginal people, this includes disengagement from country, culture and control, which market based forces are unable to take a full accounting of (see footnote 1, regarding the inclusion of cultural value in compensation Federal Court determination for loss of Native Title, Timber Creek).

Quantitative analysis and economic policy evaluation are carried out according to standard public economic paradigms and methodologies. This is contrary to the position of some health economists, who claim there are aspects of health that take health economics outside of the normal reach of economic analysis (e.g., Phelps 2010). Accordingly, the use of Gross National Product, rather than subjective wellbeing, applies when it comes to estimating national social benefit. Accounting for the important role of social wellbeing is a question of how best to integrate social accounting into Gross National Product estimates. This is the crux of Stiglitz et al's (2009) report: Commission on the Measurement of Economic Performance and Social Progress, as contracted by the President of the French Republic. Inclusion of subjective wellbeing within Gross National Product, can ensure meeting subjective wellbeing criteria are met within a long run national budgetary constraint.

This discussion also extends to considering of the provision of health benefits and the national value of human capital as an ongoing productive input, within the tradeoff between multiple input factors, multiple products and budgetary constraints. For this reason alone, it is also important to include economic analysis as part of the balance between preventative and curative health and in assessing Health in All Places/Policies, as further discussed in section 8.4. Noncommunicable disease is an impediment to the full utilization of human capital as a productive input. While there has been no consideration

of Health in All Places/Policies in the following chapters, many of the issues considered in these chapters are considered from an economic perspective. A major shortcoming with Health in All Places/Policies, at this stage, is the failure to include an economic perspective.

1.5 CONCLUSION

The loss of personal control and socioeconomic disadvantage are recognized as important factors affecting the global noncommunicable disease pandemic (Marmot 2006). Aboriginal people in remote to very remote Australia suffer the same disadvantages as other Australians in equivalent socioeconomic circumstance and levels of isolation. Aboriginal people, however, suffer the additional burden of an often violent history of disenfranchisement from country and culture – when culture sets out the structures and beliefs affecting behavior and social norms. The health impact of prior and ongoing colonization is likely to result in a greater burden to that borne by other Australians in an otherwise equivalent socioeconomic circumstance. One probable way of approaching this history of disadvantage is through the Indigenous concept of healthy country, healthy people. Such an approach might be expected to have the dual advantage of addressing the loss to society of environmental services in addition to the health of Aboriginal people. Even without the importance to society of environmental services, country has important traditional resource and cultural connections affecting Aboriginal health and wellbeing.

An important aspect to these two issues from an economic perspective is whether they are approached from an individualist position, or from that of a broader social position; which might be referred to as an extra-welfarist approach. The economic policy questions concerning healthy country, healthy people are set out in the following chapters according to both a broader social approach and an individual perspective. Although a partial economic analysis is applied, traditional caring-for-country is shown to be an effective approach to achieving substantial health and social good environmental benefits. The allocation of such culturally acceptable practices and control, provide a means of overcoming excessive psychosocial stressors and resulting risky behavioural choices. Importantly, such activities

are recognised as part of the larger domain of preventative health, although the focus here is with nonmedical primary-preventative health. These results are used to exemplify the possible social benefits that could be achieved with an initial increase in funding being given to preventative health interventions in the mitigation of noncommunicable disease.

1.5.1 Thesis Format and Presentation

The body of the thesis (chapters 2 through 7) is presented as a series of articles published in international peer-reviewed journals. The formatting of the thesis is in accordance with Flinders University guidelines, beginning with a general introduction (Chapter 1), and the concluding chapter (Chapter 8), in which the study findings, themes, reliability and future directions are summarised. There is a degree of repetition in the seven articles in chapters 2 through 7, as each article is required to stand on its own for original publication. (Chapter 1), and the concluding chapter (Chapter 8), in which the study findings, themes, reliability and future directions are summarised. There is a degree of repetition in the seven articles in chapters 2 through 7, as each article is required to stand on its own for original publication. Chapter 1, and Chapter 8 were not submitted for publication as these represent an introduction to and conclusion of this body of work. The thesis is presented in three parts. The material presented in each part constitutes initial research in the area covered, extends our knowledge in that area or highlights existing policy failures.

PART A: Cost Savings through the Interrelationship between Healthy Country, Healthy People

Chapter 2: ‘Facilitating Complementary Inputs and Scoping Economies in the Joint Supply of Health and Environmental Services in Aboriginal Central Australia’. A number of factors relevant to the thesis are set out in this chapter. These factors relate to healthy country , healthy people according to the national policy issues of the decline in Aboriginal health relative to the rest of the Australian population, and the decline in environmental services. The interrelationship between these factors for Aboriginal people is through the negative health and environmental impact of the psychosocial determinants (stressors), with, among other factors, cultural and physical disengagement from country. Exogenous stressors affect the psychosocial determinants and erode individual capacity to choose between risky and non-risky health behaviours.

These psychosocial stressors are identified as needing to be addressed outside of the health sector. Positive environmental and health impacts occur through cultural engagement with country by the traditional occupiers of country. Economic protocols in funding public incentives or disincentives for optimal private investment by Aboriginal people in traditional land management (caring-for-country) are set out. The point is also made that the lessons learnt through caring-for-country may also apply to non-Indigenous communities; as taken up in greater detail in Part C. Much of the following published material is either the first time economic research has been carried out within a particular domain, or the first time quantitative economic research has been applied to the health of Aboriginal people.

Chapter 3: ‘Potential Primary Health Care Savings for Chronic Disease Care Associated with Australian Aboriginal Involvement in Land Management’. Based on biomedical data for an Aboriginal community in West Arnhem Land in the Northern Territory’s ‘top end’, this chapter provides an estimate of the economic benefits that might be achieved through the healthy country, healthy people nexus. While a partial economic analysis, the results indicate substantial private good and social public good benefits are gained through involvement by Aboriginal people in traditional caring-for-country.

Chapter 4: ‘Application of an Integrated Multidisciplinary Economic Welfare Approach to Improved Wellbeing through Aboriginal Caring-for-Country’. The analysis of the preceding chapter is extended in Chapter 4 from that located in a tropical savanna environment to the central Australian desert, where Aboriginal communities suffered an earlier history of invasion and colonisation. That is, the results presented in this chapter extend the potential applicability of healthy country, healthy people according to different histories and across multiple environments and communities. The possible willingness of private companies to pay for biosequestration of greenhouse gases through traditional land management practices, and the provision of a range of other multijurisdictional social benefits are presented. An important aspect relating to benefit assessment, is accounting for the multiple benefits, or scoping economies that are achievable through caring-for-country; plus the complementary economies that could be obtained through joint preventative and curative health interventions.

Chapter 5: 'Responding to the Health Impact of Climate Change in the Australian Desert'. This chapter focuses on the 70% of Australia classified as desert. Aboriginal people occupy and engage with large tracts of this area through a long history of occupation. As a result of their poor socioeconomic status, Aboriginal people possess less capacity to deal with the additional environmental stress of climate change than do most other Australians. Much of the discussion of environmental service, or healthy country, is focused on correcting anthropomorphic climate change. This focus is a response to the expected substantial negative environmental and health impact for Aboriginal people in remote to very remote Australia, plus the role Aboriginal people can play in the mitigation of climate change through their involvement in caring-for-country.

PART B: Psychosocial Stressors and Economically Rational Behaviour

Part B consists of Chapter 6: 'Economic Rationality in Choosing between Short-Term Bad Health Choices and Long-term Good Health Choices'.

A simple economic optimisation model is used to test the question of economically rational behaviour, with utility and health as dependent variables, risky health choices and self-investment in education being explanatory variables, and choice occurring under a resource constraint (Attachment, Chapter 6). The assumed characteristic of selecting risky choice is immediate utility with uncertain future health and utility outcomes. The assumed characteristic of self-investment in education is foregone immediate utility with uncertain future health and utility outcomes. A requirement for self-investment in education is individual capacity to sustain self-regulation and volitional control. Capacity to sustain control is a limited resource that is eroded according to stress levels. Given the relatively higher stress levels borne by Aboriginal people and the uncertainty of future educational benefits, risky behavioural choices can be economically rational.

The body of this chapter is taken up in explaining causative relationships and possible policy responses by which behavioural incentives might be altered. The result of this implies how engagement in culturally consistent activities, such as caring-for-country, can lead to the mitigation of risky behavioural choices.

Part C: Generalising the Results of Caring-for-Country as a Preventative Intervention to the Global Noncommunicable Disease Pandemic

Part C consisting of Chapter 7, is made up of two articles: ‘Aboriginal Involvement in Caring-for-Country: An Economic Case Study in Primary Preventative Health’; and ‘Economies through Application of Nonmedical Primary Preventative Health: Lessons from the Healthy Country, Healthy People Experience of Australia’s Aboriginal People’. Recognition is here given to caring-for-country as an example of nonmedical primary-preventative health; which forms part of the larger domain called preventative health. As such, it is used in this chapter to exemplify the possible cost effectiveness of nonmedical primary-preventative health in addressing the global noncommunicable disease pandemic.

This is important for two reasons. Firstly, it is a culmination of what can be drawn from the preceding in relation to the utilisation of caring-for-country in addressing the shortfall in health outcomes for Aboriginal people. And secondly, utilisation of these results highlights government health policy failure through an excess focus on curative health relative to preventative health. Such failure can have negative impacts on health outcomes, social wellbeing, cost effectiveness, length of life and the tax base. An economic framework is used to show how nonmedical primary-preventative health policies can be applied and assessed within multiple jurisdictions, according to private good and public good social benefits. Examples of government funding for involvement by Aboriginal people in caring-for-country are provided.

Impact factor of publications

The impact of the published articles making up the body of the thesis is set out in table 1.2 according to chapter sequence. Impact is demonstrated according to journal impact factor, how many times the article has been referenced and how many times the article was read (in addition to being referenced).

As shown, the listed articles provide constructive input to health policy independent of

journal impact factor and timing of publication, with the most recent article having the highest rate of reads, given the brief timing of publication from April 2016 to March 2017; although a number of earlier published articles have larger plus reads, with the Chapter 3 article having the highest combined score.

Table 1.1: Journal impact factor, and number of times articles have been referenced and read

Chapter	Paper title	Journal title	2015 impact factor	Referenced 2016 ^a	Reads 2016 ^a
2	Facilitating Complementary Inputs and Scoping Economies in the Joint Supply of Health and Environmental Services in Aboriginal Central Australia	Rural and Remote Health Journal	0.91	20	12
3	Potential Primary Health Care Savings for Chronic Disease Care Associated with Australian Aboriginal Involvement in Land Management	Health Policy,	<u>2.032</u>	33	75
4	'Application of an Integrated Multidisciplinary Economic Welfare Approach to Improved Wellbeing through Aboriginal Caring-for-Country'	Rangelands Journal	<u>1.196</u>	9	12
5	Responding to the Health Impact of Climate Change in the Australian Desert	Rural and Remote Health Journal	0.91	22	33
6	Economic Rationality in Choosing Between Short-Term Bad Health Choices and Long-term Good Health Choices	International Journal of Environmental Research and Public Health	2.035	43	7
7'	Lessons from the Healthy Country, Healthy People Experience of Australia's Aboriginal People	Australasian Psychologist,	0.72	1	18
7''	Economies through Application of Nonmedical Primary Preventative Health: Lessons from the Healthy Country, Healthy People Experience of Australia's Aboriginal People	International Journal of Environmental Research and Public Health	2.035		46
Mean	-	-	1.61	18	29

a. Taken from *Research Gate*, April 2017.

PART A: COST SAVINGS THROUGH THE INTERRELATIONSHIP BETWEEN HEALTHY COUNTRY, HEALTHY PEOPLE.

Part A consists of chapters 2 through 5. The focus across these four chapters is with the development and application of a partial economic analysis of involvement by Aboriginal people in caring-for-country; according to healthy country, healthy people. This work relates to the first part of the thesis objective: The intention in the thesis is to apply an economic framework in assessing Aboriginal and environmental health in remote to very remote Australia according to healthy country, healthy people. In meeting this intention, the basis in which the case for nonmedical primary-preventative health as a cost effective approach to the global noncommunicable disease pandemic is set out. While Chapter 2 does not, as such, constitute a literature review, most all of the themes covered in the thesis are laid out here (see table 8.1).

CHAPTER 2

FACILITATING COMPLEMENTARY INPUTS AND SCOPING ECONOMIES IN THE JOINT SUPPLY OF HEALTH AND ENVIRONMENTAL SERVICES IN ABORIGINAL CENTRAL AUSTRALIA

INTRODUCTION

The economic question of healthy country, healthy people is set out within an economic framework according to two national policies issues: health of Aboriginal people, and maintenance of environmental service. As is explained, the economic framework bringing these two policy issues together is formed according to scoping and complementary economies.

The concepts raised in this chapter continue throughout the thesis. The integration of these concepts within an economic framework supports the quantitative and qualitative analysis and policy inference. The economic framework provides light on the observations drawn from the quantitative analysis to a number of socially important benefits and to the possible role nonmedical primary-preventative health might play in addressing the global chronic disease pandemic. In so doing, the concepts covered include:

- selection of the relative declining health of Aboriginal people and the loss of environmental services according to healthy country, healthy people;
- the private good, public good (bads), and social benefits derived through private activities by Aboriginal people in traditional land management;
- recognition of the psychosocial stressors, including the socioeconomic determinants of health and loss of connection to country, as primary causative factors, when these lead to the loss of environmental services and to the loss of health for Aboriginal people relative to the rest of the Australian population;
- limitations, as expanded upon in Chapter 6, on the capacity of Aboriginal and other peoples to be able to self-regulate or apply volitional control and willpower under highly stressful circumstances;
- market behaviour and the optimal allocation of behavioural incentives; and

- introduction of economic considerations relevant to the study, including economic private goods, economic public goods, externalities, by-products, complementary economies and scoping economies.

REVIEW ARTICLE

Facilitating complementary inputs and scoping economies in the joint supply of health and environmental services in Aboriginal central Australia

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A B S T R A C T

Two concerns of national relevance in central Australia are the continuing decline in Aboriginal health status relative to the rest of the Australian population, and the loss of environmental services. We draw on literature from a number of disciplines to show that not only are these two concerns interrelated but that dealing with them is inextricably connected through consideration of the psychosocial determinants of health. Involvement by Aboriginal people in land management can promote the joint supply of environmental and health services. We show that Aboriginal control of land management can result in economies through the joint supply of environmental and health services. However, because Aboriginal people derive little benefit from the provision of public goods generated through land management, they have little incentive to provide a socially optimal supply of these goods. The



policy issue for government is the selection of the appropriate policy tools to facilitate the involvement of Aboriginal people in land management and the optimal supply of health and environmental services. The cost-effectiveness plane is used to provide a simple framework to guide the selection of an appropriate policy tool.

Key words: Aboriginal land management, caring for country, cost-effectiveness plane, policy tools, private good, public good, social determinants.

Introduction

The poor status of Aboriginal health in Australia in general and in central Australia in particular is well documented¹⁻⁴. The status of Aboriginal health in central Australia is not unrelated to concern for the environmental status of the central Australian rangelands. To the first non-Aboriginal settlers in central Australia, the then existing vegetative cover gave the erroneous impression of high productivity to which they responded with the introduction of domestic livestock. This resulted in ecological degradation manifested in soil loss, decreased vegetative cover, and loss of native species^{5,6}. Further ecological impacts resulted from the invasion of feral species such as camels, horses, donkeys, foxes, cats and buffel grass (*Cenchrus ciliaris*) and changed fire regimes. While some Aboriginal people maintained links to country, non-Aboriginal settlement in central Australia has resulted in a changed relationship for many Aboriginal people with their country, and has contributed to a decline in ecosystem services and to poor Aboriginal health. Even with the re-establishment of Aboriginal access to traditional country, the uptake and application of culturally accepted practices has been disjointed. This is due, in part, to a sense of powerlessness from a history of dispossession⁷ and a history of externally driven and constantly changing government policy.

Increasing recognition is being given to the importance of re-establishing traditional land management practices. At the same time there is increasing loss of Aboriginal social memory and physical capacity to manage country due to poor health and premature death, and the changing priorities

of Aboriginal youth⁸. In many areas we see a negative feedback loop between country and health leading to a downward spiral of poor relative human health and poor ecological health of country.

In this article we explore some of the interrelationships of health outcomes for Aboriginal people in central Australia and the supply of central Australia-based environmental services. In particular we provide economic argument for how, under certain conditions, the joint supply of environmental and health services by a single provider results in scoping economies (see table 1 for a glossary of economic terms). Such economies are characterised by the supply of two or more services through a single provider costing less than would be the case were each service provided by a separate provider. This interconnection between environmental and health services, and the economic efficiency issues in how they may be best supplied, is relevant at the higher levels of government policy-making in decisions about budget allocations across sectors.

Aboriginal participation in land management is less than what is socially desirable because of market failure due to poor market signals (prices). Because Aboriginal people do not enjoy the full benefit of the public goods generated through their participation in land management, these public goods (such as biodiversity) are under-supplied. Governments, among others, can correct for this by providing appropriate incentives.



Table 1: Glossary of economic terms

Term	Explanation
Complementary	Occurs when for technical reasons two or more goods or inputs should be used together, such as with a left shoe and a right shoe. The economic consequence of not using complementary inputs together is that the economic efficiency of the input being provided will be less than it would be were the other complementary input/s also provided. The social determinants of health are complementary to biomedical inputs to health.
Cost effectiveness plane	Is an analytical tool used to choose between alternatives when at least two factors need to be accounted for when assessing a) the final net benefit and b) the policy response. In this instance, it is used to assess the policy response and selection of the appropriate policy tool according to the net summation of private goods and bads and public goods and bads that may result from Aboriginal land management.
Equity, horizontal and vertical	Horizontal equity involves treating those equally who are in an equal or similar condition. Vertical equity means that when choosing between two people (say) according to wealth or health condition the choice is made in favour of the least wealthy or the worst health condition. Such criteria are not un-ambiguous depending on how we measure the prior condition – is it income or health condition or is it cost of treatment or health outcome?
Externality	An externality is when the consequences of a decision or action have not been fully taken into account. An example of this when we make a decision to drive to work, the cost of the fuel used does not include the impact of the resulting greenhouse gases on health and other impacts. That is, such costs are external to the cost accounting.
Marginal cost	This is the additional cost that occurs as a result of an incremental increase in input to the production process or supply of a commodity, good or service such as health service.
Marginal value	Is the value of the additional or incremental increase in the supply of a commodity, good or service, such as health service. A necessary condition for economic efficiency is that is that marginal cost of providing goods and services is not more than the marginal value.
Marginal social opportunity cost	Economists often use the term ‘social’ to make clear that economic costs means that the choices available to society will be less – or there is a social opportunity cost. For example, a marginal increase in expenditure on health could result in a decrease in expenditure on roads, with a possible marginal social opportunity cost of increased morbidity and mortality.
Private Good	These are goods or services that are rivalrous in consumption. That is, the consumption of that good by one person decreases the amount available for others; e.g. food.
Public goods	These are goods or services that are non-rivalrous in consumption. That is, the enjoyment of that good by one person does not decrease the amount available for others; e.g. information.
Scoping economies	Such economies come about when two or more benefits can be provided at a price that is less than they would be if they were provided separately.

The issue for the government decision-maker is the selection of the appropriate policy response to facilitate the optimal joint supply of health and environmental services. We propose the cost-effectiveness plane as a simple framework to guide selection. We then discuss the importance of ensuring the incentives provided are consistent with the cultural norms of Aboriginal people.

Issues and interrelationships in health outcomes

Predisposing factors to poor health

The causes of excess morbidity and mortality in the Aboriginal population of central Australia are complex.



They include upstream, social determinants, as well as downstream behavioural factors⁴. The downstream risk relates to behavioural factors affecting the prevalence of chronic disease such as smoking, alcohol abuse, poor diet, lack of physical activity and injury, including interpersonal violence.

Pearson⁹ has argued a 'radical centrist' view that Aboriginal people not only have rights to health, but that they must also take responsibility for current circumstances in order to take control and modify the behavioural factors affecting their health. Because of the predisposing psychological and social determinants of health¹⁰⁻¹² Aboriginal people do not always have adequate opportunity or capacity to address such behavioural factors. It is therefore important to address the predisposing determinants of health in cooperation with and in support of Aboriginal people taking control of the behavioural factors affecting their health.

Social determinants of health

There is a large international volume of work on the social and psychological determinants of health – for example the collection of papers edited by Marmot and Wilkinson¹² and the steps taken by the World Health Organization in setting up the Commission on Social Determinants of Health¹¹. The social determinants particularly relevant to this article are those set out by Krieger¹³.

A small but significant body of literature provides evidence of the observed health benefits of Aboriginal people living on country and undertaking land management on their country, including harvesting and eating bush foods¹⁴⁻¹⁸. Cass et al.¹⁰ described the link between disadvantage and end-stage renal disease for Aboriginal people. Carson et al.¹⁹ reviewed the factors linking Aboriginal health outcomes with their social determinants. However the joint relationship between Aboriginal land management and improved health is poorly accounted for.

The social benefits of addressing Aboriginal health

There is a national commitment from the Australian state to its citizens to ensure delivery of a shared base-level of social services, including education, communications, housing and health. In addition there are strong horizontal and vertical equity and human rights arguments for addressing Aboriginal health, as acknowledged in the National Indigenous Health Equality Targets²⁰.

A number of economic studies provide an indication of the probable value of improved health outcomes for disadvantaged populations. Internationally, the Commission on Macroeconomics and Health estimated that raising the life expectancy of people in low income developing countries from 59 to 68 years of age would result in an annual increase in economic growth of 0.5%²¹. The Canadian Royal Commission on Aboriginal Peoples estimated an annual loss due to the marginalisation of Native Americans of 1% of gross national production²². This was based on social costs associated with the economic marginalisation of aboriginal people (foregone income) and costs incurred by governments in attempting to address social problems through remedial programs.

While there is no direct economic study of the costs of poor Aboriginal health in central Australia, Barnes et al.²³, using the same approach as used in the Canadian study, estimated the annual cost to the Northern Territory (NT) of the social disadvantage suffered by Aboriginal people in 2001 as \$1.4 billion. Further, the NT Government and its agencies have identified Aboriginal disadvantage as a key parameter influencing labour productivity and gross state productivity²⁴.

Being 'on country'

For Aboriginal people, involvement in managing country can result in confirmation of identity and cultural authority, social activities, provision of purpose, teaching and sharing



knowledge, exercise and food. Contemporary Aboriginal peoples' attachment to country is expressed in various ways including: living on traditional country; visiting their country; and carrying out land management practices, sometimes in collaboration with government or non-government bodies.

Properly initiated and supported, linkages by Aboriginal people with their traditional country have the potential to support the maintenance and reintroduction of land management practices that draw from Aboriginal tradition, and reverse the negative feedback between health and the environment. It is important that Aboriginal people have ownership of how activities that express their relationship with their country and environmental management are set up, managed and run. This is because a sense of control over one's life is a psychosocial determinant of health, and is also critical to motivation and institutional stability, as recognised in the broader economic development literature²⁵.

The practices that Aboriginal people undertake in managing country may include patch burning, control of feral animals, maintenance of language and intergenerational transmission of the ecological knowledge embedded in language and art. The public receives a number of environmental benefits from such practices. For example patch burning acts to mitigate intense, more destructive fires which pose greater risks to fire sensitive habitats and will generate relatively higher rates of greenhouse gas release. By promoting habitat diversity, patch burning contributes to the maintenance of biodiversity, while promoting the regeneration of fire-adapted species.

The private benefits to Aboriginal people from engaging in land management practices on their country may include food and exercise, income from the supply of arts and crafts, and from contracted land management. Enhanced emotional and psychological health as a result of improved cultural knowledge and status within the community can lead to greater capacity to assert control.

Consideration of a holistic approach to Aboriginal health

The importance of a holistic approach is often emphasised in discussion of the achievement of improved Aboriginal health and wellbeing. The medical use of the term refers to the treatment of the whole person. Clapham et al.²⁶ observed that '... a large number of health determinants lie outside the formal health sector', and that '[s]olutions to Indigenous health and development problems need to come from many sectors, not just the health sector' (p.272). Lutschini²⁷ has commented on the lack of cohesion in the '... meanings attached to Aboriginal holistic health [sic]'. Here we rely on a coherent and testable application of 'holistic' as it may be applied to achieving improvements in Aboriginal health.

The economic meaning of a holistic approach

According to common explanations, an advantage of a holistic approach is due to the existence of synergies. Synergies are assumed to exist when the whole (outcome) is greater than the sum of the parts (inputs). In such situations economies of scale are achievable. However, the economies that may be achieved using a holistic approach are not limited to synergies. Indeed, there are circumstances in which the economies of a holistic approach to Aboriginal health are the result of complementary inputs rather than synergies.

Complementary inputs

Complementarities normally occur as a result of a technical link between various inputs that require those inputs to be used in combination. A range of relationships are possible where complementary inputs exist. At one extreme, production will not be possible unless all inputs are present. In other situations, production will occur but productivity will be less than it would be if all complementary inputs were provided at an optimal level. For example, if you have doctors but no clinics or medical equipment, some health



outcomes will be achieved, but these will be much less than if the requisite infrastructure were also available.

An economic test of complementary inputs is when a price increase for one of the inputs, such that demand for that input falls, results in a corresponding *decrease* in the quantity demanded for the complementary inputs. This differs according to the existence of substitutable inputs where a price increase for one input results in an *increase* in the quantity demanded of the alternate inputs.

The poor outcomes and high cost of health delivery to Aboriginal people in remote central Australia, relative to the situation for the rest of Australia as a whole and to the rest of the remote central Australian community, is consistent with a failure to provide complementary inputs. Notwithstanding any improvements in health service infrastructure and staffing, Aboriginal health and wellbeing will be sub-optimal unless the social and psychological determinants of health are also addressed. This is because the psychosocial determinants of health are complementary inputs to Aboriginal health and wellbeing.

Scoping economies

A further economic characteristic of some complementary inputs is when the joint provision of goods and services results in economies of scope. Scoping economies in the supply of health and environmental services can occur when the cost of providing certain health services in conjunction with the supply of environmental services is less than the cost of providing these services through separate approaches to health service delivery and environmental management.

Scoping economies normally occur as a result of shared inputs. In the provision of health and environmental services, the potential for scoping economies occurs as a result of the technical relationship between the means used to provide environmental services and the derived health benefits. That is, the technical relationship occurs because Aboriginal people are providing knowledge and labour inputs to the supply of environmental services through the use of land

management practices that drawn on their cultural traditions. In doing so, Aboriginal people receive a range of biophysical health benefits (such as through exercise) and psychosocial health benefits (such as enhanced self esteem through recognition by others of the value of their knowledge and effort). In this way, health services and environmental services are produced jointly.

Private provision of public goods: The private supply of public goods will depend on the application of appropriate policy tools, which will vary according to the economic characteristic of the services provided and the sum of private and public benefits less costs.

Public goods and private goods: Economists differentiate goods and services according to whether they are private or public goods. A public good is one that is non-rivalrous in consumption or use, such that the enjoyment of a good by one individual does not reduce the amount available to another individual. As a result, the marginal social opportunity cost of consumption is zero. Television signals, information, and defence are examples of public goods. In contrast, private goods are those goods which, when consumed or used, are no longer available to others, and are said to be rivalrous in consumption. In this case, the social opportunity cost of consumption is greater than zero. Food and fuel are examples of private goods.

The provision of health services often involves the joint supply of public and private goods. For example, a treatment that cures someone with an infectious disease has private benefit for that individual and public benefits through the removal of a potential source of infection to the population. In addition, the public may decide to maintain the health of the public at some minimal level.

Environmental services can also involve the joint supply of public good benefits (such as biodiversity) and private good benefits (such as food and firewood). In addition many land management practices jointly provide environmental and health services, which may occur as both private and public goods. An example of this is Aboriginal cleaning and



fencing of waterholes in central Australia to exclude feral animals, to protect and conserve water. In addition to cultural benefits, this will result in private benefits through improved quantity and quality of water and an increase in the numbers of native food species. This activity can also result in private health benefits from exercise, improved food and reaffirming of cultural associations. At the same time, public good benefits for the broader community will occur as a result of a more effective public expenditure on meeting socially desirable standards in Aboriginal health and the maintenance of biodiversity.

Are health benefits an externality to the provision of environmental services?

An externality is a benefit or cost due to an activity that is not accounted for when assessing the benefits and costs of the activity. Externalities may be positive, such as when health benefits generated through participation in the supply of environmental services by Aboriginal people are not taken into account by government policy makers. Externalities may also be negative, such as when overgrazing, which results in an increased incidence of dust storms with consequent health impacts²⁸, goes unpriced.

Failure to include health benefits, when accounting for the benefits of Aboriginal land management, will result in land management being under supplied. As a result, the joint supply of health and environmental services will be sub-optimal. Alternatively, goods and services that result in negative externalities will be oversupplied, as per the overgrazing example above.

An example of a positive externality is patch burning, such as is used by Aboriginal women in some central Australian communities to assist them in food collection²⁹. While this activity is carried out to obtain private benefits, it can also generate public environmental benefits such as through the reduction in the risk of intense wild-fires.

A number of government programs have been initiated to facilitate Aboriginal land management practices to increase the supply of public good environmental services³⁰. Public good health benefits are usually not included in the accounting for such government funding. Unless such benefits are fully accounted for, the provision of Aboriginal land management practices will be undersupplied.

This is particularly important within the current policy debate concerning the movement of Aboriginal people from the smaller remote settlements into larger population centres³¹. While this movement may result in efficiencies in service delivery, it is also likely to result in disengagement from traditional country, intercommunity conflict and resulting poorer health and environmental outcomes. Inter alia, an understanding of the economic relationships between engagement in land management practices and health outcomes has been missing from this debate. For policy-makers interested in generating evidence-based policy, it is important that the information shortfalls concerning this relationship are addressed.

Facilitating the optimal supply of private and public goods

A necessary, though not sufficient, condition for the optimal supply of goods and services is that they continue to be supplied as long as the social benefit of an additional (marginal) unit is at least equal to its cost. Because the cost of providing a public good to an additional person is zero, there is an economic argument to not charge for the supply of public goods. A possible government role is to either supply public goods directly or to provide appropriate incentives for their private provision.

Policy makers need to select a policy response to ensure that Aboriginal people, as private providers, supply land management practices at an optimal level. The available responses are incentives, disincentives, or doing nothing. One method for selecting the appropriate policy response is through the use of the cost-effectiveness plane, shown in



Figure 1. This policy decision tool has been used in a number of different policy arenas, including health³², water resource management³³ and land management³⁴.

In using the cost-effectiveness plane we assume that the benefits to the broad Australian public from Aboriginal land management practices are public goods, and that the benefits to the Aboriginal people undertaking land management are private goods.

Figure 1 represents the full range of all possibilities attributable to Aboriginal land management practices. The vertical axis shows public benefits, which can be positive or negative. The horizontal axis shows private benefits, which can be positive or negative. Private benefits are the benefits less the costs incurred by Aboriginal people from their land management practices. Public benefits are the benefits that accrue to the broader public from Aboriginal land management practices less any costs that the broader public incur as a result of these practices.

Figure 1 is divided diagonally into two halves. Below the diagonal line the sum of private benefits plus public benefits result in a negative total social benefit. In the area above the diagonal line the sum of private benefits plus public benefits results in positive total social benefit. For example, points L and M represent two land management possibilities.

At L, located below the diagonal line (Fig1) there is a private loss of $OL_{private}$ and a public benefit of OL_{public} . The total social benefit of L, given by equation (E1), is shown to be negative:

$$\text{Social benefit L} = (OL_{public}) - (OL_{private}) < 0 \text{ [E1]}$$

For point M (located above the diagonal line) there is a private loss of $OM_{private}$ and a public benefit of OM_{public} . The total social benefit of M given by equation (E2) is shown to be positive:

$$\text{Social benefit M} = (OM_{public}) - (OM_{private}) > 0 \text{ [E2]}$$

Selection of policy mechanisms

In segment A quadrant 1 (Fig1), the private benefit to Aboriginal landowners from undertaking land management practices is negative (such as at point L) – that is, there is a private loss. Although there is a public benefit, the private loss exceeds the public benefit, so that the net social benefit is negative (E1). This is represented by this segment being below the diagonal line. Hence this land management practice should not be carried out.

In segment 1B a mix of private loss and public benefit continue to exist (such as point M). However in this segment, the public benefit exceeds the private loss, such that the net social benefit of undertaking the land management activities is positive (E2). Hence this land management practice should be carried out.

Nevertheless because there is a private loss, land management practices in this segment will not be undertaken by landowners without some form of incentive. The value of the incentive to the landowners will need to be at least as great as the private loss incurred from undertaking the necessary land management activities. The rate at which the incentive generates increased private land management will depend on the extent to which the value of the incentive exceeds the private loss. The marginal cost of applying the incentive will need to be no greater than the marginal value of the increase in public benefit.

In quadrant 2 landowners realise a private benefit from undertaking land management practices that also generate public benefit. As a result the net social benefit is positive, as indicated by the location of quadrant 2 above the diagonal line. Landowners will engage in these land management practices because of the positive private benefit, and no policy intervention is warranted.

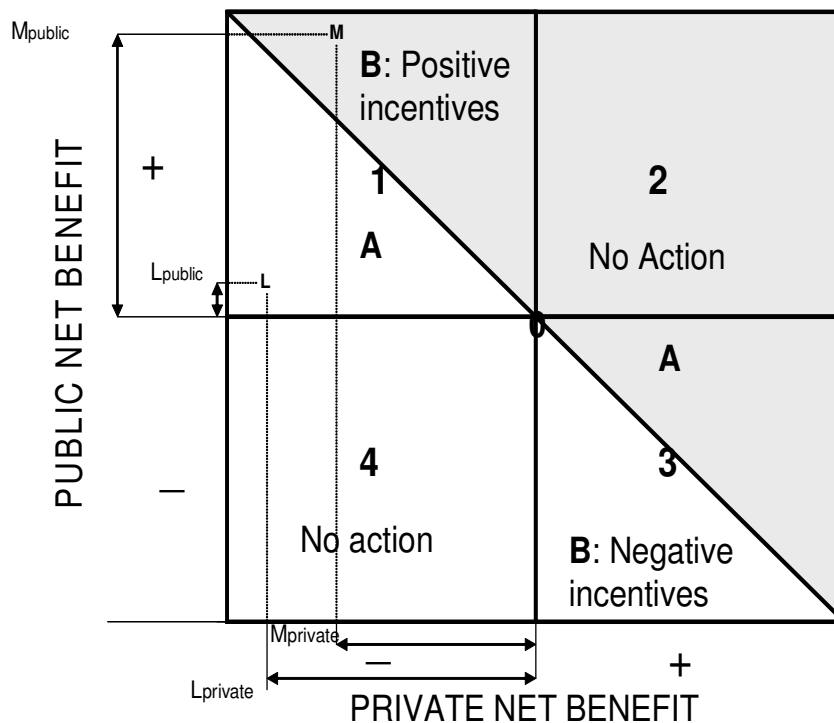


Figure 1: Cost effectiveness plane for resolving the application of private incentives.

In quadrant 3, there are positive private benefits from land management practices, but negative public benefits. For segment 3A, the private benefit from engaging in land management practices is greater than the public loss, as indicated by the location of this segment above the diagonal line. As a result the net total social benefit from land management practices located in this segment is positive. Thus, in spite of the public loss, it is appropriate for these land management practices to occur and no policy intervention is warranted.

In segment 3B the public loss is greater than the private benefit, such that the net social benefit is negative, as indicated by the location of this segment below the diagonal line. Landowners will implement the land management practices that are located in this segment because of the private benefit they gain, despite the social loss from the negative public benefit exceeds the net private benefit. The appropriate policy response, to avoid socially harmful land management practices, is to implement some form of negative incentive or sanction, such as a fine. To provide an effective deterrent, the cost to landowners from such



sanctions needs to be at least as great as their net private benefit from carrying out the practice multiplied by the probability of being caught and sanctioned.

In quadrant 4, both the private and public benefits from land management practices are negative – there are both private and public losses. Because private benefit is negative, landowners will not undertake land management practices located in this segment. Hence no policy intervention is required.

Behavioural incentives

The design of incentives – what they are applied to, their extent, timing and how they are applied – is critical if they are to be effective in the joint supply of environmental and health services. Incentives will need to be compatible with Aboriginal culture and preferences if appropriate responses from Aboriginal people are to occur.

The effectiveness of policy mechanisms aimed at optimising economic outcomes from the joint supply of environmental and health services depends on assumptions regarding human preferences and behaviour. Aboriginal people are likely to have different preference functions from the non-Aboriginal community. This highlights the importance of Aboriginal people having control over how environmental services and health services are provided. If we expect Aboriginal people to take responsibility for behavioural factors affecting their health⁹, it is important that policy actions that aim to facilitate this are compatible with Aboriginal cultural practices.

Conclusion

Two important concerns in central Australia of national relevance are the continuing Aboriginal 'mortality gap' relative to all Australia, and the loss of environmental services including biodiversity. Not only are these two concerns interrelated, but dealing with them is inextricably connected through the psychosocial determinants of health.

Aboriginal control of land management can result in economies through the joint supply of environmental and health services. This holistic relationship is due to the existence of complementary inputs. Failure to deliver the complementary inputs that are offered by Aboriginal land management will result in sub-optimal effectiveness in the delivery of health services.

The benefits from joint supply of environmental and health services may take the form of private goods that are of benefit to the Aboriginal landowners, and public goods that are of benefit to the broader community. Because Aboriginal people derive little benefit from the public goods that they provide through land management, they have little incentive to provide a socially optimal level of land management. One way of correcting for this is for government or some other body to provide appropriate incentives.

The issue for government decision-makers is the selection of appropriate policy tools. The cost-effectiveness plane provides a simple framework to guide the design of policy responses. This approach is a step to addressing an outstanding research need. That is an economic assessment of the total national social benefit from Aboriginal engagement in land management, including a closer examination of the relative strengths and weaknesses concerning Aboriginal people in central Australia living in dispersed small settlements, relative to increasing centralisation.

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CONCLUSION

In this chapter I set out my thinking and introduced new theorising as to the role of traditional land management practices that create a nexus between healthy country and healthy people. The work of the health economists Drummond et al (2006) was important to the thinking in developing this chapter and the cost effectiveness model.

Growing from the above, in the following two chapters, Chapter 3 and Chapter 4, I carry out a partial economic analysis of the possible private good and social public good benefits that could be achieved through the involvement of Aboriginal people in traditional land management, or caring-for-country. While a partial analysis, these two studies, for the first time, provide data on the economic benefits of 'healthy country, healthy people, through the involvement of Aboriginal people in caring-for country.

Early users of cost effectiveness analysis would have included the United States military soon after WWII. The cost effectiveness plane, as presented in figure 1, comes from Drummond et al (2006, p. 40), as Drummond et al's (2006, p. 40), adapted from Black (1990), in addition to the influences cited. Black refers to the use of the cost effectiveness plane as a means of presenting strategic possibilities.

CHAPTER 3

POTENTIAL PRIMARY HEALTH CARE SAVINGS FOR CHRONIC DISEASE CARE ASSOCIATED WITH AUSTRALIAN ABORIGINAL INVOLVEMENT IN LAND MANAGEMENT

INTRODUCTION

A partial economic analysis of the cost savings for three chronic or noncommunicable diseases for members of an Aboriginal community in western Arnhem Land, is carried out according to their involvement in traditional caring-for-country. The health savings achieved through traditional land management has a range of associated environmental benefits. This paper resulted through Professor Stephen Garnett who, following an earlier discussion I had with him in Darwin on the possibility of such a study, proposed the use of Dr Paul Burgess' west Arnhem Land study results (Burgess et al 2009; 2008) and the setting up of the research team, including himself, Dr Burgess and Professor John Wakerman. Burgess' original research was part of the *Sustainable Northern Landscapes and the Nexus with Indigenous Health* study (Garnett, Sithole 2007).



Potential primary health care savings for chronic disease care associated with Australian Aboriginal involvement in land management

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ABSTRACT

Rationale: To identify the possible savings in the cost of primary health care of chronic disease associated with the participation by Aboriginal people in land management. In so doing we investigate the connection of health of Aboriginal people and the extent of their involvement in land management in remote-very remote Australia.

Methods: Possible savings in primary care costs for hypertension, renal disease and diabetes were estimated using multivariate regression to examine associations between Aboriginal involvement in land management and Northern Territory Government-defined chronic disease outcomes, controlling for socio-demographics and health behaviours. Participants were 298 Aboriginal adults aged 15–54 from a remote Aboriginal community, classified by their chronic disease status and a previously validated measure of self-reported participation in land management activities.

Results: Land management participants were significantly less likely to have diabetes, renal disease or hypertension. Using the sampled mean value of engagement in land management, we found the expected net annual savings for the community from involvement in land management of \$268,000. This equates to a net present value of primary health care savings in chronic disease care for the sampled community over 25 years of \$4.08 million. This estimate does not include further savings in other primary health conditions nor costs anticipated in referred and hospital-based health care for chronic disease.

Conclusion: While the association between involvement in land management and better health requires further clarification, our findings indicate that significant and substantial primary health care cost savings may be associated with greater participation in land management activities. These estimated savings are in addition to the market and non-market economic benefits of a healthier population and environmental benefits.

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1. Introduction

Two important policy issues in remote-very remote Australia are the health of Aboriginal people [1,2] and land management [3–5]. There is increasing evidence of a strong relationship between these two policy issues [6–11].

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Under certain circumstances, a joint policy response to these two policy issues can result in cost savings and more effective use of limited medical inputs [12]. Since government funding of Aboriginal people's involvement in land management programs do not include the possibility of improved health outcomes among the benefits (e.g., National Reserve System Task Force [13]), it is likely that these programs are under-funded [12]. The purpose of this paper is to provide an indicative guide of the potential social benefits of combining these two policy issues in remote-very remote Australia in order to inform future policy responses to these issues.

1.1. Background

As is the circumstance for Indigenous peoples world wide, [14] the expected life span of Aboriginal Australians is less than that of non-Aboriginal Australians [1,2,4]. This gap in health outcomes is recognised by the Australian Government as an issue of national significance [4]. The psychosocial determinants of health are important in explaining this difference [15–17]. According to Morrisey et al. [18] cultural strength is critical to mental and emotional wellbeing. While there is a paucity of mental health data for Aboriginal Australians, there are substantial data for other minority groups including Indigenous peoples from New Zealand, and other countries, which support this connection [18:249]. Involvement in land management can be important in addressing some of the factors affecting the psychosocial determinants of Aboriginal health [6–11].

Understanding this relationship requires an awareness of the history of disconnection of Aboriginal people from their country. This disconnection from their traditional country has resulted in the direct loss of access to traditional food and medicines and important cultural aspects of living and has affected the health of the original occupiers of this country through the psychosocial determinants of health. The cultural aspects include the loss of access to culturally significant sites, personal loss of identity, the breakdown of community institutional structures, and the loss of self control of personal living [6,9,15]. Along with the trauma of invasion [20] and racism, Aboriginal people living in remote Australia suffer poorer delivery of social services relative to others in remote Australia. This includes the under servicing of health, education, adequate and appropriate housing, access to food and other resources and broad based social and economic disadvantage. These elements are important psychosocial factors that impact on the health of Aboriginal people [11,15,17].

This disconnection of Aboriginal people from their traditional country is related to the cessation of traditional forms of land management, leading to a break-down of the pre-settlement ecological systems and a consequent loss of biodiversity [5,19]. Aboriginal involvement in traditional land management in remote-very remote Australia can assist land management issues of biodiversity, biosequestration of greenhouse gases [21] and mitigation of dust storms and their transport of siliceous dust and aeroallergens throughout Australia [22].

Evidence of the health benefits of Aboriginal people's connection to their country is indicated by the work of

McDermott et al. [23] and that of Rowley et al. [24]. The McDermott et al. study involved two Aboriginal communities in central Australia. The study populations for each of the communities were classified according to whether they lived in the central settlement or on small homelands. The results of this study showed that those living on the homelands had a lower risk and occurrence of chronic disease. The Rowley et al. study was a 10-year follow-up of one of the two populations in the McDermott et al. study. The study confirmed the earlier results, and showed that homeland residents continued to reside on homelands up until any necessary hospitalisation. These results appear to indicate that the health of Aboriginal people in very remote areas is better than in remote locations [8]. This can be attributed partly to the physical activity and diet of people living in very remote locations [23–26] and partly due to differences in the cultural connection between being resident on outstations relative to living in the township [18,27].

Evidence for the association between engagement in land management and improved health outcomes was further strengthened in a study recently carried out in Arnhem Land – located in northern Australia, or the Top End of the Northern Territory [10]. This study, which involved collaborative work between an Aboriginal community in Arnhem Land and a multidisciplinary research team, investigated the ecological and human health outcomes associated with participation by Aboriginal people in land management. Part of the study involved the classification of study participants according to their chronic disease status and a previously validated measure of self-reported participation in land management activities [28,29]. In identifying the possible savings in the cost of primary health care of chronic disease the current study builds on and extends these earlier results.

2. Methods

2.1. Health assessment

2.1.1. Participants and procedure

The voluntary participants were 298 adults (59% men, $N = 175$) aged 15–54 years ($M = 30.96$, $SD = 10.15$), recruited via an outreach program of preventive health checks in a remote Arnhem Land community between March and September 2005. The participants represented 23% of the eligible population, with a cross-sectional sample age structure similar to the census profile ($\chi^2 = 9.63$, $p = 0.2$) [19]. Volunteers were recruited with different levels of involvement in land management activities. Participants came from 16 very remote homelands ($N = 106$), and remote township residences, workplaces (Indigenous rangers and non-rangers) and public spaces (outside the community store and community council buildings) [28]. All participants had reasonable and equal access to primary health care.

2.1.2. Measures

A 2-year collaboration with a remote Arnhem Land township and network of surrounding homelands identified six core land management activities: spending time on

country, burning of annual grasses, gathering of food and medicinal resources, participation in cultural ceremonies, protecting sacred areas, and artwork production. Participation in these activities was quantified on a four points ordinal response format via an interviewer-administered questionnaire. The questionnaire was rigorously and systematically validated in this population [28]. Accurate weighted composite scores (“caring for country” scores) were subsequently derived for participants (range: 6–24, $M=15.17$, $SD=5.31$) [29].

We also collected self-reported data on primary place of residence, education, income, diet, physical activity and smoking status via an interviewer-administered questionnaire [26]. Participants were also clinically assessed for chronic disease risk factors and the presence of chronic disease diagnoses [29]. Based on this clinical assessment, participants were then categorised as per Zhao et al. [30] according to their existing chronic disease status using the definitions for hypertension, type 2 diabetes, and renal disease.

2.2. Statistical methods

The associations between caring for country scores and chronic disease outcomes were tested by backwards stepwise multivariate regression using logistic regression for diabetes and ordinal logistic regression for categories of severity of hypertension and renal disease as defined by Zhao et al. [30]. Socio-demographic variables (age, sex, education level, income level and residence) and clinically significant health behaviours (smoking, alcohol use and exercise) were included alongside the weighted composite caring for country scale score. Non-significant predictors were eliminated one by one, starting with the variable with the highest p -value ($p \geq 0.05$). Regression models were re-evaluated after each deletion until only significant predictors remained.

All statistical analyses were performed with Stata, version 9.2 (Stata Corp, College Station, Texas, USA).

2.3. Costs estimate

2.3.1. Formulation

The expected net present value of primary health care savings (PVPHC) for the study population according to the three chronic disease conditions, hypertension, type 2 diabetes and renal disease, was estimated over a 25-year period using:

$$PVPHC = \beta_k \left(\sum_{t=1}^{25} \sum_{r=6}^{15} \sum_{k=1}^3 \sum_{s=1}^{k,s} \frac{C_{k,s}Z}{(1+i)^t} \right)$$

where β_k is the population expansion coefficient for condition K ($k=1, 2, 3$), Z is the number of individuals with chronic health condition K at level of severity according to chronic health condition S ($s=1, 2$ for diabetes and hypertension and $s=1, \dots, 4$ for renal disease) for a one unit increase in caring for country score, $C_{k,s}$ is the expected annual unit cost of primary health care for each chronic health condition according to the level of severity, units of

caring for country R ($r=6, 7, \dots, 15$) and time in years T ($t=1, 2, \dots, 25$) (Appendix A).

Cost data for existing cases of diabetes, hypertension and renal disease at 2003/2004 cost levels, according to level of severity, were sourced from the Northern Territory Government’s cost estimates for primary health care in remote Aboriginal communities [30]. Estimation of the cost of primary health services data was calculated using a bottom-up approach. The levels of severity are categorised (C) according to: C 1, early disease; C 2, single established disease; C 3, established disease plus one complication; C 4, established disease and two or more complications. The costs of district and centralised overheads, and the administration cost of remote healthcare centres are not included.

Costs and estimated expected savings were calculated in 2008 constant Australian dollar values by using the geometric mean of the Australian Bureau of Statistics quarterly health consumer price index – a weighting of 1.2682 based on 2003/2004 costs [31]. A discount rate of 4.075%, based on the 10-year domestic bond rate, was used to assess the 2008 dollar value of primary health care cost savings by applying standard criteria set out by the Department of Finance and Administration [31].

Ethics approval for this study was obtained from Charles Darwin University (H04053) and the NT Department of Health and Community Services (04/35).

3. Results

Two participants did not have their blood pressure recorded on the standardised equipment. One participant declined a blood test and could not be assessed for diabetes or renal failure. Several urine samples used to detect early renal disease were of insufficient volume or had leaked during transport (for details see Burgess et al. [29]).

Higher caring for country scores were associated with a lower probability of having hypertension, diabetes, and renal disease (Table 1).

The unit cost, number of cases per condition according to level of severity, and the estimated coefficient values, which provide the expected rate of change in risk according to increasing caring for country score, are provided in Table 2.

The expected cost savings of engagement in land management are estimated according to the nearest whole number of the observed mean level of participation, which was 15.17 units. With an observed starting or base level of six units, the observed mean level of participation in caring for country was nine units. On the basis of the mean caring for country score, the expected annual cost savings in primary health care for the study population was estimated at \$268,000; or an expected net present value in primary health care cost savings for the study population over 25 years of \$4.08 million

4. Discussion and policy implications

4.1. Implications for policy

Using a systematically developed and validated measure of participation by Aboriginal people in land manage-

Table 1
Final multivariate regression model outcomes for three chronic diseases.

Chronic disease outcome	Age	Female gender	More frequent Exercise	Homelands residence	Caring for country	
					Coefficient ψ^a	95% CI
Diabetes <i>n</i> = 297	0.12*** (0.03) ^b	–	–0.62* (0.23)	2.37**	–0.23*** (0.08)	–0.39 to –0.07
Renal disease <i>n</i> = 282	0.08*** (0.01)	0.80** (0.27)	–	1.07**	–0.11** (0.04)	–0.19 to –0.04
Hypertension <i>n</i> = 296	0.09** (0.02)	–	–	2.27**	–0.26** (0.08)	–0.41 to –0.10

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, $\bar{p} \geq 0.05$.

^a ψ : change in chronic disease severity category for a one unit change in weighted CFC score.

^b Standard error.

ment activities, we have demonstrated the potential for substantial primary health care cost savings for chronic disease care in a remote Aboriginal community. These findings are consistent with previous work documenting better health outcomes associated with a traditional lifestyle [22,25], and a longitudinal study demonstrating decreased cardiovascular and chronic disease risk associated with residence in homeland communities [25], where greater engagement in land management is much more common [28].

Our findings provide a conservative base estimate of the potential savings in primary health care for a specific population, based on its characteristics at a given period of time, according to the mean level of land management engagement. No account is taken of the primary health care savings for other conditions and prevention of the more expensive hospital costs associated for the three diseases under study, including transport costs. Given the reported importance of caring for country to the development of positive self-identity and the maintenance of social relations, customary governance structures [27] and the potential for sustainable economic development in remote areas [7,32], health benefits could potentially expand. These savings would occur in addition to the environmental benefits of customary land management and can be seen as either a by-product or as a joint product of investment in land management [12].

Better health outcomes are likely to be associated with diet, exercise and enhanced psychosocial factors, such as improved self esteem [6,8,31]. Campbell et al. [12] suggested that caring for country results in direct primary health care cost savings through improvements in the psychosocial determinants of health and secondary savings when such psychosocial improvements complement medical treatments. Such complementarities result in cost

savings by maintaining the technical efficiencies of medical treatments.

Participation in land management is strongly associated with residence in very remote homelands [28], where superior health outcomes have been demonstrated compared with larger remote townships [23,24,26]. There is continued pressure to centralise Aboriginal populations living on homelands into administrative 'core-centres', such as under the recently initiated Growth Towns Policy [34]. Such policies aim to engender economies of scale in the delivery of 'mainstream' services [15,33,34]. A possible alternative outcome, based on our results, suggests increased chronic disease burden and additional health care costs when there is a decline in participation in land management activities. This is compounded by the loss of other social benefits such as a healthier working population that is able to maintain traditional cultures and a range of environmental services [10,11,33].

This work has the potential to contribute to national wellbeing studies such as those used by Treasury [35–38]. Further work is now required to estimate the direct health costs of policies that might reduce Aboriginal engagement in land management as well as costs that will be incurred through a decline in the provision of environmental services.

4.2. Study limitations

The observed association between Aboriginal health and land management participation is likely to be associated with physical activity, diet and psychosocial factors [6,11,19,23,24]. A longitudinal study is merited, however, to further elucidate the causal relationships.

While not an equal probability sample, our sampling strategy to include participants with varying involvement

Table 2
Participant chronic disease diagnoses by severity and annual cost.

Condition	Increasing severity								Number with condition (% of total)
	1		2		3		4		
	<i>N</i>	Cost \$	<i>N</i>	Cost \$	<i>N</i>	Cost	<i>N</i>	Cost	
Diabetes	–	1514	22	1586	–	–	–	–	22 (7%)
Hypertension	6	445	13	1022	–	–	–	–	19 (6%)
Renal disease	71	49	18	347	5	2327	1	2466	95 (34%)

Notes: Individual cost data are 2008 values based on Zhao et al. [30].

in land management was reliable [28]. The sample age structure did not differ significantly from the most recent census [38], but probably underestimates the incidence of morbidity in the community. For example, type 2 diabetes was present in 7.4% of participants whereas the community prevalence was estimated to be approximately 15% [21]. These results suggest that volunteers for the preventive health check program were (as expected) healthier people. In light of this, we believe that our findings constitute a conservative estimate of health associations between land management participation and chronic disease outcomes.

The cost data for the three chronic diseases examined in this study are based on primary health care activities for remote Aboriginal communities in the Northern Territory, rather than the community for which the health data were collected [29]. As noted, these estimates did not include district and centralised overheads, or the administration cost of remote healthcare centres and assume a highly efficient primary health care service, and are deliberately conservative. This is unlikely to be the case given the challenging and uncertain conditions in which remote healthcare centres operate.

The use of constant 2008 dollar values assumes that the future *relative* price of health is a constant, although the consumer price index for health shows that the relative price of health has increased faster than those of other goods and services. Some of this difference in the increase in price, however, may be the result of improvements in technology and health delivery. As a result, the use of prices that are assumed to remain relatively constant over time with all other prices is likely to result in an under estimate of the cost savings.

Similarly, the estimated savings in primary health care cost are likely to be conservative because the health benefits of engagement in land management are estimated after the participation in caring for country has occurred, or *posthoc*, rather than from the base level that existed prior to the observed caring for country.

Although the possible health benefits of Aboriginal people participating in caring for country will differ between different communities, the results presented in this paper do show that the health expenditure savings through engaging in such activities can be substantial. In addition, the government pays Aboriginal people for various forms of environmental management. As no allowance is made in these programmes for improved health outcomes, our results suggest that public investment in Aboriginal land management is under-funded [12].

Further work is required to examine associations between caring for country scores and hospitalisations and social indicators such as education outcomes and contacts with the justice system [29]. If similar associations

are demonstrated, this could inform investment across a range of policy areas and contribute positively to closing the health gap between Aboriginal and non-Aboriginal Australians.

Certainly, the joint land management-health benefits, indicated here, demonstrate the advantage of a collaborative approach to public health, especially when dealing with the prevention of chronic disease – and confirm the call by Baeza et al. [39] for interdepartmental cooperation. As the outcomes of such interventions are likely to require long term analysis and will require the identification and measurement of the costs and consequences across a diversity of medical and non-medical outcomes role. As shown here, the use of a monetary numeraire is useful when dealing with multiple sources of benefit, as discussed here [40].

5. Conclusion and implications

These results underscore the potential importance of investment in Aboriginal land management for chronic disease prevention. Accordingly, we conclude that greater participation by Aboriginal peoples in land management may be associated with significant and substantial savings in primary health care expenditure for the management of chronic disease.

In light of our findings we suggest that current policy initiatives fostering centralisation of dispersed remote populations may increase costs for chronic disease care in both the primary and tertiary health care sectors and in the joint provision of land management services. At the very least, we suggest, the information provided here would be useful in exploring the cost effectiveness of centralisation policies.

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Appendix A.

Formulation	
α_k	Probability for condition K ($k = 1, 2, 3$) that an individual will move to the adjoining lower level of severity following a unit increase in caring for country
r	Number of units of caring for country ($r = 6, \dots, 15$)
t	Number of years T ($t = 1, \dots, 25$)
$N_{k,s}$	Number of people participating in the study with condition K ($k = 1, 2, 3$) with severity S ($s = 1, 2$) for diabetes and hypertension and ($s = 1, \dots, 4$) for diabetes (see Table 1)
$C_{k,s}$	Annual primary health cost for a patient with condition K level of severity S
$\alpha_k N_{k,s-1}$	Number of study participants with condition K moving from severity level S to the adjoining lower level of severity for condition K
$((N_{k,s} - (\alpha_k N_{k,s})) + (\alpha_k N_{k,s+1}))$	Number of survey participants with a given level of severity and for each chronic health condition, after a one unit increase in caring for country
$\sum_{k=1}^3 \sum_{s=1}^{ks} Z$	Number of study participants for each of the chronic disease conditions, over all levels of severity ($s = 1, 2$ for diabetes and hypertension and $s = 1, \dots, 4$ for renal disease), after a one unit increase in caring for country
$\sum_{r=6}^{15} \sum_{k=1}^3 \sum_{s=1}^{ks} Z$	Number of study participants for each of the chronic disease conditions over each level of severity, following a nine unit increase in caring for country
$\sum_{r=6}^{15} \sum_{k=1}^3 \sum_{s=1}^{ks} C_{k,s} Z$	Total cost savings in 1 year for the sample population
$\sum_{t=1}^{25} \sum_{r=6}^{15} \sum_{k=1}^3 \sum_{s=1}^{ks} C_{k,s} Z / (1 + i)^t$	Present value of primary health care for the sample population over a 25-year period, where i is the time discount rate
$\beta_k(\cdot)$	Where β_k is the population expansion coefficient for condition K (hypertension = 0.2305; renal disease = 0.2196; diabetes = 0.2313)

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CONCLUSION

Though limited in extent, the partial economic analysis demonstrates the expected social benefits achieved through caring-for-country, and by implication, the importance of such activity to Aboriginal people. I first became aware of the healthy country, healthy people concept as early as 1971. Yet, in spite of the early existence of this concept, a casual review of the literature does not reveal any other economic study of the healthy country, healthy people interrelationship.

A drawback in this analysis is the small sample size, although the sample includes a reasonable proportion of the study population. This shortfall is responded to in the following Chapter 4 and is further discussed in the concluding Chapter 8.

CHAPTER 4

APPLICATION OF AN INTEGRATED MULTIDISCIPLINARY ECONOMIC WELFARE APPROACH TO IMPROVED WELLBEING THROUGH ABORIGINAL CARING-FOR-COUNTRY

INTRODUCTION

Chapter 4 extends the economic analysis of healthy country, healthy people from the tropical north, as in the previous Chapter 3, to the central Australian desert. As no data directly connecting involvement in caring-for-country with changed chronic disease condition is available, differences in residence was used. Consistent with earlier studies, it is assumed that homeland residents, with greater access to country, would have a higher level of participation on country than township residents. This assumption is consistent, in both studies, with body mass index measures and incidence of noncommunicable disease being lower for homeland residents than that observed for township residents.

The comparative economic study of noncommunicable disease condition was carried out for two of the three conditions assessed in the previous Chapter 3. A simple population weighting of the central Australian results was used to provide a comparison of primary health care cost savings between the central Australian study results and the Arnhem Land study results according to the two disease conditions.

These results are also considered through a multidisciplinary economic welfare perspective in which the generation of multiple private good and national public good social benefits are noted. While the supply of private goods is directly linked to caring-for-country, the supply of social public goods occur as byproducts at zero cost. The tropical northern Australia and the desert central Australia comparison indicate comparable results with improved health and environmental outcomes.

Application of an integrated multidisciplinary economic welfare approach to improved wellbeing through Aboriginal caring for country

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Abstract. The lands held by Aboriginal people are mostly located in the Australian desert, aside from pastoral country purchased under the Indigenous Land Corporation, they are among the least amenable to agricultural production. Social expectations regarding land use are undergoing a multifunctional transition with a move away from a focus on production, to increased amenity and conservation uses. This change means that Aboriginal people with cultural connections to country enjoy an absolute advantage in managing country through their application of land care involving Indigenous ecological knowledge.

An integrated multidisciplinary economic welfare approach, based on data from northern Australia and the central Australian desert, is used to demonstrate the role Aboriginal people can play in caring for country. Such engagement can be to the advantage of Aboriginal people through a multiplicity of private and public good benefits, such as improving Aboriginal health, maintaining biodiversity, and the mitigation of climate change impacts through possible greenhouse gas biosequestration and the reduction of dust storms – which are an important vector of disease.

Additional keywords: closing the gap, desert, natural resource management, social determinants.

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Introduction

Indigenous Australians have jurisdiction over a significant area of country as a result of the enactment of the *Native Title Act (1993)* and land being returned to them in the Northern Territory and South Australia. While there is some uncertainty about the size of this area, estimates range up to 20% of Australia (Altman *et al.* 2007; p. 43), extending to 25.4% when non-exclusive rights are included (Lane and Williams 2008; p. 38). Most of this country is at best marginal grazing country, with all but ~0.2% in remote–very remote Australia (Altman *et al.* 2007). Demographic changes, resulting in a decreasing non-Aboriginal population and an increasing Aboriginal population with extensive land ownership in remote–very remote Australia (Brown *et al.* 2008), mean that there is an increasing land management role for Aboriginal people in this region.

Duncan (2003; p. 308) suggested that agricultural economists and farm managers play a significant role in advancing the economic wellbeing of Aboriginal Australians, given their large land holdings. He saw this as a step to overcoming the economic disadvantage suffered by Aboriginal people, but it is not surprising that there has been minimal follow-up on this suggestion. While Aboriginal people do run several successful grazing properties as, for instance, those set up by the Indigenous Land Corporation in Western Australia in cooperation with the

Western Australian Department of Agriculture and Food (ILC 2007), much of the land held by Aboriginal people is not only mostly desert but is also the least suitable for agricultural pursuits. As a result, the opportunities for Aboriginal people to overcome economic disadvantage through land ownership may seem limited. This need not be the case, as there is an important land management role for Aboriginal people in remote–very remote Australia using Indigenous ecological knowledge. Such activities can result in national economic public good benefits, in addition to private and community benefits for Aboriginal people (Campbell *et al.* 2008a).

Holmes (2006), building on the writings of earlier researchers such as Marsden (1999), Wilson (2001, 2004) and Evans *et al.* (2002), described the social expectations of land use as moving away from a focus on production to a multifunctional transition. This involves contestation among: (1) production, including agricultural production and mining; (2) amenity benefits, including tourism; and (3) protection, consisting of conservation and/or Aboriginal occupancy.

A multiplicity of benefits can be achieved through the involvement of Aboriginal people in land management according to Indigenous ecological knowledge, or ‘caring for country’. Caring for country involves practices such as spending time on country, removal of grasses through cool weather burning,

gathering of food and medicinal resources, participating in cultural activities including protection of sacred sites and the production of art and craft work (Burgess *et al.* 2008) and intergenerational transfer of knowledge (Burgess *et al.* 2008). Figure 1 presents some of the multiplicity of possible public and private benefits, of which the health of Aboriginal people is an important component. As the health of Aboriginal people is generally below the minimum national social standard (HREOC/SCIHE 2008; Rudd 2008; Rudd and Roxon 2008), raising their general level of health is a national economic public good.

It is important that such multiple benefits are included in any assessment of land management by using an integrated multidisciplinary economic welfare approach, such as proposed by Abler (2004) and Armbruster (2008). Armbruster suggested that there is 'a need to collaborate much more broadly with other researchers both inside and outside our [agricultural and resource economists] profession in order to achieve results meaningful to the complexity of the issues' (p. 1).

The purpose of this paper is to demonstrate the application of an integrated multidisciplinary economic welfare approach to assess improved economic wellbeing for Aboriginal people through caring for country. In particular, emphasis is given to economies achieved through the joint supply of health and environmental services by the private involvement of Aboriginal people in caring for country (Campbell *et al.* 2008a).

Background

Current health status

There have been minor improvements in the life expectancy of Aboriginal people over the past 20 years (Condon *et al.* 2004; Thomas *et al.* 2006; Zhao and Dempsey 2006; Wilson *et al.* 2007). However, as the national population has also enjoyed improvements in life expectancy over this time, the relative gap in life expectancy for Aboriginal people remains. Over the period 2005–07 the national life expectancy for Indigenous males was 67.2 years (a gap of 11.5 years) and for Indigenous females it was 72.9 years (a gap of 9.7 years). These figures show a longer life expectancy than earlier estimates provided by the Australian Bureau of Statistics. This is not the result of improvements in

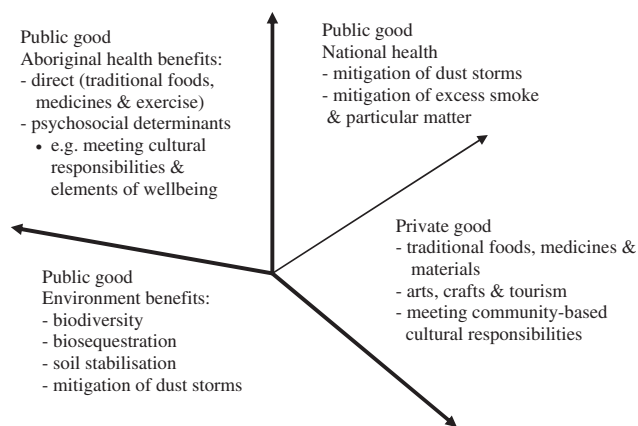


Fig. 1. Joint products originating from Aboriginal involvement through caring for country in remote–very remote Australia (based on Campbell 2008).

health outcomes for Indigenous Australians, but is the result of changes in the methodology used to estimate the expected life span of Indigenous Australians (Australian Bureau of Statistics 2008; Steering Committee for the Review of Government Service Provision 2009).

While the impact of communicable disease is important, more than 70% of Aboriginal mortality is the result of non-communicable diseases such as hypertension, diabetes and renal disease (Condon *et al.* 2004; p. 450; Zhao and Dempsey 2006). Although the factors affecting the high level of chronic disease among Aboriginal people are not fully understood (Cass *et al.* 2004), the psychological and social (psychosocial) determinants of health are important (Carson *et al.* 2007; Johnston *et al.* 2007a; Putnis *et al.* 2007; Marmot *et al.* 2008). Therefore, addressing the psychosocial determinants is fundamental to closing the gap in health outcomes. Addressing these factors through caring-for-country practices is likely to both complement biomedical interventions and result in scoping economies (Campbell *et al.* 2008a, 2011).

Connecting with country

An explanation of the interrelationship between Aboriginal health, caring for country, and the supply of environmental services starts with the arrival of non-Aboriginal settlers in central Australia some 130 years ago. These settlers observed an ecosystem that was the result of a history of caring for country by Aboriginal people, in which the use of fire was an important land management and hunting and gathering tool (Bird *et al.* 2005; Altman 2009). The use of fire normally occurred in the cooler months when it would have less impact on timber species than in the hotter months preceding the wet. These cool-weather fires led to a mosaic of burnt and unburnt areas and a complexity of plant species of varying ages (Edwards *et al.* 2008; Russell-Smith *et al.* 2009).

European settlement and the dispossession of Aboriginal people from country led to changes in land management practices, the introduction of exotic species, and ecological alterations (Gale and Haworth 2005; Lunt *et al.* 2007; Edwards *et al.* 2008). The resulting decrease in the mosaic of burnt/unburnt areas led to an increase in the occurrence, intensity and extent of wild fires over the drier, hotter months, and the release of biologically sequestered greenhouse gases due to the loss of woody plants (Edwards *et al.* 2008). The increase in smoke as a result of wild fires was also accompanied by localised increases in respiratory diseases (Johnston *et al.* 2007b). The reduction of vegetative cover can also result in increased frequency of dust storms with negative health impacts from siliceous disease and the dust acting as a vector of disease (Knight *et al.* 1995; Griffin *et al.* 2001; Campbell *et al.* 2008b).

The dispossession of Aboriginal people from their country resulted in the loss of access to traditional food and medicines, of cultural connection with country and of personal and group identity – with psychosocial impacts on Aboriginal health. Such impacts included the failure to meet cultural responsibilities on country, the breakdown of community customary governance structures, the loss of personal and group identity, and a loss of control over living as individuals and as members of a community (Carson *et al.* 2007; Johnston *et al.* 2007a; Garnett

et al. 2009). The trauma of invasion (Renolds 1992; Ashdown 2007), racism, social and economic disadvantage, and poor education and employment opportunities are also important in their effect on the psychosocial determinants of health (Anderson 2007; Siggers and Gray 2007). Due to the interrelationship between health and the capacity to care for country and the impact that the failing health of country has on Aboriginal health (Muir *et al.* 2010), in many areas there is a negative feedback loop leading to a downward spiral of poor ecological health of country and the health of Aboriginal people, which is leading to a net social loss (Campbell *et al.* 2008a).

The link with caring for country and improved health outcomes

There are two parts to this section. First, the benefits from the involvement of Aboriginal people in caring for country in the West Arnhem Land Fire Abatement Project are summarised. This includes both environmental benefits and an economic assessment of the savings in primary health care as a result of their engagement in caring for country (Campbell *et al.* 2011). Second, the results from the Arnhem Land case study are generalised to the central Australian desert on the basis of research carried out by McDermott *et al.* (1998).

West Arnhem Land case study

The West Arnhem Land data are the result of the Healthy Country Healthy People study carried out in Arnhem Land at the behest of the traditional owners (Garnett and Sithole 2007; Johnston *et al.* 2007b; Burgess *et al.* 2009). The study was intended to demonstrate a 'proof of concept' for the ancillary health benefits of participation in caring for country, and extends earlier work by Morice (1976), O'Dea (1984), O'Dea *et al.* (1988), McDermott *et al.* (1998) and Rowley *et al.* (2008).

Environmental benefits of caring for country

The West Arnhem Land region is recognised as containing Australia's largest grouping of natural ecosystems remaining in a natural state (Natural Heritage Trust 2009) – although use of the term 'natural' is misleading given the long history of occupancy and land management through caring for country by Aboriginal people. It has also been a region subject to intense annual dry season fires and smoke.

The West Arnhem Land Fire Abatement Project was initiated in 1997 and was intended to repopulate the region and counter the high incidence of wild fires in West Arnhem Land. The program included the involvement of Aboriginal people in land management practices using Indigenous ecological knowledge, and ecological studies of the impact of changing fire regimes on vegetative communities. A reduction in the release of greenhouse gases occurred as a result of the decrease in uncontrolled wild fires.

Conoco-Phillips were persuaded to make use of the reduction in greenhouse gas release in meeting the Australian and Northern Territory Governments' requirement for greenhouse gas offsets in establishing a liquefied natural gas plant in Darwin. The intended offsets are an average annual reduction of 100 000 tonnes of CO₂ equivalent over a 17-year period. The

program includes an annual payment of \$1 million for fire abatement services by traditional Aboriginal land owners through caring-for-country activities in conjunction with western land management methods (Whitehead *et al.* 2009).

A total reduction of 420 000 tonnes in greenhouse gas emissions occurred in the first 3 years of the project at a cost of less than \$10 per tonne of CO₂ equivalent (Whitehead *et al.* 2009). Additional biodiversity and social benefits also occur, along with new employment opportunities for the local Aboriginal community. Social benefits included cultural re-engagement with country, and environmental benefits including protection of *Allosyncarpia* rainforest and a range of other threatened species (Purdon *et al.* 2008; Tropical Savannas CRC 2008a, 2008b; Russell-Smith *et al.* 2009).

Expected savings in primary health care through caring for country

The following estimated cost savings in primary health care are from Campbell *et al.* (2011) using health and caring-for-country data collected by Burgess *et al.* (2009) and cost data from Zhao *et al.* (2006). These health data were collected from a targeted sample of 298 respondents aged 15–54 years. The study participants constitute 23.2% of an Arnhem Land Aboriginal community, who were recruited using targeted sampling. Survey participants' residences ranged from homelands (outstations) to the central township. Individual caring-for-country scores were assessed using a previously developed caring-for-country participation index (Burgess *et al.* 2008). The observed scores ranged from 6 to 24, of a possible 1–25, with a mean score of 15.17 (s.d. = 5.31). The index was based on six core activities: time on country, burning of grasses, gathering of food and medical resources, ceremony, protecting sacred areas, and artwork production.

Participants were clinically assessed for the risk and presence of chronic disease (Burgess *et al.* 2009). The association between the caring-for-country score and chronic disease status was investigated using multivariate regression. After controlling for sociodemographic characteristics such as age and gender, and health behaviours such as smoking and exercise, the likelihood of having a chronic disease condition was shown to decrease with increasing caring for country (Table 1).

The economic assessment (Campbell *et al.* 2011) was carried out according to the level of severity of three chronic disease conditions: hypertension, type 2 diabetes, and renal disease. The cost data used in this analysis was sourced from the Northern Territory Government's cost estimates for primary health care in remote Aboriginal communities for 2003–04 (Zhao *et al.* 2006; p. 27). The cost of district and centralised overheads, and the administration cost of remote healthcare centres were not included in the Zhao *et al.* data. The cost data were weighted using the Australian Bureau of Statistics medical consumer price index to give estimated 2008 values.

The estimated annual savings in primary health care for the study population of 1284 Aboriginal people, according to expected participation in caring for country, was \$268 000, with a present value estimated in constant 2008 dollar value over 25 years of \$4.08 million (Campbell *et al.* 2011). The present value estimate is based on a time discount rate of 4.075%,

Table 1. Multivariate regression model outcomes and annual primary care costs for three chronic diseases for the Arnhem Land Aboriginal community^A

* $P < 0.05$; ** $P < 0.01$

Condition	Increasing disease severity/complexity				Caring for country	
	1 Cost (\$)	2 Cost (\$)	3 Cost (\$)	4 Cost (\$)	Coefficient ^B (95% CI)	Number with condition (% of total)
Hypertension	455	1022	–	–	–0.26* (–0.41 to –0.10)	19 (6)
Renal disease	49	347	2327	2466	–0.11* (–0.19 to –0.04)	95 (34)
Diabetes	1514	1586	–	–	–0.23** (–0.39 to –0.07)	22 (7)

^ACampbell *et al.* (2011).

^BChange in risk for a one-unit change in weighted caring for country score.

established according to standard Department of Finance and Administration (2006) criteria. No account was taken of primary care savings for other health conditions, hospital costs, or travel.

As caring for country constitutes a preventative health intervention, there are additional economic benefits through maintaining a healthier community. While no direct estimates of environmental benefits were assessed, the results of the greenhouse gas offsets, alone, indicate these are substantial.

Comparison with Aboriginal central Australia

The central Australian results are based on McDermott *et al.* (1998) data. The data were collected from two central Australian Aboriginal communities and categorised according to whether the respondent lived on traditional homelands, usually in a small family group, or in the central township. Those living on homelands had greater access and opportunity to carry out traditional practices and the collection of traditional foods and medicines. Those living in the central township had less access to traditional country and greater access to store bought food. As a result, homeland residents were more likely to exercise and have a healthier diet.

The comparative medical results are based on differences in individual body mass index (BMI), which is the individual’s bodyweight divided by the square of their height (kg/m²). Body mass index is a reliable indicator of chronic

disease risk for Aboriginal people (Wang and Hoy 2004). The central Australian data also include prevalence of diabetes and hypertension, by residence (Table 2). Equivalent Arnhem Land data, plus the Arnhem Land composite caring-for-country scores according to residence, are included in Table 2. Both the central Australian data and the Arnhem Land data showed a lower BMI reading and a lower prevalence of chronic disease for homeland residents.

The Arnhem Land composite caring-for-country scores were higher for those living on homelands than for those living in the township [2.61 (s.e. = 0.41), v. 1.58 (s.e. = 0.49)] (Burgess *et al.* 2009). This result also implies a positive relationship between living on homelands and participation in caring for country.

The McDermott *et al.* (1998) diabetes and hypertension disease data did not consider the severity of the health conditions. Nor were there data showing expected changes in chronic disease according to changes in caring for country. Instead, the relative difference in chronic disease according to residence was considered, where residence was a proxy for caring for country. These data, along with the cost data based on Zhao *et al.* (2006) were used to measure the cost savings in 2008 dollar values according to caring for country based on residence. Two estimates are provided according to severity level 1, and severity level 2. To provide comparative measures, the cost savings were estimated for a population of 1284, which is equivalent to the Arnhem Land study population

Table 2. Comparison of body mass index (BMI) according to location of residence in Arnhem Land and central Australia

Classification	Residence			
	Township		Homelands	
	Value (std. error)	No. of respondents	Value (std. error)	No. of respondents
Arnhem Land community ^A				
Composite caring-for-country score	1.58 (0.49)	191	2.61 (0.41)	89
Difference in caring-for-country score			65%	
BMI (kg/m ²)	23.2 (5.7)	195	22.4 (5.7)	93
Difference in BMI			4%	
Central Australian communities ^B				
Body (kg/m ²)	25.7 (6.1)	296	23.5 (5.7)	530
Difference in BMI scores			9%	
Diabetes	37 (13%)	294	46 (9%)	526
Hypertension	98 (33%)	293	108 (20%)	528

^ABurgess *et al.* (2009).

^BMcDermott *et al.* (1998).

Table 3. Expected savings in primary health care costs for diabetes and hypertension as a result of homeland residency in central Australia

Estimation of:	Diabetes		Hypertension	
	Homeland	Township	Homeland	Township
Cent. Aust. no. per 1000	87.452	125.850	204.545	334.471
Difference in no. affected	38.398		129.925	
Unit cost severity level 2	\$1709.53		\$1102.07	
Total cost per 1000	\$65 642		\$143 187	
Total cost equivalent to a population of 1284 ^B	\$84 285		\$183 852	
Total cost difference for severity level 2	\$268 137			
Unit cost severity level 1	\$1632.17		\$479.38	
Total cost per 1000	\$62 672		\$62 284	
Total cost equivalent to a population of 1284 ^A	\$80 471		\$79 972	
Total cost difference for severity level 1	\$160 443			

^AThese results are based on data from McDermott *et al.* (1998) and the same cost data as for the Arnhem Land cost estimates.

^BThe Aboriginal central Australia estimates are estimated for a community population of 1284 Aboriginal people, equivalent to the Arnhem Land population.

(Table 3). The annual cost savings in central Australia were estimated to range from \$160 443 to \$268 137. By comparison, the total Arnhem Land annual expected cost savings for diabetes and hypertension was \$192 030 (Table 3).

Discussion

The Arnhem Land results show that homeland residents have higher levels of caring-for-country scores, lower BMI readings, and lower prevalence of chronic disease than township residents. The Arnhem Land cost savings were based on an expected variation in chronic disease resulting from a mean measured variation in caring-for-country score of 15, from an observed range of 6 through 24 units. No such estimation was possible for central Australia. Instead, estimated cost savings were provided according to the difference in BMI between township residents and homeland residents, where residence was used as a proxy for caring for country. Obviously, these are not equivalent measures as (1) the Arnhem Land estimated cost savings were based on the existing number of people with three chronic diseases conditions following participation in caring for country; and (2) the use of the caring-for-country score provides a better estimate of caring for country than residential location.

The central Australian and Arnhem Land results provide both a lower risk and a lower rate of chronic disease for homeland residents. Both measures are indicative of the incidence of chronic disease. Homeland residency provides greater access to caring-for-country activities, as indicated by the difference in the Arnhem Land caring-for-country scores. Two inferences can be drawn from these results. First, Aboriginal people living on homelands in remote–very remote Australia are more likely to participate in caring for country with consequent environmental benefits. Second, participation in

caring for country is strongly associated with lower chronic disease risk and lower rates of chronic disease.

One possible explanation for the lower BMI readings and lower disease prevalence for those living on homelands is that homeland residents in poor health move to the township to access health services. However, this behaviour is contradicted by the Rowley *et al.* (2008) results from a 10-year follow-up of one of the study populations in the McDermott *et al.* (1998) study, where it was shown that unhealthy people did not move off homelands to settlements. This result is also inconsistent with Aboriginal people reporting that they feel healthier as a result of moving to homelands and living in a traditional lifestyle when unwell (Morice 1976; Johnston *et al.* 2007a; Kingsley *et al.* 2009).

Environmental benefits of caring for country

Over 20 million hectares are managed under Indigenous Protected Area programs established by the Commonwealth Department of the Environment, Water, Heritage and the Arts (now the Department of Sustainability, Environment, Water, Population and Communities). This is one-quarter of the national reserve program and can be assumed to provide appropriate environmental benefits as required under the *Environment Protection and Biodiversity Conservation Act (1999)*. These areas have been managed according to Indigenous ecological knowledge by resident Aboriginal communities. The use of Indigenous Protected Areas provides some financial assistance in the maintenance of these areas while meeting national environmental protection requirements are at a lower cost than would otherwise be achieved.

In 2008 the Department increased funding for the Indigenous Protected Area program to \$180 million over 5 years. The intention was to increase the Indigenous Protected Area by at least 40% by the end of the funding grant (Commonwealth Department of the Environment Water Heritage and the Arts 2010). Consistent with the distribution of the land held by Aboriginal people, Indigenous Protected Areas are overwhelmingly located in remote–very remote areas, where most of this area is desert [see map: Indigenous Protected Areas May 2010; Department of the Environment Water Heritage and the Arts/Department of Agriculture, Fisheries and Forestry (2010)].

The activities involved in caring for country result in private and Aboriginal community benefits and national public good benefits. The public good includes the improved health of Aboriginal people and a range of other benefits (see Fig. 1) including national health benefits due to the possible mitigation of dust storms from desert Australia. Such benefits are additional to the environmental benefits accounted for by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities in their funding of Indigenous Protected Areas.

Scoping and complementary economies

Two economic characteristics important to understanding the cost effectiveness of caring for country by Aboriginal people are scoping economies and complementary economies.

Scoping economies

Scoping economies occur when the cost of providing two or more goods jointly is less than they would cost if they were to be supplied separately. That is:

$$((TC_E + TC_H) - TC_{E,H})/TC_{E,H} > 0 \quad (1)$$

where TC_E is the total cost of supplying a given amount of environmental services when it is supplied separate of health services.

TC_H is the total cost of supplying a given amount of health services when it is supplied separate of environmental services.

$TC_{E,H}$ is the total cost of supplying a given amount of environmental and health services when they are provided jointly.

Scoping economies come about when two or more products share at least one common input and the long-run marginal gain in efficiency in production of the additional product/s exceeds any long-run marginal loss of efficiency in the production of the existing product/s. Participation in caring for country is assumed to occur up to where the Aboriginal community's marginal benefits equal the marginal opportunity cost. As the marginal national social benefit of the enhanced environmental and health-related public goods resulting from caring for country are unaccounted for, that is, are external to the Aboriginal community's decision making, they will be under supplied. Using Black's (1990) cost effectiveness plane, extended by Pannell (2008) in the natural resources literature, Campbell *et al.* (2008a) have argued for public funding of Aboriginal caring-for-country activities. Such funding is applicable when the combined public and private benefits exceed what would be supplied by Aboriginal people under their own initiative.

The estimated annual cost savings in primary health care of \$258 000, for the Arnhem Land Aboriginal community is a direct result of the community's involvement in caring for country. These savings are in addition to environmental and other benefits. As noted, many of the public benefits obtainable through the involvement of Aboriginal people in caring for country are external to the decisions made by Aboriginal people.

Substitution or complementary economies?

Whether substitution or a complementary relationship applies is normally identified by whether compensated cross elasticities of supply (e_{xy}) is positive, in the case of substitution effects, or negative, in the case of complementary effects. That is, complementarities exist when:

$$e_{xy} = (\Delta Q_x / Q_x) / (\Delta P_y / P_y) < 0 \quad (2)$$

and substitution exists when:

$$e_{xy} = (\Delta Q_x / Q_x) / (\Delta P_y / P_y) \geq 0$$

where: ΔQ_x is the change in the quantity of x supplied. Q_x is the original quantity of x supplied. ΔP_y is the change in the price of Y . P_y is the original price of Y .

The failure to meet complementary economies results in a net social loss due to technical inefficiencies. There is limited direct evidence of the effectiveness of caring for country as a complement to biomedical inputs. Burgess *et al.* (2008), however, observed decreased psychological stress in line with

increased caring for country. In addition, there is substantial general argument and supporting evidence that the psychosocial determinants of health are complementary inputs to biomedical inputs (Carson *et al.* 2007; Marmot *et al.* 2008; Commission on Social Determinants of Health 2009).

Conclusion

An integrated multidisciplinary economic welfare approach has been used to demonstrate the possible improved economic wellbeing of Aboriginal people and of the public good through culturally acceptable participation in caring for country. While a range of public good and private benefits are identifiable, the focus in this paper has been on the two national policy issues of environmental management and closing the gap in Aboriginal health. Possible national benefits, in addition to the private benefits Aboriginal people might obtain, are demonstrated.

If psychosocial benefits for Aboriginal people are to be achieved, it is necessary that caring for country is carried out by people who are indigenous to that country. Accordingly, Aboriginal people have an absolute advantage in the application of Indigenous ecological knowledge in their country. Such activities are likely to result in scoping economies through the joint supply of health and environmental benefits that occur as a result of the cultural connection of Aboriginal people with country. In addition, it is likely that the psychosocial benefits of caring for country will complement biomedical inputs in closing the health gap.

While the research on which this paper is based may be criticised, there are several studies that support the inferences drawn here. Although these results are not conclusive, they provide input into the public discussion regarding the establishment of centralised settlements for Aboriginal people. They also highlight the need for a broad-based time series research on the environmental and health benefits of Aboriginal people's involvement in caring for country. Such work would complement and extend the cross-sectional data on which this paper is based.

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CONCLUSION

Chapter 4, in providing an estimate of the possible savings in primary health care in the central Australian desert, extends the possible application of the analysis carried out in Chapter 3 to Aboriginal communities across remote to very remote Australia. An important factor likely to have a strong negative effect on Aboriginal and environmental health is anthropomorphic climate change. These risks and their consequences are reviewed in Chapter 5. As discussed previously, the discussion on the possible role Aboriginal people might play in the mitigation of climate change through their involvement in caring-for-country and the biosequestration of greenhouse gases is continued.

There is some discussion as to the reliability of BMI as an indicator of health outcomes. Burgess et al's (2008; 2009) results for the west Arnhem Land community show a strong correlation between differences in health outcomes and residence, with homeland residents showing greater participation in caring for country, healthier outcomes and a mean lower BMI reading. The same correlations were observed in the McDermott et al (1998) central Australian study, with a lower BMI reading for homelands and incidence of chronic disease. While residence may have been a preferable proxy, consistent with the association made by Burgess (2008; 2009), and McDermott et al (1998), BMI provides a statistical indicator of the difference between outcomes according to residence, relative disease outcomes and probable caring for country. Burgess et al and McDermott et al's BMI measures make allowance for age, gender and disease condition..

CHAPTER 5

RESPONDING TO THE HEALTH IMPACTS OF CLIMATE CHANGE IN THE AUSTRALIAN DESERT

INTRODUCTION

Anthropomorphic climate change is a potential additional psychosocial stressor affecting the health and wellbeing of Aboriginal people in the Australian desert. That Aboriginal people have limited capacity to adapt to environmental change compounds the likely level of psychosocial stress. Such changes are likely to have a compounding rather than a linear threat to the health and wellbeing of Aboriginal people. At the same time, maintenance of and reintroduction of traditional land management practices onto country offers opportunities for Aboriginal people and for society in general.

This duality occurs as a result of the negative health impacts of anthropomorphic climate change, and through the mitigation of the causative factors affecting climate change. That is, as a result of the biosequestration of greenhouse gases through involvement by Aboriginal people in caring-for-country.

Climate Change Issue

REVIEW ARTICLE

Responding to health impacts of climate change in the Australian desert

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A B S T R A C T

Climate change is likely to have a significant effect on the health of those living in the 70% of Australia that is desert. The direct impacts on health, such as increased temperature, are important. But so too are the secondary impacts that will occur as a result of the impact of climate change on an uncertain and highly variable natural environment and on the interlinking social and economic systems. The consequence of these secondary impacts will appear as changes in the incidence of disease and infections, and on the psychosocial determinants of health. Responding to the impacts of climate change on health in desert Australia will involve the active participation of a variety of interest groups ranging from local to state and federal governments and a range of public and private agencies, including those not traditionally defined as within the health sector. The modes of engagement required for this process need to be innovative, and will differ among regions on different trajectories. To this end, a first classification of these trajectories is proposed.

Key words: Aboriginal, Australia, dust storms, environmental uncertainty, health risks, interlinking systems, primary health care.



Introduction

The expected impact of climate change on the health of residents in the Australian desert and surrounding regions and the possible responses to that impact are discussed in this article. With less than 3% of the population, the desert region consists of arid and semi-arid lands that extend over 70% of Australia¹. Characterised as hot, with poor soils, low biological productivity and a highly variable and uncertain climate, it is far removed from both political decision-makers and markets².

The direct impacts on health, such as increased temperature, are important. But so too are the secondary impacts that will occur as a result of the impact of climate change on the natural environmental and on the interlinking social and economic systems³. The consequence of these secondary impacts will appear as changes in the incidence of disease and infections, and on the psychosocial determinants of health^{4,5}.

We use a holistic approach as the basis for this analysis, as a means of interlinking the environmental, social and economic systems, and in recognition that different approaches will be required in different regions of this vast area. The content and approach taken in the article is based on the breadth of knowledge and experience of the authors, who have had an extensive involvement in these regions, together with a broad search of the recent climate change literature.

Responding to the health impacts of climate change in the Australian desert will require a high degree of collaboration among federal, state and local jurisdictions, including the integration of health services over all jurisdictions, and involvement of the private sector. The latter range from local commercial operators serving the local and tourist population to large mining industry corporations, as well as including community and individual responses.

Current environmental and health status

The introduction of domestic and feral grazing animals, weeds and the loss of traditional land management practices due to the disconnection of Aboriginal people from their country following European settlement have had a negative impact on the desert environment^{6,7}. This has resulted in a loss of biodiversity and an increase in wildfires, soil erosion and dust storms⁸. There has been an overall increase in temperature and decreased effective rainfall since the 1950s⁹.

Of the total population of 584 000 (0.11 persons km⁻²), more than half are located in the five major service centres¹⁰, with the remainder scattered across more than 400 Aboriginal settlements and 3000 pastoral properties¹¹. Aboriginal people make up 45% of the population in very remote areas¹¹, although such areas do extend beyond the Australian desert. Due to the non-Aboriginal population's relatively lower birth rate and their outward migration, Aboriginal people are expected to make up an increasing proportion of the very remote regional population¹⁰.

Death rates in regional and remote areas are reported to be 10% to 70% higher than that observed in the major cities¹². The higher rate in very remote areas is strongly influenced by the higher death rate of Aboriginal people¹³. The nature of the gap between Aboriginal and non-Aboriginal people and the expected increased costs and resources necessary to bridge this gap is well documented^{14,15}.

We suggest that the national health delivery model currently operated by the Commonwealth, State and Territory governments is inadequate for those living in the desert region and, in particular, for Aboriginal people¹². A commitment has been made by the Commonwealth government to closing this health gap¹⁶.



The impact of climate change

The major impact of climate change in the Australian desert is expected to revolve around higher mean temperatures, decreasing effective rainfall and an increased occurrence of extreme climatic conditions¹⁷. Increased temperatures will have a direct effect, causing increased heat stroke, cramps, heat exhaustion, and deaths¹⁸; while temperature increase is likely to result in increased skin cancer. These impacts will profoundly affect the need for preventive, primary level and hospital levels of care.

Those most vulnerable to climate change are the young, the elderly, the chronically ill - particularly those suffering from cardio-respiratory diseases - and the socio-economically disadvantaged who have less access to the resources to handle the increasing climatic extremes¹⁹. Vulnerability is compounded by inappropriate and inadequate housing, inadequate fresh water, poor access to essential services such as health, limited food supplies, power for cooling systems, and decreased participation in those social, cultural and economic activities most likely to be impacted by climatic change. On this basis, Aboriginal people will be the most disadvantaged, while those tied to natural resource-based industries such as pastoralism, or those otherwise required to work outside are also at greater risk. The implications for areas of health, welfare, aged care, housing, and other areas are apparent.

A variety of indirect risks are likely to be affected by climate change. Shallow groundwater supplies may dry up and become contaminated more often during dry periods. Decreased water availability could result in more cases of dehydration, increased water-borne diseases, exacerbated impacts of poor household hygiene, and skin diseases through the lack of personal hygiene and swimming in infected and biotoxin-contaminated waterholes. Likewise, increasing temperatures coupled with poor living conditions could promote flies and other pests affecting food, and food poisoning caused by organisms such as *Salmonella* and *Campylobacter*. The changed conditions could also lead to an increase in meningococcal (epidemic) meningitis²⁰. The

health impacts of poor living conditions and infectious disease will be compounded, particularly among children. There is the potential for higher incidences of diarrhoeal disease, acute respiratory and skin infections and increased hospitalisation, particularly among Aboriginal infants and children aged less than 5 years. As with the factors noted above, it is clear that there will be multiple service implications of climate change in the desert, extending also to the interests of local government in their public health and safety responsibilities.

Climate change is also likely to lead to the loss of plant and animal refuge areas for relic species and decreased biodiversity²¹, and the potential loss of native foods and traditional medicines. Increased atmospheric carbon dioxide and higher temperatures will contribute to changing vegetation composition, favouring woody plants in some regions, and increasing wildfire risk in grass-dominated regions. The spread of the introduced buffel grass (*Cenchrus ciliaris*) will lead to hotter fires and the release of greenhouse gases through the loss of woody plants in some environments. Fires can also lead to injury and death, decreased ground cover and more extreme dust storms.

Fire smoke and increased dust storms and suspended fine particulate matter will increase the frequency of cardio-respiratory disease and asthma, among other diseases. In addition to the physical irritants of siliceous dust, such storms can carry fungus, viruses and bacteria. Research carried out elsewhere shows the movement of such aeroallergens to have serious health effects^{22,23}. Dust-storms originating in the Australian desert can extend to either the west coast or to the east coast. The easterly extending storms have ranged as far north as Cairns and as far south as Sydney²⁴, with implications for health promotion and the prevention and treatment of health conditions within and beyond the Australian desert.

Similarly, beyond the evident physical health corollaries of climate change, there will be multiple mental health effects. People will be under increased mental stress with the higher level and increased incidence of climatic extremes²⁵. Health



concerns extend beyond the more obvious bio-medical impacts with increased variability and environmental uncertainty, adding to the overall stress level. Potential reductions in incomes and social connections would also impact mental health. Although suicide rates are known to be higher among men living in rural areas, there is a paucity of data on the likely impact of climate change on residents in rural and remote areas, including among Aboriginal people²⁶. The need for mental health resources is, however, clear.

There are additional low probability but high impact risks of rapid, threshold environmental changes that tip the global climate and, hence, local ecosystems to new states. Factors outside the Australian desert, such as changes in sea and atmospheric currents, could radically impact the desert climate, and further exacerbate the need for substantial responses to meeting health and other service provisions.

In summary, changes will result in a less productive environment that will affect natural systems, cultural resources, grazing and human activity. These will contribute to environmental and economic pressures against living in central Australia. People (including tourists) may be less tempted to visit or stay in the region; although, at the same time, the world will increasingly value open space. With increasing transport costs, there may be increased costs of production and lower returns from beef and native food production, tourism and local sales of Aboriginal arts and crafts. At the same time, individual demands for health and complementary inputs such as housing, water and waste management, and employment opportunities would increase supply costs.

Responses

We have suggested that environmental, social and economic structures are intimately linked to the health impacts of climate change. To be successful and cost effective, the prevention and mitigation of climate change impacts will require working with these and other interlinking structures.

Any such response will also need to accommodate the high degree of risk and uncertainty associated with these links².

It is our contention that a first step in dealing with this uncertainty is to apply a framework for identifying and categorising key variables. We suggest that it is important to recognise that remote Australia encompasses a diversity of environments, biophysically and socially^{27,28}, that may require differentiated responses. Holmes²⁷ classified 29 regions of remote Australia into seven types of regional trajectories (with 4 regions being unclassifiable); these have stood the test of time²⁹, so we adopt these types as a first effort to consider differentiated responses (Table 1, Fig 1).

The per capita demands for the full spectrum of health related services are likely to increase as a result of climate change - but in different ways in different regional types (Table 1). The total demand on health services will also depend on net migration and on the closure of the gap in health outcomes between Aboriginal and other Australians. The engagement of Aboriginal people in broader social and economic systems is vital to closing this gap and to the future management of remote Australia.

Uncertainty about future trends creates investment doubts, which are exacerbated by considering remote Australia as a single entity. By analysing social and climatic trends at a regional scale, it is possible to create a much more certain regional investment environment. Economic activity in the private sector, particularly mining and tourism, will drive opportunities in some regions. The effect that this will have on residents in the region will depend on the employment strategy used by the companies involved, and the preparedness of government and industry to negotiate new models of health support. If personnel and servicing are contracted outside of the region and flown in, there will be minimal positive impact in the region. Integration of the resident population with mining activities would be expected to have positive income and resulting health outcomes.



Table 1: A classification of current trajectories of remote regions

Existing regional trajectory		Climate scenario	
Title	Trajectory description	Health implications of a warmer wetter north	Health implications of a drier interior with more extremes
Core pastoral	Dominated by grazing industry and likely to continue to be so	Key health issues related to tropical diseases; current institutions appropriate when functional	Mental health issues will increase in industry
Marginal pastoral	Currently dominated by marginal grazing but with limited alternative options	Mental health issues largely independent of climate change; significant Aboriginal presence also with poor economic support for health services	Grazing will cease and use will move to Aboriginal (or very marginal, impoverished grazing) in most cases, with poor economic support for health services
Mining	Opportunities in strong mining economy, with other uses marginalised	Strong potential to ally with mining companies for changing model of health services (and extend these to surrounding population); focus on tropical diseases	Strong potential to ally with mining companies for changing model of health services (and extend these to surrounding population); focus on effects of extremes, dust and fire particulates
Tourism	Tourism/amenity uses dominating, dependent on natural and cultural heritage, access to urban centres	Health services will be fully public (existing models) and need to handle visitor population and risks of epidemic transmission	Health services will be fully public (existing models) and need to handle visitor population and chronic responses to heat stress, dust etc
Aboriginal	Remote Aboriginal homelands with limited services and conventional livelihood options of which arts and crafts are an important component	Major public investment required to build standards; will need to focus on increased tropical diseases and risks of new invasives; opportunities for Aboriginal livelihoods in managing these	Major public investment required to build standards; will need to focus on increased chronic disease risk, and environmental amelioration of dust, fire; opportunities for Aboriginal livelihoods in managing these
'Frontier'	Regions in flux	Model region-dependent (but focused on tropical health issues)	Model region-dependent (but focused on desert chronic diseases)

After Holmes²⁷, his 'stressed' and 'remote' pastoral regions combined as 'marginal' here against location in the continent and consequent likely climate change projections, with the possible implications for differentiated responses to health challenges. See Fig.1 for locations.

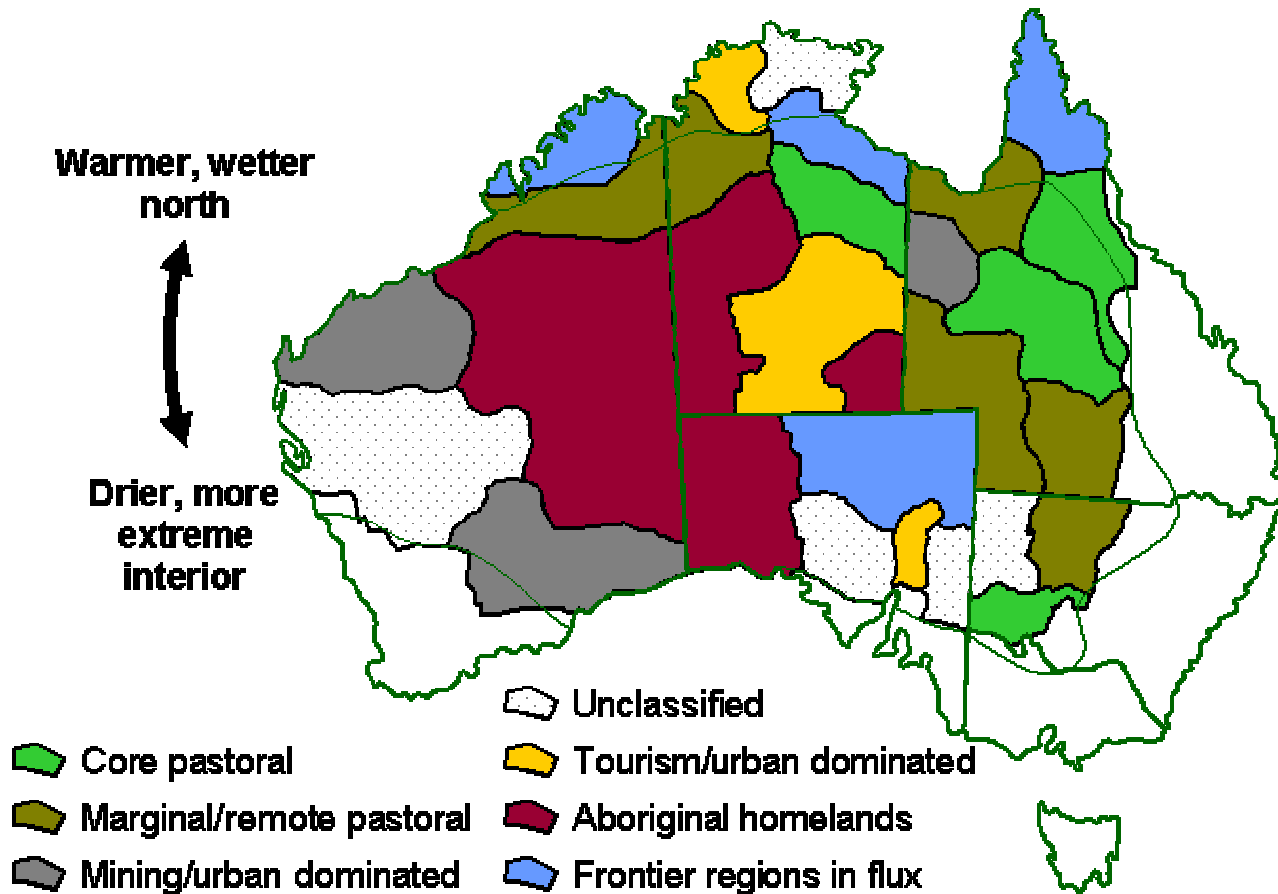


Figure 1: Locations of the different types of regions in remote Australia as defined by Holmes²⁷. See his original work for the names, more detailed characterisations, and the likely major divergent effects of climate change.

In regions not dominated by mining or tourism, there will be opportunities arising from the demands placed on the public sector as a result of climate change. These will include the need to stabilise existing vegetation to *retain* greenhouse gas (eg through biosequestration and soil stabilisation). This will, in part, involve the control of wild fires through spot burning, the control of weeds and feral animals, and the maintenance of biodiversity. One approach is to work with Aboriginal people to re-engage in traditional land management practices, while another is the engagement of pastoralists on marginal properties in stewardship activities on behalf of society. Both can have additional benefits in the joint supply of improved health outcomes and environmental

services with justifiable public funding to the degree that the public good benefits of health and biodiversity would otherwise be under supplied. Such support for local engagement in natural resource management, together with negotiating with mining companies to enhance regional engagement with their activities, are appropriate policy actions because of their immediate benefits regardless of climate change impacts.

Our key observation is that each region requires a different combination of actions, encompassing public policy, engagement of private enterprise, community involvement and personal responsibility. There is, therefore, a need for a



systematic analysis that: (i) considers whether the regionalisation we use in this analysis is the most appropriate; (ii) collates relevant information about each region; (iii) engages the community and businesses in each region (or at least each region type) in a discussion of future needs, in order to obtain their ownership of the solutions, and then (iv) proposes the appropriate balance of private responsibility and public investment for each region. This will result in far more efficient and effective outcomes than if there is an attempt to deliver to remote Australia as if one size fits all.

Conclusion

We have shown that addressing the health impacts of climate change in the Australian desert will involve working with how altered environmental, social and economic conditions interact with existing health conditions. We note that responding to the impacts of climate change on health in the Australian desert will involve the active participation of a variety of interest groups ranging from local to state and federal governments and a range of public and private agencies, including those not traditionally defined as within the health sector. The modes of engagement required for this process need to be innovative, and will differ among regions on different trajectories. To this end, we have attempted a first classification of these trajectories. This classification may require considerable refinement; however, we emphasise, it suffices to show that some form of sensible disaggregation is required to make progress in this vast and under-resourced heartland of Australia.

This large region is significant to Australia for its cultural, biodiversity and natural resources and deserves a greater degree of engagement regarding this issue than has occurred to date. Improved information and the integration of such information based on Australian and shared overseas experiences and research will assist in minimising the level of uncertainty and in defining future responses.

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CONCLUSION

An important theme in Chapter 2 is the response to Pearson's (2007) view that Aboriginal people must take control of their current circumstance in order to take control and modify the behavioural factors affecting their health. The response, at the time, is that there are a number of factors over which Aboriginal people do not have control, which may affect behaviour. Resolution of these factors is relevant to our understanding of the interrelationship between healthy country, healthy people and the jointness between improved health and environmental outcomes as a result of involvement by Aboriginal people in improved health and environmental outcomes. These factors, and closure to the context in which healthy country, healthy people are considered and dealt with in the following Part B, according to whether risky behavioural choices constitute economically rational behaviour.

PART B: PSYCHOSOCIAL STRESSORS AND ECONOMICALLY RATIONAL BEHAVIOUR

Part B consists of Chapter 6: 'Economic rationality in choosing between short-term bad health choices and long-term good health choices'. Much of the focus in the literature dealing with noncommunicable disease is focused on a curative response, with preventative responses being focused on risky behavioural choice. While the secondary causative agent, risky behaviour, is an indicator of an underlying noncommunicable disease condition.

Unfortunately, rarely is the question asked of whether risky choices are economically rational, and, if rational, under what conditions this is likely to occur. Important to engaging in less risky choices, is the ability to maintain individual capacity to self-regulate and apply volitional control and willpower; a capacity that is eroded by highly stressful circumstance. It is under these circumstances that selection of short-term self-satisfaction through risky behaviours can be economically rational.

CHAPTER 6

ECONOMIC RATIONALITY IN CHOOSING BETWEEN SHORT-TERM BAD HEALTH CHOICES AND LONG-TERM GOOD HEALTH CHOICES

INTRODUCTION

The relationship between psychosocial stressors, noncommunicable disease, risky health behaviours and economically rational behaviour is assessed in Chapter 6. It is found that risky behaviours can be economically rational, especially in the circumstances faced by Aboriginal people in remote to very remote Australia. Loss of control, including limited access to services and resources, is observed as a critical factor affecting psychosocial stressors. Cultural disenfranchisement and disengagement with country can be important contributing factors affecting control.

The public response to the thinking in this chapter ranges from advice from a senior health academic, during the development of the paper, that it would lead to a 'dead end' to one of public accolade. On publication, the paper received a Flinders University Graduate Student Publication award. In addition to which a senior Public Health Advisor, attached to a major Indigenous Health Service, as the opening guest speaker at two major health conferences in Cairns and Darwin, in 2015, advised this paper as a 'must read'. In addition to-which the paper played a substantial role, in setting out the context in which the health gap for Aboriginal people occurs, in the critique by Reilly et al (2014) of the earlier Whelan, Wright (2013) paper.

The approach undertaken here differs to that of writers, such as with Ajzen's (2002; 1991) theory of planned behaviour, and falls short of that set out in prospect theory, which accounts for 'decisions under risk' (Kahneman 2011, pp 269-288; Kahneman and Tversky, 1979); although, uncertainty as to future outcomes, is an important component in Chapter 6. A proximate aspect not accounted for in this paper is the failure to include the impact of psychosocial stressors on interpersonal and personal violence and other social misbehaviours (e.g., see Wilkinson and Pickett 2010, pp 129-156, 173-196, Mitchell 2005; Krug et al. 2002), especially given the relevance of these factors to health.

Part of the dichotomy in response to this paper is the multidisciplinary nature of this paper in particular, and throughout the thesis. As an economist with a long history in multidisciplinary research, I am familiar with the economic theory within the multidisciplinary argument considered here. This is not necessarily the circumstance for

many who might read this article. These ideas, however, are becoming less challenging as the literature in the Indigenous health sector further embraces multidisciplinary input.

Review

Economic Rationality in Choosing between Short-Term Bad-Health Choices and Longer-Term Good-Health Choices

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Abstract: Non-contagious, chronic disease has been identified as a global health risk. Poor lifestyle choices, such as smoking, alcohol, drug and solvent abuse, physical inactivity, and unhealthy diet have been identified as important factors affecting the increasing incidence of chronic disease. The following focuses on the circumstance affecting the lifestyle or behavioral choices of Aboriginal and Torres Strait Islander peoples in remote-/very remote Australia. Poor behavioral choices are the result of endogenous characteristics that are influenced by a range of stressful exogenous variables making up the psychosocial determinants including social disenfranchisement, cultural loss, insurmountable tasks, the loss of volitional control and resource constraints. It is shown that poor behavioral choices can be economically rational; especially under highly stressful conditions. Stressful circumstances erode individual capacity to commit to long-term positive health alternatives such as self-investment in education. Policies directed at removing the impediments and providing incentives to behaviors involving better health choices can lead to reductions in smoking and alcohol consumption and improved health outcomes. Multijurisdictional culturally acceptable policies directed at distal variables relating to the psychosocial determinants of health and personal mastery and control can be cost effective. While the content of this paper is focused on the conditions of colonized peoples, it has broader relevance.

Keywords: smoking; alcohol abuse; health; behavioral choice; psychosocial determinants; human capital

1. Introduction

Non-contagious, chronic disease has been identified as a global health risk [1]. Poor lifestyle choices, such as smoking, alcohol, drug and solvent abuse, physical inactivity, and unhealthy diet have been identified as important factors affecting the increasing incidence of chronic disease [2]. Some have assessed poor behavioral choices as a result of people taking a short-term or myopic view of the individual's own making, and that they should "reform themselves" [3]. Fang and Loury [3] suggest such commentary contains racial and class overtones and ignores the distal factors over which people have little or no control. Indeed, although poor lifestyle choices are the result of endogenous choice, individual endogenous status does not occur in isolation, but is impacted by exogenous factors.

Choices differ according to life experiences including the psychosocial determinants, culture and the community constraints in which they live. The following focuses on the circumstance and behaviours of Aboriginal and Torres Strait Islander people in remote-/very remote Australia; the term "remote" is used hereon. Aboriginal and Torres Strait Islander people suffer higher levels of chronic disease relative to the rest of the Australian population. Over the period 2005–2007 the life expectancy for Aboriginal and Torres Strait Islander males was 67.2 years (a gap of 11.5 years) and for Aboriginal and Torres Strait Islander females 72.9 years; resulting in a respective gap of 11.5 and 9.7 years, when compared with the rest of the Australian population [4]. The level of disadvantage for Aboriginal and Torres Strait Islander people in remote Australia is further demonstrated in school attendance rates, which are less than two thirds of the rest of the remote Australian population [5]. While attendance rates relate to individual choice, many of the schools attended by Aboriginal and Torres Strait Islanders are under-serviced [6]. While this material more closely relates to the conditions of colonised Indigenous peoples, broader based implications remain. That is, while specific differences exist between communities, commonalities exist across communities at higher levels of abstraction.

It is shown in this paper that poor health choices can be economically rational; especially when dealing with high levels of stress. Policies directed at lowering stress levels and altering the behavioral impediments and incentives people face can affect behaviour changes such as to reduce smoking and alcohol consumption and consequent improvements in health outcomes. The aim in this paper is to demonstrate the likely economic rationality of what are referred to as bad behavioral choices and how exogenous factors can influence an individual's endogenous capacity in their choosing between alternative choices. Culturally acceptable policies directed at distal exogenous variables relating to the psychosocial determinants of health, involving improve personal mastery and control resulting in improved cost effectiveness, is discussed.

2. Method

The initial question regarding the economic rationality of bad health choices draws on personal knowledge from prior research regarding traditional economic circumstance of Aboriginal and Torres Strait Islander people [7–9] and multidisciplinary research in addressing chronic disease among Aboriginal people in remote Australia [10–13]. Economic rational choice was tested using an economic optimization model based on the tradeoff in choosing between (a) short-term lifestyle choices having negative health outcomes, or "short-term gratification"; and the alternative (b) long-term choice of

“self-investment in human capital through education”—where education is an indicator of a range of positive longer-term behaviors (Appendix). The conclusion that bad health choices can be economically rational is supported through a multidisciplinary review of the literature on behavioral and health economics, primary health care, psychology and education. A working paper was forwarded to academics in the above disciplines, who are involved with Aboriginal and Torres Strait Islander health, for critiquing prior to preparation and submission of the final paper.

3. Economic Behavioral Choice

3.1. Self-Investment

Behavioural choice is assumed to be discrete and consistent, with continuous trade-offs between choices. This assumption is defensible across populations [14].

Self-investment in human capital through education can be considered according to the initial cost of capital investment, the expected annual rate of return on capital investment, the duration of capital investment, and investor time preference. These factors are considered in relation to behavioural choice. A positive correlation exists between improved health outcomes and education [1,15–18]. Improved health outcomes as a result of changes in lifestyle choice are likely to improve the quality and duration of human capital investment.

Extending Becker’s [19,20] work, Grossman [21] viewed education as an investment of market inputs and time in a human capital stock that produces an output of “healthy time”. Education improves income-earning potential and the capacity of individuals to make better life choices and improved efficiency in the use of resources [15]. The present value of capital investment is increased by minimising up-front opportunity costs and extending the time span of the flow of benefits that can be obtained by investing early in life; and when the opportunity cost of time spent in the class-room is less than it would be later in life.

Time enters and affects choice as a cost in achieving an expected healthier life, as occurs with social interactions, exercise, and education. Those expecting a longer lifespan are more likely to self-invest in education [15,22,23]. Expected life span is influenced by the observed life span of relations and community members [16]. Life span is affected by a range of factors in addition to genetic disposition [13]; including pre- and postnatal condition [24]. For example, improved survival of infants following the United Nations Expanded Programme on Immunization in Sub-Saharan Africa (Malawi, Tanzania, Zambia and Zimbabwe) influenced expectant mothers to improve their own nutrition for pre- and postnatal children [25].

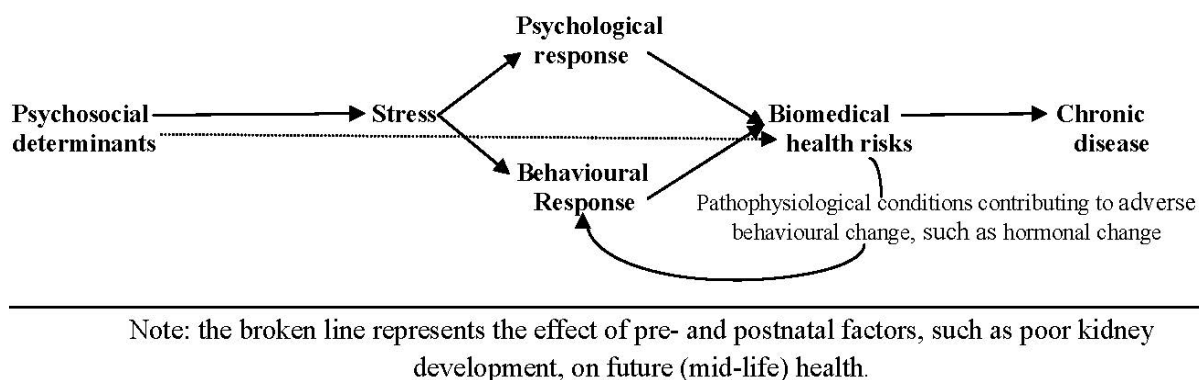
Individual demand for education is derived from an expected improvement in income, status, health outcomes and a range of other market and non-market derived benefits. Non-market benefits of education and increased knowledge can lead to better behavioral choice, such as reduced smoking [21,23] and improved efficiency in the use of market and non-market sourced resources [26].

3.2. Assessing the Future: Time Discounting, Risk/Uncertainty, Volitional Control and Stress

In choosing between good health choices or bad health choices there are immediate and longer-term opportunity costs. In choosing good health choices such as education, the benefits of improved income

and health occur in the future, with a resulting delay in utility, while the costs are immediate. With bad health choices, or short-term gratification, the initial costs and benefits enter directly into the utility function. In this instance the negative health impact on the utility function occurs in the future. In sum, the positive impacts of good health choices are delayed, with the costs up front; while the negative health impacts of bad health choices are delayed with the benefits up-front. Depending on how the future is assessed, it can be rational for a consumer to make choices that have negative long-term health effects. That is, it is possible for economically rational utility-maximizing Aboriginal and Torres Strait Islander people to make decisions leading to a negative feedback loop and an increase in the expected life gap—as is later shown and discussed in relation to Figure 1.

Figure 1. The pathway from the psychosocial determinants of health to chronic disease.



The assumption of neutral interchangeability between time periods does not hold when the comparison involves making choices involving uncertainty, rather than certainty. In-which-case, a disproportionate discount is given to uncertainty [27–31]. The decisions made by a social epidemiologist, government administrator or politician, involve large populations for which probable outcomes and probable pay-offs are known and involve risk rather than uncertainty. That is, social epidemiologists are operating in a world in which the “experiment” is repeatable, and the value of the expected outcome can be estimated using compound probabilities—although the professional reputation of the decision maker might be affected if they were to make the wrong choice. Individual lifestyle decision makers are dealing with uncertainty, with possible financial or physical constraints limiting their capacity to repeat the “experiment”. Aboriginal and Torres Strait Islander people are more likely to be under greater resource limitations and budgetary constraints and live in a more costly environment than most Australians. As a result, they are less able to “repeat the experiment”, and consequently deal with higher levels of uncertainty than most Australians.

Assertion of Self-Control

An important capacity necessary to self-invest in human capital is the individual’s capacity to self-regulate, or to apply volitional control and willpower. Muraven and Baumeister [32] described self-control as an extension of control over the self by the self to maximize long-term best interests. They described capacity to apply self-control as being used and consumed any time an individual self-initiates, alters, or stifles a response. That is, those who are undergoing stress have less capacity to delay self-gratification; while the erosion of willpower due to stress is accumulative. Ozdenoren *et al.* [33]

commented that there is evidence to suggest “that the exercise of self-control draws on a limited and fungible cognitive resource—a resource that is often called willpower”.

Cox [34] discussed how stress may be associated with behavioral outcomes of two types: direct responses, sometimes termed “self-medication” [35], such as smoking and excess alcohol; and secondary responses due to hormonal variation, such as higher cortisol levels, with lower capacity for relatively lower income groups to be persistent in carrying through tasks and to self-regulate behavior [36]. In such circumstance, smoking and alcohol consumption are used as a form of self-medication for stress; even if smokers are fully aware of longer-term negative impacts [37].

The high level of stress suffered by Aboriginal and Torres Strait Islander people in remote Australia [38] leads to a higher discount rate [39]. Indeed, the decision process might be likened to the economic minimax strategy when behavior is consistent with optimizing behavior under the assumption of the worst outcome.

4. Exogenous Variables Affecting Stress and Poor Educational Outcomes

4.1. Extending the Utility Maximization Model

The endogenous variables affecting behavioral choice can be affected by a range of exogenous variables and behavioral impediments. These can range from budgetary constraints, the quality of teaching including cultural compatibility, home and living environment, pre-school preparation, pre and post-natal nutrition, social interactions, through to the level of control. Such factors, as discussed in the following, can have a positive or negative influence on endogenous characteristics and ultimately behavioral outcomes.

4.2. Influence of the Psychosocial Determinants

4.2.1. Culture

Culture is an important aspect of self-identification [40]. The higher levels of suicide of Aboriginal and Torres Strait Islanders is associated with cultural loss [41]. Schooling can result in stressors between traditional cultural patterns and the cultural patterns of western schooling [38], resulting in a decrease in Aboriginal and Torres Strait Islander school attendance [42,43]. Nasir and Hand [44] noted that educational frameworks based on social and cultural processes are central to learning. Dockery [45,46] examined the statistical association between wellbeing and educational attainment for Aboriginal and Torres Strait Islanders. He observed a positive relationship between cultural strength and improved wellbeing, educational attainment and workforce participation.

Positive self-identity has been found to be an important factor affecting Aboriginal and Torres Strait Islander classroom engagement; when this involves the student in constant reassessment according to their own cultural norms [39]. Similar results were observed for Canadian Native Americans [47,48]. While in New Zealand the introduction of the Māori-based Māori Educational Strategy 2008–2012 [49] provides an example of the benefits of integrating school experiences with the students’ cultural norms. Māori immersion curriculums have grown, where Māori students can attend Māori immersion schools

and bilingual units and classes. The same model is being effectively applied to the delivery of health services to Māori people [50].

4.2.2. Stress

Stress is a component along the pathway from the psychosocial determinants of health to chronic disease. The Macquarie Dictionary [51] defines stress as: “a disturbing physiological or psychological influence which produces a state of severe tension”. Stress has been likened to an “inverted U” [52]; where some stress (strain or challenge) is necessary for optimal performance. Others suggest stress is different to that affecting motivation and states of arousal, workfullness, alertness and vigor [53].

In discussing the impact of the psychosocial determinants of health, Krieger [54] describes how psychosocial factors can influence the multiple sectors of human wellbeing and stress in affecting “both behavioral and endogenous biological responses to human interactions”. In this, psychological stress is identified as a result of “despairing circumstances, insurmountable tasks, or lack of social support”. These stressors, she suggests: “(a) alter host susceptibility or become directly pathogenic by affecting neuroendocrine function; and/or (b) induce health damaging behavior (especially in relation to use of psychoactive substances such as smoking, alcohol, drug and solvent abuse, diet, and sexual behaviors)”. She further explains the role of social cohesion as either a positive or a negative factor supportive of stressful circumstance and appropriate or inappropriate behavior (see Figure 1).

Figure 1 shows the complex pathway, described by Krieger [54], from social disadvantage to stress to biomedical health risks and chronic disease, via a dual pathway involving psychological responses and behavioral responses to stress and poor behavioral choice. Stress is likely to occur at higher levels of adversary, such as in circumstances involving perceived loss of control [55]. Statistics Canada [56], for example, showed an inverse association between high personal stress levels with health. While work stress was linked to negative life events, chronic strain, lack of closeness and a loss of sense of mastery (or control). Important to the argument in this paper are the psychosocial factors contributing to poor behavioral choices and pathophysiological conditions. Such responses are a result of the influence of hormonal reactions to the response of the hypothalamus to exogenous stimuli. Flinn and England [57], for example, observed that “[c]hronic stress and high average cortisol levels are associated with frequency of illness, a stress–health relation suggested by temporal associations”.

These results are consistent with the Whitehall I and Whitehall II studies [58]. The Whitehall studies were designed to explain the decrease in expected life span among British public servants with decreasing status within the public service. In the Whitehall I study, less than 25% of the difference in health outcomes with decreasing workplace status was explained by poor behavioral choices. In the Whitehall II study more than 50% of the difference in health outcomes was explained by decreasing individual opportunity to exert control in the workplace—emphasizing the role of the “psychological response”, as shown in Figure 1. The follow-up Whitehall II studies show poor workplace decision authority, high job demand, effort-reward imbalance and associated work-based stress increasing with lower work status. Stansfeld *et al.* [59] and Schnall *et al.* [60] observed increased risk of psychiatric disorders on this basis. The same results are observed outside of the workplace [61–63].

4.2.3. Aboriginal and Torres Strait Islander Experience

Continued loss of control along with a history of psychosocial factors, have ongoing effects on individual and community stress levels. Aboriginal and Torres Strait Islander people suffer higher levels of stress than the rest of the Australian population. In 2008, 65% of Aboriginal and Torres Strait Islander children (4–14 years) reported at least one stressful event for the previous 12 months—twice that reported by other Australians [2].

The effect of the loss of self-control has been reviewed among Canada's Native people [64,65] and the Elcho Island Aboriginal community off northern Australia [66]. All three studies showed decreasing health with decreasing control. Tsey *et al.* [67] discuss the results of the Whitehall studies and the consistency of these studies with the lack of control experienced by Aboriginal people. Daniel *et al.* [66] observed the high levels of suicide among young Aboriginal males in north-eastern Arnhem Land as an indicator of the lack of emotional and psychological wellbeing and low levels of mastery and control.

The relative importance of control is emphasized by the experience of the Utopia Aboriginal community in central Australia, for whom the socioeconomic indicators are lower than that generally observed for other Northern Territory Aboriginal communities. Yet, their health outcomes more closely approximate the Northern Territory non-Aboriginal community than the Aboriginal community [68]. The better health outcomes were attributed to the greater level of control community members were able to assert over their lives.

Garvey [69] identified a history of denial of humanity, existence and identity for Aboriginal and Torres Strait Islanders as a source of intergenerational stress. That many of these risk factors "... lie outside the ambits of mental health services and require long-term, sustained efforts across multiple sectors of the community, emphasizes the need for collaborative interjurisdictional partnerships". Paradies [70,71], in research carried out in Australia regarding Aboriginal and Torres Strait Islanders and for minorities in the United States of America, observed the negative impact of racism on health.

An important factor affecting control is the greater impact for Aboriginal and Torres Strait Islander people of government policies and institutions than exists for the remainder of the community [72]. The Australian Government's Northern Territory Emergency Response ("the Intervention") in 2007 [6] is a contemporary example of this. The intervention, which remains in place at the time of writing, applies across Aboriginal communities in the Northern Territory regardless of the steps undertaken by the communities. The denial of Aboriginal and Torres Strait Islander people's goals and loss of community control as a result of the intervention is likely to result in further trauma.

Stress has been observed as a barrier to quitting smoking among Aboriginal and Torres Strait Islander people in western Sydney [73]. For Aboriginal Health Workers in remote Australia, whose role includes advising on the health risks of smoking, stress is a barrier to their quitting. Stress factors included nicotine addiction, grief and loss, social connections including domestic disputes, work based stressors, and racism [37].

Although cultural differences can influence differences between peoples in their response to increased income, increased income has been found to have the greatest marginal impact on wellbeing for low income earners [74]. While mental health is positively related to socioeconomic status [75], recovery from a disability, and consequent stressors, was observed as being slower for lower income earners.

4.3. Factors Affecting School Attendance and Classroom Attention

4.3.1. Early Life Factors

Early life factors are linked through the parents' psychosocial environment. These factors affect the child's cognitive abilities, longer-term or secondary behavioral choice and immediate and longer-term health [36]. The capacity of children to engage in and benefit from school attendance is influenced by maternal nutritional status preceding and at the time of conception, by the pre- and postnatal environment, and early childhood environment [76]. These influences can include pre- and postnatal responses to poor diet, and whether the mother suffers from a cardiovascular disease condition during pregnancy [77–80]. Recent research indicates an early life gene-environment interaction contributing to later life health risks, where low and excessive birth weights have negative influence on later life outcomes [81,82].

These early influences are represented by the broken line in Figure 1, where the secondary feedback is represented by the line from biomedical health risks to poor behavioral responses. The environmental factors impinging on a child's socio-emotional development include diet, crowding, noise, and substandard housing conditions. Children from low-income families, exposed to these conditions, have higher systolic and diastolic blood pressure, and higher cortisol, epinephrine and norepinephrine readings; indicating higher stress levels than their middle class cousins [36].

Such differences indicate decreased capacity for lower socioeconomic groups to carry through tasks due to poor self-regulation, resulting in poor attention to immediate health factors such as smoking, alcohol, drug and solvent abuse, physical inactivity, unhealthy diet and to longer-term factors such as education. Dunbar and Scrimgeour [83], for example, noted the negative effect of poor hearing on the uptake of classroom lessons by Aboriginal children in remote Australia. As an impediment to classroom attention, health impediments such as poor hearing, is a further burden on individual capacity to self-regulate.

Flinn and England [57], in a longitudinal study in the Commonwealth of Dominica, noted the interconnection between childhood stress and caretaker support by monitoring changes in cortisol levels. They found poor relationships (including family conflict and residential change) between the child and their caretaker, along with peer group and work pressures, high disease and low nutrition levels, led to increased cortisol levels. The authors found increased cortisol levels to be associated with immune suppression, inhibited growth, psychological problems and energy depletion.

4.3.2. Pre-Preparation for Schooling

Heckman and Masterov [84] highlighted the importance of developing cognitive skills at a very early age, as gaps in cognitive ability remain constant after age eight. They concluded that policies to supplement child-rearing resources for disadvantaged families will not only reduce inequality, but will result in economic pay-offs through improved health, educational attainment and decreased antisocial behavior.

Increasing emphasis is given in Australia to the role of the home environment in preparing children for school. Zubrick *et al.* [85] recommend the engagement of Aboriginal parents and caregivers as educators of their children in the first five years of life. Dockett *et al.* [86] emphasised the important

role of school readiness for Australian Aboriginal and Torres Strait Islander children. Important to this is an understanding by guardians of what is required in preparing children for “school readiness”.

4.3.3. Affecting Effort in the Classroom

Akerlof and Kranton [87] noted that increased investment in education did-not always result in improved outcomes as students may place a higher value on their peer group relationship than their own academic performance. Students, they suggest, think of themselves and of others according to different social categories and that individual students gain utility when their own actions and the actions of others enhance their own self-image. Important to self-esteem is the congruence between the students’ social category/self-image and the social/school environment. Such congruence is influenced by the students’ ascriptive characteristics, including social background and capabilities. Students maximize their utility by implicitly choosing their social category and then choosing the educational effort according to the norms of their chosen category. Accordingly, the authors conclude, that the level of student engagement in education (time and effort) is influenced by the degree of social difference in their school environment rather than their expected future wage.

Malin [88] noted a two-way relationship between health and education for Aboriginal children, with a failure in health outcomes and school attendance due to lack of control within and outside of the classroom. She suggested that the subjective experience of discrimination, by provoking particular responses such as anger, cynicism and anxiety, may generate stresses. Although the causative relationship proposed in this paper is that the line of causality proceeds from stresses to stress to behavioral responses, this still leads, as Marlin suggests, to cardiovascular reactivity, high blood pressure and negative health outcomes. Berkman and Kawachi [89] found the most successful interventions for minimizing risk factors are those that incorporate social and organizational interaction and support.

The acceptance of poor academic performance can have a cumulative effect leading to limited access to lifelong learning, and lost employment and economic opportunities [85]. The quality of teaching for Aboriginal and Torres Strait Islander people in remote Australia has in many instances been below that received by other Australian children. This, in addition to the class-room environment failing to engage with the experience and culture of Aboriginal and Torres Strait Islander students [90]. The often harsh schooling experience of parents and older family members means carers may not be supportive of school attendance, and fail to engage children in preschool preparation. While the observed poor work opportunities of community elders, means children may question the benefits of schooling [90]. Zubrick *et al.* [85] suggest that educators should collaborate with parents and caregivers and encourage their participation in ensuring educational standards and performance and the needs of students are met.

5. Discussion and Conclusion

High stress levels have been shown to affect the selection of short term poor lifestyle choices in preference to the selection of longer term benefits through self-investing in education. It is helpful to identify the structural and causal interrelationships if we are to access their effect on stress. According to Anjzen’s [91] Theory of Planned Behaviour (TPB), intended and ultimate behavior can be explained

according to: (a) structural norms, involving the influence of an individual's attitude to a behavior and their capacity to handle stress, as per the endogenous factors discussed in Section 2; (b) the subjective norms, involving the influence of others on an individual's behavioral intention; and (c) the effect of perceived behavioral control on initial intention and ultimate behavior; when (b) and (c) are exogenous influences affecting individual intention and ultimate behavior. Stress, then, is an important endogenous condition affecting intention and behavioral choice; when stress levels are the result of exogenous factors, as explained by subjective norms and perceived behavioral control.

According to the TPB, perceived volitional control is a necessary condition for intention and behavioral outcomes. Perceived behavioral control is a function of past experiences and existing conditions including feedback mechanism of the hormonal response to stress [55,91]. Stress levels are the result of psychosocial factors, control and the possible mitigation of stress through social support and social interactions. Such factors must be considered within the context of the community, especially for isolated Aboriginal and Torres Strait Islander communities in remote Australia. In which case, personal resilience to the psychosocial determinants of health and community resilience are likely to be closely interrelated. Closely related to the development of community resilience is the development of social capital, reciprocity, collective action, interpersonal interaction and collective efficacy [47,48].

In-addition-to-which, outcomes are a function of achievable as well as perceived control, and can be an impediment to behavioral outcomes [55]. Cox [34] discussed how stress may be associated with behavioral outcomes of two types: direct responses, sometimes termed "self-medication" [35], such as smoking and excess alcohol; and secondary responses due to hormonal variation, such as higher cortisol levels, with lower capacity for relatively lower income groups to self-regulate behavior and to be persistent in carrying through tasks [36]. As shown in Figure 1, hormonal variation is likely to result in a feedback affecting lifestyle behavioral choice.

It appears that health targeted expenditures are primarily focused on meeting proximate based risk factors and disease conditions, when the expected primary global cause of poor health are preventable. It is shown that distal factors and ongoing control are important to improving expected life outcomes through decreased stress and likely behavioral change. This result is consistent with Dockery's [45,46] results in that Aboriginal and Torres Strait Islander people possessing cultural strength are more likely to engage in education and work. As shown, ongoing behavioral control is likely to result in a reduction in bad behavioral choices including reduced smoking and alcohol consumption.

A possible economic advantage in addressing the distal psychosocial factors is the possibility of cost efficiencies through scoping economies involving multiple benefits [10,12]. Research carried out in joint participation with an Aboriginal community of nearly 1,300 people in tropical Northern Territory showed decreased incidence of diabetes, renal disease and hypertension with increasing participation in traditional caring for country [92–94]. These results were estimated to have brought about annual savings in primary health care of \$280,000 [11]. These savings were in addition to a range of public good benefits such as the biosequestration of greenhouse gases, maintenance of biodiversity and the mitigation of smoke and dust storms, which have physiological consequences and are a vector of disease [10,13]. Such activities also reinforce cultural connection, self-worth, and the capacity to self-regulate.

These results show that the cost effectiveness of policies directed at changing the relative advantage of long-term benefits over short term benefits can be achieved by addressing distal psychosocial causative agencies. We can therefore expect greater productivity over a longer life span, and delays in medical costs. In-addition-to-which are the possibilities of scoping economies. Such scoping economies would occur through the multiple benefits achievable through educational attainments, plus more specific benefits, such as in the above example. Although not discussed here, is the likely-hood of complementary economies. The possibilities of achieving such economies, in the context of remote Australia, are discussed in Campbell [10] and Campbell *et al.* [12].

It has been shown that short-term bad health choices in preference to long-term good health choices can be economically rational. The incidence of bad health choices is likely to increase with increasing levels of stress and loss of volitional control. It is shown that policy interventions directed at exogenous variables such as the distal psychosocial determinants of health can assist in changing the variables affecting endogenous choice. It is worth observing that in general terms the approach proposed here, in regard to the prevention and mitigation of smoking, excessive alcohol and solvent abuse includes a whole of life approach in addition to specific targeting.

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Conflicts of Interest

The authors declare no conflict of interest.

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Appendix: Testing Economic Rational Choice in Choosing between Poor Behavioral Choice and Education

Carson *et al.* [1] ([38] in the main article) observed the health of Aboriginal people as a function of exogenous and endogenous factors. These two sets of factors are represented by $\mathbf{X}_{j,k}$: “j” indicates events and conditions exogenous to the individual occurring independent of individual choice; “k” represents self-initiated, or endogenous behavioral choice influenced by exogenous variables.

Changes in the initial expected long-term disposition of Aboriginal and Torres Strait Islander health (H) as a function of exogenous events and endogenous behavioral choice, is:

$$\Delta H = f(\mathbf{X}_{j,k}) \quad (1)$$

Exogenous conditions and endogenous choice are assumed to have either positive health outcomes, when j, or k = 1, or negative health outcomes when j, or k = 2. Initially, it is assumed that exogenous conditions are neutral with j held constant, with expected change in life span a function of behavioral choice.

Endogenous choice is classified according to whether there is a negative or positive effect on Aboriginal and Torres Strait Islander health and expected life span. That is $\partial H / \partial \mathbf{X}_{.,1} > 0$ and $\partial H / \partial \mathbf{X}_{.,2} < 0$; assuming: $\mathbf{X}_{.,1} \geq 0$; $\mathbf{X}_{.,2} \geq 0$.

Choices are made on the basis of individual preference so as to maximize utility (U) on the basis of choosing between education, $\mathbf{X}_{.,1}$, or bad behavioral choices, $\mathbf{X}_{.,2}$ within a budgetary constraint (B), where C_k is a vector of costs:

$$\begin{aligned} \text{Max. } U &= U(\mathbf{X}_{.,1}, \mathbf{X}_{.,2}) \\ \text{Subject to: } &f(C_k, \mathbf{X}_{.,k}) \leq B \end{aligned}$$

A utility-maximizing decision maker will allocate their budget in choosing between $\mathbf{X}_{.,1}$ and $\mathbf{X}_{.,2}$, based activities such that the marginal benefit equals the marginal opportunity cost of the foregone alternative choices: $\partial U / \partial \mathbf{X}_{.,1} = \partial U / \partial \mathbf{X}_{.,2}$.

The positive impacts of $\mathbf{X}_{.,1}$ are delayed, with the costs up front; while the negative health impacts of $\mathbf{X}_{.,2}$ are delayed with the benefits up-front. Depending on how the future is assessed, it can be rational for a consumer to make choices that have negative long-term health effects. That is, it is possible for economically rational utility-maximizing Aboriginal and Torres Strait Islander people to make decisions in favor of bad behavioral choices that lead to a negative feedback loop and an increase in the expected life gap. Or, $\partial U / \partial \mathbf{X}_{.,2} > 0$, even when $\partial H / \partial \mathbf{X}_{.,2} < 0$.

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CONCLUSION

Chapter 6 concludes the response to the intention to assess, through an economic framework, Aboriginal and environmental health in remote to very remote Australia according to the nexus between healthy country healthy people. As shown in Parts A and B, the policy implications to achieving and maintaining improvements in the health of Aboriginal people and that of the environment occur as a result of nonmedical interventions.

The intention is to now extend these results as a case study exemplifying the possible application of nonmedical primary-preventative health to the global noncommunicable global disease pandemic.

**PART C: GENERALISING THE RESULTS OF CARING-FOR-COUNTRY AS A
PREVENTATIVE INTERVENTION TO THE GLOBAL CHRONIC
DISEASE PANDEMIC**

Part C consists of Chapter 7, which is made-up of two peer reviewed articles: ‘Aboriginal Involvement in Caring-for-country: and An Economic Case Study in Primary Preventative Health’; and ‘Economies through the Application of Nonmedical Primary Preventative Health: Lessons from the Healthy Country, Healthy People Experience of Australia’s Aboriginal People’.

In the following I address the second part of the intended thesis objective, which is to extend the results of the primary intended objective, as carried out in chapters 2 through 6. That is, to extend the results as a case study in nonmedical primary-preventative to the global noncommunicable disease pandemic. In so doing, it is recognised that caring-for-country is but one example of the domain of nonmedical primary-preventative health interventions, and of preventative health in general, when it is applicable to the circumstance of Indigenous people.

**EXTENSION OF LESSONS LEARNT THROUGH HEALTHY COUNTRY,
HEALTHY PEOPLE, TO THE GLOBAL NONCOMMUNICABLE DISEASE
PANDEMIC**

Chapter 7

INTRODUCTION

Chapter 7 consists of two peer reviewed articles. While these papers have some similar content, they were developed for different audiences and serve different purposes. The first of these, published in *Australian Psychiatry*, ‘Lessons from the Healthy Country, Healthy People Experience of Australia’s Aboriginal People’, drives home the general applicability of caring-for-country as a means of addressing the disadvantage suffered by Indigenous people in Australia and Indigenous people world-wide.

Reinforcing this point at this stage is important, as the focus in the second article, published in the *International Journal of Environmental Research and Public Health*, might be misconstrued as being the sole purpose of this study; that is to demonstrate the possible role of nonmedical primary-preventative health interventions to the global noncommunicable disease pandemic. This is not the case; that this initial work, concerning the health of Aboriginal people through caring-for-country, provides such a case study, is another socially beneficial by-product.

The purpose of the second article, ‘Economies through application of nonmedical primary-preventative health: lessons from the healthy country, healthy people experience of Australia’s Aboriginal people’, concerns the imbalance between preventative and nonmedical primary-preventative health. This imbalance occurs in part through preventable noncommunicable disease accounting for almost 60% of global deaths. This imbalance, as referenced in the article, occurs in contradiction to the strong argument that has been made for an appropriate response to the socioeconomic determinants. Instead, national and international health bodies focus on health care and curative health, with minimal recognition given to the application of preventative health. The steps by-which a rebalancing of

preventative and curative health might be assessed and applied is set out in the following, including the joint funding of curative health according to the marginal benefits enjoyed by multiple public and private jurisdictions.

Importantly, as noted in the second paper in this chapter, caring-for-country is but one example of nonmedical primary-preventative health that is culturally acceptable to Indigenous people, rather than being a special recompense that is unavailable to others.

ABORIGINAL INVOLVEMENT IN CARING-FOR-COUNTRY: AN ECONOMIC CASE STUDY IN PRIMARY PREVENTATIVE HEALTH

Aboriginal involvement in caring-for-country: an economic case study in primary preventative health

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Abstract

Objective: Firstly, to demonstrate the involvement of Aboriginal people in caring-for-country as a case study of how appropriately targeted non-medical primary preventative health strategies can be a cost-effective approach to addressing chronic disease among Indigenous people. Secondly, to demonstrate the use of an analogous approach in addressing the global chronic disease pandemic.

Method: A review of prior biomedical and economic research based on the involvement of Aboriginal people in caring-for-country is used to: (a) exemplifying the cost effectiveness of a non-medical preventative health intervention; and (b) the process by which such an approach might be applied across a broader context.

Results: The presented results demonstrate one non-medical primary preventative health approach to addressing the health burden affecting Indigenous peoples.

Conclusions: The suggested steps in optimising the cost effectiveness of such an approach demonstrate how it could be applied in addressing the global chronic disease pandemic.

Keywords: preventative health, Indigenous, psychosocial stressors, government failure, chronic disease pandemic

With chronic disease (CD) accounting for almost 60% of global deaths, chronic disease constitutes a global pandemic.¹ Indigenous peoples suffer a higher CD burden, leading to an expected shorter life. In Australia, the respective expected life gap between male and female Indigenous and non-Indigenous Australians is 10.6 and 9.5 years.² Based on the experience of Australian Aboriginal people in remote Australia, the purpose of this paper is to demonstrate how appropriately targeted non-medical primary preventative health strategies can be a cost-effective approach in addressing the Indigenous CD burden and mitigation of the global CD pandemic.

Critical to the level of CD are the psychosocial stressors involving social disenfranchisement, cultural loss, insurmountable tasks, and loss of volitional control – including resource access. Psychosocial stressors lead to risky behavioural choices, and the erosion of individual capacity to handle stress and commit to long-term positive health behaviours, such as self-investment in education.³ Mitigation of CD has been observed through involvement by Aboriginal people in traditional caring-for-country, with these activities addressing psychosocial stressors.

Noting the relationship between the psychosocial stressors and CD, the World Health Organization and the

Australian Institute of Health and Welfare suggest a rebalancing of resources from curative to preventative health.^{1,4} Contrary to such recommendations, little or no change has occurred. Such government failure is likely to be the result of a misdirected political response to the uncertainty people have regarding preventative health benefits as compared with the known benefits of curative health.⁵

Cass et al. proposed a multilayered causative pathway from upstream distal psychosocial stressors to proximal risky behavioural responses to CD,⁶ with risky behavioural choice as a secondary causative factor. This is consistent with the Whitehall I and II results,⁷ and research carried out among Australian and Canadian Aboriginal peoples.^{8,9} A rebalancing of the health budget can result in a reduction in health and associated costs. Additional savings could occur with an increase in expected life and delayed morbidity till close to death.¹⁰ Such improvement in human capital could result in an enhanced tax base.

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Context

Context is important in targeting resources to the particular circumstances to which the primary preventative health intervention is applied. Life exists through the maintenance of a complex dynamic equilibrium, or homeostasis, which is constantly challenged by stress. Extended stress levels and disruption of the homeostasis system leads to cognitive disorders, biomedical health risks, CD and the loss of resistance to contagious disease. Disadvantaged people are more likely to suffer higher ongoing levels of chronic stress with less opportunity and capacity to cope. Indigenous peoples suffer additional and likely more extreme stressors to that suffered by others.

Indigenous Australians have exclusive jurisdiction over 20% of Australia, and 25.4% when non-exclusive rights are included. However, 97% of the area over which Indigenous rights are held is desert.¹¹ As the Australian ecological system is an anthropomorphic creation over tens of thousands of years of Aboriginal occupancy, Aboriginal people continue to have an important land management role in remote Australia. The 2011 census gives the Aboriginal population in remote, very remote Australia as 161,000, or 24% of the total Aboriginal, Torres Strait Islander population.

Biomedical and economic studies

McDermott et al. reported on a study of two central Australian Aboriginal communities, in which the association between high biological risk factors and type of residence were examined.¹² Homeland residents were found to have lower mortality, hospitalisation, hypertension, diabetes and injury levels than settlement residents. A 10-year follow-up was carried out by Rowley et al. for the Utopia community.¹³ One of McDermott et al.'s two central Australian communities, it confirmed McDermott et al.'s results. Better health outcomes might be explained with people moving into the township to access the health centre when they are ill. As Rowley et al.'s study was based on the same population sample, this is unlikely. Utopia mortality rates were also observed to be closer to non-Indigenous Territorians than Indigenous Territorians, although Utopia had lower socioeconomic indicators. This is attributed to Aboriginal residents maintaining better cultural connection to country and their families, and having greater control of personal circumstance.

The final biomedical study is the Burgess et al. west Arnhem Land study on the nexus between caring-for-country and CD.¹⁴ A caring-for-country index was defined according to six traditional land management activities. An inverse linear relationship was observed between caring-for-country and diabetes, hypertension and renal disease, by disease severity.

The first of two studies of cost savings in primary health care according to caring-for-country¹⁵ was based on the results of Burgess et al.'s study. Annual savings in primary health care of AUD\$268,000, for a population of 1300, and present value of savings over 25 years of AUD\$4 million, were identified. No accounting was taken of hospital cost

savings, transport to and from hospital, the value of a healthier population, nor environmental benefits.

The second study extended the Arnhem Land economic results to central Australia.¹⁶ This study is based on data from the McDermott et al. study, which was limited to hypertension and renal disease, with no disease severity or caring-for-country data. Comparison is made according to residence and body mass index, with homeland residence being a proxy for caring-for-country. Estimates were carried out for both levels of disease severity. Comparison of Utopia with west Arnhem Land was made with a simple population weighting being applied to the Utopia results. The annual Utopia cost savings with increasing disease severity were AUD\$160,443 and AUD\$268,137. The Arnhem Land savings for hypertension and diabetes was AUD\$192,030.

Both biomedical studies relied on self-reported samples, while projection of the study results to the population suffers from a range of confounding factors. These results were likely influenced through the 1970's homelands movement. Such behaviour is consistent with people reconnecting with country and asserting greater control, when they had the opportunity to do so.^{14,16}

Multiple benefits

Figure 1 shows four sets of jointly produced multiple benefits through caring-for-country, one labelled 'private-good' and three labelled 'public-good'. Private-good benefits are enjoyed by caring-for-country participants; public-good benefits are enjoyed by society, with: (a) Aboriginal health benefits contributing to the national policy goal of closing the gap in Aboriginal disadvantage; (b) national health benefits occurring with the mitigation of airborne particulate matter and pathogens; and (c) environmental benefits, as with biodiversity, biosequestration and the mitigation of likely disease-bearing dust storms. The public-good benefits, which occur as a by-product of caring-for-country, are provided at zero cost.

Private goods provide the incentive for involvement in caring-for-country. Public goods are by-products that do not influence the decision to participate in caring-for-country. Even if the private benefit of caring-for-country is optimal, the combined marginal benefits of private and public goods will likely exceed the marginal cost of caring-for-country. Such market failure can be corrected through the provision of additional caring-for-country incentives. The cost effectiveness of such an action depends on the cost of: (a) negotiating an agreement among traditional land owners and multijurisdictional beneficiaries; (b) setting-up the necessary institutional structures; and (c) ongoing administration, monitoring and control costs.

Concluding discussion

Four aspects shown to be fundamental to addressing CD are: (a) the role of non-medical primary preventative health; (b) the primary preventative, cost-effective, health

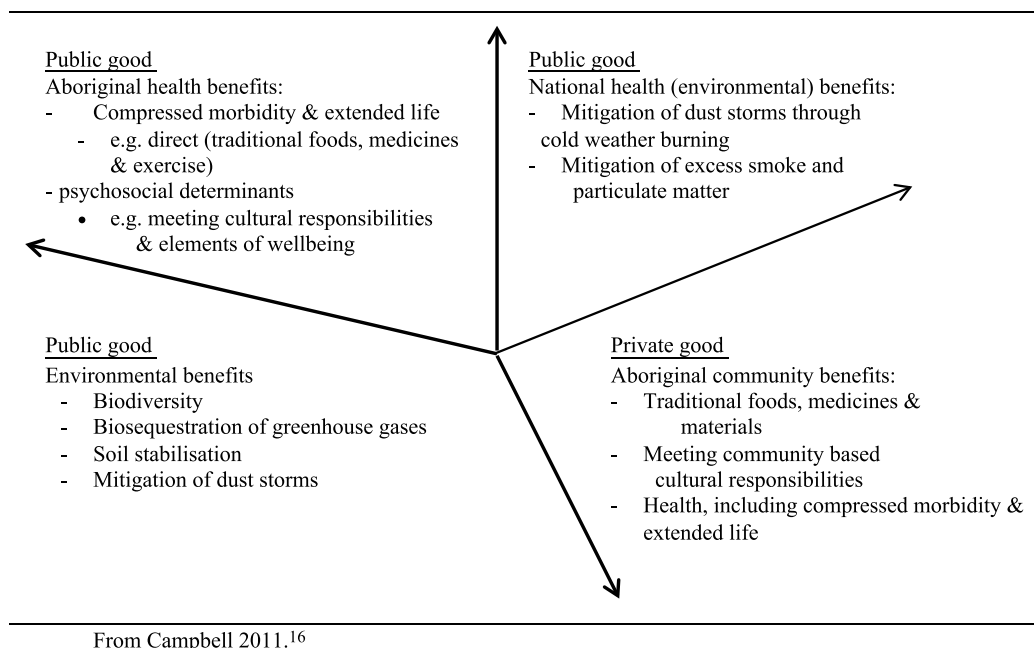


Figure 1. Joint products originating from Aboriginal involvement through caring-for-country in remote–very remote Australia.

benefits for Aboriginal people through their involvement in caring-for-country; (c) the broader social benefits through improved Aboriginal health outcomes and public-good social benefits occurring as by-products of Aboriginal involvement in caring-for-country; and (d) the possibilities of non-medical primary preventative health interventions in addressing the global CD pandemic. These results are shown to be achievable through the mitigation of upstream distal causative agents, the psychosocial stressors.

Nationally, these results provide an argument in support of an important aspect to closing the gap in Indigenous disadvantage. National and international public discussion includes the increasing cost of CD, and the erosion of the tax base among ageing advanced economies. These results provide an important approach in mitigating the net social cost of CD and extending the tax base through the enhancement of human capital.

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**ECONOMIES THROUGH APPLICATION OF
NONMEDICAL PRIMARY PREVENTATIVE
HEALTH: LESSONS FROM THE HEALTHY
COUNTRY, HEALTHY PEOPLE EXPERIENCE OF
AUSTRALIA'S ABORIGINAL PEOPLE**

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Commentary

Economies through Application of Nonmedical Primary-Preventative Health: Lessons from the Healthy Country Healthy People Experience of Australia's Aboriginal People

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Abstract: The World Health Organization reports noncommunicable disease as a global pandemic. While national and international health research/policy bodies, such as the World Health Organization and the Australian Institute of Health and Welfare, emphasize the importance of preventative health, there is a continuing distortion in the allocation of resources to curative health as a result of government failure. Government failure is, in part, the result of a political response to individual preference for certainty in receiving treatment for specific health conditions, rather than the uncertainty of population-based preventative intervention. This has led to a failure to engage with those primary causative factors affecting chronic disease, namely the psychosocial stressors, in which the socioeconomic determinants are an important component. Such causal factors are open to manipulation through government policies and joint government-government, government-private cooperation through application of nonmedical primary-preventative health policies. The health benefits of Aboriginal people in traditional land management, or caring-for-country, in remote to very remote Australia, is used to exemplify the social benefits of nonmedical primary-preventative health intervention. Such practices form part of the “healthy country, health people” concept that is traditionally relied upon by Indigenous peoples. Possible health and wider private good and public good social benefits are shown to occur across multiple disciplines and jurisdictions with the possibility of substantial economies. General principles in the application of nonmedical primary-preventative health activities are developed through consideration of the experience of Aboriginal people participation in traditional caring-for-country.

Keywords: chronic disease pandemic; Indigenous; social benefit; psychosocial stressors; environmental benefit; noncommunicable disease

1. Introduction

This paper concerns the imbalance between curative and nonmedical primary-preventative health. While substantial health gains are attributed to nonmedical primary-preventative health [1–4], there is an apparent lack of systematic coordination of such aspects in the overall management of health outcomes. The application of nonmedical primary-preventative health is shown to be effective in the prevention and mitigation of noncommunicable or chronic disease among Australia's Aboriginal people. This experience is relevant to correcting the health disadvantages suffered by Australia's Aboriginal and Torres Strait Islander peoples and the world population of Indigenous people. At a higher level of abstraction, nonmedical primary-preventative health is relevant to the prevention and mitigation of the global chronic disease pandemic [3–6].

Given the global noncommunicable disease pandemic [5,7], the application of preventative health is particularly important at this time. National and international health research/policy bodies, such as the World Health Organization [5–7] and the Australian Institute of Health and Welfare [8,9], acknowledge the importance of preventative actions, especially when it comes to the socioeconomic determinants of health. In spite of the strong argument made for a commensurate response to the socioeconomic determinants, there has “... been a failure for a commensurate response” [10] (p. 138). Bryant *et al.* [11], in the case of Canada, and Fisher *et al.* [12], in the case of Australia, commented on this failure, and noted an apparent preference by policy makers to focus on the delivery of health care/curative health. As explained in the following, economists, such as Keech and Munger [13], and Watts and Segal [14], identify such resource misallocation as government policy failure.

Use of the term “primary” is in reference to the primary causative agents, or stressors affecting the increasing incidence of noncommunicable disease [15–21]. Early and ongoing nonmedical life factors affect noncommunicable health outcomes. These factors include a range of social, economic (the socioeconomic determinants) and psychological factors including lack of access to and control over resources, social isolation, social disenfranchisement, racism, class distinction, and lack of mastery and control over life circumstances [1,21–24]. These factors extend beyond the socioeconomic determinants of health and are referred to here as psychosocial stressors, in which the causal pathway to noncommunicable disease is emphasized. Depending on individual coping capacity and response, stressors can lead to chronic stress, disruption of the endocrine system and an increase in long term morbidity and mortality risk [25,26]. Cass *et al.* [27], for example, highlighted the role of distal upstream psychosocial stressors as primary causal agents leading to noncommunicable disease, with risky behavioral responses being a secondary causative agent.

On average, less than 3% of the national annual health budgets of the Organization for Economic Cooperation and Development members, including Australia, are allocated to preventative health – with little of this funding allocated to the mitigation of upstream psychosocial stressors [28,29]. Such accounting makes no explicit allowance for expenditures outside of the health budget that might affect health outcomes. These expenditures include housing, education, direct investment in Aboriginal involvement in traditional land management, public transport, access to resources, and services for those who are financially disadvantaged.

The Experience of Aboriginal People as a Case Study

The burden of chronic disease is unevenly distributed, with the world’s Indigenous peoples suffering a heavier burden of noncommunicable disease [30] (Table 1). This maldistribution includes Australia’s Aboriginal and Torres Strait Islander peoples, who suffer a heavier burden of chronic disease to that suffered by other Australians (Table 1). One approach in addressing this burden among Indigenous peoples is through their engagement in “healthy country, healthy people”. The benefit of this approach is shown on the basis of the results of the involvement of Australia’s Aboriginal people in traditional land management, or caring-for-country¹ [31–38].

Table 1. Age standardized relative indicators of Indigenous noncommunicable disease burden [37].

Year/s	Condition	Rate Relative to Non-Indigenous
2012	Death rate	1.6 times that of non-Indigenous
2010–2012	Life expectancy	10–11 years less than non-Indigenous
2012	Diabetes death rate	7 times that of non-Indigenous
2009–2012	End stage renal disease	6.2 times that of non-Indigenous
2012–2013	Hospitalization for injury	~Twice that of non-Indigenous
2012–2013	Respiratory condition	1.2 times that of non-Indigenous
2012–2013	High to very high levels of Psychological stress	2.7 times that of non-Indigenous

Such activities are an example of nonmedical primary preventative health. Economic analysis of such activities shows how such actions can be a cost effective approach to the prevention and mitigation of noncommunicable disease among Australia's Aboriginal people [38]. In addition, at a higher level of abstraction, nonmedical primary-preventative health interventions can be applied as a cost effective means to the prevention and mitigation of the global chronic disease pandemic [3,5–7]. The following shows that nonmedical primary-preventative health can reduce the demand and associated costs for health services, including reductions in the health risks of wrongly prescribed pharmaceutical and clinical interventions. People can be expected to live longer and healthier lives, with morbidity being compressed till close to death—thus leading to increased human capital, improved social wellbeing, reduced private and public health costs [39–41], increased mean per-capita disposable income, and an expansion of the tax base. This can be achieved while providing a range of nonmedical public good social benefits at no additional cost.

2. Context of Aboriginal People Being on Country

The successful application and cost effectiveness of a nonmedical primary-preventative health program will need to meet the contextual and cultural circumstance of the people involved. While the circumstances of Aboriginal people are discussed in this section according to residence in remote to very remote Australia, these contextual circumstances are also relevant to Aboriginal people beyond this region. Aboriginal and Torres Strait Islander people are 3% of the Australian population, or 721,000 people. Aboriginal people suffer higher levels of chronic diseases and a shorter life span than do other Australians [42] (Table 1).

Indigenous Australians have inalienable or exclusive possession of approximately 20% of Australia [43], and 25.4% when non-exclusive rights are included [43]. Nearly all of the area under some form of Aboriginal possession is located in the 70% of Australia that is remote to very remote, with 97% of this area being desert [44]. Aboriginal people constitute a twelfth and a fifth of the semi-arid and arid populations.

Most Aboriginal residents are distributed throughout remote to very remote Australia in family groups or in small settlements, with most non-Aboriginal residents concentrated on mining sites and in the five major population centers [44]. Aboriginal people are accordingly well placed to carry out land management across a large region of Australia. This is especially the case as much of the remote Australian ecological system is an anthropomorphic creation over tens of thousands of years of Aboriginal residency [45–51]. Since early this century, there has been a shift in social land use expectations from one based on agricultural production to one that includes tourism, conservation and Aboriginal occupancy. These changes in social preference emphasize the continued land management role of Aboriginal people and meet with tourist expectations of cultural contact with traditional occupants [51–53].

Noncommunicable disease undermines the capacity of Aboriginal people to fulfill this land management role and their socioeconomic advancement [51]. Psychosocial stressors and natural environmental stressors, including climate change [54], further erode health and capacity to perform land management roles and the delivery of private and public good social benefits. This is especially important in the Northern Territory, where Aboriginal people are approximately 30% of the total population.

Davies *et al.* [55] reviewed the cultural, health, self-determination, close cultural connection with country and the cultural, family and stewardship responsibilities that are met through land management. Non-Aboriginal invasion and settlement in Aboriginal country disrupted these relationships, while contributing to the poor health of Aboriginal people and environmental degradation [56,57]. Following a history of often violent disconnection from country, cultural loss, and perceived and actual loss of control [58], reestablishment of Aboriginal jurisdiction over country, and the uptake and application of traditional cultural practices is disjointed.

Variation in government policies and institutions have a greater impact on personal control and self-mastery than exists for non-Aboriginal peoples [58]. The Commonwealth Government's ongoing

2007 Northern Territory Emergency Response is an example of this [59]. Government emphasis on curative health and the Prime Minister's deprecating comment in 2015 that attachment to country is a "lifestyle choice" [60], indicates a misunderstanding of or an ignoring of the possible cultural importance of country to personal wellbeing and health. It also ignores the broader national social benefits that can be achievable through caring-for-country.

3. Psychosocial Realities: Causal Factors Affecting Risky Behavioral Choice

"Life exists through maintenance of a complex dynamic equilibrium, termed homeostasis, that is constantly challenged by intrinsic or extrinsic, real or perceived, adverse forces, the stressors" [61] (p. 259). Extended stress as a result of the psychosocial stressors and corresponding disruption of the homeostasis system leads to a range of noncommunicable disease and cognitive disorders [16,18,62]. Stressors result from multiple endogenous and exogenous emotional and physical sources [16,63–65]. Endogenous factors include genetic disposition, culture, personal attitudes, and perceived loss of control—when perceived control is affected by exogenous factors including the attitudes of close associates, and the effect of current and previous experiences on perceived control [26,64,65]. Such exogenous factors are open to manipulation, whether deliberate, through policy change, or otherwise, with positive or negative impacts [66].

3.1. Conversion of Stressors to Stress

The conversion of stressors to stress depends on coping capacity, stressor characteristics, personal disposition, learnt strategies, resource access, access to social support and context [23,62,67–72]. Inadequate or excessive adaptive responses can lead to endocrine, metabolic, autoimmune, and psychiatric disorders [16]. People in poor socioeconomic circumstance are more likely to suffer stressors and to have less opportunity and resources to cope with stressors [64]. Aboriginal people, and Indigenous peoples in general, are likely to suffer higher levels of stress than others in similar socioeconomic circumstance because of the additional range of stressors due to their Aboriginality. These include social, cultural and physical disenfranchisement [69–72] and limited access to resources [67].

3.2. Stress Leads to Two Interrelated Sets of Outcome

Stress includes two sets of outcomes. Firstly, when extended stress leads to disruption of the homeostasis system and to noncommunicable disease, loss of resistance to contagious disease and to cognitive disorders [18,63]. The second set of outcomes are risky behavioral responses, including lack of exercise, smoking, excess alcohol and poor food selection—although consideration of selection of food choice needs to take account of inadequate availability and the higher cost of good fresh food choices when living in remote areas. Remembering that risky behaviors are often the result of chronic stress, they are a secondary rather than a primary causative agent. Even when people are fully aware of the possible health impacts of risky choices, they may continue to engage in risky behaviors as a result of overwhelming stress [73].

As an example of the role of the psychosocial stressors through loss of personal control, the British Whitehall studies showed diabetes to be inversely related to the British Public Service hierarchy. The Whitehall I studies showed risky health choices explained less than 25% of diabetes incidence. The Whitehall II studies showed loss of control with decreasing public service status, explained more than 50% of diabetes incidence, with risky behavioral choices being, at least in part, a secondary response to primary psychosocial stressors [21]. Similar results have been observed for Australian and Canadian Aboriginal peoples [17–20,74,75]. It is important to recognize that the combined experience of Indigenous and non-Indigenous peoples is relevant when assessing the causative relationship between the primary causative stressors and health outcomes.

As many of the social connections held by Aboriginal people interconnect with country, dispossession from country can erode social connections and lead to negative health outcomes. Participation in traditional land management practices provides cultural and personal strength

and control. An accumulating literature shows a positive correlation between participation in caring-for-country, control and health [31–36].

Fleming and Ledogar [76] and Ledogar and Fleming [77], for example, showed that for Australian and Canadian Indigenous peoples, cultural interaction enhances self-identity, confidence, behavioral norms and resilience. Cultural strength has been observed to provide the emotional strength for Aboriginal and Torres Strait Islander peoples to engage in western work and education [78–80].

Campbell [25] used an economic optimization model to explore whether the selection of poor health choices by Aboriginal people could be economically rational. In doing so, he reviewed an extensive literature showing those suffering high stress levels and uncertainty over future outcomes are less able to assert long-term self-control. This was shown to lead to a higher discount rate being placed on future outcomes, such as the possible benefits of self-investing in human capital, including healthy behavioral choices and education [81–84]. It was concluded that under chronically stressful circumstance, it can be economically rational to choose short-term risky behavioral choices that have a certain short term outcome, in preference to uncertain longer-term benefits, as through education. The solution to such behavioral responses is to alter the incentive structure through the removal of the psychosocial stressors [25].

4. Cost Savings through Caring-for-Country

4.1. Biopathological Assessment

Participation in caring-for-country associated with homeland residency in small family groups is shown to provide improved control and cultural and emotional strength [36]. The expectation for Aboriginal people to have the choice of remaining on traditional country has been criticized as unrealistic [60,85–87]. The following studies of Aboriginal communities in remote to very remote Northern Territory provides a counter argument to this view.

The change in mental and biophysical health status following the movement of Aboriginal people off the multi-tribal Papunja government settlement onto traditional homeland at Kungkayunti, or Brown's Bore, provides an early example of the benefits of being on country [36]. There was an observed reduction in risky health behaviors. Three factors important to these changes were improved ego identity and improved self-esteem, opportunity to establish self-control, and, finally, the increased role of traditional doctors in addressing psychosomatic and psychic dysfunction [36].

Later studies include those by McDermot *et al.* [34] and Rowley *et al.* [35], in relation to the Algawarr and Anmatyerr peoples living on traditional homelands on what was the Utopia pastoral station and adjoining un-alienated country, in central Australia. The McDermott *et al.* [34] study involved Aboriginal residents in Hermannsburg and Utopia, while the follow-up study by Rowley *et al.* [35] was limited to the Utopia community. McDermot *et al.* [34] examined the association between high biological risk factors according to residence in the Utopia and Hermannsburg communities over seven years to 1995. Homeland residents were observed to have lower mortality, hospitalization, hypertension, diabetes and injury levels than settlement residents.

The 10 year follow-up by Rowley *et al.* [35], based on a cohort of McDermott *et al.*'s [34] Utopia population sample, supports McDermott *et al.*'s [34] results. Utopia residents were observed to have lower mortality rates than the Northern Territory Aboriginal population as a whole, even though their socioeconomic status was lower. This, it was suggested, is due to positive psychosocial responses attributed to increased personal control and connection to country and family. That the managers of the Utopia property were more accepting of traditional cultural connection to country is also likely to have been important [88].

The final example, in the West Arnhem Land Northern Territory top-end, involved traditional land owners and a multidisciplinary team of medical, ecological and social researchers [31,33,36]. Important to this study is the interrelationship between caring-for-country with an inverse association

between caring-for-country and diabetes, hypertension, and renal disease [31,33]. Burgess *et al.* [31] noted homeland residents as being less likely to participate in risky health behaviors.

4.2. Economic Assessment

Two economic studies were carried out using data from the above studies. The first of these, by Campbell *et al.* [89], used Burgess *et al.*'s [33], West Arnhem Land data, to estimate primary health care cost savings for diabetes, renal disease and hypertension according to participation in caring-for-country. Cost data are from Zhao *et al.* [90]. The results showed potential annual savings of \$268,000, for an eligible population of 1284 Aboriginal people aged between 15 and 55 years, with an estimated present value of savings over 25 years of \$4.08 million. No allowance was made for the social benefit of a longer more productive and satisfactory life, savings in ongoing medical, transport and hospital costs, or for environmental benefits.

In a later study by Campbell [91], the West Arnhem Land results were compared with possible savings in central Australia on the basis of the incidence of diabetes and hypertension according to differences in body mass index (BMI), which differed according to township residence or homeland. The central Australian BMI results were respectively 25.7 (6.1), 23.5 (5.7) (standard error). This 9% difference indicates a lower health risk for homelands residents [34]. These results indicate the broader applicability of the Arnhem Land results. Based on an equivalent population size, the possible annual cost savings in central Australia were estimated to range between \$160,443 (severity of disease level 1) and \$268,137 (severity of disease level 2). Estimated annual cost savings for these conditions in Arnhem Land was \$192,030. While a range of confounding factors can have influenced these results, failure to respond to these results could be a greater error [13].

4.3. Economic Characteristics

Recognition of the economic characteristics is important in optimizing the benefits of nonmedical primary-preventative interventions in comparing its cost effectiveness with alternatives, such as curative interventions. The benefits of caring-for-country include the Aboriginal community's intended private goods benefits, and the jointly produced public goods (or bads) that provide national social benefits (disbenefits) (Table 2). These social benefits occur as unintended byproducts, or externalities; that is, without accompanying negative byproducts, or "bads", these byproducts occur at no cost to society. Private good benefits consist of consumables, cultural connection and access to arts and crafts production. An often missed aspect of the indigenous art industry is that it provides a culturally intimate opportunity for people, who are otherwise unprepared for work, to earn income [92].

Private goods are rivalrous in consumption, with consumption by one person reducing the amount available to others. Public good benefits are non-rivalrous in consumption, which, in this instance, are socially beneficial. Some economists also require the additional condition that it is not possible to provide such goods through the market. As long as the social marginal benefit in the long run supplying the good exceeds the social marginal cost in the long run, an economic efficiency argument to supply the good through the market does not necessarily exist. Meeting such a requirement can result in economic inefficiencies. A distributional argument could, however, apply if higher income earners are the major beneficiaries.

Three sets of public good benefits are identifiable on this basis (Table 2). The first of these are the Aboriginal health benefits, as when these benefits go towards meeting the Council of Australian Government's policy goal of closing the gap in Aboriginal social disadvantage [93]. The second set is the national health benefits, through the mitigation of airborne particulate matter and pathogens affecting East and West Coast populations. Environmental benefits make up the final set of public good benefits including biodiversity and the biosequestration of greenhouse gases.

Table 2. Joint products originating from Aboriginal traditional involvement in caring-for-country in remote to very remote Australia [91].

Private Good
<ul style="list-style-type: none"> • Aboriginal community benefits: <ul style="list-style-type: none"> - Traditional foods, medicines and materials - Meeting community based cultural responsibilities - Health, including compressed morbidity & extended life
Public Good
<ul style="list-style-type: none"> • National health (environmental) benefits: <ul style="list-style-type: none"> - Mitigation of dust storms through cold weather burning - Mitigation of excess smoke and particulate matter
Public Good
<ul style="list-style-type: none"> • Environmental benefits: <ul style="list-style-type: none"> - Biodiversity - Biosequestration of greenhouse gases - Soil stabilization - Mitigation of dust storms
Public Good
<ul style="list-style-type: none"> • Aboriginal health benefits: <ul style="list-style-type: none"> - Compressed morbidity & extended life; e.g., direct: traditional foods, medicines & exercise - Psychosocial determinants; e.g., meeting cultural responsibilities & elements of wellbeing

Scoping economies and economic complementarities are important in affecting caring-for-country benefits. Scoping economies occur when the joint supply of two or more products is less than what they would be if they were supplied separately. Assuming no negative byproducts through caring-for-country, public good social benefits are provided at zero cost, and total marginal social benefit will exceed marginal private cost. Scoping economies are a result of joint or technical interdependence in production, or through economic interdependence, “... created by non-allocable inputs or linkages created by allocable fixed or quasi-fixed inputs” [94] (p. 10).

Complementarities occur when, firstly, the benefits of two or more components of a whole make-up for deficiencies in the other. This is the case when appropriate institutional structures create the incentives necessary for private investment in caring-for-country – as with private payment for biosequestration of greenhouse gases – or with the joint provision of preventative health and curative health in reducing the incidence and effect of chronic disease. Complementarities can be observed to exist when a reduction (increase) in the price of one good, or input, leads to an increase (decrease) in the demand for the other [95,96]. Supply side complementarities depend on the degree of non-substitutability between at least two inputs [97]. Regarding caring-for-country, cold weather use of fire is a complementary input to hunting and to land management, in addition to the scoping economies achieved through biosequestration, in aiding hunting and in maintaining biodiversity [34,98]. Indeed, the whole concept of “healthy country, healthy people”, is an example of complementary economies.

5. Optimizing Social Benefits through Caring-for-Country as a Preventative Intervention

5.1. Conditions for Optimality

The optimal allocation of resources across preventative and curative health is affected by government failure and/or market failure. Optimality exists when marginal cost intersects average cost from below and short-run and long-run functions intersect at the same point – thus meeting the necessary long-run and short-run marginal conditions. This requires the economic system to be in equilibrium. As economies are rarely, if ever, in equilibrium, this is neither likely, nor necessarily

desirable [13]. It is appropriate, however, for policy objectives to be directed at, if not actually achieving, this objective.

5.2. Explaining Government and Market Failure

5.2.1. Government Failure

The preference for curative health can be partly explained by a political response to individual preference for certainty in receiving treatment for specific conditions, rather than the personal uncertainty of population-based preventative intervention [13,14,99,100]. Implicit to this is that people may believe that the allocation of resources between preventative and curative health is rivalrous. If so, this response is akin to a minimax strategy, when people assume the worst in conditions of uncertainty and maximize according to what they know. Any rebalancing of health policies that engage with nonmedical primary-preventative health interventions requires a fully informed public. This is particularly relevant, if lack of information is important to people taking a minimax approach.

Health policy can be further distorted with suggested political competitiveness being an incentive for “bigger and better”, and “newer and more expensive” curative technologies [100]. The \$20 billion Research Future Fund, proposed in the Australian Commonwealth Government’s 2014–2015 Annual Budget [101], and legislated in September 2015, being a possible example. Also relevant to possible distortion of government funding is lobbying by those with economic interests in curative health; e.g., pharmaceutical and medical manufacturers, hospital interests and general practitioners – especially given the gatekeeper role in primary health care of general practitioners [8].

An alternative or accompanying explanation is the existence of high discount rates by individuals or by government [102], which is likely to elicit a response in favor of acute health care in preference to preventative health. The focus on interest rates can be misleading. The short election cycle, by acting as a time constraint, can be a major cause affecting government policy choice, rather than what Lawless [102] attributes as being due to a high discount rate. A likely consideration affecting the focus on curative health is the training of those making and/or advising on policy decisions. That is, when those principally called on to provide policy advice come from a biological educational background.

An economically rational response, and one requiring careful explanation to the public, would be to allocate resources according to an economic criterion that is neutral in the maintenance of health. Allocating resources according to marginal cost-effective-need might go to meeting this. Any such analysis would need to take into account any nonhealth joint products, as observed with caring-for-country. As data on all aspects of such a program may not be readily available, all that is necessary is to show whether one approach is likely to be preferable to the other, or to narrow the range of unknown benefits and costs. This was the approach undertaken in the initial Hells Canyon analysis, which, as in this case, was to do with nonmarket based social values [103].

5.2.2. Market Failure

When concerning market failure, the private provision of jointly provided private goods and public goods is likely to be sub-optimal. This can occur because of cultural differences, as when what Aboriginal people are seeking through caring-for-country does not match the expectancies of the wider community; e.g., protection of threatened species is seen as a foreign and unwarranted concept – or, alternatively, when people lack a broader view of recent changes, such as when they are unaware of the conditions that existed prior to feral animals [104]. Any such difference is likely to affect both the nature of and the level of private initiated investment in caring-for-country. Market failure can also occur when there is limited access to traditional country, or people are inhibited from participating in caring-for-country activities due to perceived or actual lack of mastery and control, [105]. Finally, market failure can occur when the private benefit of participation in caring-for-country is optimal, yet the combined marginal private and social public good benefits exceed the marginal cost of caring-for-country, such that the supply of these joint products is non-optimal. This is especially

likely to occur when social public goods are provided as a byproduct at zero cost. As the public are the beneficiaries of these public goods, an economic argument can be made for public funding to enhance access to country, assertion of control, and extending caring-for-country.

The costs incurred in providing additional public funding by a single provider may be excessive. One approach is for each multijurisdictional beneficiary to fund incentives according to the relative benefits received. A multidisciplinary, multijurisdictional economic welfare framework can be used to assess the relative benefits using Black's [106] cost effectiveness plane [107]. A negative aspect in a multijurisdictional approach is that costs are likely to increase as the number of jurisdictional partners increase; that is, transaction costs are likely to increase with increasing jurisdictional partners, in addition to possible loss of scale economies.

5.3. A Summation of Savings

As previously mentioned, an important factor affecting the cost effectiveness of primary-preventative health is the compression of morbidity with increasing age [40]; that is, since the 1950s, primary intervention has been observed to lead to an increase in modal length of life, a decrease in the standard deviation of age of death, and the delay of morbidity till close to death. Mur [45], while noting a general acceptance of the hypothesis, queried whether the global obesity epidemic could change this relationship. The Association of Faculties of Medicine of Canada [39] noted a positive relationship between life extending activities and improved health outcomes, so as to extend the "disability-free survival curve". Important, as a result of compressed and decreased morbidity, is a likely decrease in misprescribed pharmaceutical and clinical interventions resulting in a further decrease in morbidity and mortality [108].

One issue in financing a rebalancing of resources to accommodate primary preventative health is the time lag that will occur before any reduction in demand for curative health occurs. This means the initial period of time during which the effect of primary-preventative health works its way through the population will require additional funding. Such changes will lead to additional improvements in human capital and social wellbeing, and savings in pharmaceutical and clinical costs and related treatment, including hospitalization.

6. Examples of External "Incentive" Payments

In addition to individual self-interest, there has been a history of ongoing public and private funding for Aboriginal involvement in caring-for-country. These include private, state, territory and commonwealth payments and transfers. In addition to other programs, the Commonwealth Government's Indigenous Land Corporation provides funding for the purchase of country for communities who are unable to gain rights over traditional country through the Native Title Act 1993. This is provided for purpose of protecting cultural and environmental values, and enhancing Aboriginal and Torres Strait Islander socioeconomic development. The Department of the Environment carries out joint programs providing funding for the involvement of traditional owners in traditional land management programs on country. These range from specific programs, such as a "two-way" botanical survey involving Indigenous and western ways of identifying and classifying Arnhem Land native species [109] and funding for Indigenous Protected Areas under the National Reserve System. The budget for the current five year Indigenous Protected Areas program, starting in 2013–2014 was set at \$78.3 million. Indigenous protected areas make up approximately 40% of the total National Protected Area Program of 137.5 million hectares. Such programs also provide culturally acceptable employment in locations in which employment opportunities are limited—with consequent, and unaccounted for, social and health benefits.

Traditional cool weather burning has potential for commercial development of carbon credits. An early Australian program started in 2006 with the establishment of a 17-year agreement in West Arnhem Land involving traditional land owners, the Northern Territory Government and Conoco-Phillips/Santos. Intended to offset greenhouse gases generated through the establishment

and running of a liquefied natural gas plant in Darwin, it involves an annual \$1 million fee paid by Conoco-Phillips/Santos to fund joint traditional and western land management practices. Intended benefits are the annual biosequestration of greenhouse gases equivalent to 100,000 tonnes of CO₂, the protection of fire-threatened plant species and local employment of traditional owners [110].

The Fish River property of 178,000 hectares, owned by the Indigenous Land Corporation, north-western Northern Territory provides another example. This involved the sale of 25,884 Australian Carbon Credit Units at \$20 per tonne of CO₂ equivalent to Caltex Australia Oil Co [111]. This and subsequent carbon credit agreements with traditional land holders, were carried out under the Commonwealth Government's Carbon Credits (Carbon Farming Initiative) Act 2011. Greenhouse gas abatement levels of these programs are expected to range between 25% and 48%, with efficacy of cool weather burning varying according to location and seasonal variation [112]. While these programs resulted in multiple benefits, including health, environmental benefit was the primary policy objective.

7. Conclusions

The starting point for this paper is the imbalance between non-medical primary-preventative health and curative health, and extending the applicability of non-medical primary-preventative health to the global noncommunicable disease pandemic. Two case studies, one in tropical northern Australia and the second in the central Australian desert, were used to exemplify the broad social benefits of a nonmedical primary-preventative health approach to the mitigation of noncommunicable disease.

The two case studies demonstrated the possibility of substantial savings in primary health care, the implied medical savings in foregone hospital treatment and patient air evacuation to and from hospital care. These savings occurred in addition to the private, family and Aboriginal community benefits of healthy members. A range of private and public good social benefits are shown to be achieved through caring-for-country, with the public good social benefits provided at zero cost as a byproduct of caring-for-country.

A theoretical public economics framework is used to examine the economic structure of the case studies. This allowed identification of the private good and social public good benefits, the respective roles played by the private and public sectors, and how this knowledge could be applied in achieving optimal outcomes. This approach allows recognition of multiple benefits (disbenefits) and the multidisciplinary, multijurisdictional interests of these benefits. These aspects are important to the cost effectiveness of non-medical primary-preventative health. Relevant to this are the possibilities of scoping economies and the presence of complementary economies between nonmedical primary-preventative health and curative health. Awareness of the probable existence of such economies is important in designing, applying and estimating the relative benefits of a non-medical primary-preventative health intervention, and in optimizing the social benefits within the national budgetary constraint.

Applying nonmedical primary preventative health will differ between population groups according to location and context, including the culture and history of the people involved. In addition to likely savings in health costs, a rebalancing to primary preventative health is likely to result in a more productive population due to extended life and morbidity compression; that is, people can be expected to live and work longer, and the demand for curative services to be reduced and discounted into the future. Such outcomes are important in developed and developing economies alike, especially if the full national social benefits of human capital and extension of the tax base are realized—an especially important point of consideration among aging national populations.

Consideration of the health and broader benefits of Aboriginal people in caring-for-country demonstrate the possible advantages of primary preventative health in general. In doing so, it also shows that support of programs based on caring-for-country is not something “special” or covert welfare for Aboriginal people. Instead, it exemplifies the application of primary preventative health according to the context of the population involved. A possible urban example might relate to the relative benefits of rail *versus* road infrastructure when there are direct health issues of injury and

pollution, and mass movement of people and goods under conditions of limited space, average time spent travelling and distributional impacts according to cost and time spent—especially given that the less wealthy are more likely to be located in the outer suburbs, and loss of time through extended travel are added to individual social disruption.

In conclusion, the material presented here provides a strong economic argument in favor of consideration of traditional caring-for-country practices, especially among Aboriginal people in remote to very remote Australia, as well as to Indigenous people in general. At a higher level of abstraction, these results have been used to show how nonmedical primary-preventative health interventions can be applied as a cost effective means to the prevention and mitigation of the global chronic disease pandemic.

Achieving a systematic coordinated balance between curative and nonmedical primary-preventative health will require research that accounts for the particular complementarities between preventative and curative health. As suggested, public support for the introduction of nonmedical primary-preventative health requires the public to be fully informed if the political support for the application of nonmedical primary-preventative health might occur.

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CONCLUSION

Nationally, these concluding results from the experience of involvement by Aboriginal people in caring-for-country and the nexus, between healthy country healthy people, has provided lessons in support of closing the gap in Indigenous disadvantage and to addressing the global noncommunicable disease pandemic. Two national policy aspects in Australia are the increasing costs in the provision of health services and how Australia might go in 'rebalancing the books'. Over the longer-term, the application of nonmedical primary preventative health, by reducing health costs and expanding the productive life span, provides an opportunity to address both of these policy areas. As noted, the achievement of such advantages will incur an initial higher cost.

CHAPTER 8

THEMES, COGNITIVE FACTORS AND FUTURES

8.1 INTRODUCTION

The intention in the preceding chapters has been to assess possible changes in Aboriginal and environmental health outcomes according to the nexus between healthy country healthy people. This has been carried out within an economic framework in remote to very remote Australia according to involvement by Aboriginal people in traditional land management. And to then extend the results of this analysis as two case studies that exemplifying the application of nonmedical primary-preventative health to the global noncommunicable global disease pandemic. Parts A and B of the thesis relate to the first part of the study objective, with Part C relating to the second part of the study objective.

8.2 PRINCIPAL THEMES

The response to this objective is developed across seven published papers incorporated in Chapters 2 through 7. Multiple connecting themes, relating to the study objective, are developed across these chapters within an economic logic. A listing of the principle themes used in development of the thesis is set out in table 8.1.

Table 8.1: Distribution of research themes

Themes	Chapters:					
	2 ^a	3 ^b	4 ^c	5 ^d	6 ^e	7 ^f
Healthy country, healthy people	√	√	√	√	-	√
Psychosocial determinants	√	√	√	√	√	√
Psychosocial stressors	√	-	-	-	√	√
Chronic and noncommunicable disease	√	√	√	√	√	√
Global noncommunicable disease pandemic	√	-	-	-	-	√
Psychosocial stressors	√	-	√	-	√	√
Control	√	√	√	√	√	√
Scope and complementary economies	√	-	√	-	√	√
Caring-for-country/traditional land management	√	√	√	√	√	√
Biosequestration of greenhouse gases	√	-	√	√	-	√
Risky behavioural choice	√	-	√	√	-	√
Market failure	√	√	√	-	√	√
Government policy failure	-	-	-	-	-	√
Private & public goods	√	-	√	√	-	√
Cost savings	√	√	√	√	√	√

Multijurisdictional & multidisciplinary	-	-	√	-	-	√
Incentive payments	√	-	√	-	-	√

- a. *Facilitating*, Chapter 2: ‘Facilitating complementary inputs and scoping economies in the joint supply of health and environmental services in Aboriginal central Australia’.
- b. *Arnhem Land*, Chapter 3: ‘Potential primary health care savings for chronic disease care associated with Australian Aboriginal involvement in land management’.
- c. *Integration*: Chapter 4: ‘Application of an integrated multidisciplinary economic welfare approach to improved wellbeing through Aboriginal caring for country’.
- d. *Climate*, Chapter 5: ‘Responding to the health impacts of climate change in the Australian desert’.
- e. *Behaviour*, Chapter 6: ‘Economic rationality in choosing between short-term bad-health choices and longer-term good-health choices’.
- f. *Primary-prevention and Government failure*, Chapter 7: ‘Economies through Application of Nonmedical Primary Preventative Health: Lessons from the Healthy Country Healthy People Experience of Australia’s Aboriginal People’.

8.2.1 Part A

Most of the themes introduced in Chapter 2, are responded to in Part A, chapters 2 through to 5. The potential relationship between the decline in Aboriginal health, relative to the rest of the Australian population, and the loss of environmental services in remote to very remote Australia are important to part A. This involves the nexus between healthy country, healthy people, when positive outcomes depend on the formation of a holistic approach as defined by complementary and scoping economies.

Total social benefits through involvement by Aboriginal people in caring-for-country consist of private good benefits enjoyed by caring-for-country participants, and public good social benefits enjoyed by Australian society as a whole. Private good benefits involve the supply of commodities such as traditional food and medicines, income from the supply of arts and crafts and meeting family and cultural responsibilities. Public good social benefits are provided at no cost as by-products of caring-for-country and include maintenance of biodiversity, mitigation of dust storms and the biosequestration of greenhouse gases.

As social benefits occur as by-products, and are of little or no interest to those involved in caring-for-country, they will be under supplied, thus leading to market failure. Optimal supply of net social benefits will require a mix of some form of external funding, when this will require the development of appropriate institutional structures. An example of this is through the development of a market in individual transferable greenhouse gas credits, or the establishment of government project requirements. An example of changes in institutional structures is the Commonwealth Government’s introduction of the *Carbon Credits (Carbon Farming Initiative) Act* 2011 in Chapter 7. While an example of the latter is given in Chapter 4 in relation to the requirement of Conoco-Phillips/Santos to provide greenhouse gas offsets

in the setting-up of a liquid gas plant in Darwin. These initiatives include support of traditional land management practices leading to the biosequestration of greenhouse gases.

It is important to note, however, that the examples of government payment for greenhouse gas carbon credits under the *Carbon Credits (Carbon Farming Initiative) Act 2011* in Chapter 7, may involve economically irrational behaviour by government, or government failure. This occurs through the public paying the cost of greenhouse gas mitigation through their taxes, with greenhouse gases being generated through the action of private companies. Such institutional structures remove price as an incentive to reduce use of the atmosphere as a depository for greenhouse gases. While these carbon credits are 'used' irrespective of the social value placed on these credits. This includes the final consumers of the products and services provided receiving these benefits at less than social cost. A possible appropriate institutional structure could be achieved through an appropriately established and administrated greenhouse gas market. The application of this approach to open or shared access to resources has been shown for fisheries (Campbell, 1985; Campbell et al. 2000).

Future stressors for Aboriginal people include the expected impact of anthropomorphic generated climate change. At the same time, one of the social benefits of caring-for-country, as noted above, is the biosequestration of greenhouse gases. As discussed in Part A and Part C, biosequestration of greenhouse gases and the land management needs for the maintenance of biodiversity, provide probable commercial opportunities for caring-for-country participants. Although the provision of cost effective health benefits of caring-for-country are important, these benefits have not to-date been taken into account in caring-for-country funding.

Using a partial economic analysis, the efficacy of involvement by Aboriginal people in caring-for-country is supported through substantial savings in primary health care and environmental benefits. These savings are achieved in tropical west Arnhem Land and in the central Australian desert. The observed consistency in per capita savings in primary health care and multiple environmental benefits, as identified in chapters 3 and 4, help to confirm the broad based social benefits achievable through caring-for-country. The reliability of these results is further discussed in section 8.3.

Chapter 5 provides consideration of the response by residents in the Australian desert to climate change, with a focus on the circumstance of Aboriginal people. The generally poor

health and tighter resource constraints of Aboriginal people in remote to very remote Australia makes them particularly vulnerable to the environmental impacts of climate change. Such impacts include increased temperatures and decreased effective moisture over much of the desert region¹. Increased tropical rainfall is expected in the northern regions, with a likely increase in insect borne disease. The ability of Aboriginal people to adapt to environmental change and manage the environment is critical to their ongoing wellbeing and their ongoing involvement in regional land management.

Aboriginal people are identified in Part A as having a two-way relationship with climate change through the negative effect on their health, and their role in the biosequestration of greenhouse gases. Involvement by Aboriginal people in this latter role provides possibilities for market-based, culturally acceptable employment benefits along with accompanying health and social advantages. Aboriginal people, as traditional occupiers of country, have specific culturally based local knowledge of caring-for-country, which gives them an absolute advantage in the supply of appropriate land management.

In summary, it is shown in Part A that a strong nexus exists between the economic imperatives of environmental management and the sociocultural and biological health of Aboriginal people through their engagement in caring-for-country.

8.2.2 Part B

The extent to which Aboriginal people benefit economically and health-wise from the healthy country, healthy people nexus is influenced by their capacity to choose appropriate long-term behaviours the consequent maintenance of a healthy lifestyle.

A number of factors are observed to affect the probability of selecting short-term risky choices in preference to long-term choices. These relate to long-term uncertainty, loss of control and empowerment, and the socioeconomic context in which Aboriginal people live. The latter includes the same socioeconomic stressors suffered by other Australians plus additional stressors through Aboriginality. Such additional stressors include intergenerational stressors resulting from colonisation, cultural and socioeconomic disenfranchisement and racism. A necessary requirement in preferring a long-term alternative is individual capacity to self-regulate and apply volitional control and willpower, a capacity that is eroded by stress. Stress, in combination with future uncertainty, creates circumstances in which choosing risky behavioural choices can be economically rational.

¹ More recent research indicates increasing rainfall being more extensive than originally shown, and extending from tropical northern Australia to south of Alice Springs (Gerritsen 2012).

The question of whether these risky behavioural choices are economically rational is examined in Chapter 6. The question is tested using an economic optimisation model. This involves a trade-off between short-term lifestyle choices – with immediate utility and increased possibility of long-term negative health impacts; as against the alternative of self-investment in human capital through education – with increased possibility of improved long-term health and other benefits, and the certainty of forgone short-term benefits.

It is shown that under highly stressful circumstance, the selection by Aboriginal people of risky health choices can be economically rational. Cultural strength, and perceived and actual mastery and control are important to overcoming stressors, such that healthier long-term choices are preferred. Involvement in traditional caring-for-country can be an important approach to mitigating psychosocial stressors and asserting control.

8.2.3 Part C

The purpose of Part C, Chapter 7, is to generalise the results developed in chapters two through six, and to draw out generalizable policy implications.

Other researchers have demonstrated the technical interrelationship of healthy country, healthy people. This leaves open the question of optimal allocation of resources to healthy country, healthy people. The partial economic analyses carried out in Chapter 3, and in Chapter 4, demonstrate the likely cost effectiveness of caring-for-country. These results have important policy relevance in relation to the balance between curative health and nonmedical primary-preventative health. This, in the first place, is in relation to the allocation of scarce resources to involvement by Aboriginal people and to Indigenous people globally, to caring-for-country. And, in the second place, is in relation to addressing the global noncommunicable disease pandemic, when such actions are likely to have health and other external benefits.

The World Health Organization and the Australian Institute of Health and Welfare recognise the important role nonmedical primary-preventative intervention can play in the mitigation of noncommunicable disease. Contrary to this recognition, little has occurred in applying preventative health policies either in Australia or globally. This constitutes government policy failure. National policy failure can be a political response to public uncertainty as to the personal benefits of nonmedical preventative interventions, the short election cycle and special pleading by those with financial and professional interests in curative health. Nonmedical primary-preventative health policies are shown to result in healthier, longer lived

lives, with compression of morbidity till close to death resulting in an extension of the tax base and a reduction in health costs².

8.3 CONFOUNDING AND OTHER QUANTITATIVE RISKS

The reliability of the data and the estimated causative correlations on which economic assessments in Chapters 3 and 4 are based might be questioned, especially as the population samples are based on 'self-selected' non-equal probability samples. The Arnhem Land sample population, for example (Chapter 3), was identified as being healthier than the Arnhem Land population as a whole. This, however, is more likely to have weakened rather than strengthened the causative association between caring-for-country and expected improved health (Burgess et al. 2009). Estimated cost savings are therefore more likely to have been an under estimate rather than an over estimate.

Consideration also needs to be given in regard to the assumptions made and the representativeness of the two resident populations to the total remote to very remote Aboriginal population. The populations on which the studies included in chapters 3 and 4 are located reside in the environmental extremes of tropical northern Australia and the central Australian desert; while the Aboriginal populations in each region suffered different histories of colonisation. In addition-to-which, different methodologies were used, in the analysis carried out in chapters 3 and 4, in estimating the cost savings for the Arnhem Land and the central Australian populations. The relative consistency in estimated per capita savings in primary health care, across both populations, is indicative of qualitative consistency with expected outcomes for the Aboriginal population across remote to very remote Australia.

Confidence in the analytic results is further supported by an increasing number of associated case studies of Aboriginal people in remote to very remote Australia. These include the earlier studies by Morice (1976) and O'Dea (1984), and the later work by Garnet and Sithole (2007), plus, the studies referred to in the respective quantitative analyses: Burgess et al (2009; 2008), Rowley et al. (2008), and McDermott et al. (1998).

Understanding the causative relationship affecting the possible interrelationship linking caring-for-country with observed health outcomes is important. While differences in diet and

² Care needs to be taken in consideration of this relationship. As for example, an increase in human capital will not result in an increase in per capita productivity if such output is constrained through lack of complementary inputs (see the discussion in *The Economist*: 'Health and wealth: improved health does not always make countries richer' (Nov. 20th 2008), and Acemoglu et al (2003).

exercise are readily observed, the impact of variation in psychosocial stressors – including cultural connections, interconnection with family, and personal mastery and control, are not so readily observed. Although not a systematic review, a number of studies cited in the thesis engage with and help explain the impact of psychosocial stressors and how these stressors might be mitigated (see for example Fisher et al., 2016; Baum and Fisher, 2014; Fleming and Ledogar, 2008; Ledogar and Fleming, 2008; Daniel et al., 2006; Marmot et al., 1997, 2006; Daniel et al., 2005; Paradies, 2005; Wilkinson and Marmot, 2005; Daniel et al., 1999; Marmot et al., 1997). The healthy country benefits, are more readily observed than those achieved through ‘cultural connections, interconnection with family, and personal mastery and control’ (see for example Russell-Smith et al., 2009; Garnet & Sithole, 2007; Luckert et al., 2007).

8.4 EVALUATION OF POLICY APPLICATION

8.4.1 Identified benefits

For a government concerned in controlling increasing health costs and budgetary demands, the integration of nonmedical primary-preventative health interventions can result in a reduction in health costs and/or improved health outcomes and an expansion of the tax base. This can be achieved through the mitigation of noncommunicable disease, with people living longer, and the delay and compression of morbidity occurring later in life closer to death. Such delays in cost further discounts the health costs, with resources going to alternative uses in the interim. With people living a longer and healthier life, they are likely to be more productive, thus giving a greater return to investment in human capital and a possible increase in the tax base.

Scoping economies are realised through the multiple provision of jointly supplied private good and public good social benefits. To this is added the complementary economies through combining primary-preventative and curative health interventions, when shortfalls in each are compensated for by the strengths of the other.

8.4.2 Future steps

The joint issues of a continuing decrease in the health of Aboriginal people relative to the rest of the Australian population and loss of environmental services is set out in Chapter 2. Although a partial economic analysis, chapters 3 and 4 results still demonstrate how

participation in caring-for-country might result in substantial cost savings in primary health care as well as environmental benefits. Importantly, these results provide a strong indication of expected cost effectiveness for Aboriginal people and for society in general. International and national agencies are fully aware of the causative relationship role of the socioeconomic determinants and the role nonmedical interventions can play in overcoming this pandemic. Contrary to this recognition, however, there has been minimal applied follow-up by these bodies in integrating nonmedical primary-preventative health interventions within existing health programs.

The higher level of psychosocial stress and uncertainty as to future outcomes, as borne by Indigenous people, is an impediment to making healthier, longer term choices. At a national policy level, individuals can face uncertainty as to whether preventative health intervention is to their advantage. Married to this is the short-term election cycle, which creates a politically negative environment in which the long-term benefits of nonmedical primary-preventative health interventions would function. Added to this is special pleading of those with a professional and financial interest in curative health. Overcoming these impediments and creating the political environment in which nonmedical primary-preventative health policies are applicable, requires governments and the public being fully informed of the expected advantages.

Broad based economic studies, such as that by the Commission on the Social Determinants of Health (2008), are important to this realignment, as they provide background input to the interface between government and the public. Though limited in their scope and relating to a specific circumstance, the two studies presented in chapters 3 and 4 provide a positive example of the application of a nonmedical primary-preventative health intervention. More extensive studies are necessary across multiple nonmedical means of preventative health at national and regional levels. This is especially so if the allocation of resources between preventative and curative health intervention is to be optimised. Some of the principles to be applied in this process are set out in Chapter 7. This includes the need to account for the risks associated with not implementing such policy programs, as well as the risks associated with their implementation.

Two possible approaches to evaluating associated risks inherent in such programs can be through point estimation, as is applied in Chapters 3 and 4, or through application of a stochastic risk model. The application of both models could be rerun according to changes in

coefficient values and in the time discount rates. The application of higher discount rates, for example, will account for future uncertainty by decreasing the value placed on future returns (see Campbell 2012, pp 408, for a fuller explanation).

An alternative to point estimation is use of a stochastic model in which the expected distribution of returns across a probability distribution might be provided. Such modelling can be applied using a SAS Monte Carlo simulator model (Der, Everitt, 2015). Campbell and Hamal (1993) used this model to estimate expected returns for an Australian based albacore fishery according to alternative management and marketing options.

The focus in the economic studies was according to the health and environmental benefits of traditional land management. A possible methodological example might be according to the possible health benefits through differences in transport infrastructure. The infrastructure example given in Chapter 7 concerned the movement of people into and around Melbourne according to private road transport relative to public rail transport.

Consideration of health impacts in Australia, for example, have been included by *Infrastructure Australia* (2016), in its benefit/cost assessment of proposed infrastructure projects; their assessment of the proposed Melbourne to Brisbane rail link being a case in point – although questionable in regard to nonmarket impacts, such as differences in the impact of rail versus road transportation on the generation of greenhouse gases. These examples, however, include health impact as an ancillary element rather than being targeted as part of a broader based social public good policy requirement. Such refocusing would make greater allowance for factors such as anthropomorphic induced climate change, and the establishment of ‘walkable cities’ (New South Wales Government 2013; Lehman et al 2007). While such detailed analysis will likely involve increased cost, it is likely that identification of additional social benefits, such as through improvements in human capital through preventative interventions, could more than compensate for any such cost increase.

Policies aimed at economic optimisation in the integration of preventative and curative medical interventions will require assessment of the expected macro directions of change. International assessments in which such comparisons are carried out include the United Kingdom inclusion of subjective wellbeing when assessing public policy programs (Dolan et al., 2011). Subjective wellbeing includes most, if not all, of the factors affecting the psychosocial stressors. Such an approach could be included in assessing alternative approaches to preventative intervention. That is, as long as recognition is given to ensuring

subjective wellbeing, along with meeting other social demands, fit within national capital constraints, as defined in gross or net national product (Stiglitz et al. 2009).

Economic assessment of the impact of policy change at the macro level could be carried out using macro models such as Victoria University's Regional Model (VURM). This model is currently used by the Australian Productivity Commission to carry out macro impact assessments of national policies (Adams et al., 2015)³. The type of analysis that might be carried out using the VURM could include policy changes along the lines of:

- comparative long-run and short-run shifts in health costs, as a result of alternative changes in infrastructure, such as with private versus public transport;
- variation in population and demographic flows, when variation in the respective coefficient values are expected; and
- changes in labour force participation rates, and consequent expected changes in taxes raised.

Such analysis might be assessed, for example, according to variation in cost effectiveness across population descriptors, including Aboriginality and socioeconomic status, on a regional basis (Gretton, 2008). This analysis would provide macro data suitable for major policy change, as with optimal integration of preventative and curative health. The result of such studies can then be submitted to the Council of Australian Governments (COAG) to ensure coordination of state, territory and commonwealth policy roles (Anderson, 2008).

Finally, as noted, political constraints, including special pleading, are important limitations to the timing and application of nonmedical primary-preventative health policies. The creation of a fully informed public is important to overcoming such constraints. In achieving a fully informed public, the inclusion of policy assessments by organisations such as *Infrastructure Australia*, and COAG, can play an important role in achieving public acceptance. This will help overcome public uncertainty as to the personal implication of an optimally integrated preventative/curative health program, and counter special pleading or lobbying, by those with a financial interest in maintenance of the current emphasis on curative health. Important to defining financial interest is the personal interest in

³ 'The Productivity Commission is the Australian Government's principal review and advisory body on microeconomic policy, regulation and a range of other social and environmental issues. Its role, expressed simply, is to help governments make better policies in the long-term interest of the Australian community' (Australian Government Productivity Commission (2014)).

maintaining existing returns to existing human capital, as such policy change can decrease demand for medical based human capital.

Such disruption is likely to need careful consideration in policy development and application. Also important in the introduction of such a program is that combined preventative and curative costs are likely to initially increase, until associated demographic changes work their way through the system. In conclusion, these results provide firstly, a strong argument for a more extensive application of nonmedical primary-preventative health interventions, as characterised by caring-for-country; and secondly, a strong argument for the integration of nonmedical primary-preventative health interventions in addressing the global noncommunicable disease pandemic.

That the thesis is by publication means the core content has already been tested in the market of ideas. The results of this are shown in 'Table 1.2: Journal impact factor, and number of times articles have been referenced and read'. Four papers receiving particular note are 'Potential primary health care savings for chronic disease care associated with Australian Aboriginal involvement in land management' (Chapter 3), with 31 references and 27 reads; 'Responding to the Health Impact of Climate Change in the Australian Desert' (Chapter 5), with 27 references and 27 reads; 'Economic Rationality in Choosing Between Short-Term Bad Health Choices and Long-term Good Health Choices' (Chapter 6), with 36 references and 6 reads; and 'Economies through application of nonmedical primary preventative health: lessons from the healthy country, healthy people experience of Australia's Aboriginal people' (Chapter 7), which has received 25 reads within four months of publication. It is useful to note that referencing of these papers is not necessarily dependent on the impact factor in which the paper has been published.

I suspect an important factor affecting the take-up of the publications that form the body of the thesis, is the different perspectives or additions to the thinking concerning the national and international policy issues covered in the thesis. Henryks, Brimblecombe (2016), for example, in their review of the factors affecting food consumption in remote Indigenous communities, cites Campbell (2013), Chapter 6, in setting out an economic perspective to this question.

POSTSCRIPT

WHAT ARE WE
FOOLS TO BE
CLIMBING UP
THIS SHEET OF GLASS
THE WORLD
FOR WHICH TO SEE
WHEN WE CAN
STAND HERE BELOW AND
BEHOLD ALL WE WISH
TO KNOW?

AND WHEN THE NIGHT IS OVER
AND WHEN THE DAY IS DONE
SHALL OUR SILENT PASSING
BE NOTED BY A LOVED ONE
OR SHALL ALL OUR YEARNING
TO BETTER BE
PASS AWAY WITH HISTORY
ALONG WITH YOU AND ME?

SHALL THE KNOWLEDGE WE HAVE GATHERED
AND THE SKILLS WE HAVE POSSESSED
GIVE US PEACE AND HAPPINESS
WHEN WE ARE LAID TO REST?

David Campbell (1978, p. 95)

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