Analysing the link between noncommunicable diseases and happiness: evidence, policy and lessons from Bhutan

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Thesis by published works
Submitted in fulfilment of the requirements of the degree of
Doctor of Philosophy

Sydney School of Public Health
Faculty of Health and Medicine
University of Sydney
July 2018
Declaration

This thesis is submitted to the University of Sydney in fulfilment of the requirements for the Degree of Doctor of Philosophy.

To the best of my knowledge, the work presented in this thesis is original. I carried out the research and compilation of this thesis under the supervision of Professor Dr. Mu Li, Sydney School of Public Health, University of Sydney, Dr Anne Marie Thow, Menzies Centre for Health Policy, University of Sydney; and Associate Professor Li Ming Wen, School of Public Health, University of Sydney and Health Promotion Unit, Sydney Local Health District, New South Wales, Australia.

The secondary data from Ministry of Health and the Centre for Bhutan Studies and Gross National Happiness Research has been availed with due administrative approval from the respective organizations.

Assistance received in preparing the thesis and all sources have been acknowledged. My specific contributions to jointly authored papers are outlined in the relevant chapters.

I have not submitted this material, either in full or in part, for degree at this or any other institution.

Gyambo Sithey

Date: 29 July 2018
Acknowledgments

I would like to first thank and acknowledge my supervisor, Professor Mu Li and my associate supervisors, Dr. Ann-Marie Thow and Dr. Li Ming Wen. Their wisdom, encouragement and patience made this project possible. I would also like to thank the Australian Endeavour Postgraduate Scholarship which enabled me to undertake this PhD program.

My thanks also go to Dorji Penjore (PhD) and Tshoki Zangmo of Centre for Bhutan Studies for facilitating the GNH data. I also thank the Ministry of Health, Bhutan for providing the 2014 NCD STEPS data.

My profound gratitude goes to Apa Tshering & Karma Lhadon, my niece Namgay Bidha, nephew Namgay Dorji of Bhutan Majestic Travel and my beloved friend Tshering Tenzin (Tashikee) and Ashley Perera.

Finally, but by no means least, thanks go to my wife Pema Dema, my four children, my elder brother Chencho Dorji (for taking care of our mother), Namgay Retty and my mother Chencho Om. They are the most important people in my life.
Authors Contribution

The candidate conducted the work presented in this thesis under the supervision of Professor Dr. Mu Li, Dr. Anne Marie Thow and Associate Professor Dr. Li Ming Wen. The original idea and the objective of the study was conceived by the candidate. Finalisation of the study objective and methods were agreed between the candidate and his supervisory team during the course of the study.

For all the quantitative and qualitative analysis presented in this thesis the candidate availed the data from the Ministry of Health and Centre for Bhutan Studies and GNH centre, analysed the data, interpreted results and drafted and revised the manuscript for submission to peer-reviewed journals. The specific contribution of co-authors to each manuscript is provided in the Chapter Three through Nine. Professor Dr. Mu Li and Anne-Marie Thow provided editorial guidance in the draft of the Introduction (Chapter Two) and Conclusion (Chapter Ten). The candidate wrote and compiled this thesis.
Ethical Clearance

Gross National Happiness survey of 2010 and 2015 and the STEPS 2014 noncommunicable disease survey were reviewed and cleared by the National Statistic Bureau of Bhutan and the Research Ethics Board of Health respectively.

For our secondary data analysis, we were provided with randomly coded data that has no identifying information. Administrative approvals were granted by Ministry of Health and Centre for Bhutan Studies and Gross National Happiness Research, Thimphu Bhutan.
Abbreviations

CMD : Common Mental Disorders
CVD : Cardiovascular Diseases
DOPH : Department of Public Health
GNH : Gross National Happiness
GNHC : Gross National Happiness Commission
GNH PST : Gross National Happiness Policy Screening Tool
GHQ : General Health Questionnaire
HMIS : Health Information Management System
MOH : Ministry of Health
NSB : National Statistical Bureau of Bhutan
ORC : Out Reach Clinic
NCD : Non-Communicable Disease
RGOB : Royal Government of Bhutan
SRH : Self-Reported Health Status
VHW : Village health Volunteers
WHO : World Health Organization
Glossary of terms used in this thesis

Centre for Bhutan Studies and Gross National Happiness: Centre for Bhutan Studies is a social science research institute established in 1998. It is the primary institute entrusted by the government of Bhutan to develop GNH Index, indicators and to conduct the periodic GNH surveys.

Gross National Happiness Index: A summary statistic of the wellbeing of individuals in nine domains computed by 33 indicators & 124 variables using the formula; GNH Index = H^H + ( H^U * A^{U_{suff}}). (Page 27 to 36 of the reference, ‘An extensive analysis of GNH Index’ gives the details calculation of the GNH Index)

Gross National Happiness domains: Broad specification of the areas of concern for well-being in Bhutan. (See the list of nine domains in Chapter 2, Table 1)

Gross National Happiness determinants: 22 subjective and objective factors that influence the GNH domains and the GNH Index. The Centre for Bhutan Studies and GNH research developed them in 2010. (See the list of GNH determinants in Chapter 2, Table 1)

Gross National Happiness indicators: There are 33 GNH indicators. They are statistically robust and they measure the progress of GNH domains. These indicators reflect the Bhutanese values. (See Appendix 5, The 33 GNH indicators, their construction and justification. Reference 8, An extensive analysis of GNH Index, K.Ura)

Gross National Happiness Framework: In this thesis, GNH framework refers to nine GNH domains and their indicators and the GNH protocol for policy formulation including the GNH policy screening tool.
**Gross National Happiness Commission:** The Gross National Happiness Commission (GNHC), known as the Planning Commission until 2008, is the coordinating agency that implements Bhutan’s five-year development plan. It is the central government body for coordinating policy formulation to ensure cohesion between sectoral policies and alignment with the national development objectives and GNH.

**Gross National Happiness multisectoral committee:** A heterogeneous group of 15 experts from relevant sectors and agencies selected by Gross National Happiness Commission to review the policy under consideration using the GNH policy screening tool (Reference 8, The experience of GNH as development framework, K. Ura).


**Health:** ‘as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’ (World Health Organization, 1948).

**Noncommunicable diseases (NCDs):** Noncommunicable diseases, also known as chronic diseases are diseases of long duration and generally slow progression. The four main types of noncommunicable diseases are cardiovascular diseases (like heart attacks and stroke), cancer, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes (World Health Organization, 2013, 2018c).

**National NCD action plan:** Multisectoral national action plan for the prevention and control of NCDs, 2015-2020, Bhutan.
Abstract

Background

Noncommunicable diseases (NCDs), such as cardiovascular diseases, cancer, diabetes and chronic respiratory diseases, are the leading global causes of death, they are responsible for 70% of deaths worldwide. (World Health Organization, 2017b) In 2015, almost three quarters of all NCD deaths (30.7 million) occurred in low-and middle-income countries. (World Health Organization, 2018a) To strengthen national efforts to address the burden of NCDs, the 66th World Health Assembly endorsed the ‘Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020’ (here after referred as the global NCD action plan). The global NCD action plan provides Member States with a road map and menu of policy options which, when implemented, will achieve 9 global NCD targets, including a 25% relative reduction in premature mortality from NCDs by 2025. (World Health Organization, 2013)

Progress in the prevention and control of NCDs is uneven and insufficient. (World Health Organization, 2017b) Factors impeding the implementation of global NCD action plan spans from lack of political commitment and leadership to unmet needs and demands for technical assistance, and to inadequate fund and limited progress in engaging non-health sectors. (Alwan, 2017) This underscores the need and challenges for countries to scale up actions for prevention and control of NCDs. Responding to these NCD challenges, Bhutan Government developed the “Multisectoral national action plan for the prevention and control of NCDs, 2015-2020’ (here after referred as the national NCD action plan) and the Council of Cabinet Ministers endorsed this plan in 2015.

The main aims of my thesis is to generate evidence to support NCDs as a policy priority and to provide action oriented recommendations to strengthen prevention and control of NCDs through strategic engagement with Gross National Happiness (GNH).
Methods

This research used mixed methods, incorporating both quantitative and policy analysis methods. For the quantitative component, we analysed three national level data sets. First, we availed the 2014 national NCD STEPS data from the Ministry of Health, Bhutan. Second, we availed the 2010 and 2015 national data on Gross National Happiness. The logistic regression analysis (Paper 1 and Paper 3) and General Estimate Equation (Paper 2) were used. The statistical analyses were carried out using STATA (Paper 1 and Paper 2) and SAS (Paper 3).

For the policy analyses, an extensive literature review was conducted on health and happiness (Paper 4, Paper 6 and Paper 7). Then we analysed Bhutan’s GNH Index in conjunction with the global NCD prevention and control objectives to identify strategic policy opportunities where action on NCDs could be improved through engagement with GNH. In a stepwise process, we firstly established the linkage between GNH determinants and the health (Paper 5). In the second step we identified the shared agendas, determinants and specific policy questions that can integrate the NCD policy priorities into relevant policies across sectors (Paper 6).

Results

The subject of well-being and happiness has gained political momentum and the attention of political leaders. In addition health is the single most important determinant of wellbeing and adverse health conditions have lasting and negative effect on well-being (Paper 4).

Analysis of the 2014 national NCD STEPS data found that the prevalence of modifiable risk factors of NCDs namely; tobacco use, harmful use of alcohol and low fruits and vegetables intakes were 24.8% (95% CI: 21.5, 28.5), 42.4% (95% CI: 39.4, 45.5) and 66.9% (95%CI: 61.5, 71.8), respectively. Similarly, the prevalence of metabolic risk factors like overweight,
hypertension and diabetes were also very high, 32.9% (95% CI: 30.0, 36.0), 35.7% (95% CI: 32.8, 38.7) and 6.4% (95% CI: 5.1, 7.9), respectively (Paper 1). At the same time, the least often studied form of NCDs, the common mental disorders, was highly prevalent in Bhutan (Paper 2).

Admittedly, we also found that socioeconomic factors were significantly associated with overweight/obesity, hypertension, diabetes, symptoms of common mental disorders and the sleep duration (Paper 1, 2 and 3). For example, we observed that older age groups and tobacco users are more likely to be overweight, hypertensive and diabetic. Likewise, our analysis (Paper 2) confirmed the importance of established socio-economic risk factors for Common Mental Disorder (CMD), and suggested a potential link between spiritualism and mental health.

Further, our in-depth analysis of GNH and global NCD action plan (Paper 6) identified five shared agendas between prevention and control of NCDs and GNH. They are 1) prevention of premature deaths and disability due to NCDs 2) strengthening leadership and governance for policy prioritization 3) mainstreaming social determinants of health in all relevant policies 4) strengthen research and development and 5) monitoring the policy impact on health and GNH determinants. These shared agendas can be integrated into policies across relevant sectors by asking specific policy questions on shared GNH determinants namely, health, education, decision making opportunities, engagement in productive activities, economic security, time use and balance, material well-being, social support, equity and transparency (Paper 5 and 6).

Analysis of the linkage between health domain and GNH determinants demonstrated that policy impact on GNH determinants can adversely affect health (Paper 5).
Conclusions

The research conducted in this thesis contributes to measuring NCDs as a major public health problem in Bhutan; highlights that the prevention and control of NCDs can be addressed as a whole-of-government approach by identifying shared agendas and determinants between the NCDs and Gross National Happiness (Paper 7).
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To parents of past, present and future.
Chapter 1: Thesis overview

**Analysing the link between health and happiness: evidence, policy & lessons from Bhutan.**

1. Introduction
   - Setting the context & objective of the thesis.

2. What evidence is there to support that NCDs are policy priorities in Bhutan?
   - Prevalence & risk factors of NCDs
   - Prevalence and factors associated with Mental Health.
   - Sleep duration and its association with self-reported health status.

3. How can health sector integrate NCD policy priorities into Gross National Happiness?
   - Linking health & GNH: a policy guide for health sector
   - Identifying shared agenda & determinants between prevention and control of NCD & GNH.

4. Discussion and Conclusion
   - Addressing NCD policy priorities as whole-of-government approach by strengthening GNH.
This thesis responds to the epidemiological transition in Bhutan, which is characterised by a shift from high morbidity and mortality due to infectious diseases, to increasing mortality from noncommunicable diseases. About 62 percent of disease burden in Bhutan is now attributed to NCDs. (World Bank, 2011)

In 2013, World Health Assembly passed the ‘Global action plan for the prevention and control of noncommunicable diseases 2013-2020’. (World Health Organization, 2013 ) This plan provides a road map of policy options which when implemented will contributed to progress on 9 global NCD targets, including a 25% relative reduction in premature mortality from NCDs by 2025. Building on the global NCD action plan, the Government of Bhutan developed its own ‘Multisectoral national action plan for the prevention and control of NCDs, 2015-2020’ in 2015.

However, much of this plan is still not costed and NCD prevention and control is not included into one of the 6 planned flagship programmes of the 12 Five Year Plan.(UN Interagency Task Froce on NCDs, 2017) Flagship programs are considered as major means to achieve the GNH with a tentative budgetary allocation of Nu.15 billion.(GNH Commission, 2016)

Bhutan is a global leader in pursuing the Gross National Happiness (GNH), which shifts the emphasis from measuring economic production to measuring people’s happiness(Ura, 2015; Ura, Alkire, Zangmo, & Wangdi, 2012b). GNH consists of nine domains, 33 indicators and 22 determinants. Health is a domain as well as an indicator in the GNH. All policies in Bhutan must ensure to advance the nine domains of GNH.
In this thesis, I address two research questions:

1) What evidence is there to support NCDs as a policy priority for achieving the Gross National Happiness?

2) How can the health sector strategically engage with GNH, and with the associated policy processes, to strengthen action on NCDs?

I have addressed these questions through a mixed-methods study that draws on quantitative and qualitative (policy analysis) methods. Detailed methods are explained in Chapter 2.

This is a Thesis by Publication. There are 6 published papers and 1 under review. The publications are organised as chapters in three sections.

In Section I, I present NCDs as public health problem and that NCD prevention and control is a policy priority in Bhutan.

In Section II, I present policy analysis to action prevention and control of NCDs as a whole-of-government approach.

In Section III, I discuss and summarised how this thesis answers my overarching research question on how health sector can strategically engage with Gross National Happiness to strengthen action on NCD prevention and control.

**Thesis context**

The context of the thesis is situated specifically in Bhutan. The Introduction presents existing data regarding the epidemiological transition in Bhutan, particularly the existing evidence for the burden of NCDs and introduces the concept of GNH (GNH pillars and GNH domains), its measurement (GNH Index & GNH indicators) and the GNH policy tools (protocol for GNH policy formulation, GNH policy screening tools and the GNH determinants).
Section 1. New evidence on NCDs in Bhutan

In this Section, I present new evidence of the prevalence of NCD risk factors and their association with sociodemographic factors. The evidence highlights NCDs is a major public health problem in Bhutan, requires a whole-of-government approach for NCDs prevention and control. This section consists of three papers.

Paper 1 presents prevalence of key metabolic risk factors for NCDs in Bhutan, including high blood pressure, overweight and raised blood glucose level and their association with modifiable and sociodemographic risk factors.


Paper 2 presents the magnitude and the determinants of common mental disorders (CMDs) in Bhutan; an often-overlooked non-communicable disease. The paper discusses the potential effects of sociodemographic factors, disability, self-reported health status and spirituality on mental health. It confirms that mental health is an emerging issue that requires political commitment and policy priority.


Paper 3 reveals that both shorter (≤ 6 hours) and longer (≥ 11 hours) sleep durations were associated with poor self-reported health status. This finding is significant as it highlights
sleep duration as an emerging lifestyle related health risk behaviour even in a developing country.


**Section II:** Addressing NCDs prevention and control through a whole-of-government approach.

This section presents policy analysis particularly focussed on strengthening policy action on NCDs across sectors through engagement with the GNH policy agenda. Drawing on the studies presented in Section I, it is clear that the prevention and control of NCDs is essential for achieving GNH. This policy analysis identified strategic policy opportunities to integrate the national NCD action plan into policies across all relevant sectors via the policy processes associated with GNH.

This section includes three papers (Paper 4, 5, 6) which describe how the health sector can strategically engage with GNH to address prevention and control of NCDs as a whole-of-government approach.

**Paper 4** explains the link between health and happiness, and establishes the rationale (at the global level) for strengthening action on health, including NCDs, as a critical contributor to happiness. This paper summarises the recent political momentum for GNH, the evidence linking health and happiness at the global level, and the policy implications for NCDs.

**Paper 5** defines the GNH determinants from health policy perspective and articulates the policy impact on health. It also provides an in-depth analysis of the link between the GNH domain ‘health’ and the GNH determinants. We particularly divulge on how health sector can articulate the GNH determinant to raise policy priority for prevention and control of NCDs through specific policy questions. All policy makers can use this as an important reference for policy development, especially policies that have health impact.


**Paper 6** analyses the synergies between health and GNH domain and the six objectives of the global NCD action plan. We explain how the health sector can engage with GNH to address the prevention and control of NCDs. We identified shared agendas and shared determinants between prevention and control of NCDs and GNH. This paper also highlights strategic opportunities to address health in other jurisdictions where happiness is on the national agenda, or where action on health could be improved through engagement with other existing multisectoral platforms.


**Section III: Discussion and conclusion**
**Paper 7** brings the whole thesis together and is particularly relevant for policy makers in Bhutan. It explains how health sector can establish the need for action on NCDs as a policy priority by engaging with the GNH.


Chapter 10 (Conclusion) provides the summary of the finding of this thesis and concludes by providing recommendations for future research.
Chapter 2: Introduction

This thesis focuses on Bhutan and its developmental philosophy of Gross National Happiness (GNH). It arises from the premise that GNH provides whole-of-government approach to policy formulation and implementation. Bhutan is increasingly beset by noncommunicable diseases. However, at present, there is no explicit consideration of NCD policy priorities as necessity to achieving GNH. (Ministry of Health, 2015a; World Health Organization, 2017a) This has the potential to limit Bhutan’s ability to achieve its policy goals of improving GNH. This thesis supports health sector’s endeavour to address prevention and control of NCDs in line with Bhutan’s unique developmental philosophy of GNH.
1. Bhutan

Bhutan is a small land locked kingdom nestled in the Eastern Himalayas between two populous countries, India and China (Figure 1). The Himalayas form a formidable natural boundary in the north and the plains of India border the southern part of the country. It has a total area of 36,394 km$^2$, spanning roughly 170 km north to south and about 300 km east to west, and a population of 768,577. (National Statistics Bureau, 2016) The elevation ranges from about 180 meters in the south to more than 7,550 meters in the North. The country’s terrain is mountainous and rugged with beautiful valleys, fortified monasteries and pristine environment.

Seventy-five percent of the land mass is covered by forest and only 2.9% is under cultivation. Bhutan is one of the global biodiversity hotspots and a carbon negative country. The culture of Bhutan is deeply immersed in the traditions of Buddhism. Due to its remoteness and isolation, it has managed to preserve its unique culture, it therefore, has been referred to as the last Shangri-la. (Phuntsho, 2013)

The main ethnic groups of Bhutan are Ngalops, Sharchops, and Lhotshampas. Dzongkha is the national language and English is the medium of instruction in schools and institutions. The country is administratively divided into 20 Dzongkhags (districts) which are further divided into 205 Gewogs (blocks). Bhutan has never been colonized,(Choden & Penjore, 2004; Dorji Penjore, 2004) it became an absolute monarchy in 1907 with the enthronement of the first King.(Aris., 1995; Kinga, 2009) After 100 years of peaceful monarchy, Bhutan smoothly transitioned into democratic and parliamentary form of government in 2008.(The constitution of the kingdom of Bhutan, 2008) The form of government is Democratic Constitutional Monarchy. Bhutan’s political environment is stable and is rated the 12 most peaceful countries in the world.(Tshering Palden, Kuensel)
The process of modern development started only in 1961 with the commencement of first five-year plan. Since then it has made an enormous progress, achieving human development indicators that put it at par with the rest of South Asian nations.

**Figure 1:** Bhutan map showing the international boundary

Source: This map is generated using [https://maphub.net/](https://maphub.net/) which allows one to create interactive map for sharing.
Today more than 90% of the population has access to primary health care,(Sharma, Zangpo, & Grundy, 2014) 97.7% of the households have access to safe drinking water,(Ministry of Health, 2012) 80% of school-age children are enrolled in primary school and 66% are literate.(National Statistic Bureau, 2017) Life expectancy is 69.5 years.(World Health Organization, 2017a) The country’s unemployment rate is estimated at 2%.(National Statistic Bureau, 2017)

Bhutan has one of the smallest but fastest growing economies in the world. Annual average growth between 2006 and 2015 was estimated at 7.5%.(World Bank, 2017) The GDP per capita in 2016 was USD 2879.(National Statistic Bureau, 2016) The country’s economy is aid-dependent and predominantly driven by hydropower sector. Bhutan’s currency, Ngultrum (Nu), is pegged on a par with Indian Rupees.

2. Gross National Happiness

Overall, Bhutan’s socioeconomic development is guided by four pillars of Gross National Happiness, which seeks to institute metrics outside of economics into measures of development. The development efforts in Bhutan set out to integrate these principles, to bring comprehensive development, balancing environmental sustainability, social well-being and spirituality.

GNH is a development philosophy which was first introduced in 1972 by His Majesty the King Jigme Singye Wangchuk.(Ura et al., 2012b) Since then, the country has oriented its national development towards achieving the Gross National Happiness. There is no single definition of GNH, the most commonly cited is, “GNH measure the quality of a country in more holistic way [than GNP] and believes that the beneficial development of human society takes place when material and spiritual development occur side by side to complement and reinforce each other”.(Ura et al., 2012b)
Similarly, in 2012 His Majesty the King stated, “today, GNH has come to mean so many things to so many people but to me it signifies simply - Development with Values. Thus for my nation today GNH is the bridge between the fundamental values of kindness, equality and humanity and the necessary pursuit of economic growth.”

Article 2 of the Constitution of the Kingdom of Bhutan directs the State “to promote those conditions that will enable the pursuit of Gross National Happiness” (The constitution of the kingdom of Bhutan, 2008)

In essence, GNH is a holistic and sustainable approach to development, which aims to increase the “well-being” of the population by balancing the nine domains (Table 1) i.e. the social, economic, environmental and cultural needs of the people.

3. GNH pillars, domains, indicators and index

GNH is best understood through its four pillars, nine domains and 33 indicators (Table 1). The four pillars are; good governance, sustainable socio-economic development, cultural preservation, and environmental conservation. These pillars are further divided into nine domains to reflect the holistic range of GNH values. The domains are psychological well-being, health, time use, education, cultural diversity and resilience, good governance, community vitality, ecological diversity and resilience and living standard. Each domain is further measured by specific number of indicators (Table 1). For example the domain ‘health’ is measured by four indicators i.e. self-reported health status, healthy days, disability and mental health (Table 1).

GNH is measured by a multidimensional mechanism called GNH Index. The GNH Index measures the population well-being by starting with each person’s achievement in each of the GNH indicators, using the Alkire-Foster methodology, a multidimensional approach for
measuring wellbeing index. (Ura et al., 2012b) Overall, the GNH Index identifies four groups of people i.e. unhappy, narrowly happy, extensively happy and deeply happy. Further details of GNH measurements are described in chapter 8, paper 6 of this thesis. In addition to GNH and GNH Index, Bhutan has stream-lined the protocol for GNH policy formulation including screening of all policies using the GNH policy screening tool.

4. Protocol for GNH policy formulation

All policies in Bhutan with the exception of a Royal Command or national exigencies have to be originated as a concept note and approved by the Council of Cabinet Ministers based on recommendations from the Gross National Happiness Commission (GNHC). (Cabinet Secretariat, 2015) Upon approval of the concept note, the process commences with the policy formulation and the draft policy submitted to the GNH Commission. The GNH Commission reviews the draft policy and circulates the draft to all relevant sectors and even publishes draft policies online, for the public to comment. After incorporation of the comments and agreement between the relevant sectors and GNHC, the revised draft will be subjected to GNH policy screening tool, exercised by a 15-member multisectoral committee constituted by the GNH Commission. This committee will score all elements of the policy on a scale 1 to 4. The policy along with the screening results is submitted to the cabinet for approval. The detailed process of GNH policy formulation is provided in Appendix A. Since 2010, as per the approved policies listed on the GNH commission website, 2 health policies have been approved. (Gross National Happiness Commission, 2018) They are ‘National health policy, 2011’ and the ‘National policy and strategic framework to reduce harmful use of alcohol, 2015-2020’. (Ministry of Health, 2011, 2015b)
Table 1: GNH Domains, indicators and the determinants. (Gross National Happiness Commission, 2016)

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<tr>
<th>Domains of GNH (9)</th>
<th>GNH indicators (33)</th>
<th>GNH determinants(22)</th>
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<tbody>
<tr>
<td>1. Living Standard</td>
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<td>2. Good Governance</td>
<td>8. Literacy</td>
<td>5. Decision making opportunity</td>
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<td>9. Schooling</td>
<td>6. Anti-corruption</td>
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<td>10. Knowledge</td>
<td>7. Legal recourse</td>
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<td>11. Value</td>
<td>8. Rights</td>
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<td></td>
<td>Health Status</td>
<td>10. Transparency</td>
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<td>13. Healthy days</td>
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<td>14. Disability</td>
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<td>15. Mental Health</td>
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<td>17. Urban issues</td>
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<td>towards environment</td>
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<td>issues</td>
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<td></td>
<td>21. Safety</td>
<td>17. Family</td>
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<td>22. Community</td>
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<td>relationship</td>
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<td>23. Family</td>
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<td>25. Sleep</td>
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<td>(artistic skills)</td>
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<td>20. Values</td>
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<td>22. Stress</td>
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<td></td>
<td>28. Speak native</td>
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<td></td>
<td></td>
<td>language</td>
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<td>29. Driglam Namzha</td>
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<td></td>
<td></td>
<td>31. Life satisfaction</td>
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<td></td>
<td></td>
<td>32. +ve emotions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33. -ve emotions</td>
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</table>
5. GNH Policy Screening Tool and its implementation process

GNH policy screening tool (Appendix B) is a matrix which allows the GNHC and the 15-member multisectoral committee to screen the impact of the policy on GNH. The purpose is to assess the effect of the policy on GNH determinants so that all possible mitigations by way of revisions and negotiations with the relevant sectors are explored.

During the GNH policy screening, the multisectoral committee will score the GNH determinants from one to four. One denotes negative impact, two uncertain, three neutral and four denotes positive impact. The minimum score for the policy to be approved is 66 points (3x22), below which the policy would require changes to be made to acquire the minimum points or result in rejection. Those policies which attain the minimum score will be submitted to the Cabinet for final approval.

This approach mandates that all GNH domains and determinants are considered in the policy and consequently, supports a holistic approach to policy development. Health is both a domain and a determinant in the GNH. Therefore, GNH policy screening tool provides a platform for health sector to assess the impact of policies on health. It also provides an opportunity for health sector to ensure policy coherence in addressing health priorities.

6. Health care system in Bhutan

All mainstream health services are provided by the government. They are free of charge at the point of use. (Sharma et al., 2014) Government resources fund around 75% of the health spending in the country, insurance schemes fund only about 0.75% and out of pocket by private citizens stands at 25%. (Ministry of Health and World Health Organization, 2016) The Government is mandated under the Constitution (promulgated in 2008) to “provide free access to basic public health services in both modern and traditional medicines”.

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constitution of the kingdom of Bhutan, 2008) This constitutional responsibility is discharged through a three-tiered health care delivery system, with primary healthcare provided at the Basic Health Units (BHU), secondary healthcare at the district hospitals, and tertiary healthcare at the regional and national referral hospitals. At present, there are 31 hospitals providing both allopathic and indigenous medical care, 235 Basic Health Units (BHUs), 562 Out Reach Clinics (ORC) and 54 indigenous units spread over 205 gewogs (blocks) throughout the country (Refer to Figure 2). (Ministry of Health, 2016) There are 251 medical doctors, 147 drungtshos and menpas (Indigenous Physicians), 1105 nurses, 548 health assistants and 965 technicians providing health care services in these facilities. (Ministry of Health, 2016)

**Figure 2:** Bhutan map showing health facilities across 20 districts.

Source: Annual Health Bulletin, MoH. (Ministry of Health, 2017) With permission from Policy and Planning Division, Ministry of Health, Bhutan
Currently, there are 3.3 doctors per 10,000 populations and the ratio of hospital bed per 10,000 populations is 1.8. (Ministry of Health, 2017) About 95% of the population lives within 3 hours by any means of travel to the nearest health facility. (World Health Organization, 2017a)

Overall, the health system is decentralised with the central government managing the overall planning, while local governments identify the needs and implements policies and programs accordingly.

7. Health situation and epidemiological transition

Bhutan has made a considerable progress in improving the health status of its people in recent decades (Table 2). Life expectancy at birth has increased from 32 years in 1960 to 69 years in 2014. Maternal deaths have declined from 255 deaths per 100,000 live births in 2000 to 86 in 2012, under-five death rate has decreased from 84 per 1000 live births to 37.3. Skilled birth attendance has increased from 23.7% in 2000 to 89% in 2016, and immunization coverage is sustained above 94.4%. (World Health Organization, 2017a) Access to safe drinking water is 97.7% and 66.3% of the households have access to improved sanitation facilities. (Ministry of Health, 2012)

<table>
<thead>
<tr>
<th>Table 2: Summary of Key Health Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Health Facilities</strong></td>
</tr>
<tr>
<td>Life expectancy at birth (years)</td>
</tr>
<tr>
<td>Crude birth rate</td>
</tr>
<tr>
<td>Crude death rate</td>
</tr>
<tr>
<td>Total fertility rate</td>
</tr>
<tr>
<td>Maternal mortality ratio (per 100,000 live births)</td>
</tr>
<tr>
<td>Infant mortality rate (per 1000 live births)</td>
</tr>
<tr>
<td>Under 5 mortality rate (per 1000 live births)</td>
</tr>
<tr>
<td>Deliveries attended by skilled health personnel (%)</td>
</tr>
<tr>
<td>Access to health services</td>
</tr>
</tbody>
</table>


Despite the achievements, Bhutan, like other countries in South Asia, is undergoing an epidemiological transition with a persistent high prevalence of communicable diseases and rising prevalence of noncommunicable diseases (NCD). (Kinga Dema, 2015; Ministry of Health, 2014, 2017) The annual administration report compiled by Health Information Management System (HIMS) report showed that diarrhoeal diseases, skin and respiratory infections are the top three causes of morbidity (Table 3). On the other hand, NCDs are steadily increasing (Table 4).

**Table 3:** Trends of top 10 morbidity indicators, 2011-2015

<table>
<thead>
<tr>
<th>Diseases</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhoea*</td>
<td>2257</td>
<td>2368</td>
<td>1927</td>
<td>2244</td>
<td>2004</td>
</tr>
<tr>
<td>Skin infections*</td>
<td>1463</td>
<td>1444</td>
<td>1316</td>
<td>1335</td>
<td>1218</td>
</tr>
<tr>
<td>Pneumonia *</td>
<td>974</td>
<td>1204</td>
<td>1080</td>
<td>1138</td>
<td>905</td>
</tr>
<tr>
<td>Hypertension**</td>
<td>325</td>
<td>375</td>
<td>409</td>
<td>469</td>
<td>458</td>
</tr>
<tr>
<td>Conjunctivitis**</td>
<td>487</td>
<td>529</td>
<td>564</td>
<td>567</td>
<td>395</td>
</tr>
<tr>
<td>Diabetes**</td>
<td>53</td>
<td>57</td>
<td>80</td>
<td>134</td>
<td>164</td>
</tr>
<tr>
<td>Intestinal worms*</td>
<td>186</td>
<td>133</td>
<td>129</td>
<td>118</td>
<td>96</td>
</tr>
<tr>
<td>STD/STI **</td>
<td>12</td>
<td>41</td>
<td>59</td>
<td>72</td>
<td>92</td>
</tr>
<tr>
<td>Alcohol liver diseases**</td>
<td>29</td>
<td>29</td>
<td>36</td>
<td>42</td>
<td>41</td>
</tr>
</tbody>
</table>

Source: Annual Health Bulletin 2016

*Incidence per 10,000 under five children.
**Incidence per 10,000 population

**Table 4: Number of cases of noncommunicable diseases**

<table>
<thead>
<tr>
<th>Types of cases</th>
<th>2012</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>4097</td>
<td>12120</td>
</tr>
<tr>
<td>Hypertension</td>
<td>27023</td>
<td>30260</td>
</tr>
<tr>
<td>Ischemic Heart Diseases</td>
<td>447</td>
<td>352</td>
</tr>
<tr>
<td>Rheumatic Heart Disease</td>
<td>718</td>
<td>920</td>
</tr>
<tr>
<td>Cataract</td>
<td>885</td>
<td>841</td>
</tr>
<tr>
<td>Alcohol Liver Diseases</td>
<td>2059</td>
<td>3508</td>
</tr>
</tbody>
</table>

Source: Annual Health Bulletin 2017
8. Burden of Noncommunicable Diseases

NCDs now account for about 69% of all deaths in Bhutan making it the leading cause of all preventable deaths. (World Health Organization, 2018b) The rapidly growing burden of NCDs is expected to increase further as Bhutan is still in the early stages of demographic transition. (Ministry of Health, 2015a; World Bank, 2011)

With decreasing overall death rates and increasing life expectancy, the population projection estimates a rise in the population 65 years and above to 7.3% by 2025. (Ministry of Health, 2015a)

This requires a renewed and focused approach in risk factor reduction, prevention, control and management of NCDs, both within and outside of the health sector.

The STEPS 2014 study revealed that 33% of the adult population were overweight, 35.7% with raised blood pressure (SBP ≥140 and/or DBP ≥90 including those on medication) and 6.4% were diabetic (blood glucose ≥ 126 mg/dl including those on medication). (Ministry of Health, 2014) The study also reported that 24.8% of the adult population were currently smoking or chewing tobacco products, 42.4% were consuming alcohol, 66.9% did not consume sufficient fruits and vegetables (consumed < 5 servings of fruits and vegetables on average per day) and 6.4% had insufficient physical activity (defined as <150 minutes of moderate-intensity activity per week). (Ministry of Health, 2014)

Diabetes, hypertension and alcohol induced liver diseases increased exponentially between 2012 and 2016, (Ministry of Health, 2017) and alcoholic liver disease is the leading cause of death in hospitals. (Ministry of Health, 2017) Similarly, the incidence of cancer per 100,000 population had increased from 43.7 in 2010 to 101.2 in 2014. (Ministry of Health, 2017)

Among deaths caused by NCDs, cardiovascular diseases are responsible for the majority of
cases (28%), followed by cancer (9%), respiratory diseases (6%) and diabetes (2%)(Ministry of Health, 2015a). Cancer, Chronic rheumatic heart diseases and renal failure are the top three conditions refereed abroad and the cost of referral is borne by the government. (World Health Organization, 2017a) This makes NCDs Bhutan’s biggest health burden.

9. Current approaches to prevention and control of NCDs in Bhutan

In accordance with the National Health Policy 2011, all NCD prevention and control activities are integrated into the general health-care delivery system and delivered to communities through a network of district hospitals, Basic Health Units, and a system of monthly Out Reach Clinics conducted by the health centres and village health volunteer workers.

Further, Bhutan has adopted a number of policies and regulations that address the prevention and control of NCDs. Concerns of NCDs are deeply reflected in existing national legislations, policies and strategies. The Tobacco Control Act passed in 2010 banned the cultivation, import and sale of all tobacco products. The National Health Policy, 2011 recognizes NCD as major public health problems and outlines key policy statements for prevention and control of NCDs. (Ministry of Health, 2011) The National Alcohol Policy,(Ministry of Health, 2015a, 2015b) and the current Five-Year Plan (2013-2018) entails inclusive NCD prevention and control strategies to reduce the preventable and modifiable burden of NCDs through multisectoral collaboration and cooperation. (Gross National Happiness Commission, 2013)

The government on an average allocates about 8% of the total budget to health sector, annually. (Ministry of Finance, 2016, 2017)

Prevention and control of NCDs are integrated into primary health care system; essential medicines and technologies for treatment of NCDs have been updated in line with the WHO Package for Essential NCDs. Opportunistic screening for blood glucose and urine protein is available at Basic Health Units.
NCDs are part of curriculum in Bachelors of Public Health and Health Assistant courses at the faculty of nursing and public health. (Ministry of Health, 2015a)

Although NCDs are preventable by addressing the modifiable NCD risk factors, tobacco use, unhealthy diets, insufficient physical activity and harmful use of alcohol the health sector alone cannot adequately deal with the deep-rooted social determinants of NCDs. Hence, it requires a whole-of-government approach as many of strategies and interventions for the prevention and control of NCDs are beyond the jurisdiction of health sector. For example, implementation of Tobacco Control Act and National Alcohol Policy requires partnership with Ministry of Trade and Economic Affairs, Royal Bhutan Police, Customs and other enforcement entities. Likewise, promoting physical activity requires partnership with urban planners, parents, schools and teachers, employers, religious leaders and financial support for building the environment. Promoting healthy diets encompasses working with Ministry of Agriculture, Ministry of Economic Affairs and so on for food production, food import policies and regulations.

Responding to these NCD challenges, Ministry of Health developed the “Multisectoral national action plan for the prevention and control of NCDs, 2015-2020’ and the Council of Cabinet Ministers endorsed the action plan in 2015. (Ministry of Health, 2015a)

10. Synergies between health, happiness and noncommunicable diseases

World Health Organization defines health as ‘state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’. (World Health Organization, 1948) In Gross National Happiness, health is described as not only an absence of illness but also as an outcome of relational balance between mind and body, and between persons and the environment. (Ura, Alkire, Zangmo, & Wangdi, 2012a) In particular, the health domain in GNH measures the physical and mental health (Refer Table 1).
While the social and material conditions for creating good health such as clean air and water, family relationships or community relationships are covered in other domains such as ecology diversity and community vitality. Emotional balance and spirituality are included in psychological wellbeing domain. (Ura et al., 2012a) In this manner the broad definition of health in GNH conforms to the WHO definition of health.

There is compelling evidence that health is an important determinant of happiness (Diener & Chan, 2011; Graham, 2008) and an adverse health changes have lasting and negative effect on happiness. (Easterlin, 2003) Further improved physical health is found to be the single most important factor that has improved human happiness across all level of development status of a country. (Helliwell, Layard, & Sachs, 2012) Also, good health is associated to higher happiness level (Gerdtham & Johannesson, 2001) and illness is shown to have negative effect on happiness. Health is a measurable variable that accounts for happiness, for example, the Gross National Happiness study from Bhutan reveals that health domain contributes the most (14%) to happiness of the people and happy people enjoy highest sufficiency in disability and mental health. (Ura et al., 2012a)

Similarly, happiness positively impacts on short term and long term health outcomes and (Howell, Kern, & Lyubomirsky, 2007) thus rendering protection from becoming illnesss. (Veenhoven, 2008) Happiness is also associated with lower morbidity (Lyubomirsky, King, & Diener, 2005) and longevity (Veenhoven, 2008) and with better health outcomes. (Gerdtham & Johannesson, 2001) Happy people are found to lead healthy life styles by engaging in sports, weight watch and healthy eating habits. (Sabatini, 2014) This evidence of symbiotic relationship between health and happiness complement each other for improving the health and happiness of the population and provides an opportunity to usher health as an instrument for increasing the overall well-being of the people.
Although there are wealth of literature linking health and happiness, there are very little evidences linking specific health outcomes like noncommunicable diseases and their risk factors to happiness. From the limited available evidences there is a strong correlation between NCDs and happiness. (DeNeve & Cooper, 1998; Graham, 2008) For example, a literature review using data from16 countries by David et al. show that happier nations report systematically lowers levels of hypertension. (Blanchflower & Oswald, 2008) Obesity has a negative and statistically significant relationship with happiness. (Katsaiti, 2012) Further, specific chronic physical health conditions like muscular-arthritis-rheumatism, heart attacks and strokes are found to reduce happiness. (Shields & Price, 2005)

Thus there is an opportunity for improving health and happiness through reducing NCDs by linking policies from multiple sectors with complementary objectives to reduce NCDs and enhance Gross National Happiness.

11. Global NCD action plan and whole-of-government approach

Bhutan’s NCD challenge mirrors the global experience. NCDs are recognized as one of the major health and development challenges of the 21st century. (Beaglehole et al., 2011) It is now the leading cause of death and disability worldwide, contributing to 38 million deaths in 2012. (Mendis, 2014) The leading cause of NCDs deaths are cardiovascular diseases (46.2% of NCD deaths), cancer (21.7% of NCD deaths), respiratory diseases (10.7% of NCD deaths) and diabetes (4% of NCD deaths). (Mendis, 2014) Similarly, NCDs account for 55% of all deaths in the WHO South-East Asia Region. (World Health Organization, 2011) NCDs, once linked only to affluent societies, are now a global public health problem, and the poor suffer the most. Over 80% of cardiovascular and diabetes deaths, 90% of chronic obstructive pulmonary diseases deaths and two third of all cancer deaths occur in developing countries. (Islam et al., 2014)
Recognizing the social, economic and public health impact of NCDs, world leaders adopted a political declaration to address the global threat of NCDs in 2011. (Beaglehole et al., 2011) Subsequently, the World Health Assembly endorsed the “Global action plan for the prevention and control of noncommunicable diseases 2013-2020”, (UN General Assembly, 2011) which includes six objectives, nine voluntary global targets (Appendix C) and a list of policy recommendations for prevention and control of NCDs (Appendix D). The global NCD action plan recommended raising priority accorded to NCDs through improving governance, leadership, whole-of-government approach, addressing social determinants of health, strengthening health systems, research and surveillance. (World Health Organization, 2013)

The emphasis on whole-of-government approach began with the adoption of the Declaration of Alma-Ata in 1977, which called for intersectoral collaboration to address health as a fundamental social goal, and the most recently in the discourse on Health in All Policies. (Lencucha, Drope, & Chavez, 2015; Nutbeam, 1994; World Health Organization, 1986) WHO defines it as “whole-of-government approach is one in which public service agencies work across portfolio boundaries, formally and informally, to achieve a shared goal and an integrated government response to particular issue”. It aims to achieve policy coherence in order to improve effectiveness and efficiency”.(World Health Organization, 2016)

There is a global consensus that whole-of-government approach is an effective approach for prevention and control of NCDs.(Beaglehole et al., 2011) Political declaration of the high level meeting of the UN General Assembly in 2011 endorsed and recommended the whole-of-government approach to reduce prevalence, morbidity and mortality of NCDs.(UN General Assembly, 2011) Global NCD action plan outlined the whole-of-government approach as one of its core principles to address NCDs.(World Health Organization, 2013)
To address the rise in NCDs, governments are encouraged to put forward multisectoral approaches to NCD prevention and control.

In response, Bhutan Government formulated and adopted the “Multisectoral national action plan for the prevention and control of NCDs, 2015-2020’ in 2015. (Ministry of Health, 2015a) Although, the national NCD action plan is in line with the global NCD action plan. The national NCD action plan, however, failed to take Bhutan’s unique and mandatory development framework, the Gross National Happiness into consideration. In this thesis we explore how GNH can strengthen the implementation of the national NCD action plan as a whole-of-government approach through the legal framework and institutional arrangements provided by the GNH.

The approach of engaging with GNH to implement NCD policy priority has several advantages. First, it uses the existing GNH policy process and platform to implement identified policy priorities through whole-of-government approach. Second, GNH objectives are national priority and every sector has the moral and legal obligation to collaborate to its achievement. Third, integrating the NCD policy priority into relevant policies across sectors through GNH increases the sectoral accountability to agreed agendas. Finally, the draft 12th Five Year Plan which will be launched in last quarter of 2018 includes components of a comprehensive NCD response. In this new Five Year Plan, the specific issues for health include programs and interventions to reduce the percentage of population living with diabetes and raised blood pressure, and percentage of tobacco users. The fact that these indicators are included in the National Key Results Area reflects the importance of prevention and control of NCD as a priority for the Government as well. (UN Interagency Task Froce on NCDs, 2017)
12. Research aims and objectives

This thesis responds to the epidemiological transition in Bhutan, which is characterised by increasing mortality from noncommunicable diseases. The national NCD action plan has been endorsed in 2015, but effective policy action is being hampered by several factors. In particular 1) most of the activities in the national NCD action plans are not fully financed (UN Interagency Task Force on NCDs, 2017) 2) NCD prevention and control is not included into one of the 6 planned flagship programs of the 12th Five Year Plan (2018-2023). (GNH Commission, 2016) The five flagship programs (integrated water security, economic diversification, quality of education, livelihood of vulnerable groups and improving highlands livelihood programme) are considered as a major means to achieve the GNH with a tentative budgetary allocation of Nu. 15 billion.(GNH Commission, 2016) 3) There is limited evidence regarding the relationship between NCDs and measures relating to GNH, and 4) a lack of policy research into the relationship between NCDs and Bhutan’s unique developmental framework, the GNH.

In this thesis, I address two research questions, 1) what evidence is there to support NCDs as a policy priority for achieving the Gross National Happiness? 2) How can the health sector strategically engage with GNH, and with the associated policy processes, to strengthen action on NCDs?

The two main aims of this thesis are:

i. To generate new evidence of NCDs in Bhutan, in the context of the current policy priority regarding Gross National Happiness.

ii. To provide action-oriented recommendations to strengthen action on NCDs through strategic engagement with Gross National Happiness framework.
Specific objectives are:

i. To determine the prevalence of modifiable risk factors for NCDs and to investigate the associations of selected physical (overweight and hypertension) and biochemical (diabetes) measurements with socio-demographics and modifiable risk factors.

ii. To provide evidence supporting that prevention and control of NCDs are policy priority.

iii. To identify strategies of integrating NCD policy priorities into GNH by identifying shared agendas between NCD prevention and control action and Gross National Happiness.

iv. To define the GNH determinants from health policy perspective to enhance the health sector’s competence in using the GNH policy screening tool for policy development.

v. To articulate how the implementation of Gross National Happiness (GNH) could inform other countries to enhance policy priority for–and implementation of–the Global NCD Action Plan.

13. Methods

In this thesis both quantitative and policy analyses were conducted to answer the research questions.

Quantitative Analysis

The aim of our quantitative analysis was to present evidence to increase political commitment and policy priority for prevention and control of NCDs. To determine the NCD risk factors and their association with NCDs. In this thesis, we analysed three nationally represented data.
1. NCD STEPS data, 2014 availed from Ministry of Health.
2. GNH survey 2010, availed from Centre for Bhutan Studies and GNH Research.
3. GNH survey 2015, availed from Centre for Bhutan Studies and GNH Research.

Further detailed information about the data and their methodology are discussed in Paper 1, Paper 2 and Paper 3 of this thesis. Statistical methods include logistic regression (Paper 1 and Paper 3) and General Estimating Equation (Paper 2) are used to present the determinants and association of NCDs. Statistical package used are STATA (Paper 1 and Paper 2) and SAS (Paper 3). The detailed information about each analysis method are discussed in specific papers.

**Policy analysis**

The aim of this in-depth analysis is to identify policy opportunities to integrate NCD policy priorities into relevant policies across sectors using the existing GNH policy process. We drew on policy theory to underpin the analysis – particularly the Walt and Gilson policy analysis triangle, which emphasises the need to consider policy content, context, actors and processes in developing recommendations for policy change. For this task we followed the following step wise process.

First, we identified the link between health and GNH by analysing the GNH determinants from health policy perspective. For this we conducted a literature search on Gross National Happiness, health, well-being, social determinants of health and the GNH determinants to evaluate the relationship between health and the GNH determinants. This analysis also helped define the GNH determinants from health policy perspective.
The main documents we reviewed were ‘extensive analysis of GNH index’ and the ‘The experience of gross national happiness as development framework’ in conjunction with the social determinants of health.

In the second step, to make it possible to pursue opportunities to strengthen policy to improve health and happiness we identified elements in the six objectives of the global NCD action plan and in the GNH that share the objective of strengthening outcomes applicable to both policy areas-we call these ‘shared agendas’. For this task, we reviewed the global, regional and national NCD policies, strategies, and action plans along with literature on GNH policy process. In particular, the ‘Global action plan for the prevention and control of noncommunicable diseases 2013-2020’, ‘Action plan for the prevention and control of noncommunicable diseases in South-East Asia, 2013-2020’ ‘Bhutan National Policy and Strategic Framework on Prevention and Control of NCD’, ‘Bhutan National strategy to reduce the harmful use of alcohol to reduce harmful use of alcohol’, ‘Bhutan National Tobacco-Control Act, 2010’, ‘extensive analysis of GNH index’, ‘2015GNH survey report: A compass towards a just and harmonious society’, ‘The experience of gross national happiness as development framework’ were reviewed.

Further, we reviewed the implementation process of GNH policies (protocol of GNH policy formulation, GNH policy screening tool), the GNH domains and the GNH determinants in conjunction with the six objectives of global NCD action plan and identified the shared agendas and shared determinants between NCD and GNH. Implementing and monitoring these shared agendas would achieve the objectives of NCD and GNH.

In the third step, the ‘protocol for GNH policy formulation’ and the ‘Gross National Happiness policy screening tool’ were analysed to identify strategic policy opportunities for health sector to engage with GNH policy process.
14. Involvement of Ministry of Health

The Honourable Secretary of Ministry of Health, Bhutan released the national data on NCDs (STEPS 2014 data) for the purpose of this study. To large extend the study is specific for the context of Bhutan, to ensure the relevancy of the results and recommendations I have worked with several colleagues in Bhutan. In both the quantitative and policy analysis, the key decision makers from the MOH were consulted during policy analysis and preparation of the manuscripts. The Senior Program Officer for the Prevention and Control of NCDs, co-authored the paper on prevalence and risk factors of Non Communicable Diseases in Bhutan (Paper 1). The Senior Planning Officer, Policy and Planning Division, MOH was involved in the policy analysis and co-authored two papers a) interpreting GNH determinants (Paper 5) and taking action on prevention and control of NCDs (Paper 7). Further, the Director for Public Health, who is responsible for overseeing prevention and control of NCDs co-author the paper on taking action on prevention and control of NCDs in Bhutan (Paper 7). We have also involved Dr. Tandi Dorji, the founder and researcher at the Centre for Research Initiatives, Bhutan while analysing the GNH determinants (Paper 5).

15. My personal journey

I worked in various capacities in the Ministry of Health (MOH) for 12 years (1996-2008) before joining the Centre for Research Initiatives, Bhutan in 2008. During my tenure in MOH, I worked in Nutrition Program, Expanded Program on Immunization, Noncommunicable Diseases Division and World Bank Project on HIV/AIDS. It was during my tenure in the Nutrition Program, Bhutan achieved the sustainable elimination of Iodine Deficiency Disorders, formulated the national breastfeeding policy and the national nutrition and food safety policy in 2003.
I also worked as a short-term professional in WHO, SEARO during which time I provided technical assistance to Maldives, Bangladesh and Indonesia in the area of adolescent nutrition. After 12 years of operational work and in my new role as a researcher, I realised my desire for further research training and development.

In 2014, I received the prestigious Australian Endeavour Postgraduate scholarship to pursue higher degree by research (PhD). These led me to Sydney, Australia.
References


Section I

What evidence is there to support that NCDs are policies priority in Bhutan?

Section I generates new evidence showing the prevalence of NCD risk factors and their association with sociodemographic factors. This section presents NCDs as a major public health problem that requires political and policy commitment. A population with high proportion overweight, hypertension, diabetes and with symptoms of common mental disorders cannot be happy. This section contains three papers i.e. 1) prevalence and risk factors for NCDs, 2) common mental disorders and 3) association of sleep duration with self-reported health status.
Chapter 3: Paper 1

Title of the article: Prevalence and risk factors of Non Communicable Diseases in Bhutan: a cross-sectional secondary analysis of data from Bhutan’s Nationwide STEPS Survey, 2014. (Submitted)

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**Word Count**: 4093
ABSTRACT

Background: Bhutan is facing the epidemic of noncommunicable diseases (NCD), now accountable for 53% of all deaths. The recently completed 2014 STEPS survey revealed high proportion of NCD risk factors and clustering of risk factors. Since most NCDs are results of four modifiable risk factors (tobacco use, physical inactivity, unhealthy diet, and the harmful use of alcohol), we assessed associations of selected physical (overweight and hypertension) and biochemical (blood glucose level for diabetes) measurements with socio-demographics and the modifiable risk factors.

Methods: We used dataset of the WHO STEPS Survey 2014 of Bhutan, a nationwide, multistage, stratified cluster sampling survey of 2820 adults (18-69 years). Data were analysed using multiple logistic regressions, constructed with overweight, hypertension and diabetes as outcome variables and modifiable risk factors as independent variables.

Results: The prevalence of modifiable risk factors namely; tobacco use, harmful use of alcohol and low fruits and vegetables intakes were 24.8% (95% CI: 21.5, 28.5), 42.4% (95% CI: 39.4, 45.5) and 66.9% (95%CI: 61.5, 71.8), respectively. Similarly, the prevalence of overweight, hypertension and diabetes were high, 32.9% (95%CI: 30.0, 36.0), 35.7% (95% CI: 32.8, 38.7) and 6.4% (95% CI: 5.1, 7.9), respectively. From the logistic regression, we observed that older age groups and tobacco users are more likely to be overweight, hypertensive and diabetic. Education was not associated with any of the outcome variables. Alcohol users are more likely to be hypertensive while those who are physically active are less likely to be overweight. On the contrary, those consuming more fruits and vegetables are more likely to be overweight.
Conclusions: The prevalence of overweight, hypertension, diabetes and the modifiable NCD risk factors is high.

These estimates indicate that NCD prevention and control programs are urgently needed and require political priority. As NCDs cannot be addressed by the health sector alone, we recommend the whole-of-government approach through the Gross National Happiness framework.

Key words: Noncommunicable diseases, Bhutan, Prevalence, modifiable risk factors,

Introduction

Noncommunicable diseases (NCDs) are the leading cause of death worldwide. Each year they kill 40 million people, equivalent to 70% of all deaths globally (1-3). The World Health Organization (WHO) estimates that by 2020, NCDs will account for 80% of the global burden of disease (4). Almost three quarters of all NCD deaths occur in low- and middle-income countries (1). The four most common modifiable NCD risk factors are tobacco use, physical inactivity, unhealthy diets and the harmful use of alcohol (5). It is estimated that more than half of the NCD burden could be avoided through the prevention of these modifiable risk factors (6). In the WHO region of South East Asia, deaths due to NCDs are projected to increase by 20% between 2010—2020 (2). The World Economic Forum estimates that over the next 20 years NCDs will cost more than US$ 30 trillion, forcing millions of people below poverty line (7).

Bhutan is a small (38,394 sq. km) landlocked Himalayan country with a population of 768,577, and one of the least developed countries on the United Nation’s list (8) (9). Seventy percent of the Bhutanese population reside in rural areas. The literacy rate is 63% (10) and 62.2% of the population are dependent on agriculture for their livelihood (11). Although Bhutan has adopted a circumspect approach to economic development, it is facing an epidemiological transition and grappling the double burden of communicable and noncommunicable diseases. While considerable gains have been made in the prevention of and control of communicable diseases, the prevalence of NCDs has risen considerably (12). WHO estimates indicate that NCDs account for 56% of all deaths and 21% premature deaths (1, 13). Modifiable NCD risk factors such as alcohol consumption, high-salt and high-fat diets and low consumption of fruits and
vegetables are deeply rooted in Bhutan’s cultural tradition and pose a serious challenge for effective health interventions (14). Investigating modifiable risk factors and their adverse health outcomes will help Bhutan to reduce the overall morbidity and mortality from major NCDs.

The objectives of this paper are: 1) to estimate the prevalence of modifiable risk factors for NCDs in Bhutan, and 2) to investigate the associations of selected physical (overweight and hypertension) and biochemical (blood glucose level for diabetes) measurements with socio-demographics and modifiable risk factors. The findings from this study would be useful for formulating NCD prevention and control strategies in Bhutan.

**Methods**

**Study design and sampling selection**

We used data from the first national survey for NCD risk factors conducted by the Ministry of Health, Royal Government of Bhutan in 2014. This was a nationally representative cross-sectional survey to estimate the prevalence of NCD risk factors using the WHO STEPS survey protocol.

STEPS is a standardised method for collecting, analysing and disseminating data for NCDs. A multi stage sampling methodology was administered to select enumeration areas, households and respondents at each level. Sample size was calculated using the prevalence of overweight (53%) from the 2007 STEPS survey conducted in Thimphu, the capital city. In total 2912 respondents aged 18-69 years were sampled, assuming an 80% response rate. The primary sampling unit was the block for the rural areas and town for the urban areas. Secondary sampling units (SSU) were the villages. A total of 77 primary sampling units and 182 secondary sampling units were selected using probability proportionate to size. Respondents from the SSU households were
selected using simple random sampling. Further details of data collection and management procedures are described in the ‘National survey for noncommunicable disease risk factors and mental health using WHO STEPS approach in Bhutan-2014’(15).

Data collection

Data collection followed the STEPS protocol: STEP I included information on age, gender, education, marital status, area (rural and urban), occupation as well as information on modifiable risk factors: tobacco use, harmful consumption of alcohol, fruit and vegetable consumption and level of physical activity. STEP II covered physical measurements, height, weight, waist circumference and blood pressure; STEP III biological measurements including fasting blood glucose and total cholesterol level.

Definition used for modifiable NCD risk factors in this study

Tobacco use was defined as use of smoked and/or smokeless forms of tobacco. Alcohol use was defined as individuals who have consumed any alcohol within the past 30 days(15). Physical activity was classified into three groups. High and moderate physical activity were defined as seven or more days of any combination of walking, moderate-or vigorous-intensity activities accumulating at least 3000 and 600 MET-minutes/week respectively. Low physical activity was defined as MET-minutes/week <600MET in a form of work, travel and from places, recreational activities. No activity was reported or some activity is reported but not enough to meet high and moderate physical activity (16). Low fruit and vegetable intake was defined as < five servings of fruits and vegetables per day (17).
Data analysis

Data from the STEPS survey was imported to Stata version 13, which was used for all analyses (Stata Statistical Software: Release 13 College Station, TX: StataCorp LP). Separate weights were calculated for all the 3 different steps because the sample size varied between different steps due to a different response rate in each steps. All estimates were weighted and presented with 95% Confidence Intervals (CI).

Sociodemographic (age, gender, education, marital status, area of living and occupation) and four common modifiable risk factors (tobacco use, alcohol use, physical activity and fruits and vegetable consumption) were considered independent risk factors for selected NCDs.

In the first step, we examined the characteristics of the respondents by gender using the Chi-squared test. In the second step, bivariate association between the outcome variables (overweight, hypertension and type 2 diabetes mellitus) and categorical risk factors were also examined by Chi-squared test.

Finally in the third step, multiple logistic regression models were constructed with overweight (BMI ≥ 25.0 kg/m²), hypertension (systolic blood pressure ≥ 140 mm Hg and/or diastolic blood pressure ≥ 90 mm Hg during the study, or currently on medication for raised blood) and type 2 diabetes mellitus (individuals with a random blood sugar of ≥ 110 mg/dL) as outcome variable (15, 17), which were modelled individually with sociodemographic and modifiable risk factors. All variables that were found to be associated with outcomes at p≤0.25 in the univariable analyses were included in multiple logistic regression models to allow for maximum potential confounders to be included in the model (18). We then employed backward elimination stepwise model building processes and eliminated non-significant variables(p>0.05) from the model,
assuming a lack of confounding if parameter estimate of all remaining variables did not change by more than 10% after addition or removal of the potential confounder. Odds Ratio calculated using the model reflects the risk of having an NCD. Adjusted Odds Ratio and 95% Confidence Interval (CI) were used for interpretation of the adjusted risk and p value < 0.05 was considered statistically significant, due to the large sample size. Collinearity between variables were checked using variance inflation factors and found to be < 2 (19). All analyses, bivariate, univariate and multivariate logistic regression, were adjusted for cluster and sample weights.

**Ethic statement:** The study protocol has been reviewed and approved by Research Ethic Board of Health, Bhutan. For this study we used secondary data that has no identifying information. Approval for secondary data analysis was given from Secretary, Ministry of Health, Royal Government of Bhutan.

**RESULTS**

**Characteristic of participants enrolled in the survey**

The socio-demographic characteristics of the survey population are presented in Table 1. A total of 2822 adults (18-69 years) participated in the survey. Of these, 1074 (38.1%) were men and 1748 (61.9%) were women, 68.6% were from rural areas, 56.1% had no formal education, 82.7% were married, 53.1% were self-employed consisting of mainly farmers, 22.9% were government employees and 14.1% were homemakers. The age range of the sample was 13% in the 18-24 years, 34.1% in the 25-34 years, 26.1% in the 35-44 years, 14.4% in the 45-54 years and 12.4% in the 55-69 years. Overweight, hypertension and diabetes mellitus (fasting blood glucose were measured in 2748, 2814 and 2743 respectively of the 2822 respondents.
Table 1. Study sample characteristics: prevalence and risk factors by gender.

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Total N (%)</th>
<th>Men n (%)</th>
<th>Women n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2822</td>
<td>1074 (38.1)</td>
<td>1748 (61.9)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>281 (13.0)</td>
<td>78(10.7)</td>
<td>203 (15.9)</td>
</tr>
<tr>
<td>25-34</td>
<td>761 (34.1)</td>
<td>264(35.4)</td>
<td>498 (32.5)</td>
</tr>
<tr>
<td>35-44</td>
<td>751 (26.1)</td>
<td>284(26.7)</td>
<td>467 (25.3)</td>
</tr>
<tr>
<td>45-54</td>
<td>572 (14.4)</td>
<td>239(14.4)</td>
<td>333 (14.5)</td>
</tr>
<tr>
<td>55-69</td>
<td>456 (12.4)</td>
<td>209(12.8)</td>
<td>247 (11.8)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>1766 (56.1)</td>
<td>574(48.1)</td>
<td>1192 (66.3)</td>
</tr>
<tr>
<td>Formal Education</td>
<td>1054 (43.9)</td>
<td>499(51.9)</td>
<td>555 (33.7)</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Married</td>
<td>2278 (82.7)</td>
<td>907(84.5)</td>
<td>1371 (80.5)</td>
</tr>
<tr>
<td>Never married</td>
<td>225 (10.5)</td>
<td>104(12.0)</td>
<td>121 (8.6)</td>
</tr>
<tr>
<td>Single/divorce/widow</td>
<td>317(6.8)</td>
<td>62(3.5)</td>
<td>255 (10.9)</td>
</tr>
<tr>
<td><strong>Area of living</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1952 (68.6)</td>
<td>775 (70.3)</td>
<td>1177 (66.6)</td>
</tr>
<tr>
<td>Rural</td>
<td>870 (31.4)</td>
<td>299 (29.7)</td>
<td>571 (33.4)</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self employed</td>
<td>1558 (53.1)</td>
<td>606(53.6)</td>
<td>952 (52.6)</td>
</tr>
<tr>
<td>Home makers</td>
<td>559 (14.1)</td>
<td>26(1.5)</td>
<td>533 (30.2)</td>
</tr>
<tr>
<td>Government</td>
<td>480 (22.9)</td>
<td>328(33.5)</td>
<td>152 (9.4)</td>
</tr>
<tr>
<td>Others</td>
<td>223 (9.8)</td>
<td>113(11.4)</td>
<td>110 (7.9)</td>
</tr>
<tr>
<td><strong>Tobacco use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non users *</td>
<td>2255 (75.2)</td>
<td>733 (66.4)</td>
<td>1522 (86.4)</td>
</tr>
<tr>
<td>Users</td>
<td>565 (24.8)</td>
<td>340(33.6)</td>
<td>225 (13.6)</td>
</tr>
<tr>
<td><strong>Alcohol use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non users *</td>
<td>1685 (57.6)</td>
<td>527 (50.0)</td>
<td>1158 (67.2)</td>
</tr>
<tr>
<td>Users</td>
<td>1164 (42.4)</td>
<td>574 (50.0)</td>
<td>590 (32.8)</td>
</tr>
<tr>
<td><strong>Physical activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactive*</td>
<td>204 (6.2)</td>
<td>53 (3.8)</td>
<td>151 (9.2)</td>
</tr>
<tr>
<td>Moderate</td>
<td>408 (12.8)</td>
<td>126 (10.3)</td>
<td>282 (15.9)</td>
</tr>
<tr>
<td>Vigorous</td>
<td>2196 (81.0)</td>
<td>889 (85.9)</td>
<td>1307 (74.8)</td>
</tr>
<tr>
<td><strong>Diet habits</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 5 serving/day**</td>
<td>1901 (66.9)</td>
<td>702 (64.8)</td>
<td>1199 (69.6)</td>
</tr>
<tr>
<td>≥ 5 servings/day</td>
<td>916 (33.1)</td>
<td>34.5(35.2)</td>
<td>547 (30.4)</td>
</tr>
</tbody>
</table>

* p≤0.05, ** p>0.05  
1 include smoked and smokeless.  
2 Inactive (<600 MET minutes per week), Moderate (600-2999 MET minutes per week), Vigorous (≥ 3000 MET minutes per week),  
3 Include serving of fruits and or vegetables on average per day
Prevalence of modifiable risk factors

Tobacco use

The overall prevalence of current tobacco use (smoked or smokeless form) was 24.8% (95% CI: 21.5, 28.5), 7.4% were smoking and 19.7% were using smokeless tobacco. Tobacco use was significantly (p≤0.05) higher in men 33.6% (95% CI: 28.9, 38.7) than women 13.6% (95% CI: 11.1, 16.6). There was no significant difference in tobacco use by area of living.

Alcohol consumption

Prevalence of current use (last 30 days) of alcohol was 42.4% (95% CI: 39.4, 45.5). We observed that more men 50% (95%CI: 45.5, 54.4) were consuming alcohol compared to women 32.8% (95% CI: 29.6, 36.1) (p≤0.05). There was no significant difference in the prevalence by area of living.

Low physical activity

The prevalence of low physical activity was found to be 6.2% (95%CI: 4.9, 7.8). The prevalence was significantly higher in women 9.2% (95% CI: 7.0, 12.1) than men 3.8% (95% CI: 2.7, 5.1) (p≤0.05). Similarly, the prevalence of low physical activity was significantly higher (p≤0.05) in urban areas 12.9% (95%CI: 9.2, 17.7) than those living in the rural areas 3.1% (95%CI: 2.3, 4.2).

Low fruit and vegetable intake

Overall 66.9% (95%CI: 61.5, 71.8) of the population had insufficient intake of fruit and vegetables, which was not significantly different by gender and area of living.
Prevalence of overweight, hypertension and diabetes

Overweight

The overall prevalence of overweight (BMI > 25) was 32.9% (95%CI: 30.0, 36.0). There was a significant difference (p<0.05) in the prevalence of overweight by gender, age group, marital status, area of living, occupation or modifiable risk factors including tobacco use, physical activity and intake of fruits and vegetable. Education and alcohol consumption were not associated with overweight on bivariate analysis (p>0.05) (Table 2).

Hypertension

The prevalence of raised blood pressure, including those who were on medication for hypertension was 35.7% (95% CI: 32.8, 38.7). There was a significant difference (p<0.05) in the prevalence by age, education, marital status, occupation or modifiable risk factors including tobacco use and alcohol consumption. However, there was no significant difference in prevalence by gender, area, physical activity and dietary habits (p>0.05) (Table 2).

Type 2 Diabetes

The prevalence of diabetes mellitus was 6.4% (95% CI: 5.1, 7.9). Significantly (p<0.05) higher prevalence was observed in urban residents 8.6% (95% CI: 6.1, 11.8) than rural residents 5.4% (95% CI: 4.1, 7.2), while there was no significant difference by gender (p>0.05).

Associations of socio-demographics and modifiable risk factors with overweight, hypertension or diabetes

Results of the multiple logistic regression analyses (Table 3) show that overweight was significantly associated with age, gender, marital status, area, occupation, tobacco use, physical
Table 2. Factors associated with selected Non-communicable Diseases on bivariate analyses

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Overweight/ Obesity&lt;sup&gt;4&lt;/sup&gt; n (%)</th>
<th>Hypertension&lt;sup&gt;5&lt;/sup&gt; n (%)</th>
<th>Diabetes&lt;sup&gt;6&lt;/sup&gt; n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ( N=2822)</td>
<td>1051 (32.9)</td>
<td>1101 (35.7)</td>
<td>183 (6.4)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>321 (27.4)*</td>
<td>423 (35.5)**</td>
<td>73(6.5)*</td>
</tr>
<tr>
<td>Women</td>
<td>730 (40.3)</td>
<td>678 (35.9)</td>
<td>110 (6.3)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>45 (14.1)*</td>
<td>34(13.0)*</td>
<td>8(3.9)*</td>
</tr>
<tr>
<td>25-34</td>
<td>289 (33.3)</td>
<td>191(25.2)</td>
<td>27(2.8)</td>
</tr>
<tr>
<td>35-44</td>
<td>309 (36.1)</td>
<td>319 (40.4)</td>
<td>50(9.4)</td>
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<tr>
<td>45-54</td>
<td>240 (39.3)</td>
<td>287 (51.5)</td>
<td>52(10.0)</td>
</tr>
<tr>
<td>55-69</td>
<td>168 (36.8)</td>
<td>270 (60.2)</td>
<td>46(8.4)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>660 (32.9)**</td>
<td>783(40.6)*</td>
<td>125(6.9)**</td>
</tr>
<tr>
<td>Formal Education</td>
<td>391 (33.0)</td>
<td>318 (29.5)</td>
<td>58(5.8)</td>
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<td><strong>Marital Status</strong></td>
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<tr>
<td>Married</td>
<td>898 (35.0)*</td>
<td>906 (36.9)*</td>
<td>149(6.6)**</td>
</tr>
<tr>
<td>Never married</td>
<td>33 (12.9)</td>
<td>42 (19.6)</td>
<td>10 (4.1)</td>
</tr>
<tr>
<td>Single/divorce/widow</td>
<td>120 (38.5)</td>
<td>153 (46.1)</td>
<td>24 (7.2)</td>
</tr>
<tr>
<td><strong>Area of living</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>630 (27.5)*</td>
<td>778 (35.9)**</td>
<td>112 (5.4)*</td>
</tr>
<tr>
<td>Urban</td>
<td>421 (45.0)</td>
<td>323 (35.4)</td>
<td>71 (8.6)</td>
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<tr>
<td><strong>Occupation</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Self employed</td>
<td>555 (28.4)*</td>
<td>661(39.0)*</td>
<td>94 (5.1)**</td>
</tr>
<tr>
<td>Home makers</td>
<td>271 (50.4)</td>
<td>184 (31.5)</td>
<td>37 (6.8)</td>
</tr>
<tr>
<td>Government Employees</td>
<td>187 (40.3)</td>
<td>177 (33.6)</td>
<td>39 (8.5)</td>
</tr>
<tr>
<td>Others</td>
<td>38 (16.1)</td>
<td>79 (28.7)</td>
<td>13 (8.0)</td>
</tr>
<tr>
<td><strong>Tobacco use&lt;sup&gt;1&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non users</td>
<td>890 (35.8)*</td>
<td>907 (37.5)*</td>
<td>141 (5.8)**</td>
</tr>
<tr>
<td>Users</td>
<td>161 (24.4)</td>
<td>194 (30.4)</td>
<td>42 (8.2)</td>
</tr>
<tr>
<td><strong>Alcohol use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non users</td>
<td>608 (31.8)**</td>
<td>576 (31.9)*</td>
<td>99 (6.2)**</td>
</tr>
<tr>
<td>Users</td>
<td>443 (34.5)</td>
<td>525 (40.9)</td>
<td>84 (6.8)</td>
</tr>
<tr>
<td><strong>Physical activity&lt;sup&gt;2&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactive</td>
<td>110 (54.8)*</td>
<td>84 (39.4)**</td>
<td>12 (5.5)**</td>
</tr>
<tr>
<td>Moderate</td>
<td>179 (45.0)</td>
<td>161 (39.1)</td>
<td>33 (7.3)</td>
</tr>
<tr>
<td>Vigorous</td>
<td>756 (29.3)</td>
<td>853 (35.0)</td>
<td>137 (6.3)</td>
</tr>
<tr>
<td><strong>Fruits or vegetable consumption&lt;sup&gt;3&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 5 servings/day</td>
<td>665 (30.7)**</td>
<td>711 (34.3)**</td>
<td>125 (6.6)**</td>
</tr>
<tr>
<td>≥ 5 servings/day</td>
<td>386 (37.4)</td>
<td>389 (38.6)</td>
<td>58 (6.1)</td>
</tr>
</tbody>
</table>

<sup>1</sup>p≤0.05, ** p>0.05
<sup>1</sup>Include smoked and smokeless.
<sup>2</sup>Inactive (<600 MET minutes per week), Moderate (600-2999 MET minutes per week), Vigorous (≥ 3000 MET minutes per week),
<sup>3</sup>Include serving of fruits and or vegetables on average per day. <sup>4</sup>Overweight = BMI ≥ kg/m<sup>2</sup> & non pregnant
<sup>5</sup>Hypertension = SBP > 140 mm Hg or DBP > 90 mm Hg or on medication for hypertension
<sup>6</sup>Diabetes = Fasting blood glucose > 110 mg/dl and or on medication for diabetes
activity and dietary habits, after adjusting for education and alcohol use (p≤0.05). Compared to those aged 18-24 years, older age groups were more likely to be overweight, 25-34 years (2.57 95% CI: 1.65, 4.01), 35-44 years (3.23 95% CI: 2.17, 4.83), 45-54 years (4.06 95% CI: 2.59, 6.37) and 55-69 years (3.88 95% CI: 2.51, 5.98), respectively. Further, being female (1.70 95% CI: 1.27, 2.27), single/divorced/widow (1.02 95% CI: 0.75, 1.36), homemakers 1.91 (95% CI: 1.18, 2.28), government employees (1.65 95% CI: 1.18, 2.28), living in urban areas (1.77 95% CI: 1.36, 2.30) and dietary intake of ≥ 5 servings of fruits and or vegetables per day (1.44 95% CI: 1.16, 1.79) were more likely to be overweight. While tobacco users (0.71 95% CI: 0.53, 0.96), moderately active (0.75 95% CI: 0.47, 1.19) and vigorously active (0.46 95% CI: 0.30, 0.70) were less likely to be overweight.

Although hypertension was significantly associated with age, tobacco use and alcohol consumption (p<0.05), it was not significantly associated with gender, education, marital status, occupation, alcohol consumption, physical activity and dietary intake. When using 18-24 years as reference category, there was a trend of significant increase in the odds of reported hypertension with age, 25-34 years (2.01 95% CI: 1.21, 3.35), 35-44 years (4.08 95% CI: 2.46, 6.76), 45-54 years (6.17 95% CI: 3.66, 1.04), 55-69 years (9.23 95% CI: 5.61, 15.19), respectively. Among the modifiable risk factors, tobacco user were less likely to be hypertensive (0.74 95% CI: 0.56, 0.97), while those currently consuming alcohol are more likely to be hypertensive (1.41 95% CI 1.15, 1.74).

Diabetes mellitus was significantly associated with age, area of living and tobacco use. Sociodemographic factors like gender, marital status, education, occupation, and modifiable risk factors such as alcohol consumption, physical activity and dietary habits were not associated with diabetes mellitus. Compared to those aged 18-24 years, cohorts in higher age groups 25-34
Table 3. Risk factors of selected non-communicable Diseases using multiple logistic regressions.

<table>
<thead>
<tr>
<th></th>
<th>Overweight(^b)</th>
<th>Hypertension(^b)</th>
<th>Type 2 Diabetes(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>P value</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td><strong>Socio-demographic characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>Referent</td>
<td>&lt;0.001</td>
<td>Referent</td>
</tr>
<tr>
<td>25-34</td>
<td>2.66 (1.69, 4.18)</td>
<td>2.01 (1.21, 3.35)</td>
<td>0.82 (0.31, 2.18)</td>
</tr>
<tr>
<td>35-44</td>
<td>3.41 (2.28, 5.10)</td>
<td>4.08 (2.46, 6.76)</td>
<td>3.24 (1.34, 7.84)</td>
</tr>
<tr>
<td>45-54</td>
<td>4.09 (2.60, 6.43)</td>
<td>6.17 (3.66, 1.04)</td>
<td>4.02 (1.62, 9.99)</td>
</tr>
<tr>
<td>55-69</td>
<td>4.11 (2.66, 6.33)</td>
<td>9.23 (5.61, 15.19)</td>
<td>3.44 (1.43, 8.32)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>Referent</td>
<td></td>
<td>Referent</td>
</tr>
<tr>
<td>Women</td>
<td>1.70 (1.27, 2.28)</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>No formal education</td>
<td>Referent</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>Formal education</td>
<td>a</td>
<td></td>
<td>a</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
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<tr>
<td>Married</td>
<td>Referent</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>Never married</td>
<td>0.54 (0.34, 0.87)</td>
<td>0.96 (0.58, 1.61)</td>
<td>a</td>
</tr>
<tr>
<td>Single/divorce/widow</td>
<td>0.99 (0.74, 1.33)</td>
<td>1.10 (0.80, 1.42)</td>
<td>a</td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>Referent</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>Urban</td>
<td>1.79 (1.38, 2.32)</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Self employed</td>
<td>Referent</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>Home maker</td>
<td>1.81 (1.29, 2.56)</td>
<td>0.87 (0.65, 1.17)</td>
<td>1.46 (0.78, 2.75)</td>
</tr>
<tr>
<td>Government employee</td>
<td>1.63 (1.18, 2.26)</td>
<td>1.05 (0.70, 1.58)</td>
<td>1.63 (0.98, 2.73)</td>
</tr>
<tr>
<td>Others</td>
<td>0.76 (0.39, 1.51)</td>
<td>0.95 (0.61, 1.50)</td>
<td>1.95 (0.65, 5.80)</td>
</tr>
<tr>
<td><strong>Modifiable risk factors</strong></td>
<td>0.025</td>
<td>0.030</td>
<td>0.030</td>
</tr>
<tr>
<td>Tobacco use(^1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Referent</td>
<td>Referent</td>
<td>Referent</td>
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<tr>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td>0.71 (0.52, 0.96)</td>
<td>0.74 (0.56, 0.97)</td>
<td>1.64 (1.05, 2.56)</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>0.084</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td>0.74 (0.56, 0.97)</td>
<td>1.41 (1.15, 1.74)</td>
<td>a</td>
</tr>
<tr>
<td>Physical activity&lt;sup&gt;2&lt;/sup&gt;</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td>0.47 (0.31, 0.70)</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Dietary habits&lt;sup&gt;3&lt;/sup&gt;</td>
<td>0.001</td>
<td>0.197</td>
<td></td>
</tr>
<tr>
<td>&lt;5 servings fruits &amp; vegetables per day</td>
<td>Referent</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>≥5 servings of fruits/vegetables per day</td>
<td>1.46 (1.17, 1.82)</td>
<td>1.21 (0.90, 1.62)</td>
<td>a</td>
</tr>
</tbody>
</table>

1 Include smoked and smokeless.
2 Inactive (<600 MET minutes per week), Moderate (600-2999 MET minutes per week), Vigorous (≥ 3000 MET minutes per week),
3 Include serving of fruits and or vegetables on average per day
4 Overweight = BMI ≥ 25 kg/m²
5 Hypertension = SBP > 140 mm Hg or DBP > 90 mm Hg or on medication for hypertension
6 Diabetes = Fasting blood glucose > 110 mg/dl and or on medication for diabetes
a Not significant at univariate model then dropped.
years (0.82 95% CI: 0.31, 2.18), 35-44 years (3.24 95% CI: 1.34, 7.84), 45-54 years (4.02 95% CI: 1.62, 9.99) and 55-69 years (3.44 95% CI: 1.43, 8.32) were more likely to be diabetic. Similarly, urban residents (1.74 95% CI: 1.09, 2.79) and tobacco user (1.64 95% CI: 1.05, 2.56) were also more likely to be diabetic.

DISCUSSION

This study shows that overweight, hypertension and diabetes mellitus are major public health problems in Bhutan with one third of the adult population being overweight (32.9%) or hypertensive (35.7%), and 6.4% with diabetes mellitus. In addition, there is a wide variation in the prevalence of NCD risk factors by age group, gender and area of living. This study demonstrates the need to increase policy priority to reduce exposure to modifiable NCD risk factors and their underlying social determinants.

Modifiable risk factors

Although the cultivation, manufacture, sale, and distribution of tobacco products are banned in Bhutan since June 2010 (20), the prevalence of tobacco use is still high at 24.8% with the majority consuming smokeless tobacco (19.7%) compared to smoking (7.4%). Much higher prevalence of smokeless tobacco consumption compared to smoking has also been reported from Bhutan (21). Gurung et.al (22) attributed the higher proportion of smokeless tobacco use to affordability. The national ban on the import and sale of tobacco has pushed the illegal sale of tobacco products to an exorbitant price. A packet of popular brand of Indian cigarette “Wills” is sold between Nu. 150-170 (US$ 2.5), while a packet of chewable tobacco “baba” is sold at Nu. 20 (US$ 0.3). Further, the smoking ban in public places and random inspection by authorities might have deterred people from smoking. Authorised inspectors can demand proof of tax and duty payments from the smokers (20).
Bhutan Narcotic Control Agency’s (BNCA) inspection teams collected a total of Nu 84,500 (USD 2000) in an 10-hour operation as fines in 2015 (23).

In line with our finding of high rates of binge drinking, the annual per capital adult consumption (8.5 litres) in Bhutan is substantially higher than the average global consumption of 6.2 litres (24). Such high consumption may provide an explanation of the high mortality due to alcoholic liver disease (one death every two days in Bhutan, 190 deaths in 2016) (25). The government’s decision to liberalise production and distribution of industrial alcoholic beverages including liberalisation of bar licenses and low cost of alcohol coupled with cultural norms are probable reasons attributed to the high prevalence of alcohol drinking (26). A standard serving (30-60 ml) of black mountain whiskey with 42.8% alcohol by volume sold for Nu. 15 (US$ 0.25), a bottle (650 mL) of beer (8% alcohol by volume) sold for Nu.75 (US$ 1.25). There is one licensed alcohol outlet for every 98 Bhutanese, a total of 5407 outlets countrywide (27). Culturally, alcohol is a vital part of religious ceremonies and social functions. It is normal for Bhutanese to drink and some at a very young age (24, 28, 29). This may explain why a large proportion (86%) of the alcohol consumed is ‘homebrew’(30) which conforms to situations in the middle and low-income countries (31).

The prevalence of physical inactivity was low (6.2%), which is similar to China (6.9%) and Nepal (3.4%) (32, 33). This could be due to a high percentage (68.6%) of the respondents residing in rural areas where 53% of respondents reported an agricultural or labour occupation. As elsewhere, the overall prevalence of physical inactivity was higher in women than men (34).

More than two thirds (66.9%) of the population did not consume the recommended five or more servings of fruits and/or vegetables.
A similar trend is reported from Nepal (99%) and Bangladesh (91.8%) nationwide STEPS survey (33, 35). Low consumption of fruits and vegetables could be attributed to multiple factors like seasonal availability and dietary habits. Culturally, Bhutan is a rice eating country; 50% of the daily calorie requirement comes from rice (36).

Overweight, hypertension and type 2 diabetes

Although the majority (93.8%) of respondents were engaged in either moderate or vigorous physical activity, the current prevalence of overweight (32.9%) in Bhutan is one of the highest in the WHO region of South East Asia (37). This suggests that the double burden of malnutrition is well advanced in Nepal. The overweight prevalence in Bangladesh, Nepal and Thailand are 16.9%, 21% and 28.3%, respectively (33, 35, 38). Overweight is linked to rapid urbanisation, low nutrition literacy and sedentary life style (39-41), all of which have been seen in Bhutan. Another major driver in Bhutan could be diets high in carbohydrate and low in protein, which were reported in a cross sectional study among adolescent in one of the eastern districts of Bhutan (42). The national nutrition surveys in Bhutan indicate high prevalence (37% in 2009) of stunting (43). Growth failure in the first two years of life is associated with reduced stature and an increased risk of overweight in adulthood (44, 45). A recent study from Indonesia showed that stunted children were significantly more likely to be overweight than children of a healthy height (46). This highlights the need for early life intervention to avert the growth failure to decrease childhood stunting and adult overweight problems.

Similar to previous studies in developing countries, the prevalence of overweight is increased with age, being female, being home makers and government employees and residing in urban areas (33, 35, 38, 47). Review has shown that level of physical activity is twice as much among rural residents than their urban counterparts due to higher household activities (48).
Occupation is a risk factor in our study partly of its association with socioeconomic and behavioural factors such as physical activity and sedentary time. Concurrently, homemakers and office workers are at risk for overweight compared to farmers.

Moderate and vigorous physical activity and tobacco consumption have negative association with overweight. These findings are consistent with other studies in India and Thailand (38, 49). This could be partly explained by a combination of reduced food intake and the thermogenic effects of smoking (50). Considering the impact of tobacco use on overall morbidity and mortality, efforts must continue to support the tobacco control.

Interestingly, in this study we observed a positive association between fruits and vegetables intake and overweight. A large cross sectional study from Australia reported that overweight and obese women are more likely to consume high intakes of fruits and vegetables (51). Further, a prospective cohort study from the US found that increased intake of starchy vegetables such as potatoes, peas and corn were associated with weight gain (52). Maize, potatoes and rice are staple foods in Bhutan, and are classed as starchy vegetables in the STEPS survey (53). This suggests that more in-depth studies are needed to separate types of fruits and vegetables consumed.

The overall prevalence of raised blood pressure has increased from 26% in 2007 to 35.7%, although the 2007 study was only conducted in the capital city (54). The current prevalence is consistent with estimates from India, Thailand and Democratic People’s Republic of Korea (55). Our analyses show a progressive increase of raised blood pressure with age. The Framingham Heart Study, which followed patients for 30 years, showed that mean blood pressure rose steadily with age in both men and women (56). The increase in the blood pressure with age is likely due to changes in arterial and arteriolar stiffness (57-59). A diet rich in oil, fat and salt could be a key contributing factor to this situation (60).
Alcohol consumption is strongly associated with an increased risk of hypertension (61, 62). Our study shows that alcohol users were 1.4 (95% CI: 1.15, 1.74) times more likely to be hypertensive compared to those who did not drink. Alcohol abuse is a serious social and health problem in Bhutan (26). Political commitment towards the realisation of the ‘National Policy and Strategic Framework to Reduce Harmful Use of Alcohol 2015-2020’ is urgent.

Our analyses show that tobacco users are less likely to be hypertensive after adjusting for possible confounding factors such as, alcohol consumption, physical activity, dietary habits, age, gender, education, occupation, marital status and area of living. This is somewhat consistent with other epidemiological studies that report lower blood pressures in tobacco users than non-users (63-66). Overall, however, the association of tobacco use with hypertension is inconsistent (67, 68), although it is recognised that tobacco use can cause an acute increase in blood pressure (64, 69-71). Some epidemiological studies found no difference in the prevalence of hypertension according to smoking status (72), while a nationally representative study from England found that blood pressure values associated with tobacco use differed with age and gender (73). Many factors contribute to the heterogeneity of the findings, including masked hypertension, time relation between tobacco consumption and BP measurement, type of smoking, duration and onset of BP increase (67, 68). However, given the adverse effect of raised blood pressure and smoking on coronary heart disease, it is important that persons with raised BP are advised to stop smoking.

The observed prevalence of diabetes in the current study (6.4%), similar to neighbouring countries like India (7.3%) and Thailand (6.9%) (74, 75). It is slightly higher compared to Nepal (4%), but less than the estimate for the WHO Region for South East Asia (33, 76). Globally diabetes in older adults is a major public health concern and is a major contributor to the diabetes epidemics (77).
In our analyses, we also observed that the prevalence of diabetes increases with age similar to overweight, which is one of the main risk factors for diabetes (76). This suggests that diabetic screening and follow-up need to focus on older age groups and those who are overweight. Urban residents and tobacco users are also more likely to be diabetic compared to rural residents and non-tobacco users respectively, which is consistent with findings in other studies (33, 78).

Interestingly, in this analysis physical activity, fruits and vegetable intake and alcohol consumption were not associated with diabetes. Gilles et al. suggested that conventional risk factors do not fully account for the higher prevalence of diabetes in low-income countries (79). This suggests that other factors may be more important and are responsible for diabetes in low-income countries. More in-depth epidemiological and sociological studies are needed to fill the knowledge gap.

**Strengths and limitations of the study**

The main strengths of this study include that the use of large nationally representative data of respondents from all adult age groups, between 18-69 years. In addition, the analysis a range of social, demographic factors and potential modifiable risk factors for selected NCDs were taken into account in the multivariate analyses. However, the study was limited by a cross-sectional design which does not permit us to assign causality to the relationships. It is also possible that the social stigma associated with tobacco use and alcohol consumption might have led to an underestimating of the prevalence rates, since it relies on self-reported data (22).

**CONCLUSION**

This study provides the first comprehensive, national level evidence on the magnitude of sociodemographic, modifiable and metabolic NCD risk factors in Bhutan. This study also
presents that pattern of association between socio-demographic and modifiable risk factors with overweight, hypertension and diabetes.

The estimate generated by this analysis confirms that prevention and control of NCDs requires political priority and whole of government approach to reduce the NCD risk factors. Addressing NCDs is in line with the Government of Bhutan’s commitments to Gross National Happiness and wellbeing. This study suggests that there is an urgent need to scale up implementation of the cross-sectoral action plan ‘The multisectoral national action plan for the prevention and control of NCDs, 2015-2020’.

It is imperative that the Government of Bhutan focus its intervention on reducing the highly prevalent modifiable risk factors i.e. harmful consumption of alcohol and low intake of fruits and vegetables.

Our study also highlights that the conventional identified NCD risk factors may not fully account for the high prevalence of overweight, hypertension and diabetes in low-middle income countries. Hence, further in-depth studies are recommended to fill in the knowledge gaps.
DECLARATION

Abbreviations
BMI, Body Mass Index; CI, confidence interval; MET, Metabolic Equivalent of Task; NCD, noncommunicable diseases; Nu, ngultrum; WHO, World Health Organization;

Acknowledgement
The authors would like to thank the Ministry of Health, Bhutan for the 2014 NCD STEPS Data.

Authors’ contributions
GS performed the statistical analysis and drafted the manuscripts. ML, supervised the whole process of analysis and manuscript writing. LMW assisted with the analysis and the interpretation of the results. LD assisted with the writing and confirming national estimates. AMT assisted with the overall conceptualization of the paper and helped draft the manuscript. All authors contributed to revising the manuscript and read and approved the final version of the manuscript.

Consent for publication
Not applicable

Availability of data and materials
No additional data are available
Competing interests
None declared

Funding
None

Ethic statement
The study protocol has been reviewed and approved by Research Ethic Board of Health, Bhutan. For this study we used secondary data that has no identifying information. Approval for secondary data analysis was given by Secretary, Ministry of Health, Royal Government of Bhutan.

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REFERENCES


Chapter 4: Paper 2


Gyambo Sithey,1 Mu Li,1 Li Ming Wen,1,2 Patrick J Kelly,1 Kelly Clarke3

ABSTRACT

Objective Common mental disorders (CMDs) are a major cause of the global burden of disease. Bhutan was the first country in the world to focus on happiness as a state policy; however, little is known about the prevalence and risk factors of CMDs in this setting. We aim to identify socioeconomic, religious, spiritual and health factors associated with symptoms of CMDs.

Design and setting We used data from Bhutan’s 2015 Gross National Happiness (GNH) Survey, a multistage, cross-sectional nationwide household survey. Data were analysed using a hierarchical analytical framework and generalised estimating equations.

Participants The GNH Survey included 7041 male and female respondents aged 15 years and above.

Measures The 12-item General Health Questionnaire was used to measure symptoms of CMDs. We estimated the prevalence of CMDs using a threshold score of ≥12.

Results The prevalence of CMDs was 29.3% (95% CI 26.8% to 31.8%). Factors associated with symptoms of CMDs were: older age (65+) (β=1.29, 95% CI 0.57 to 2.00), being female (β=0.70, 95% CI 0.45 to 0.95), being divorced or widowed (β=1.55, 95% CI 1.08 to 2.02), illiteracy (β=0.48, 95% CI 0.21 to 0.74), low income (β=0.37, 95% CI 0.15 to 0.59), being moderately spiritual (β=0.61, 95% CI 0.34 to 0.88) or somewhat or not spiritual (β=0.76, 95% CI 0.28 to 1.23), occasionally considering karma in daily life (β=0.53, 95% CI 0.29 to 0.77) or never considering karma (β=0.80, 95% CI 0.26 to 1.34), having poor self-reported health (β=2.59, 95% CI 2.13 to 3.06) and having a disability (β=1.01, 95% CI 0.63 to 1.40).

Conclusions CMDs affect a substantial proportion of the Bhutanese population. Our findings confirm the importance of established socioeconomic risk factors for CMDs, and suggest a potential link between spiritualism and mental health in this setting.

INTRODUCTION

WHO estimates that approximately 450 million people worldwide suffer from a common mental disorder (CMD) and 75% of them live in low-income and middle-income countries (LMICs) where social inequalities are high.1 CMDs are ‘disorders which are commonly encountered in community settings, and whose occurrence signals a breakdown in normal functioning’.2 WHO refers to CMDs as a range of anxiety and depressive disorders that impact on the mood or feelings of the affected person.3 CMDs lead to disability and reduced work participation and productivity.4 5 National-level epidemiological data on CMDs from LMICs are lacking, hindering mental health service and policy development.6

In some LMICs, risk factors for CMDs include poverty, lack of education, female sex, marital discord and divorce.7 8 9 10 11 However, in other settings factors such as education
and income have been found to be less relevant. Similarly, there have been heterogeneous findings regarding the association between rural versus urban residence and CMDs. For example, a meta-analysis of studies from high-income countries, including the UK, the Netherlands, Canada and the USA, found a higher risk of CMDs in urban settings. Religion and spiritual factors also contribute to mental health. A meta-analysis of 147 studies that involved nearly 100,000 subjects from mainly high-income settings found that religiousness was associated with fewer depressive symptoms. Conversely, a study from mainland China, a middle-income setting, reported a higher risk of mental disorders among religious individuals.

The aim of this study is to identify factors associated with symptoms of CMDs in Bhutan, a lower middle-income South Asian country. Bhutan was the first country to focus on happiness as a state policy, however, little is known about mental ill health in this setting. Two Gross National Happiness (GNH) Surveys were conducted in 2010 and 2015 to assess happiness. Through these surveys, data were also collected on CMDs. Our study is a secondary analysis of data from the GNH Survey 2015 and aims to examine associations between socioeconomic, religious, spiritual and health factors, and symptoms of CMDs.

**METHODS**

**Study setting and participants**

Bhutan is a mainly Buddhist country in the Eastern Himalayas. Seventy per cent of its population live in rural areas and 69% of the total population are farmers. The national literacy rate is 63% among people aged 6 years and above. We used data from the second GNH Survey, conducted between January and May 2015 by the Centre for Bhutan Studies and GNH Research, Royal Government of Bhutan. The GNH Survey is a household survey administered verbally via a trained enumerator to minimise potential literacy barriers. A nationally representative household-based sample was created using a stratified, multistage cluster sampling strategy. First, urban and rural areas within each district were identified as the main sampling strata. Second, the blocks were selected systematically using probability proportional to size. Third, households were randomly selected within the designated enumeration areas. Further details of data collection and management procedures are described in the 2015 GNH Survey report.

**Measures**

The GNH Survey measured symptoms of CMDs using the embedded 12-item General Health Questionnaire (GHQ-12). The GHQ-12 is a screening tool to detect minor psychological distress in the general population or in a non-clinical setting. It has been extensively used in population studies in diverse cultures and contexts. The tool consists of 12 items assessing the severity of a symptom over the last 4 weeks using a 4-point Likert scale (0-1-2-3). For each participant, the 12 items were summarised into a single score by adding together responses for each item, giving an overall score that could range from 0 to 36. A higher score indicated poorer mental health. The GHQ-12 has not been validated in Bhutan, though it has been validated in other South Asian settings.

A participant was classified as having a CMD if he or she had a total GHQ-12 score of 12 or more. This threshold was recommended by Goldberg et al and has a sensitivity of 78.9% and specificity of 77.4%. Furthermore, Lundin et al reported that this threshold score provides the optimal trade-off between sensitivity and specificity for the GHQ-12 scored using the Likert method. Hence, we have chosen a threshold of 11/12 (a score of 11 or less indicating the absence of CMD and a score of 12 or greater indicating the presence of CMD) to report the prevalence of CMDs in the population.

From the GNH Survey, we also extracted the data on social and economic status (age, gender, residence, income, marital status, literacy, occupation and household size), religion and spirituality (spirituality, karma and meditation) and health (self-reported health status, disability and walking distance to the nearest health centre) to assess the association of these factors with symptoms of CMDs. A person was considered literate if they were able to read and write in English, Dzongkha (National Language) or Nepali. Urban areas were defined as any settlement with a resident population of more than 5000 and more than 50% of the population being dependent on non-primary economic activities such as construction, the service sector and the civil sector. Rural areas were defined as having a smaller and more sparsely distributed population where the main economic activities are agriculture, livestock and forestry. Household income measures included income earned by all household members from any sources, including salary, agricultural/livestock/forestry products and non-agricultural activities, adjusted for in-kind payments. We dichotomised income based on mean annual household income of Nu.164,829 (US$2535).

Respondents were asked which religion they followed: Buddhism, Hinduism, Christianity, other or none. Spirituality was assessed by asking ‘How spiritual do you consider yourself to be: very, moderately, somewhat or not at all?’ We combined respondents who answered ‘not at all’ and ‘somewhat’ due to low numbers in these categories. The GNH Survey collected data on frequency of meditation. Data were also collected on belief in Buddhist concepts of karma by asking ‘Do you consider karma in the course of your daily life: regularly, occasionally, rarely or not at all?’

Self-reported health status was determined by a single question ‘In general, would you say your health is excellent, very good, good, fair or poor?’ Due to a low number of cases and to be consistent with previous studies, we combined responses into good health (ie, ‘excellent’, ‘very good’ and ‘good’) and poor health (ie, ‘fair’ and

We also used data on disability and walking time to the nearest health centre.

Analysis

Stata V.13 was used for all analyses. The prevalence of CMDs was estimated as the proportion of respondents classified as having a CMD. Due to the survey design, estimates were obtained using stratification of district and sample weights of the primary sampling units. Internal consistency for the GHQ-12 score was checked using Cronbach’s alpha.

Based on the global literature and on local concepts of mental illness in Bhutan,30–34 we identified factors from the GNH Survey dataset that were potentially associated with CMDs. We organised factors into an analytical framework (figure 1). This framework draws on socioecological models for CMDs,35 36 and distinguishes potentially distal socio-economic factors (level 1) from more proximal religious and spiritual factors (level 2) and health-related factors (level 3).

We analysed GHQ-12 score as a continuous outcome and explored the association of potential risk factors with

Figure 1 Analytical framework for the analysis. GHQ-12, General Health Questionnaire.
GHQ-12 score through univariable and multivariable linear regression models using generalised estimating equations (GEE). GEE models were used to account for the clustering of respondents within the primary sampling units. We assumed an exchangeable correlation structure and applied sandwich estimator to obtain robust SEs. We also included district as an explanatory variable in all models. The regression coefficients ($\beta$) denote the average change in GHQ-12 score.

All factors that showed an association at P $\leq$ 0.25 in the univariable analyses were included in the multivariable modelling stage. Multivariable models included only those respondents with complete data. To guide multivariable analyses, we applied the analytical framework in figure 1, entering groups of factors into the model procedure in a hierarchical order. The socioeconomic variables (level 1) that showed an association at P $\leq$ 0.25 with GHQ-12 score in the univariable analyses were included in model 1. Model 2 included the socioeconomic variables that remained associated with GHQ-12 score at P $\leq$ 0.1 in model 1, plus religious and spiritual variables (level 2) that were associated at P $\leq$ 0.25. Model 3 included variables that were associated with GHQ-12 score in model 2 (P $\leq$ 0.1), along with health-related factors (level 3) from the univariable analysis (P $\leq$ 0.25). This approach avoided reliance on statistical associations by considering the hierarchical inter-relationship between risk factors. A P $\leq$ 0.25 was used for inclusion in the multivariable models to ensure that no important variables were missed. However, in the final model (model 3), variables were considered statistically significant if P $< 0.01$, due to the large sample size. Collinearity between variables was checked using variance inflation factors and found to be <2 for all variables. The fit of the final model was checked using residual plots, which indicated model assumptions were adequately satisfied.

We used secondary data that had no identifying information.

RESULTS

In total there were 7153 respondents, of whom 7041 had complete data. Table 1 presents key characteristics of respondents: 59% were women; 48% were farmers; 58% had no formal education; more than 60% were from the low-income group; three-quarters were married; 46% said they were ‘very spiritual’ and 72% lived in rural areas.

GHQ-12 scores were normally distributed with a mean of 9.4 (SD ±4.8). Cronbach’s alpha was 0.84 indicating satisfactory internal consistency. The estimated prevalence of CMDs was 29.3%, 95% CI 26.8% to 31.8%. Table 1 also shows the estimated prevalence for each potential factor and results from univariable analyses. All socioeconomic factors were associated (P $\leq$ 0.25) with GHQ-12 score. Among the religious and spiritual factors, degree of spirituality and consideration of karma in daily life were associated with higher GHQ-12 scores. Religion was not associated with GHQ-12 score (P=0.67). All three health-related factors (self-reported health status, disability and walking time to the nearest health centre) were univariably associated with higher GHQ-12 scores (P<0.01).

Table 2 shows the results of the multivariable models. In model 1, older age, being female, being divorced or widowed, illiteracy, low income and occupation were associated with higher GHQ-12 scores, and were therefore retained in model 2. Rural residence and household size were not associated with GHQ-12 score in model 1. In model 2, level of spirituality and consideration of karma were associated with GHQ-12 score along with retained variables from model 1. In model 3, poor self-reported health status and disability were associated with higher GHQ-12 scores along with retained variables from model 2.

In the final model (model 3), factors independently associated (P $< 0.01$) with higher GHQ-12 scores were: age, gender, marital status, literacy, occupation, income, spirituality, karma, self-reported health status and disability. GHQ-12 score was higher for older (β=1.29, 95% CI 0.57 to 2.00), female (β=0.70, 95% CI 0.45 to 0.95), divorced/widowed (β=1.55, 95% CI 1.08 to 2.02), illiterate (β=0.48, 95% CI 0.21 to 0.74) and low-income respondents (β=0.37, 95% CI 0.15 to 0.59). Respondents who were moderately spiritual (β=0.61, 95% CI 0.34 to 0.88), not or somewhat spiritual (β=0.76, 95% CI 0.28 to 1.23), or who occasionally considered karma in daily life (β=0.80, 95% CI 0.26 to 1.34) had significantly higher GHQ-12 scores. Respondents with poor self-reported health status (β=2.59, 95% CI 2.13 to 3.06) and with disability (β=1.01, 95% CI 0.63 to 1.40) also had higher GHQ-12 scores.

DISCUSSION

In line with previous research, our study suggests that older age, being female, being divorced or widowed, illiteracy, occupation, low income, poor self-reported health status and having a disability are potential risk factors for CMDs in Bhutan. Conversely, we found that increased spirituality and belief in karma were protective for CMDs.

We report a 29.3% prevalence of CMDs, similar to community-based studies in other South Asian settings. Our estimate was higher compared with the estimate in the 2015 GNH Survey report (10.3%) because we used a lower GHQ-12 threshold score (≥12 vs ≥16). Our threshold score was selected based on findings from the Goldberg et al study and the Lundin et al study.

Socioeconomic factors are important determinants of mental health status

Our findings support existing evidence that social and economic factors are independently associated with CMDs. We found that divorced or widowed respondents were at risk of CMDs. The prevalence of divorce in Bhutan is increasing, leading to a rise in matrimonial cases and single mothers seeking support for their families from...
Table 1 Univariable results of factors associated with GHQ-12 score, GNH Survey 2015

<table>
<thead>
<tr>
<th>Variables</th>
<th>Participants*</th>
<th>Prevalence of common mental disorders</th>
<th>Unadjusted mean change in GHQ-12 score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N  n %† (95% CI)</td>
<td>β‡ (95% CI) P value</td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High income</td>
<td>2711 640 24.0 (21.6 to 26.6)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Low income</td>
<td>4330 1411 32.7 (30.9 to 34.6)</td>
<td>0.98 (0.73 to 1.22)</td>
<td></td>
</tr>
<tr>
<td>Residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1987 472 24.7 (20.9 to 28.8)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>5059 1579 31.4 (29.7 to 33.1)</td>
<td>0.71 (0.20 to 1.21)</td>
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</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2923 776 26.9 (24.6 to 29.3)</td>
<td>Reference</td>
<td></td>
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<tr>
<td>Female</td>
<td>4120 1273 30.9 (27.8 to 34.2)</td>
<td>0.94 (0.69 to 1.19)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–24</td>
<td>1113 297 26.9 (24.0 to 30.0)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>25–34</td>
<td>1800 439 24.3 (21.8 to 26.9)</td>
<td>−0.20 (−0.53 to 0.13)</td>
<td></td>
</tr>
<tr>
<td>35–44</td>
<td>1562 402 26.5 (22.8 to 30.6)</td>
<td>−0.08 (−0.58 to 0.41)</td>
<td></td>
</tr>
<tr>
<td>45–54</td>
<td>1183 376 31.9 (29.0 to 34.9)</td>
<td>0.49 (0.02 to 0.97)</td>
<td></td>
</tr>
<tr>
<td>55–64</td>
<td>776 263 34.4 (30.9 to 38.1)</td>
<td>0.80 (0.25 to 1.34)</td>
<td></td>
</tr>
<tr>
<td>65+</td>
<td>612 274 44.3 (39.8 to 49.0)</td>
<td>2.48 (1.77 to 3.18)</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
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</tr>
<tr>
<td>Married</td>
<td>5328 1498 26.6 (25.6 to 31.0)</td>
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<td></td>
</tr>
<tr>
<td>Never married</td>
<td>1070 281 28.2 (24.0 to 29.3)</td>
<td>−0.20 (−0.66 to 0.26)</td>
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</tr>
<tr>
<td>Divorced/widowed</td>
<td>648 272 42.4 (38.1 to 46.7)</td>
<td>2.35 (1.82 to 2.88)</td>
<td></td>
</tr>
<tr>
<td>Literacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literate</td>
<td>3578 878 25.0 (22.7 to 27.4)</td>
<td>Reference</td>
<td></td>
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<tr>
<td>Illiterate</td>
<td>3468 1173 33.9 (31.4 to 36.5)</td>
<td>1.28 (1.01 to 1.56)</td>
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</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers</td>
<td>3377 1116 33.2 (31.5 to 34.8)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Home makers</td>
<td>1177 327 28.2 (23.4 to 33.6)</td>
<td>−0.17 (−0.68 to 0.33)</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>545 145 27.0 (23.9 to 30.4)</td>
<td>−1.01 (−1.46 to −0.55)</td>
<td></td>
</tr>
<tr>
<td>Civil/business§</td>
<td>1541 323 21.7 (18.8 to 24.9)</td>
<td>−1.33 (−1.63 to −1.03)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>405 140 34.2 (28.7 to 40.1)</td>
<td>0.51 (−0.06 to 1.08)</td>
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</tr>
<tr>
<td>Household size</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3–4 members</td>
<td>2491 712 29.0 (25.8 to 32.3)</td>
<td>Reference</td>
<td></td>
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<tr>
<td>1–2 members</td>
<td>910 302 33.0 (29.6 to 36.6)</td>
<td>0.60 (0.16 to 1.04)</td>
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</tr>
<tr>
<td>5–6 members</td>
<td>2453 688 28.1 (25.6 to 30.7)</td>
<td>0.03 (−0.23 to 0.28)</td>
<td></td>
</tr>
<tr>
<td>≥7 members</td>
<td>1190 347 29.3 (26.4 to 32.5)</td>
<td>0.05 (−0.32 to 0.43)</td>
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<tr>
<td>Religion</td>
<td></td>
<td></td>
<td>0.670</td>
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<tr>
<td>Buddhist</td>
<td>5882 1679 28.7 (26.5 to 31.1)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Hindu</td>
<td>1000 331 33.0 (28.9 to 37.5)</td>
<td>0.03 (−0.32 to 0.38)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>163 41 25.1 (18.6 to 33.0)</td>
<td>−0.27 (−0.92 to 0.38)</td>
<td></td>
</tr>
<tr>
<td>Spirituality</td>
<td></td>
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<td>&lt;0.001</td>
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<tr>
<td>Very</td>
<td>3262 889 27.3 (25.1 to 29.7)</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Moderately</td>
<td>3174 960 30.3 (27.1 to 33.7)</td>
<td>0.51 (0.27 to 0.74)</td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>610 202 33.4 (29.6 to 37.4)</td>
<td>0.88 (0.44 to 1.32)</td>
<td></td>
</tr>
<tr>
<td>Meditation</td>
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</tr>
<tr>
<td>Yes</td>
<td>1291 390 30.7 (28.0 to 3.5)</td>
<td>Reference</td>
<td></td>
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<tr>
<td>Never</td>
<td>5755 1661 28.9 (26.3 to 31.7)</td>
<td>0.21 (−0.10 to 0.51)</td>
<td></td>
</tr>
</tbody>
</table>

Continued
Social stigma associated with divorce and court proceedings, coupled with the financial stress of raising a child as a single parent could partly explain the link between divorce and CMDs in Bhutan. We found that older respondents as well as those who are illiterate or have a low income are more at risk of CMDs, in line with studies from other LMICs.\(^7\)\(^8\)\(^30\)\(^40\)\(^45\)\(^46\) In Bhutan, 37% of adults are illiterate, however, this is lower among younger generations due to improved utilization of educational services. Illiteracy may be a marker of relative poverty and marginalisation, as well as low utilization of health and education services. WHO reports that CMDs are 1.5–2 times more prevalent among low-income groups.\(^47\) This may be because people living in poverty lack the financial means to education and employment opportunities, perpetuating a negative cycle between poverty and CMDs.\(^47\) Older people may be more at risk of CMDs compared with other age groups due to increased social isolation and susceptibility to non-communicable disease.\(^48\)

We did not find any association between residence (rural/urban) and CMDs. This could be due to the massive rural to urban migration in Bhutan over recent years,\(^49\) masking any potential association. It could also be due to the inclusion of other more distal markers of socioeconomic status in the model, such as income and occupation. Findings from other settings have been heterogeneous. Some studies in USA and Australia found no difference in risk of CMDs between rural and urban areas.\(^50\)\(^54\) Studies in the UK\(^14\)\(^52\) and Canada\(^46\)\(^53\) reported higher rates of CMDs in urban areas compared with rural areas, whereas studies in China\(^24\) and India\(^55\) reported lower or similar rates of CMDs in rural and urban areas. Such mixed findings could be due to different definitions of rural and urban areas which may incorporate population density,\(^46\) remoteness and accessibility to health services.\(^13\)\(^53\)

Are spirituality and religious involvement beneficial for mental health?

We found that spirituality was associated with higher GHQ-12 scores. This is consistent with findings from other studies suggesting that spirituality is associated with mental health.\(^56\)\(^58\) We also found that respondents who occasionally and never considered karma in their daily lives reported higher GHQ-12 scores compared with respondents who regularly considered karma. Regular consideration of karma may relate to an individual’s level of religious involvement. Raphael et al found a significant positive association between religious involvement and mental health in a review of 43 studies.\(^32\) Similarly, a recent reviews reported that religious participation was inversely associated with depressive symptoms, anxiety, stress and suicide.\(^59\)\(^60\)

Bhutan is a predominantly Buddhist country and more than 90% of its population report that they are spiritual.\(^17\) In this setting, spirituality and religious involvement may promote mental health through supportive faith-based community networks, and by providing individuals with a sense of inclusion and community acceptance, as well as meaning and goals for their lives.\(^57\)\(^59\)\(^61\) Religious

**Table 1**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Participants*</th>
<th>Prevalence of common mental disorders</th>
<th>Unadjusted mean change in GHQ-12 score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>n</td>
<td>%† (95% CI)</td>
</tr>
<tr>
<td>Consideration of karma in daily life</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regularly</td>
<td>4048</td>
<td>1107</td>
<td>27.5 (24.9 to 30.3)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>2219</td>
<td>685</td>
<td>30.9 (27.6 to 34.4)</td>
</tr>
<tr>
<td>Never</td>
<td>776</td>
<td>258</td>
<td>33.3 (29.7 to 37.0)</td>
</tr>
<tr>
<td>Self-reported health status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good health</td>
<td>6315</td>
<td>1660</td>
<td>26.4 (24.2 to 28.7)</td>
</tr>
<tr>
<td>Poor health</td>
<td>731</td>
<td>391</td>
<td>54.1 (48.9 to 59.3)</td>
</tr>
<tr>
<td>Disability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5960</td>
<td>1601</td>
<td>27.0 (24.6 to 29.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>1084</td>
<td>448</td>
<td>42.1 (38.6 to 45.7)</td>
</tr>
<tr>
<td>Walking distance to health centre (min)</td>
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<td></td>
</tr>
<tr>
<td>≤30</td>
<td>3529</td>
<td>929</td>
<td>26.6 (24.3 to 29.1)</td>
</tr>
<tr>
<td>31–60</td>
<td>1379</td>
<td>408</td>
<td>29.5 (25.4 to 34.1)</td>
</tr>
<tr>
<td>≥61</td>
<td>2137</td>
<td>714</td>
<td>33.5 (30.9 to 36.2)</td>
</tr>
</tbody>
</table>

*Missing values for all factors were <112.
†Percentage may not match n/N due to adjustment for the survey design using Stata’s SVY command.
‡The regression coefficients (β) denote the average change in GHQ-12 score.
§Includes civil servants, local government, corporate, business and armed forces.
GHQ-12, General Health Questionnaire; GNH, Gross National Happiness.
Table 2  Multivariable analyses of factors associated with GHQ-12 score, GNH Survey 2015

<table>
<thead>
<tr>
<th>Socioeconomic factors</th>
<th>Model 1 (Socioeconomic factors)</th>
<th>Mean change β* (95% CI)</th>
<th>P value</th>
<th>Model 2 (Socioeconomic, spiritual and religious factors)</th>
<th>Mean change β* (95% CI)</th>
<th>P value</th>
<th>Model 3 (Socioeconomic, spiritual, religious and health factors)</th>
<th>Mean change β* (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>15–24</td>
<td>Reference</td>
<td></td>
<td>&lt;0.001</td>
<td>Reference</td>
<td></td>
<td>&lt;0.001</td>
<td>Reference</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>25–34</td>
<td>−0.28 (−0.73 to 0.18)</td>
<td>−0.18 (−0.64 to 0.28)</td>
<td>&lt;0.001</td>
<td>−0.28 (−0.73 to 0.16)</td>
<td></td>
<td></td>
<td>−0.28 (−0.77 to 0.21)</td>
<td></td>
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</tr>
<tr>
<td>35–44</td>
<td>−0.21 (−0.73 to 0.32)</td>
<td>−0.05 (−0.56 to 0.46)</td>
<td>&lt;0.001</td>
<td>−0.28 (−0.77 to 0.21)</td>
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<td>−0.28 (−0.77 to 0.21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45–54</td>
<td>0.24 (−0.34 to 0.82)</td>
<td>0.47 (−0.12 to 1.06)</td>
<td>&lt;0.001</td>
<td>0.08 (−0.48 to 0.65)</td>
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<td></td>
<td>0.08 (−0.48 to 0.65)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55–64</td>
<td>0.52 (−0.11 to 1.14)</td>
<td>0.80 (0.18 to 1.42)</td>
<td>&lt;0.001</td>
<td>0.32 (−0.26 to 0.90)</td>
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<td></td>
<td>0.32 (−0.26 to 0.90)</td>
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<tr>
<td>65+</td>
<td>1.90 (1.14 to 2.65)</td>
<td>2.24 (1.46 to 3.02)</td>
<td>&lt;0.001</td>
<td>1.29 (0.57 to 2.00)</td>
<td></td>
<td></td>
<td>1.29 (0.57 to 2.00)</td>
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</tr>
<tr>
<td>Gender</td>
<td></td>
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<td>&lt;0.001</td>
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<td>&lt;0.001</td>
</tr>
<tr>
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<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.84 (0.59 to 1.10)</td>
<td>0.82 (0.57 to 1.08)</td>
<td>&lt;0.001</td>
<td>0.70 (0.45 to 0.95)</td>
<td></td>
<td></td>
<td>0.70 (0.45 to 0.95)</td>
<td></td>
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<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Married</td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never married</td>
<td>0.26 (−0.23 to 0.74)</td>
<td>0.18 (−0.30 to 0.66)</td>
<td>&lt;0.001</td>
<td>0.13 (−0.34 to 0.60)</td>
<td></td>
<td></td>
<td>0.13 (−0.34 to 0.60)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divorced/widowed</td>
<td>1.64 (1.12 to 2.17)</td>
<td>1.65 (1.13 to 2.17)</td>
<td>&lt;0.001</td>
<td>1.55 (1.08 to 2.02)</td>
<td></td>
<td></td>
<td>1.55 (1.08 to 2.02)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literacy</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
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<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Literate</td>
<td>Reference</td>
<td></td>
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<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
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</tr>
<tr>
<td>Illiterate</td>
<td>0.61 (0.33 to 0.88)</td>
<td>0.57 (0.29 to 0.84)</td>
<td>&lt;0.001</td>
<td>0.48 (0.21 to 0.74)</td>
<td></td>
<td></td>
<td>0.48 (0.21 to 0.74)</td>
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</tr>
<tr>
<td>Occupation</td>
<td>0.002</td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Farmers</td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home makers</td>
<td>0.02 (−0.43 to 0.47)</td>
<td>0.04 (−0.39 to 0.48)</td>
<td>&lt;0.001</td>
<td>−0.01 (−0.46 to 0.43)</td>
<td></td>
<td></td>
<td>−0.01 (−0.46 to 0.43)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>0.02 (−0.83 to 0.16)</td>
<td>−0.38 (−0.88 to 0.12)</td>
<td>&lt;0.001</td>
<td>−0.42 (−0.92 to 0.09)</td>
<td></td>
<td></td>
<td>−0.42 (−0.92 to 0.09)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil/business †</td>
<td>0.02 (−0.67 to −0.01)</td>
<td>−0.35 (−0.66 to −0.04)</td>
<td>&lt;0.001</td>
<td>−0.31 (−0.62 to −0.00)</td>
<td></td>
<td></td>
<td>−0.31 (−0.62 to −0.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>0.02 (0.13 to 1.31)</td>
<td>0.73 (0.16 to 1.30)</td>
<td>&lt;0.001</td>
<td>0.64 (0.10 to 1.17)</td>
<td></td>
<td></td>
<td>0.64 (0.10 to 1.17)</td>
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<tr>
<td>Income</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>High income</td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
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</tr>
<tr>
<td>Low income</td>
<td>0.45 (0.23 to 0.68)</td>
<td>0.44 (0.22 to 0.67)</td>
<td>&lt;0.001</td>
<td>0.37 (0.15 to 0.59)</td>
<td></td>
<td></td>
<td>0.37 (0.15 to 0.59)</td>
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</tr>
<tr>
<td>Residence</td>
<td>0.507</td>
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<td></td>
<td></td>
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<tr>
<td>Urban</td>
<td>Reference</td>
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<td>Reference</td>
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<td>Reference</td>
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<tr>
<td>Rural</td>
<td>0.12 (−0.24 to 0.48)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Household size</td>
<td>0.03 (−0.03 to 0.08)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Religious and spiritual factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Spirituality</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
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<tr>
<td>Very spiritual</td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
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</tr>
<tr>
<td>Moderately spiritual</td>
<td>0.56 (0.30 to 0.87)</td>
<td></td>
<td>&lt;0.001</td>
<td>0.61 (0.34 to 0.88)</td>
<td></td>
<td></td>
<td>0.61 (0.34 to 0.88)</td>
<td></td>
<td></td>
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<tr>
<td>No and somewhat</td>
<td>0.79 (0.29 to 1.29)</td>
<td></td>
<td></td>
<td>0.76 (0.28 to 1.23)</td>
<td></td>
<td></td>
<td>0.76 (0.28 to 1.23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consider karma in daily life</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Regularly</td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>0.52 (0.28 to 0.77)</td>
<td></td>
<td>&lt;0.001</td>
<td>0.53 (0.29 to 0.77)</td>
<td></td>
<td></td>
<td>0.53 (0.29 to 0.77)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>0.81 (0.26 to 1.35)</td>
<td></td>
<td></td>
<td>0.80 (0.26 to 1.34)</td>
<td></td>
<td></td>
<td>0.80 (0.26 to 1.34)</td>
<td></td>
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</tr>
<tr>
<td>Meditation</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
<td>Reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>−0.22 (−0.52 to 0.08)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Health-related factors</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Self-reported health status</td>
<td></td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Continued
involvement is found to be associated with a better ability to cope with stress, and depression, suicide, anxiety and substance abuse. In Bhutan, Buddhist values encompass acceptance, forgiveness and law of karma, which could help to build tolerance and reduce tensions in communities, with benefits for individual mental health. On average, people spend 51 min per day on religious activities. Since the majority of the population is involved in religious activities, the national mental health strategy and action plan (2015–2023) includes working with the monastic and religious institutions in the country. Spiritual beliefs and practices may enable people to face difficulties and provide guidelines for individuals to live and work together. In other words, development policies need to consider religious amenities like temples, monastic schools and access to spiritual leaders as basic consideration in any settlement plans.

Our study did not find an association between frequency of meditation and GHQ-12 score. This may be due to the small proportion (7.5%) of respondents who reported meditating. Meditation is a higher spiritual Buddhist practise uncommon among lay people.

Interdependency of physical and mental health
In line with several previous studies, we found that individuals with poor self-reported health status or a disability had higher GHQ-12 scores. Due to the cross-sectional nature of the data, it is not possible to determine the direction of effect between physical health and mental health, However, a bi-directional relationship in which mental ill health exacerbates physical illness which further impacts on mental health is highly plausible. At present, there is no legislation or national policy on disability in Bhutan. Findings from our study suggest that any future disability initiative in this setting should consider incorporating a mental health component.

Table 2

<table>
<thead>
<tr>
<th>Socioeconomic factors</th>
<th>Mean change β* (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good health</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Poor health</td>
<td>2.59 (2.13 to 3.06)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Disability</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>No disability</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Disability</td>
<td>1.01 (0.63 to 1.40)</td>
<td></td>
</tr>
<tr>
<td>Walking distance to health centre (min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤30</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>31–60</td>
<td>–0.01 (–0.30 to 0.32)</td>
<td></td>
</tr>
<tr>
<td>≥61</td>
<td>0.30 (0.01 to 0.60)</td>
<td></td>
</tr>
</tbody>
</table>

*The regression coefficients (β) denote the average change in GHQ-12 score.
†Includes civil servants, local government, corporate, business and arm force.
GHQ-12, General Health Questionnaire; GNH, Gross National Happiness.

Our study identifies possible targets for mental health promotion strategies, which could be delivered by non-specialised mental health workers. Potential strategies include provision of mental health support to older people, and mental health literacy programmes for non-specialist health workers to aid recognition, management and prevention of CMDs among individuals with poor general health. In rural Bhutan, task shifting to non-specialised health workers like village health volunteers will be essential in providing access to mental health services. At present, there are only four psychiatrists in the country and only 1% of the total expenditure of health is directed towards mental health. This study highlights the need for more research to help advocate for increased resources and political commitment for a national mental health programme.

Strengths and limitations
The main strengths of this study are the large nationally representative sample including all age groups of 15 years and above from both rural and urban communities of Bhutan. In addition, a range of social, economic, religious and health factors were included in the multivariable analysis. However, the study has several limitations. First, it used cross-sectional data making it impossible to establish causal relationships. Second, the GHQ-12 has not been validated in Bhutan, however we used a continuous outcome to conduct the analyses in order to avoid over-reliance on a non-validated threshold score. The GHQ-12 is a self-reported screening tool. Although it is not diagnostic of CMDs, it is a feasible approach to assess mental health in a large national survey. The prevalence of CMDs reported in this study is an estimate due to the lack of a locally validated threshold score. Third, the GHQ-12 was not translated into the local language in the questionnaire. Enumerators translated the items from
English into the appropriate language for each respondent and this could potentially have led to some inconsistencies in translation. Finally, data on other established risk factors of CMDs, such as alcohol, substance abuse and history of mental illness were not collected.

CONCLUSIONS

Findings from this study highlight the importance of established socioeconomic factors of CMDs in Bhutan and suggest that religious involvement and spirituality may be protective factors for mental health in this setting. Further studies are needed to understand causal pathways to CMDs and to provide evidence to support mental health policy decisions and investment.

Acknowledgements

The authors would like to thank Dasho Karma Ura, Dorji Penjore and Tshoki Zangmo of the Centre for Bhutan Studies and GNH Research, Royal Government of Bhutan, for providing the data and rendering all possible support.

Contributors

GS, ML and LMW conceived and designed the concept of the paper. GS analysed the data and wrote the manuscript. PJK and LMW contributed to the data analysis and to the interpretation of the results. ML and KC contributed to the content and editing of the manuscript. ML supervised the whole process. All authors reviewed and approved the final manuscript.

Funding

The 2015 GNH study was funded by the Royal Government of Bhutan and Japan International Cooperation Agency.

Competing interests

None declared.

Patient consent

Obtained.

Ethics approval

The National Statistics Bureau of the Royal Government of Bhutan reviewed and approved the study protocol.

Provenance and peer review

Not commissioned; externally peer reviewed.

Data sharing statement

No additional data are available.

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REFERENCES

34. Tshomo D. Focus is on the rising menace of depression, Thimphu, Bhutan: Kuenzel, 2017.
36. Shidhaye R, Patel V. Association of socio-economic, gender and health factors with common mental disorders in women: a
population-based study of 5703 married rural women in India. *Int J Epidemiol* 2010;39:1510–21.


44. Namgyal G. Dzongkhag court sees rise in matrimonial cases, people blame development Bhutan Observer, 2011.


Gross National Happiness Study, 2015

Gyambo Sithy, Mu Li, Li Ming Wen, Patrick J Kelly and Kelly Clarke

BMJ Open 2018 8:
doi: 10.1136/bmjopen-2017-018202
Chapter 5: Paper 3

Association between Sleep Duration and Self-Reported Health Status: Findings from the Bhutan’s Gross National Happiness Study

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1Sydney School of Public Health, The University of Sydney, New South Wales, Australia; 2Health Promotion Unit, Sydney Local Health District, New South Wales, Australia

Study Objectives: Short and long sleep durations have been found to be associated with chronic conditions like diabetes mellitus, hypertension and cardiovascular disease. However, most studies were conducted in developed countries and the results were inconsistent. The aim of this study is to investigate the association between sleep duration and self-reported health status in a developing country setting.

Methods: We conducted secondary data analysis of the 2010 Gross National Happiness study of Bhutan, which was a nationwide cross-sectional study with representative samples from rural and urban areas. The study included 6476 participants aged 15–98 y. The main outcome variable of interest was self-reported health status. Sleep duration was categorized as ≤ 6 h, 7 h, 8 h, 9 h, 10 h, and ≥ 11 h. Multiple logistic regressions were conducted to investigate the association between sleep duration and self-reported health status.

Results: The mean sleep duration was 8.5 (± 1.65) h. Only 9% of the respondents slept for 7 h; 6% were short sleepers (≤ 6 h) and 84% were long sleepers (21%, 8 h; 28%, 9 h; 22%, 10 h; 13%, ≥ 11 h). We found that both short (≤ 6 h) and long sleep duration (≥ 11 h) were independently associated with poor self-reported health status.

Conclusions: This study found that people with shorter and longer sleep durations were more likely to report poorer health status.

Keywords: sleep, sleep duration, self-reported health status, developing country, rural population


INTRODUCTION

Sleep duration is reportedly associated with perceived physical and mental health status.1–3 There is increasing evidence that too little or too much sleep is associated with adverse health outcomes including mortality and morbidity.4–10 Many studies report a U-shaped association between sleep duration and increased health risks.11–15 In addition, systematic reviews and meta-analyses show that both long and short sleep durations are associated with non-communicable diseases (NCDs) such as diabetes,16–18 hypertension,9 cardiovascular disease,19,20 and obesity.21,22 While we know the important association between sleep duration and various health risks, little is known about the relationship between sleep duration and self-reported health status.

Self-reported health status is a subjective measure of an individual’s health and is commonly used in monitoring public health programs and epidemiological studies. It is an inexpensive method which can assess important and valid indicators of an individual’s health status. It is recommended as a health indicator by the World Health Organization.23–25 In addition, self-reported health status is strongly associated with morbidity,26 and it is a strong independent predictor of mortality,27 not only in the elderly group but also in the middle-aged population.28 Studies from high-income countries also indicate that too little and too much sleep are associated with chronic health conditions.8,9,18

Furthermore, some studies have indicated that sleep duration was associated with poor self-reported health status, but they were mostly conducted in developed countries and the results were not consistent. For example, large nationally represented studies from Korea (≥ 19 y),29 Australia (45–74 y)30 and United States (≥ 18 y)31 found that both short (≤ 5 h, ≤ 6 h, and ≤ 6 h, respectively) and long (≥ 9 h, ≥ 9 h, and ≥ 8 h, respectively) sleep durations were associated with poor self-reported health status. Conversely, a study conducted among elderly population (> 60 y) in Lima, Peru and a large multi-country study among university students aged 17–30 y found that only short sleep duration (< 6 h and < 7 h, respectively) was associated with poor self-reported health status.32,33 whereas Jean-Louis et al. found no association between sleep duration and the health-related quality-of-life score in a small sample size (273...
We conducted secondary data analysis using data extracted from the 2010 Gross National Happiness Study, a nationally represented Bhutanese sample. This study is different from previously reported studies because 60% of the survey respondents were farmers residing in the remote rural villages. Only 20% and 51% of the respondents had access to internet and television, respectively. Also, the sample size is nationally representative encompassing all groups aged above 15 y.

**METHODS**

**Study Design**

We conducted secondary data analysis using data extracted from the 2010 Gross National Happiness (GNH) study conducted by The Centre for Bhutan Studies and GNH Research, Royal Government of Bhutan. It was a nationwide cross-sectional study designed to produce statistically reliable estimates of people’s happiness (using the Gross National Happiness Index) at the national level with representative samples from rural and urban areas of each of the 20 districts. The study background and the details of the study design, questionnaire and methods are described in the World Happiness Report 2012 and in the Report titled “An Extensive Analysis of GNH Index.” In brief, it was a multi-stage, stratified cluster sampling study design, using the 2005 national census data for sampling frame and selection of clusters. The primary sampling units (PSU) were selected using probability proportional to sampling (PPS) method. The households listing for the PSUs were taken from the districts immigration office and selected by random systematic selection procedures.

**Survey Respondents and Instrument**

The survey was conducted between April and December 2010 by trained enumerators through household visits. The survey questionnaire had nine domains, including “Time use and balance.” Totalling 7,142 respondents aged 15–98 y were surveyed with mean age of 41 y. Of the total sample surveyed, 6,476 (91%) had complete information on sleep duration and they were included in this analysis.

**Main Variable of Interest**

The main outcome variable of interest in this study was the self-reported health status which was determined by a single question: “In general, would you say your health is excellent, very good, good, fair or poor?” In this analysis we have combined the responses into a binary outcome, good health (i.e., excellent, very good, and good) and poor health (i.e., fair and poor).

**Sleep Duration**

Under the survey domain, “Time use and balance,” the respondents were asked how they spent their time during the previous day, “beginning with when you woke up, can you please recount various activities you performed and how long they took?” From this 24-h recall period, the sleep duration was recorded as continuous variable in minutes and converted into hours with one decimal place, then they were categorized into ≤ 6 h, 7 h, 8 h, 9 h, 10 h, and ≥ 11 h. These categories were consistent with previous studies on sleep and self-reported health status. Seven hours is used as a reference category because the majority of the studies have used 7 h as the reference category and 7 to 8 h sleep is also reportedly associated with the lowest risk of morbidity and mortality.

**Other Main Covariates**

Sociodemographic factors like age, gender, household income and household size were included in the analysis. Age was assessed as a continuous variable and was also divided into six groups 15–24 y, 25–34 y, 35–44 y, 45–54 y, 55–64 y, and ≥ 65 y. Health-related behaviors such as consumption of alcohol and chewing betel nuts during the past 12 mo were also included in the model, as well as subjective well-being and number of working hours per day. Subjective well-being was assessed on a Likert scale 0 to 10, where 0 is not a very happy person and 10 being very happy person.

**Statistical Analysis**

We examined the characteristics of the respondents by categories of sleep duration with \( \chi^2 \) test. Bivariate association between self-reported health status and categorical covariates were examined by \( \chi^2 \) test. We estimated crude odds ratio and 95% confidence intervals (CI) for the relationship between poor self-reported health status and each of the covariates using simple logistic regression models.

Multiple logistic regression models were fitted to assess the association of sleep duration (predictor) with poor self-reported health status (outcome). In these models we categorized sleep into 6 groups: ≤ 6 h, 7 h, 8 h, 9 h, 10 h, and ≥ 11 h, and used 7 h as the referent group. A total of 16 variables with \( p \) value of < 0.25 based on the Wald \( \chi^2 \) statistics from the univariate analysis were included in the multivariate analysis. A value of \( p < 0.25 \) was chosen to allow for maximum potential confounders to be included in the model. Data were checked for collinearity. Backward elimination technique was performed. Demographic variables like place of residence (rural and urban), education level, occupation, marital status, spirituality, household size, and health-related behavior such as smoking and chewing tobacco were statistically not significant (\( p > 0.05 \)), therefore removed from the final model. Their removal from the model did not result in any substantial (< 10%) change in the parameter estimate. The final adjusted model consisted of 8 variables, i.e., sleep duration, age, gender, total household cash income, working hours, subjective well-being, alcohol consumption, and chewing betel nuts.

The adjusted odds ratio and 95% confidence interval (CI) of sleep duration associated with poor health (poor and fair) were calculated. The data were analyzed using SAS 9.4 and the results were reported as adjusted odds ratios and 95% confidence intervals, with a \( p \) value < 0.05 considered statistically significant. There were no significant interaction terms.
RESULTS

Table 1 presents characteristics of the study population. Of the 6,476 respondents, 48% were male and 52% were females. Seventy-eight percent of them were from rural and 22% from urban area. Sixty-five percent had no formal education, and 60% of the respondents were farmers by occupation.

A total of 415 respondents (6%) were sleeping ≤ 6 h, 612 (9%) were sleeping ≤ 7 h, and 5,499 (84%) were sleeping 8 h or more (21% 8 h; 28% 9 h; 22% 10 h and 13% ≥ 11 h). The mean sleep duration was 8.5 (± 1.65) h. Table 1 also shows very strong overall associations (p < 0.001) of sleep duration with sociodemographic characteristics, health-related behaviors (smoking, alcohol consumption, chewing betel nut), subjective well-being and self-reported health status.

Sleep duration and other characteristics of the 530 (8%) respondents with poor health status (poor and fair) are presented in Table 2. Among them 39 (7%) reported sleeping ≤ 6 h, 40 (8%) sleeping for 7 h, and 451 (85%) were sleeping ≥ 8 h (17%, 8 h; 26%, 9h; 24%, 10 h, and 19% ≥ 11 h).

Table 2 also presents the association between sleep duration and self-reported health status showing the unadjusted and adjusted results from the logistic regression models. After adjusting for gender, age, total cash income, alcohol consumption, chewing betel nut, subjective well-being, and working hours, poor health status was positively associated with respondents sleeping ≤ 6 or sleeping ≥ 11 h. The adjusted odds of reporting poor self-reported health status was 1.86 times (95% CI: 1.14, 3.04) or 1.59 times (95% CI: 1.05, 2.41) higher in those sleeping ≤ 6 h or those sleeping ≥ 11 h than those having sleep duration of 7 h, respectively.

When taking 15–24 y as the reference age group, there was a trend of significant increase in the odds of reporting poor health with aging. Furthermore, female respondents were more likely to report poor health status with adjusted odds of 2.08 (95% CI: 1.69, 2.54) compared with males.

The model also shows that respondents who were drinking alcohol or chewing betel nuts were less likely to report poor health status with adjusted odds of 0.67 (95% CI: 0.54, 0.82) or 0.76 (95% CI: 0.63, 0.92), respectively. The adjusted odds of reporting poor health was 1.55 times (95% CI: 1.26, 1.92) higher in low income groups (< 25th percentile) than those in middle income group (50 percentile).

There was also a statistically significant association between working hours and poor health status. Respondents working < 7 h were more likely to report poor self-reported health status with adjusted odds of 1.39 (95% CI: 1.05, 1.85) compared with those working 7–8 h.

DISCUSSION

This secondary data analysis of the 2010 Gross National Happiness Study found that people having both short (≤ 6 h) and long (≥ 11 h) sleep durations were more likely to report poor health status (poor and fair) compared to those having 7 h of sleep duration. This association was found to be independent of the factors including age, gender, household income, alcohol consumption, chewing betel nut, subjective well-being and working hours.

This study for the first time shows that the prevalence of sleep duration, and those characteristics associated with sleep duration in a low-income country with a predominantly (78%) rural sample, and 66% of the respondents without formal education. This, to our knowledge, is also the first study to investigate the association between sleep duration and self-reported health status from a developing country, with a nationally representative sample encompassing all groups aged above 15 y. Previously, almost all studies on sleep duration and self-reported health status were from developed or high income countries, except for one study with university students from a number of low income countries.

Sleep duration, both long and short, has been shown to be associated with adverse health effects. Our study found that a large proportion (63%) of the Bhutanese population was sleeping for a longer duration (≥ 9 h), and this proportion was larger than that of other countries. For instance, cross-sectional studies from Korea, United States and Australia revealed that only 8%, 9%, and 17% of surveyed population slept ≥ 9 h, respectively. In addition, Bhutan’s average sleep time of 8.5 h is high when compared to other nationally representative studies from Finland (7.5 h), Austria (7 h), Korea (6.7 h), and United States (7.2 h). The high proportion of long sleepers in Bhutan could be because the majority of the respondents were from the rural areas without formal education. Furthermore, only 20% and 51% had access to internet and television, respectively, and 42% of the respondents were drinking alcohol.

Our findings provide further evidence that both short and long sleep durations are significantly associated with poor self-reported health status. These findings are important because both long and short sleep durations are reportedly associated with adverse health outcomes such as diabetes, hypertension, obesity, and cardiovascular diseases. Further, a systematic review and meta-analysis conducted by Cappuccio et al. showed that short sleepers (commonly < 7 h per night, often < 5 h per night) and long sleepers (commonly > 8 h or 9 h per night) have a 12% and a 30% greater risk of dying, respectively, than those sleeping 7 to 8 h per night.

As the evidences suggest, sleep duration is an emerging public health problem related to life style. In addition, awareness among general public and health care providers on the importance of sleep is low. Therefore, public health interventions to raise awareness on sleep health may play an important role in promoting health and well-being of the population.

The main strengths of the study are the large nationally representative sample size from all 20 districts encompassing all age groups above 15 y of age of both rural and urban communities of Bhutan; in addition to sleep duration, a range of sociodemographic factors are taken into account in the multivariate analyses. There were several limitations to our study. First, the Gross National Happiness Study was a cross-sectional study, so we cannot establish any causal relationship between sleep duration and self-reported health status. A future prospective longitudinal study is required to establish the causal relationship. Second, the sleep duration was measured subjectively, which could have introduced recall bias. A more objective...
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Table 1—Characteristic of the study population by sleep duration based on the 2010 Gross National Happiness (GNH) study.
Characteristics
Age, y
15–24
25–34
35–44
45–54
55–64
> 65

Total (n = 6,476)

≤ 6 h (n = 415)

7 h (n = 612)

8 h (n = 1,390)

9 h (n = 1,812)

10 h (n = 1,393)

≥ 11 h (n = 854)

844 (13)
1,771 (27)
1,378 (21)
1,133 (18)
807 (12)
529 (8)

43 (10)
103 (25)
93 (23)
84 (20)
51 (12)
38 (9)

65 (11)
149 (24)
132 (22)
133 (22)
88 (14)
44 (7)

182 (13)
389 (28)
299 (22)
263 (19)
170 (12)
85 (6)

219 (12)
546 (30)
405 (22)
296 (16)
219 (12)
125 (7)

186 (13)
385 (28)
309 (22)
225 (16)
162 (12)
125 (9)

149 (18)
199 (23)
140 (16)
132 (16)
117 (14)
112 (13)

Gender
Male
Female

3,105 (48)
3,366 (52)

272 (66)
142 (34)

310 (51)
302 (49)

640 (46)
748 (54)

845 (47)
967 (53)

615 (44)
777 (56)

423 (50)
430 (50)

Residence
Rural
Urban

5,040 (78)
1,436 (22)

284 (68)
131 (32)

439 (72)
173 (28)

996 (72)
394 (28)

1,395 (77)
417 (23)

1,198 (86)
195 (14)

728 (85)
126 (15)

Working hours
<7h
7–8 h
>8h

2,037 (32)
668 (10)
3,664 (58)

138 (34)
33 (8)
231 (57)

165 (28)
52 (9)
381 (64)

359 (26)
124 (9)
885 (65)

544 (30)
180 (10)
1,070 (60)

453 (33)
164 (12)
767 (55)

378 (46)
115 (13)
330 (39)

Education
No formal education
Primary
Lower/Middle level
High school & above

4,237 (65)
895 (14)
830 (13)
514 (8)

220 (53)
75 (18)
79 (19)
41 (10)

365 (60)
104 (17)
84 (14)
59 (10)

876 (63)
199 (14)
201 (14)
114 (8)

1,166 (64)
248 (14)
253 (14)
145 (8)

987 (71)
181 (13)
134 (10)
91 (7)

623 (73)
88 (10)
79 (9)
64 (7)

Occupation
Unemployed
Farmers
Housewives
Civil servants
Business
Others

92 (1)
3,882 (60)
590 (9)
727 (11)
663 (10)
520 (8)

6 (1)
177 (43)
25 (6)
90 (22)
67 (16)
50 (12)

6 (1)
312 (51)
57 (9)
82 (13)
90 (15)
65 (11)

22 (2)
725 (52)
171 (12)
173 (12)
175 (13)
124 (9)

27 (1)
1,073 (59)
193 (11)
203 (11)
189 (10)
125 (7)

18 (1)
974 (70)
100 (7)
116 (8)
97 (7)
88 (6)

13 (2)
621 (73)
44 (5)
63 (7)
45 (5)
68 (8)

Marital Status
Never married
Married
Single/divorced/widow

623 (10)
5,173 (80)
671 (10)

46 (11)
337 (81)
32 (8)

60 (10)
504 (82)
48 (8)

119 (9)
1,148 (83)
122 (9)

165 (9)
1,464 (81)
181 (10)

131 (9)
1,095 (79)
164 (12)

102 (12)
625 (73)
124 (15)

Spirituality
No-somewhat
Moderate
Very

516 (8)
2,580 (40)
3,380 (52)

29 (7)
138 (33)
248 (60)

28 (5)
220 (36)
364 (59)

117 (8)
556 (40)
717 (52)

134 (7)
756 (42)
922 (51)

118 (8)
568 (41)
707 (51)

90 (11)
342 (40)
422 (49)

Income
Low income
Middle income
High income

1,650 (25)
3,207 (50)
1,619 (25)

70 (17)
210 (51)
135 (33)

130 (21)
294 (48)
188 (31)

292 (21)
689 (50)
409 (29)

428 (24)
923 (51)
461 (25)

426 (31)
690 (50)
277 (20)

304 (36)
401 (47)
149 (17)

Household size
1–2 members
3–4 members
5–6 members
> 7 members

891 (14)
2,376 (37)
2,113 (33)
1,096 (17)

56 (13)
170 (41)
127 (31)
62 (15)

80 (13)
233 (38)
190 (31)
109 (18)

178 (13)
500 (36)
479 (34)
233 (17)

235 (13)
656 (36)
625 (35)
296 (16)

198 (14)
503 (36)
444 (32)
248 (18)

144 (17)
314 (37)
248 (29)
148 (17)

Currently drink alcohol
Yes
No

2,749 (42)
3,727 (58)

179 (43)
236 (57)

237 (39)
375 (61)

534 (38)
856 (62)

762 (42)
1,050 (58)

622 (45)
771 (55)

415 (49)
439 (51)

Currently smoking
Yes
No

253 (4)
6,138 (95)

23 (6)
388 (94)

28 (5)
575 (95)

53 (4)
1,318 (96)

63 (4)
1,723 (96)

39 (3)
1,341 (97)

47 (6)
793 (94)

Currently chewing tobacco
Yes
No

698 (11)
5,774 (89)

52 (13)
363 (87)

59 (10)
553 (90)

140 (10)
1,250 (90)

151 (8)
1,659 (92)

175 (13)
1,217 (87)

121 (14)
732 (86)

Currently chewing betel nut
Yes
No

3,883 (60)
2,591 (40)

251 (61)
163 (39)

374 (61)
238 (39)

831 (60)
559 (40)

1,133 (63)
679 (37)

831 (60)
561 (40)

463 (54)
391 (46)

Subjective well-being
Not happy (0–5)
Happy (6–10)

2,692 (42)
3,773 (58)

144 (35)
270 (65)

226 (37)
386 (63)

541 (39)
849 (61)

760 (42)
1,049 (58)

616 (44)
771 (56)

405 (47)
448 (53)

Self-reported health status (SRH)
Poor
530 (8)
Good
5,946 (92)

39 (9)
376 (91)

40 (7)
572 (93)

91 (7)
1,299 (93)

136 (8)
1,676 (92)

125 (9)
1,268 (91)

99 (12)
755 (88)

Values presented as n (%).

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p value
< 0.001

< 0.001

< 0.001

< 0.001

< 0.001

< 0.001

< 0.001

< 0.001

< 0.001

0.1271

< 0.001

< 0.0001

0.004

< 0.001

< 0.001


measure will help to minimise the misclassification of sleep duration. Third, the choice of 7 h as the sleep reference category is based on limited evidence on the association of sleep duration and self-reported health status. The optimal sleep duration for various populations needs to be further explored.

**CONCLUSIONS**

In summary, this study has shown that people with shorter or longer sleep durations were more likely to report fair or poor health status. In particular, longer sleep duration reflects the current lifestyle of the Bhutanese population which could be due to limited access to television, internet and high proportion of illiterate respondents. At the same time, we recommend the need for public awareness on the importance of adequate sleep duration and its health benefits.

**ABBREVIATIONS**

CI, confidence intervals  
GNH, gross national happiness  
NCD, non-communicable diseases  
PSU, primary sampling units  
PPS, probability proportional to sampling  
SRH, self-reported health status  
WHO, World Health Organization

**REFERENCES**

G Sithey, LM Wen, P Kelly et al. Sleep Duration and Self-Reported Health Status


ACKNOWLEDGMENTS

The authors thank Dasho Karma Ura, Executive Director and Ms. Tshoki Zangmo, of the Centre for Bhutan Studies and GHN Research, Royal Government of Bhutan for providing the data and rendering all possible support.

SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication May, 2016
Submitted in final revised form August, 2016
Accepted for publication August, 2016
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DISCLOSURE STATEMENT

This was not an industry supported study. The authors have indicated no financial conflicts of interest.
Section II

How can health sector integrate noncommunicable diseases policy priority into Gross National Happiness?

This section presents the analyses of strategic policy opportunities for health sector to integrate the ‘Multisectoral national action plan for the prevention and control of NCDs, 2015-2020’ into policies across all relevant sectors. We argue that addressing NCDs aligns with the optimization of GNH and the Government of Bhutan recognize the prevention and control of NCDs as an integral element for achieving GNH. This section has three papers 1) evidence linking health and happiness, and the political momentum in GNH, 2) in-depth analysis of the link between domain ‘health’ and GNH determinants and 3) shared agenda and determinants between prevention and control of NCDs and GNH.
Chapter 6: Paper 4

Gross national happiness and health: lessons from Bhutan

Gyambo Sithey, a Anthony Thowb & Mu Lic

Bhutan was the first country in the world to pursue happiness as a state policy. The Bhutanese concept of happiness is deeper than the common meaning of happiness in industrialized countries. The philosophy of gross national happiness has several dimensions: it is holistic, recognizing people's spiritual, material, physical or social needs; it emphasizes balanced progress; it views happiness as a collective phenomenon; it is both ecologically sustainable, pursuing well-being for both current and future generations, and equitable, achieving a fair and reasonable distribution of well-being among people. Since the early 1970s, Bhutan has promoted population well-being over material development. Happiness, health and well-being are closely related. Good health is often considered the single most important determinant of well-being; conversely, adverse health changes have lasting and negative effects on well-being. In industrialized countries, happiness is often linked with material consumption. A basic level of material wealth is necessary, but citizens of richer and more technologically advanced countries are not necessarily the happiest. Along with economic growth, there is a need to measure well-being and ecological sustainability to reflect the overall progress of nations and of humankind. Given increasing evidence that the current trajectory of human development is not sustainable, there is an urgent need for more inclusive measures of progress than traditional economic indicators such as gross domestic product. Since the global recession of 2008–2009, the importance of well-being has gained political momentum – driven, in part, by a perception that the poorest and most vulnerable members of society are paying the price for excessive greed and risk-taking in the financial sector. In Europe, a shift in emphasis from measuring economic production to measuring people's well-being has been recommended. Following a resolution proposed by Bhutan, the United Nations convened a high level meeting at which the Secretary-General Ban Ki-moon called for development outcomes that value and measure happiness and well-being. The recent political momentum and the close links between health and well-being present an opportunity for health objectives to be included in other policy domains. Gross national happiness has greatly influenced the health system in Bhutan, as reflected in the constitution which states that "the state shall provide free access to basic public health services in both modern and traditional medicines." Health is recognized as a prerequisite for economic and spiritual development and as a means to achieving gross national happiness.

In Bhutan, 7.4–11.4% of total government spending is in the health sector. Primary health care is emphasized; privatization of health services is prohibited. A health trust fund was established in 1998 to ensure uninterrupted supply of essential drugs and vaccines. These policies are based on the philosophy of gross national happiness and provide an indication of the population-health benefits of prioritizing well-being in national policy-making. Bhutan screens all sectoral plans and policies to ensure that they are consistent with gross national happiness.

At the global level, translating gross national happiness into policy has the potential to promote health as defined in World Health Organization (WHO) charter, acknowledging the role of the environment, ecological sustainability, good governance and social determinants. WHO can play a more active role in strengthening consultation between sectors, improving access to relevant data and disseminating evidence on health and well-being. As a leader in the happiness movement, Bhutan has hosted several international conferences on gross national happiness; a further conference will be held in November 2015. The conference will be an opportunity to collate and disseminate the latest evidence from Bhutan and other countries linking health and well-being. Participants will discuss tools needed to pursue research and policy initiatives that contribute to sustainable development goals. First, the philosophy of gross national happiness needs to be understood more widely in the corporate boardroom. Second, the required indicators should be incorporated into current databases in the health sector. Third, the health sector has a responsibility to communicate the fact that health, human happiness and ecologically sustainable development are interdependent.

References

Chapter 7: Paper 5

Citation:
Interpreting the GNH Determinants From Health Policy Perspective: A Guide for Health Policy Makers

Gyambo Sithey,¹ Jayendra Sharma,² Tandi Dorji,³ Anne-Marie,¹ & Mu Li¹

Introduction

Gross National Happiness (GNH) is a developmental philosophy which aims to strike a balance between material and non-material values, prioritizing the happiness and well-being of all sentient beings. The objective of GNH is to achieve a holistic, sustainable and balanced form of development by considering a range of domains each of which makes a vital contribution to happiness. The domains are living standard, good governance, education, health, ecology diversity, community resilience, time use & balance and psychological well-being.

The concept of GNH was introduced in 1972. Over the period of 45 years, two national GNH surveys (2010 and 2015) were conducted. GNH transitioned from developmental philosophy to policy formulation tool. The GNH Index, GNH domains, GNH indicators, GNH determinants and GNH Policy Screening Tool (GNH-PST) all assist in policy formulation and policy screening (Table 1).

In 2010, the GNH Policy Screening Tool that systematically reviews the effect of policies and projects on GNH was developed by the

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Interpreting GNH Determinants From Health Policy Perspective

Centre for Bhutan Studies and Gross National Happiness (CBS & GNH) and implemented by Gross National Happiness Secretariat (GNHC). The purpose of GNH-PST is to screen the adverse effect of the policies on GNH determinants (Table 2) during the policy formulation.

Protocol for GNH Policy Formulation

All policies in Bhutan with exception of Royal commands or national exigencies should originate as a concept note which should be approved by the Gross National Happiness Commission (GNHC) and then by the Cabinet (Cabinet Secretariat, 2015). Upon approval of the concept note, the proponent commences with the policy formulation and submits the draft policy to the GNHC. The GNHC reviews the draft policy and circulates the draft to all relevant sectors and even publishes draft policies online, allowing the public to comment. After incorporation of the comments agreed on between the sectors and GNHC, the revised draft will be reviewed by an independent 15-member multi-sector committee constituted by the GNHC. This committee will use the GNH-PST to review the policy impact on GNH domains. As of June 2017, 22 policies have been approved by GNHC. The implementation process of GNH-PST is detailed below.

GNH Policy Screening Tool and the GNH Determinants

GNH policy screening tool is a mandatory step in policy formulation protocol (Cabinet Secretariat, 2015). The purpose is to assess the policy impact on GNH domains so that all possible mitigations by way of revisions and negotiations with relevant sectors are explored.

The GNH-PST constitutes a list of 22 GNH determinants (Table 1) against which specific policy questions are articulated to assess the broad effect of the policy on each of these determinants. The multi-sector committee members score each of the 22 determinants from 1
to 4. 1 denotes negative impact of the policy on the determinant, 2 uncertain, 3 neutral and 4 denotes positive impact. The minimum score for the policy to be approved is 66 point (3x22), below which the policy would require changes to acquire the minimum points to be considered, or it will be rejected. Those policies which attain the minimum required score will be submitted to the Cabinet for approval (GNH, 2015).

This approach mandates that all 9 domains of GNH are considered in the policy process and, consequently, supports an integrated approach to policy development. It also provides a platform for all stakeholders across all sectors to work a consensus about a policy impact. The tool primarily reviews the potential effect of the policy on the GNH of the population based on expected impacts on the key determinants of GNH. It facilitates policies that enhances GNH and reject policies that adversely affect the determinants of GNH.

**GNH Determinants and Health Policy**

There are 22 GNH determinants (Table 1) in the GNH-PST. An adverse policy effect on each of these determinants will impact the nine GNH domains, and health is one of the GNH domains. Any negative or adverse effect of the policy on health would also compromise on achieving the GNH because health and happiness are interdependent. Therefore, protecting the health domain would increase GNH.

There is compelling evidence showing that health is the single most important determinant of well-being and increasing happiness will only occur where health is protected and promoted. An adverse health conditions have negative effect on well-being (Easterlin, 2003; Gerdtham & Johannesson, 2001; Graham, 2008; Gyambo Sithey, Thow, & Li, 2015). Further, health and happiness share similar determinants which affect health and happiness in the same directions (Oshio & Kobayashi, 2010; Pierewan & Tampubolon,
2015). The GNH domain contributes the highest (14%) to Gross National Happiness (Ura, Alkire, Zangmo, & Wangdi, 2012).

Realising the role of health in GNH, health has been identified as a GNH domain with four indicators. They are self-reported health status, mental health (GHQ-12), healthy days and disability. These four indicators collectively assess the health domain.

Health domain can be promoted and protected by integrating health priorities in all policies and by mitigating the adverse effect of the policy on health domain. This can be achieved by articulating the GNH determinants during the GNH policy formulation. The process involves identifying the shared agenda between GNH and health and asking specific policy questions for each shared agenda. The detail analysis is given in a separate paper titled ‘Strengthening non-communicable disease policy through shared agendas: lessons from Bhutan for linking happiness and health policy action’.

For this, health sector requires a broad definition of the GNH determinants and how each GNH determinants affect the health. At present, there is no definition of GNH determinants.

Therefore, the objective of this paper is to define the 22 GNH determinants from health policy perspective and their implication on health sector. It intends to provide a reference point for planners and policymakers to understand GNH and its determinants from a health policy perspective.

**Methodology**

The GNH determinants were obtained from the ‘Gross National Happiness Policy Screening Tool’ available on the GNHC website (Gross National Happiness Commission, 2017)

A systematic search of the GNH determinant was conducted in Medline to identify relevant literature that explains the relevance of the determinants to health policy in context to Bhutan.
The key national documents, in particular, the ‘protocol for policy formulating’, ‘An extensive analysis of GNH Index’, ‘National health policy 2011’, ‘Eleventh five year plan volume 1 & 2’, ‘2015 GNH survey report’ and ‘The experience of Gross National Happiness as development framework’ were reviewed in conjunction with the specific policy questions outlined in the GNH policy screening tool with a focus to define the GNH determinants in relation to present health situation and policy priorities in Bhutan. Furthermore, a specific policy questions were cited drafted for every determinant to give a general idea of its application to health policy.

**GNH Determinants From Health Policy Perspective**

**Equity**

World Bank defined equity in terms of two basic principles. First is equal opportunity for life achievements based on his or her talents and efforts, rather than by pre-determined circumstances such as race, gender, social or family background. The second principle is the avoidance of deprivation in outcomes, particularly in health, education and consumption levels (World Bank, 2006). In GNH framework, equity is under the domain living standard or the material wellbeing (income, assets and housing) (Ura et al., 2012: 168).

Most frequently cited definition of health equity is ‘differences in health that are unnecessary, avoidable, unfair and unjust’ (Whitehead, 1992). WHO documents quote equity as the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically (World Health Organization, 2017b).

Health sector can articulate this determinant to reduce the systematic disparities in health which primarily arise due to disparities in the social determinants of health between different
groups or communities (Braveman & Gruskin, 2003). Reducing health inequities is important because health is a fundamental human right enshrined in the constitution of the Kingdom of Bhutan and in the WHO constitution (Kingdom of Bhutan, 2008; World Health Organization, 1948). Empirical evidence report that difference in health status occurs by socioeconomic, political and cultural stratification within the country. For instance, children born in the poorest section of household in India are three times more likely to die before their fifth birthday than children in the richest 20% of the households. Similarly, in Bhutan children of uneducated mothers (37%) and from the poorest family (41%) have the highest prevalence of malnutrition compared to educated mothers (23%) and from the richest family (21%). Antenatal attendance is 64% among poorest household compared to 92% among the richest household and literacy rate (among women 15-24) is higher in the urban area (78%) compared to rural areas (46%) (National Statistics Bureau, 2011a, 2011b, 2011c).

The determinant ‘equity’ can identify priority determinants of health inequities and review the impact of the proposed policy on these inequities during the GNH policy screening tool.

Does the policy negatively affect the accessibility to health, education and safe drinking water?

**Economic Security**

Economic security is defined as the ability of individuals, households and communities to sustainably meet their essential needs particularly about health, education, dwelling, information and social protection (International Committee of the Red Cross, 2013). In GNH, economic security features under the domain of living standard. It covers income, financial and food security, housing and asset (table 1).
Economic security is critical to health because health and economic profiles are inherently intertwined as it affects the delivery of quality and timely health care services. One year improvement in life expectancy contributes to an increase of 4% in output indicating that increased expenditure in improving health contributes to productivity (Bloom, Canning, & Sevilla, 2004). In Bhutan, government predominantly finances health expenditure. The total health expenditure as percentage of GDP is 3.6% in 2014. In absolute figure, the budget allocation for the current five year plan (11FYP) is Nu. 13952 million and the out of pocket expenditure constitute only 12% in 2014 (Thinley et al., 2017). Existing policy initiatives like health contribution from salary and Bhutan Health Trust Fund to supply Essential Drugs supports the economic security for health.

The determinant ‘economic security’ can function to ensure continued government resources to provide access to basic public health services in both modern and traditional medicines.

Does the policy lead to increase in out-of-pocket expenditure for health? Does the policy impact health financing and the likely drain of financial resources?

**Material Well-being**

Material wellbeing refers to the fulfilment of basic material needs for comfortable living. In GNH framework three indicators are used to assess the material wellbeing. They are household income, assets and housing conditions (Ura et al., 2012). Household income includes income earned by all the individuals in a household from within or outside the country and are adjusted for in-kind payments. Assets include livestock, land and household appliance while housing conditions include room ratio, roofing type and sanitation facilities.

Material wellbeing closely relates to poverty. World Bank describes poverty as being hungry, lack of shelter, clothing, to be sick and
Illiterate. In absolute terms, World Bank defines poverty as anyone living below US$1.90 a day (World Bank, 2016)

Material wellbeing or poverty is a major cause of ill health and a barrier to accessing health care. Poverty denies access to health services, medicines, routine vaccination and poverty creates illiteracy affecting their employability (Marmot, 2005; Organization, 2001, 2002). In Bhutan 12% of the population are under poverty (US$1.25) (Bhutan National Statistics Bureau; World Bank, 2014). Poverty creates ill-health because poverty forces people to live in an environment that makes them sick, without decent shelter, clean water or adequate food and sanitation. Annual Health Bulletin 2016, reports diarrhoeal diseases and respiratory related infections as the top cause of morbidity. These diseases are related to poverty, hygiene, sanitation and literacy.

The determinant ‘material well-being’ can assess the policy impact on poverty. Health and poverty are inextricably linked and poverty is a cause and consequence of poor health. These conditions make people vulnerable and susceptible to diseases.

Does the policy support poverty alleviation? Does the policy affect the local employment opportunities?

**Engagement in Productive Activities**

Engagement in productive activities reviews people capacity and opportunity to engage in productive activities along the life course. Despite the ambiguity over what constitutes a ‘productive’ role or a ‘contribution’ to society. Herein, productive activity is defined as that generates good and services and for which the individual may or may not be paid (Morrow-Howell, Hinterlong, & Sherraden, 2001).

Engagement in productive activities is a pathway to good health and well-being. However, 11% of the Bhutanese youth are unemployed according to 2015 labour force study (Ministry of Labour and Human Resources, 2015). Literature reports that prevalence of large
section of disengaged cohort is a risk factor for premature death and disability. This is because, unengaged or unemployed individuals or groups are more likely to indulge in unhealthy behaviours such as alcohol, tobacco consumption, diet and exercise which subsequently lead to increased risk for diseases, premature mortality and disabilities (Dooley, Fielding, & Levi, 1996). In addition, healthy workers lose less time from work due to ill health and are more productive when working (Bloom & Canning, 2000). An estimated US$ 23 billion was lost in India in 2004 from days spent ill and in care-giving efforts (World Health Organization, 2011).

Health sector can engage the determinant ‘Engagement in productive activities’ to review the impact of the policy on ‘time and leisure’ domain of GNH, employment opportunities, workplace health and safety and occupational health.

Does the policy consider provisions for productive engagement of people with special needs and the old age population (geriatric)?

**Decision Making Opportunity**

In the GNH Framework, this determinant relates to people’s participation in decision making at local level (Zomdu) and participation in the electoral process (local government and Assembly election) (Ura et al., 2012).

Health participation in policy formulation and implementation is necessary as health problems are greatly influenced by social and economic determinants like income, education, environment, employment, gender, water, agriculture, urbanization etc. Also, health is a social determinant for both economic and spiritual well-being of the population (Howell, Kern, & Lyubomirsky, 2007; Koenig, 2009; Miret et al., 2014; Van Zon & Muysken, 2005).

Addressing the social determinants of health, economic growth and overall wellbeing of the population provides an opportunity for participatory alliance with government agencies (such as agriculture,
education, finance, media and information, urban planning, trade, transport), civil societies, academia, private sectors and development partners. Currently national level committees like Multisector Task Force for HIV/AIDS and National Committee for Disaster Management are few examples that considers health sector in policy implementation.

The determinant ‘decision making opportunity’ can review the role and level of health sector in the implementation of the policy.

Does the policy include health sector as a stakeholder in its policy implementation? Does the governance include all levels of society, including the poor themselves in formulation of the policy?

**Anti-corruption**

Corruption is defined by Transparency International as “the abuse of entrusted power for private gain” and is regarded as a major obstacle to any development. Anything that curbs and is against corruption is anti-corruption. The determinant anti-corruption falls under the domain good governance. GNH questionnaire 2015 has one question ‘please rate the government performance in fighting corruption?’

Corruption hampers economic development, destabilise government systems and thereby negatively affects population health. The Royal Audit Authority of Bhutan report abuse of functions by public servants as the largest (43%) alleged corruptions. The same report also presents Nu. 524 million as unresolved irregularities in 2017 (Royal Audit Authority, 2016). Ministry of Health lost Nu.73 million to corruption in the procurement of medical equipment’s which accounts for 22% of the total contract value in 2011 (Anti-Corruption Commission, 2011).

Establishment of Anti-corruption Commission with Anti-corruption Commissioner as constitutional post in 2008 is a step towards anticorruption. The determinant ‘anti-corruption’ can review the
transparency and openness in policy formulation, implementation, policy impact on social determinants, policy beneficiaries, regressive and distorting subsidies etc. The purpose of the determinant is to screen all such policies that could reduce corruption practice.

Does the policy reveal the financial information that’s easy to understand by the public? Does the policy provide opportunity for public to give feedback on the policy outcomes? Will the policy adversely influence the procurement system negatively providing more room for corruption?

Legal Recourse

Legal recourse stipulates that the legal frameworks are adequately in place to guarantee entitlements, and enable the population to enjoy rights and protection. Laws guarantees access to justice, redress and reparations mechanisms for people whose entitlements and rights are violated. In GNH, legal recourse comes under good governance.

In health, the constitution, existing health related legislations and the national health policy 2011 provide guarantees and legal framework for health policies, programmes and services. The Constitution of the Kingdom of Bhutan mandates State to provide "free access to basic public health services in both modern and traditional medicines." Tobacco control regulations or the enforcement of warning signs on baby food or tobacco products are examples of societal level benefits of health promoting laws. Such provisions guarantee citizen rights and access to services. There are, however, instances where existing legal framework could also negatively impact health. For example, criminalising consensual sex and enforcing third party authorization for services could hinder access and utilisation of services by the affected groups. It is critical, therefore, to revisit legal frameworks that could potentially have detrimental impact on health.

The absence of a Health Act and other limited health related legislations have limited the number of legal cases reaching the court.
The provision of free health care may have contributed to patients feeling obliged not to report cases for legal action and to accept errors as part of this free health services.

Eventually, seeking legal recourse for health-related events will emerge. A few health-related legislations have been adopted of which the Bhutan Medical and Health Council Act (2002) is most relevant for legal recourse. Others such as The Medicine Act (2003), Tobacco Control Act (2010) and the Narcotic Drugs, Psychotropic Substances & Substance Abuse Act of Bhutan (2015) are intended more for safeguarding public health.

The determinant ‘legal recourse’ protects patients that may emerge from negligence and ensures that their rights are upheld during treatment. Further, this determinant also shields health providers and allows them to practice their profession without fear and anxiety when giving care. This determinant also ensures that citizen entitlements and rights are protected and that the proposed policies and programmes do not adversely impact these rights and entitlements. It also guarantees access to justice and that adequate legal mechanisms and support systems are available for people whose entitlements and rights have been violated or whose protection is hampered.

Does the policy contradict any legal provisions of the country? Is the policy aligned with international health regulations, covenants and agreements that health is signatory to? Does the policy provide legal mechanisms and support system in place for those adversely affected?

**Rights**

GNH framework includes 10 fundamental rights i.e. right to freedom of speech, right to vote, right to form tshogpa (political parties), right to equal access and opportunity to join public services, right to equal pay for equal work and free from discriminations
based on gender, religion, language and political affiliation (GNH 2015 Questionnaire). This is a summary of the fundamental rights as enshrined in Article 7 of the constitution of the Kingdom of Bhutan which guarantees every citizen with certain unalienable Rights.

In health, the right to health is defined as the ‘the right to the enjoyment of the highest attainable standard of physical and mental health’ (World Health Organization, 1948). Right to health ensure that health services are accessible, available, of a quality that is acceptable and equitably distributed for everyone irrespective of gender, religion, geographical location and political affiliation.

The determinant ‘right’ can review policies to provide health care as a public good that must be provided equitably including those conditions that are needed for good health such as a clean environment, sanitation, housing, adequate food and good working conditions.

Does the policy impact the rights of people to access health services? Are there pockets or groups of people that could be denied their fundamental rights including health because of this policy?

**Gender**

In GNH, gender address the difference in power and social relations between and among women and men in varied socio-cultural contexts and enable equitable access to resources, multiple roles, workloads, representation, voice, agency and status (Verma & Ura, 2015). Gender is one of the determinants of good governance and is considered an important component in the analysis for all other domains.

World Health Organization defines genders as ‘socially constructed characteristics of women and men such as norms, roles and relationships of and between groups of women and men’ (World Health Organization, 2015). The needs of women, men, girls, boys and all those in the spectrum of gender identities must be addressed
in policies to ensure there is equitable delivery of health programs. Gender differences in health are well known. In Bhutan tobacco use, alcohol consumption and blood pressure are higher in men. Obesity and physical inactivity are higher in women (Ministry of Health, 2014). 2015 GNH study report that men fair better in the domain of education and psychological happiness while there is no significant difference in health domain (Verma & Ura, 2015).

The determinant ‘gender’ mainstreams gender concerns of both men and women’s as an integral part of policy formulation, implementation, monitoring and evaluation to achieve gender equality and equity. This determinant enables mitigation to gender imbalances and inequities be identified, assessed and overcome during the formulation of any development policy or project.

Will the policy negatively impact the health of women, men, boys, girls and those with diverse gender identities? To what extent does the policy lead to gender bias and possible discrimination? Are people with certain gender excluded by the policy?

**Transparency**

Transparency is defined as ‘the legal, political, and institutional structures that make information about the internal characteristics of a government and society available to actors both inside and outside the domestic political system’ (Finel & Lord, 1999). It is also summarised as a public value demanded by citizens to combat corruption, open decision making by organizations and as a tool for good governance by governments and non-government agencies (Ball, 2009). Transparency in decision making curbs corruption whether real or perceived, and restricts secrecy and collusion through more openness.

Formation of Bhutan Transparency Initiative as a Civil Society Organization is a positive step to improve transparency. However,
the ‘right to information bill’ which guarantee right to information is still not passed by the parliament.

Transparency in governance enhances accountability of decision makers for safer systems, engaging clinicians and care providers in improving services and garnering the trust of the patients. Recruitment, appointment and trainings and health supply and procurement needs to be done in a transparent manner. Abuse of functions by public servants constitutes the largest (43%) alleged corruption type according to Royal Audit report 2016.

At the patient level, health systems need to be more transparent on the provision of health information including costs, duration of treatment, risks and potential harm. Private health services are just beginning in the country and it is crucial that transparency in health care be promoted.

The determinant ‘transparency’ can assess the extent of transparency in health care including accountability and equity in services.

When reviewing any policy, the impact of the policy on the transparency of public services needs to be reviewed as it will impact on the quality of public service. Some specific questions to review are provided below.

Does the policy impair access to information by public? Does the policy make provision of health care more transparent or opaque?

**Skills and Learning**

Determinant ‘Skills and learning’ represents the ‘education’ domain in GNH Policy screening tool. GNH promotes holistic education which includes conventional modern education and building a foundation in traditional knowledge, common values and skills. The purpose is to nurture productive and employable citizen with high ethical values grounded on the principles of Buddhist values. The
domain has four indicators 1) literacy, 2) schooling, 3) knowledge and 4) value.

Education is a strong determinant of physical and mental health (CSHD, 2008; Ross & Wu, 1995). The association between education and health is reported by many countries. Educated people experience better health than the poorly educated and conversely low educational attainment is associated with higher rates of infectious and chronic diseases, poor self-reported health status and shorter life expectancy (Pincus, Callahan, & Burkhauser, 1987; Ross & Wu, 1995; Russ et al., 2012). Education level is also associated with healthy life style behaviour; well-educated are less likely to smoke, have higher physical activity and likely to drink moderately than the poorly educated (Ross & Wu, 1995). In Bhutan, more than half of the population (55%) have no education (National Statistics Bureau of Bhutan and Asian Development Bank, 2013). Further, the National Health Survey 2012 report that only 16.8% of the population have comprehensive knowledge of HIV/AIDS which is considered as a measure of health literacy in GNH study.

The determinant ‘skills and learning’ can assess the impact of the policies on early childhood care and development, education for all, basic minimum education, non-formal education programme, Educating for GNH, school health programme, religion and health, health literacy etc.

Does the policy recognize that health literacy improves physical and mental health of the population? Does the policy recognize that there are strong links between poor health and educational achievement?

**Health**

Health is one of the nine domains and it is gauged by four indicators i.e. 1) Self-reported-health status, 2) mental health (GHQ-12 item), 3) healthy days and 4) disability. GNH aspired to have over 26 healthy
days a month, have high self-reported health, and must not suffer from serious deprivations from disabilities (Ura, 2015).

World Health Organization (WHO) defined health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (World Health Organization, 1948). The constitution of the kingdom of Bhutan reads that “The State shall provide free access to basic public health services in both modern and traditional medicines”. Therefore, any policy that would negatively contravene the delivery of public health services needs to be mitigated.

Empirical evidence suggests that health is necessary for achievement of happiness and increasing the happiness will only occur where health is protected and promoted. At present NCDs account for 56% of all deaths in Bhutan and mental health affects about 30% of the population. Health is one of the single most important determinants of well-being and adverse health changes have lasting and negative affect on wellbeing (Easterlin, 2003; Graham, 2008). GNH 2010 study report that health is the single most important contributor to GNH.

In the GNH Policy Screening Tool, health domain is assessed by only one determinant i.e. ‘health’. Therefore ‘health’ includes delivery of basic public health services in both modern and traditional medicine as enshrined in Article 9 clause 21 of the constitution of the Kingdom of Bhutan. The health services include primary health care services, medical services, supply of essential drugs, immunization etc. The determinants ‘health’ must capture the health impact of the policy. This determinant can serve as the scoping step of the Health Impact Assessment.

Does the policy impact the health (physical and mental health) of the population either during implementation or after the implementation?
**Water and Air Pollution**

This determinant encompasses two primary facets of environmental pollution. Air pollutants are classified as suspended particulate matter (dusts, fumes, mists, and smokes), gaseous pollutants (gases and vapours) and odours (Kjellstrom et al., 2006). Water pollution is the contamination of ground, surface and coastal water with chemicals, heavy metals, synthetic compounds and persistent organic pollutants attributed to discharge of untreated waste, industrial waste and run-off from agricultural lands.

Clean air (indoor and outdoor) and water are basic requirements of human health and well-being. However, air and water pollution causes 12.6 million deaths globally and of the 133 disease groups listed in the Global Health Observatory, 101 are linked to environmental health (A. J. Cohen et al., 2005; Prüss-Üstün & Neira, 2016). In Bhutan, Annual Health Bulletin reports high incidence of respiratory infections (pneumonia, bronchitis and bronchiolitis), diarrhoeal diseases, and skin infections which can be caused by environmental risk factors. The most relevant environmental risk factor is exposure to indoor smoke pollution from traditional firewood stoves in Bhutan. Most of the rural households use traditional firewood stoves as Liquid Petroleum Gas and Kerosene are expensive and short in supply (Tenzin Wangchuk, 2017; Wangchuk, He, Knibbs, Mazaheri, & Morawska, 2017).

The determinant water and air pollution can review the health impacts of water and air pollution. It screens policies that could cause adverse impact on the air and water quality.

Does the policy impact the prevention and control of water and airborne diseases? Does the policy increase stress and health hazards to residents and commuters due to noise, air and water pollution during the policy implementation (hydro project sites, road widenings and house construction)?
Land Degradation

Land degradation is "any form of deterioration of the natural potential of land that affects ecosystem integrity" (McDonagh, Lu, & Stocking, 2006). The issue is largely bound in the ecological concepts of ecosystem integrity, productivity, species richness and ecological resilience (Board, 2005).

Land degradation impacts directly and indirectly in many ways on people’s livelihoods, food security and nutritional status. While long term good health relies on continued stability and functioning of ecosystem (Chivian & Bernstein, 2010). The possible impacts of land degradation on human health are indirect, contributed through its impacts on climate, biodiversity, agriculture and others.

The determinant ‘land degradation’ can articulate the policy impact on food security, availability, nutritional status as well as infectious diseases which are strongly associated with poverty, agricultural productivity and ecological health.

Does the policy promote agriculture productivity through better land management?

Bio-diversity Health

Biodiversity refers to all kinds of living organisms. It includes plants, animals, fungi and other living things. World Wild Life states ‘when we say we want to save the planet, we use the word ‘biodiversity’ to encompass this entire concept’. There is no single indicator for biodiversity. The constitution of the Kingdom of Bhutan states the ‘a minimum of 65% of Bhutan’s total land shall be maintained under forest cover for all time’.

Human health depends upon availability of water, food and fuel. Disruption of ecosystem have major influence on the emergence, transmission, and spread of infectious diseases (Lewis, 2006). Policies
that degrade land, water, flora and fauna will impact health of the population directly and indirectly.

Determinant ‘biodiversity health’ emphasises the importance of maintaining a healthy bio-diversity to secure maximum population health gains. The determinant can be used to articulate the health impact associated with changes to the ecosystem, climate change, deforestation and loss of bio-diversity. It attempts to moderate human activity as a threat to bio-diversity.

Does the policy minimize human activity as a threat to bio-diversity? Are infectious diseases outbreaks more probable because of this policy?

**Social Support**

There is no consensual definition of social support and its measurements (Heitzmann & Kaplan, 1988; House, 1987). It is described as a social support accessible to an individual through social ties to other individuals, groups and larger community (Lin, Ensel, Simeone, & Kuo, 1979). The most commonly mentioned supports are emotional, informational, instrumental (House, Kahn, McLeod, & Williams, 1985). Emotional support includes love, care, encouragement; informational pertains to providing advice or relevant information that may help to solve the problem and instrumental support refers to material assistance like monetary help.

From GNH standpoint, social support depicts the civic contributions made, pertains to availability of social safety nets and measures people’s perceived social support (Page 133, GNH 2015). Social support is a determinant of domain community vitality.

Social support affects mental and physical health through its influence on emotions, cognition and behaviour (Cohen 1988). Social support also plays role in the progression of, and recovery from physical illness. Hypothesis is that social relationships influence behaviour with implications for health such as diet, exercise,
smoking, alcohol, sleep etc. Social support is now recognized as a determinant of health (House, Landis, & Umberson, 1988; World Health Organization, 2018). Lack of social support is a risk factor for mortality and morbidity (House et al., 1988). Review by Fatih Ozbay et al report low levels of social support is associated with heighten stress, elevated heart rate and increased blood pressure, depression and mood disorder (Ozbay et al., 2007). Uchino cited evidences linking social support to cardiovascular, neuroendocrine and immune system (Uchino, 2006). Further, a large body of data suggests that social support may have impacts on physical and psychological health through its stress-mediating or stress buffering role and several pathways have been proposed (Sheldon Cohen, 2004; Sheldon Cohen, Underwood, & Gottlieb, 2000). Therefore, social supports have strong influence on NCD and well-being (Berkman, Glass, Brissette, & Seeman, 2000; S. Cohen & Wills, 1985).

The determinant ‘social support’ can assess and support the integration of social support components (social security, safety nets, old age and disability supports systems, social cohesions among family and neighbourhood) in the policies across sectors.

Does the policy consider community engagement, volunteer, counselling, domestic violence, shelter homes, geriatric care and community safety in the neighbourhood?

Family

From GNH standpoint, well-being of families is the cornerstone on which society rests. The quality of family relations is detrimental to mental wellbeing throughout a person’s entire life cycle, from childhood to old age. Bhutanese social structure and religion deem that we take care of each other as if we are all related (Leaming, 2004). Family is one of the determinants of domain community vitality. GNH 2015 report that 96% of the respondents were satisfied with family relationship.
Family is a social determinant of health and greater support from families, friends and communities is linked to better health (McNeill, 2010; World Health Organization, 2017a). For health sector, family is an economic unit bound together by emotional ties. Hence, family has a pivotal role to care (emotional care, material care like housing and nutrition) for family members, and, in the case of children, readying them for healthy, happy and productive lives (McNeill, 2010). The socio-economic status of the family (income, education and occupation-family size, number of children) and the social support within the family have impact on the physical and mental health (Reyes et al., 2004; Ross, Mirowsky, & Goldsteen, 1990).

The determinant ‘family’ can assess the impact of the policy on family cohesion and Bhutanese family values.

Does the housing framework of the Draft Human Settlement Policy consider enough space for joint families to stay together?

**Leisure**

Determinant leisure broadly encompasses working hours, sleep duration and leisure. Working hours include both paid and unpaid work such as child care, labour contribution, voluntary work and informal help (Ura et al., 2012). Leisure is defined as amount of activities/time spent outside obligated work time and/or engagement in leisure as subjectively defined, preferred activities pursued during free time for their own sake, fun, entertainment, or self-improvement (Argyle, 1996), as time not occupied by paid or unpaid work personal chores and obligations (Sonnenntag, 2001).

Overall the determinant leisure is intended to review the work-life balance in the population by administering time use diary of the last 24 hours from which one can estimate the number of hours an individual spends on paid work, unpaid work, sleep duration and other activities such as social cultural activity, sports and other leisure...
activities (Galay, 2009; Ura et al., 2012). It attempts to analyse the importance of maintaining a harmonious work-life balance.

Empirical literatures report that prolonged working hours are associated numerous health risk, including hypertension, cardiovascular diseases, depression, anxiety, sleep lost, fatigue and occupation injuries (Shields, 1999; Sparks, Cooper, Fried, & Shirom, 1997; Virtanen et al., 2011). Meta-analysis found that working hours is detrimental to health and an increased health symptoms is reported with increasing hours (Sparks et al., 1997). Study report that those work 55 hours or more per week have 1-3 times higher risk of incident of stroke than those working standard hours (35-40 hours). In addition, there is a U-shaped association between sleep duration (Cappuccio, D'Elia, Strazzullo, & Miller, 2010) and increased health risk. Gyambo et.al found that both short (≤ 6 h) and long sleep duration (≥ 11 h) were independently associated with poor self-reported health status in a study among Bhutanese population (G Sithey, Wen, Kelly, & Li, 2017).

Further, leisure-time physical activity protects against the risk of chronic diseases such as cardiovascular disease, diabetes, cancer, obesity, hypertension and mental health, including death (Bauman, 2004; Paluska & Schwenk, 2000; Penedo & Dahn, 2005). Physical activity contributes to primary and secondary prevention of these diseases and there is a linear relationship between hours of physical activity and health status. The most physically active are at found to be at the lowers risk of premature death (Warburton, Nicol, & Bredin, 2006; World Health Organization, 2013). Hence, participation in leisure activities has a therapeutic affect because it serves as a means for preventing risk, coping with stress and impact of negative life events and transcending illness and disability (Caldwell, 2005; Coleman & Iso-Ahola, 1993). Therefore, leisure has a restorative and beneficial effect on the health of an individual.

The determinant ‘leisure’ can assess the policy impact on life style related diseases such as hypertension, diabetes, obesity, cardiovascular diseases and mental health diseases which are strongly
associated with physical activity, working hours, work conditions, social engagements etc.

Does the policy consider public amenities (like sports facilities, parks, outdoor gyms, temples and monasteries etc) for children, disabled and old age to balance work-leisure relationship? Does the policy impact the working hours, working conditions and leisure time of the community?

**Culture**

GNH seeks to preserve and promote distinctive Bhutanese culture (language, dress, music, arts and crafts, festivals, events, ceremonies, etiquette etc.,) to protect the sovereignty in the face of evolving socio-cultural change. The preservation and promotion of culture is a domain in GNH.

Culture has a strong effect on health outcomes by way of its influence on attitudes, beliefs and practices. For example, a study conducted by Rinchen Pelzang found that 99% (105) of the respondents performed religious ceremonies when someone is sick (Pelzang, 2010). Culture is identified as one of the social determinants of health. World Health Organization recommends using the UNESCO definition of culture ‘set of distinctive spiritual, material, intellectual and emotional features of society or a social group, and that it encompasses in addition to art and literature, ways of living together, value systems, traditions and belief’ as it conceives cultures as a way of life (WHO Regional Office for Europe, 2015)

When culture works unchecked to hinder positive health outcomes, an effort should be made to address the cultural practise. For example, a study from the eastern Bhutan report that a breastfeeding mother would stop breastfeeding if her child gets diarrhoea for fear of causing it more harm (Bøhler & Ingstad, 1996). On the contrary, when culture creates favourable conditions to optimise health outcomes, endeavour should be made to understand and promote
those practices (Napier et al., 2014). For example, the long median duration of breastfeeding (23 months) due to cultural norm is a desired practise as breastmilk is an important source of nutrition and helps in optimal development of infant and young child (National Statistics Bureau, 2010). Neglect of culture in health and health care is considered single biggest barrier to the advancement of highest standard of health (lancet 2014).

The determinant ‘culture’ can enhance health services to achieve highest standard of health.

Will the policy negatively impact the health seeking practices due to promotion of certain Bhutanese culture?

**Values**

Bhutan is predominantly a Buddhist country that beliefs in the principles of peace, compassion and Karma (cause and affect). The core GNH values are the five Buddhist moral precepts. 1) Refraining from harming living a thing 2) taking what is not given (stealing) 3) sexual misconduct 4) lying and 5) taking intoxicating substances (creating disharmony) (Ura et al., 2012).

These GNH values have a strong influence on health outcomes. Study among health workers report that the belief in the law of cause and affect espouse loyalty and mindfulness in their work for fear of accumulating negative merit (Pelzang, Johnstone, & Hutchinson, 2017). These basic precepts support family and community coherence, healthy vegetarian diet, care for the vulnerable, refraining from multiple sexual partners and substance abuse.

Policies that promote these core GNH values can positively impact health outcomes and can enhance the quality of health care services. Determinant ‘values’ can assess the impact of the policy on culture, tradition and values.

Will the policy impact the Bhutanese culture, tradition and values?
Stress

Stress has been defined as ‘a response characterised by physiological arousal and negative affect, especially anxiety’ (Folkman, 2013). It is the physical, mental and emotional human response to a stimulus, often referred to as ‘stressor’ such as unemployment, hectic work schedule, family and relationship problems, financial stress, etc. In children and adolescent, the most common stressors are exposures to violence abuse (sexual, physical, emotional, neglect) and divorce (Cicchetti & Toth, 2005). Stressful life events are causal for the onset of depression and it often precedes anxiety disorders.

Over all 30% of the Bhutanese report mental distress with women, divorced, and illiterates reporting higher prevalence of mental distress (G Sithey, Li, Wen, Kelly, & Kelly, 2017). Population that live in stressful environment are at increased risk of anxiety, mood disorder, morbidity and mortality. Stress is also associated with unhealthy behaviours like smoking, substance abuse, higher consumption of alcohol, accidents, increased sleep problem and eating disorders (Cooper & Marshall, 2013; Schneiderman, Ironson, & Siegel, 2005; Vrijkotte, Van Doornen, & De Geus, 2000). Stress in work environment leads to peptic ulcer, cardiovascular disorders and high blood pressure (Schuler, 1980).

Stress in GNH Policy Screening Tool, represent the subjective wellbeing (Refer table). Subjective wellbeing is defined as person’s cognitive and affective evaluation of his or her life (Diener, Oishi, & Lucas, 2009) and literatures report that health and wellbeing are interdependent (Howell et al., 2007; Gyambo Sithey et al., 2015). In short subjective well-being adds 4 to 10 years to life compared to low subjective wellbeing (Diener & Chan, 2011).

The determinant ‘stress’ supports and promotes population well-being. For which the policy should be supporting all the GNH determinants which includes health.
Has the policy considered the impact of long-term potential urban stressors? Does the policy consider the potential risk factors for mental health related to urbanisation and increase settlement?

**Spiritual Pursuit**

Religion connotes organised and institutional components of faiths, traditions or an organized system of beliefs, practices, rituals and worship of God (Koenig, McCullough, & Larson, 2001). Spirituality is more difficult to define as it is more personal and subjective. Pulchalski defined spirituality to find meaning and purpose in life by connecting to the moment, to nature, to others and to the scared (Puchalski, 2012). While Koenig define spirituality a personal quest for understanding life and about relationship with the sacred or transcendent (Koenig, 2009). In fact, there is a growing trend that people categorise as spiritual but not religious.

In GNH framework, spirituality is one of the indicator for psychological well-being and it constitutes 1) self-reported spirituality level, 2) belief in Karma, 3) praying and 4) meditation (Ura et al., 2012).

Bhutan is a Buddhist (83%) country with a significant Hindu population (14.5%). GNH 2015 study reports that 91% of the population are spiritual and on an average Bhutanese people spent 51 minutes per day on religious related activities. The average time spent on religious activities by those were engaged was 1 hour and 41 minutes (Centre for Bhutan Studies, 2016)

Spirituality and the religious involvement impacts physical and mental health, for example, frequent church attendance was associated with lower symptoms of depression, similarly person with greater religious involvement have lower rates of substance abuse (Koenig, 2009; Moreira-Almeida, Lotufo Neto, & Koenig, 2006; Smith, McCullough, & Poll, 2003). Gyambo Sithey et.al found that
spirituality and religious involvement are independent predictors of common mental disorders in Bhutan.

The determinant ‘spirituality’ can articulate the policy impact on Central Monastic Body (Dratshang Lhentshog), freedom and right of any individual to practise any faith base organization and to include the Central Monastic Body in all aspects of GNH policy formulation and implementation.

Does the policy consult Central Monastic Body in the formulation and implementation of the policy? Does the policy consider monasteries, temples and retreat facilities as a core component and/or as basic public amenities to balance material and spiritual development?

**Discussion and Conclusion**

The protocol for GNH policy formulation provides legitimate institutional arrangements allowing stakeholders to participate in the development and implementation of GNH friendly policies and project. Further, the GNH Policy Screening Tool evaluates the policy impact on the GNH domains by assessing the policy impact on the GNH determinants. A well-defined GNH determinant would improve detection and mitigation of adverse impacts of the policy on the GNH domains.

Health is one of the GNH domains and to effectively assess the policy impact on health domain. Health sector must articulate the relationship between health and each of the GNH determinants. The literature reviews and the analysis of the GNH determinants conducted in this paper indicate that GNH determinants partially represent the social determinants of health. In which case, any adverse effect on the GNH determinants would also impact the health of the population. This is because, many factors combine to affect the health of the population. Factors such as where we live, environment, genetics, income, education level, and our
relationships with friends and family etc. have bearings on health apart from factors such as health care and services.

The GNH-PST also provides an opportunity to integrate health in all sectors. Health sector can use GNH determinants (during GNH-PST) to select health enhancing polices because health is one of the nine domains for GNH. In other words, the GNH-PST and the GNH determinants can function as health impact assessment tool allowing health to administer the scooping step of the health impact assessment. GNH-PST helps decision-makers make choices about alternatives and improvements to prevent unwanted health outcomes and to promote health.

However, for an effective use of the GNH policy screening tool, health sector must articulate the relationship between health and each of the GNH determinants. For this, our paper provides a preliminary definition of each of the 22 GNH determinants from health policy perspective and articulates the impact of the determinants on health.

As evident from the write up, the interpretation of GNH determinants can vary by policy, sectors, institution and with time and policy priority. This paper, therefore, intends to clarify and standardise the definition and evidences surrounding GNH determinants and its implications to health. It is intended as a reference point for planners and policy makers during policy screening and health impact assessment.
Interpreting GNH Determinants From Health Policy Perspective

Table 1. GNH domains, determinants and the indicators.

<table>
<thead>
<tr>
<th>GNH Domain</th>
<th>GNH Determinants</th>
<th>GNH Indicators</th>
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<tbody>
<tr>
<td>Living Standard</td>
<td>Equity</td>
<td>Per capita income</td>
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<td>Economic security</td>
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<td>Material well-being</td>
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<td></td>
<td>Engagement in productive activities</td>
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<td>Education</td>
<td>Skills &amp; learning</td>
<td>Literacy</td>
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<td>Value</td>
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<td>Health</td>
<td>Public Health</td>
<td>SRH</td>
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<td>Healthy days</td>
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<td>Disability</td>
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<td></td>
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<td>Mental Health</td>
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<tr>
<td>Cultural diversity &amp; resiliency</td>
<td>Culture</td>
<td>Zorig Chusum skills (artistic skills)</td>
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<td>Values</td>
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<td>Community vitality</td>
<td>Social support</td>
<td>Donations</td>
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<td></td>
<td>Family</td>
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<tr>
<th>Community relationship</th>
<th>Family</th>
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<tr>
<td>Time use and balance</td>
<td>Leisure</td>
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<td>Work</td>
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<td>Sleep</td>
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<td>Psychological Well-being</td>
<td>Spiritual pursuits</td>
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<td>–ve emotions</td>
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<td></td>
<td>Spirituality</td>
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<td>Ecology diversity &amp; resilience</td>
<td>Water and air pollution</td>
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<td>Urban issues</td>
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<td>Wildlife damage</td>
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<td>Responsibility towards environment</td>
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<td>Eco logical issues</td>
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<td>Good Governance</td>
<td>Decision making opportunity</td>
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<td>Fundamental rights</td>
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<td>Gender</td>
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<td>Transparency</td>
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Reference


Chivian, E., & Bernstein, A. (2010). *How our health depends on biodiversity*. Center for Health and


Interpreting GNH Determinants From Health Policy Perspective


Interpreting GNH Determinants From Health Policy Perspective


Pincus, T., Callahan, L. F., & Burkhauser, R. V. (1987). Most chronic diseases are reported more frequently by individuals with fewer than 12 years of formal education in the age 18–64 United States population. *Journal of chronic diseases, 40*(9), 865-874.


Chapter 8: Paper 6

Strengthening non-communicable disease policy with lessons from Bhutan: linking gross national happiness and health policy action

Gyambo Sithey1,2 · Mu Li2 · Anne Marie Thow3

Abstract There is growing global interest in Gross National Happiness (GNH) as a metric to capture population well-being and economic development. Empirical evidence suggests that health is necessary for achievement of happiness. The growing epidemic of non-communicable diseases (NCDs) threatens to undermine the achievement of GNH. We analyze synergies between current policy priorities and the institutional mechanism for GNH and the Global NCD Action Plan 2013–2020 that has informed Bhutan’s approach to NCDs. We identify strategic policy opportunities to strengthen outcomes for both policy areas. Lessons from Bhutan also suggest strategic opportunities to address NCDs in other countries where happiness is on the national agenda, or where action on NCDs could be improved through engagement between health and other sectors, especially where ways to promote and measure GNH (population well-being) already exist.

Keywords Health policy · Health and happiness · Gross national happiness · Shared agenda · Policy innovation · Noncommunicable disease

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Published online: 27 June 2018
Introduction

Worldwide each year, 16 million people die prematurely before the age of 70 from non-communicable Diseases (NCDs), and four out of five of these deaths occur in low- and middle-income countries [1, 2]. Having recognized the social, economic, and public health impacts of NCDs, in 2013, the World Health Assembly endorsed the Global Action Plan for the Prevention and Control of Non-communicable Diseases 2013–2020 (referred to below as the Global NCD Action Plan) [3]. The Plan provides a menu of recommended policy options and cost-effective interventions to achieve nine globally agreed NCD targets (Box 1), including an overall 25% relative reduction in premature mortality from NCDs by 2025. Effective implementation of the Plan remains slow and challenging [2]. Impediments to NCD prevention and control include raising political commitment and engaging sectors beyond health [4]. Effective innovation in NCD policy remains a priority, particularly in low- and middle-income countries [5, 6] (See Box 1).

Bhutan is a small country in South East Asia with a population of 779,666 [8] where NCDs account for 68% of deaths [2]. Urgent action is needed [9, 10].

The objective of this paper is to identify opportunities to integrate NCD policy priorities into a multisectoral forum focused on Gross National Happiness (GNH), through identifying shared policy agendas. First, we introduce Bhutan’s approach to gross national happiness, much of which has been adopted elsewhere, and its GNH policy screening tool. Then we describe synergies between policy priorities related to GNH and prevention and control of NCDs. We examine the policy implications of health—particularly NCD prevention—as a strong correlate of well-being by identifying specific policy opportunities to strengthen outcomes for both policy areas. We analyze how Bhutan’s implementation of GNH could inform countries beyond Bhutan to enhance attention to and implementation of the Global NCD Action Plan and present a process for engaging governments in this sort of policy strengthening to improve health and happiness consistent with their own cultures and values.

Box 1: Nine voluntary targets for the prevention and control of NCD to be achieved by 2025

1. A 25% relative reduction in the overall mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases
2. At least 10% relative reduction in the harmful use of alcohol, as appropriate, within the national context
3. A 10% relative reduction in prevalence of insufficient physical activity
4. A 30% relative reduction in mean population intake of salt/sodium
5. A 30% relative reduction in prevalence of current tobacco use in persons aged 15 + years
6. A 25% relative reduction in the prevalence of raised blood pressure, or containment of the prevalence of raised blood pressure, according to national circumstances
7. Halt the rise in diabetes and obesity
8. At least 50% of eligible people receive drug therapy and counseling (including glycemic control) to prevent heart attacks and strokes
9. An 80% availability of the affordable basic technologies and essential medicines, including generics, required to treat major NCDs in both public and private facilities

Source World Health Organization [7]

Gross national happiness

The concept and development of methods to measure GNH in Bhutan

Bhutan is a global leader in pursuing gross national happiness. GNH reflects a shift in emphasis from measuring economic output to measuring happiness with recognition of the importance of fulfilling material, spiritual, and emotional needs of the individuals who make up the population [11]. In 1972, the fourth King of Bhutan, Jigme Singye Wangchuck, introduced the term ‘Gross National Happiness.’ It has since evolved from a developmental philosophy to a set of quantitative measurements (Bhutan’s GNH Index, see p. 33, Ref. [12]) and policy formulation tools (Gross National Happiness policy screening tool [13]).

Box 2. Glossary of terms

**Happiness or well-being** The degree to which an individual judges the overall quality of his/her own life [14]. (In this study, we define happiness and well-being to be the same and use them interchangeably)

**Happy people** People who attained sufficiency in 66% or more of the weighted indicators—equivalent to six of the nine domains. (See p. 30 Ref. [11])

**Gross national happiness** There is no single official definition of gross national happiness [12]. In this paper, we define it as the extent to which Bhutan’s nine domains of gross national happiness are fulfilled

**Gross National Happiness Index** It is a single number composite index, computed from GNH indicators and GNH domains using Alikre–Foster methodology (2011). Gross National Happiness Index = 1 − HA′ [12]

**Gross National Happiness domains** Broad specification of the areas of concern for well-being in Bhutan. [12] (See the nine domains in Table 1)
**Gross national happiness determinants** 22 subjective and objective factors that influence the GNH domains and the GNH Index. The Centre for Bhutan Studies and GNH research developed them in 2010. (See Table 1)

**Gross national happiness indicators** These are statistically robust indicators that reflect Bhutanese values and happiness. These 33 GNH indicators are easily understandable by citizens and measure the progress of GNH domains. Appendix 5 of reference 11 describes the 33 indicators [12]

**Sufficiency threshold** Sufficiency threshold shows how much a person needs in order to enjoy sufficiency in each of the 33 indicators. Appendix 5 of reference 11 gives the sufficiency cutoffs for each indicator [12]. See Appendix 5, The 33 GNH indicators and their constructions, justifications, and sufficiency thresholds, p. 33, Ref. [11]

**Gross National Happiness Commission** The central government body for coordinating policy formulation to ensure cohesion between sectoral policies and alignment with the national development objectives and GNH

**Gross National Happiness multisectoral committee** A heterogeneous group of 15 experts from relevant sectors and agencies selected by Gross National Happiness Commission to assess a policy under consideration [15]. For example, decision makers from 10 central ministries and central autonomous agencies like Royal Civil Service Commission, Royal Monetary Authority, National Environmental Commission, National Commission for Woman and Children, Tourism Council of Bhutan, Bhutan Information, Communication, and Media Authority, etc


**Menu of policy options** The list of policy options and cost-effective interventions for prevention and control of major NCDS listed in Global NCD Action Plan (Appendix 3), to assist member states in implementing actions to achieve the nine voluntary global targets [7]

**Social determinants of health** World Health Organization defines social determinants of health as the conditions under which people are born, grow, live, work, and age. GNH determinants share many of the same elements as the social determinants of health. For example, GNH determinants such as material well-being, equity, gender, education, culture, and stress are also among the social determinants of health defined by WHO

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**Development of the Gross National Happiness Index (GHI)**

In 2005, the Royal Government of Bhutan decided to develop a GNH Index, with ‘domains’ and ‘indicators’ (See definitions in Box 2) to operationalise the concept of GNH (p. 1, Ref. [12]). In consultation with experts and from the literature reviews, the Centre for Bhutan Studies developed a preliminary set of questionnaires in English covering nine domains. In 2006 and 2008, Bhutan then carried out a series of pilot surveys. The pilot questionnaire included data for more than 1000 variables. Completion of the questionnaire took 4–7 h.
Strengthening non-communicable disease policy with lessons…

Table 1  Bhutan’s indicators for measuring gross national happiness using domains, indicators and determinants. Reproduced with permission from [13]

<table>
<thead>
<tr>
<th>Domains of GNH (9)</th>
<th>GNH indicators in GNH Index (33)</th>
<th>GNH determinants in GNH policy-screening tool (22)*</th>
</tr>
</thead>
</table>

*See Box 2 for definitions of terms

Drawing on the 2006 and 2008 GNH pilot surveys, Bhutan prepared its first GNH index in 2008 (with 33 indicators for the nine domains, constructed using 124 variables). The nine GNH domains are equally weighted to reflect equal importance of each for attaining happiness [15]. Twenty-four out of the 33 indicators are quantitative, and 9 are qualitative. Participatory consultations involving decision makers
from central government agencies, autonomous bodies, and academicians informed the selection of the indicators, as did empirical and theoretical work.

Since then, Bhutan has conducted two national GNH surveys (2010 and 2015). The 2015 GNH questionnaire contains 148 questions and the interviewers require about an hour and a half to complete it with each respondent. The field period lasted approximately 5 months, covering 7153 respondents across all 20 districts of Bhutan [16].

Bhutan continues to represent GNH using the nine ‘domains’ of gross national happiness set out in Table 1 (p. 10 Reference [12]) with the 33 ‘GNH indicators’ to track and measure a ‘sufficiency threshold’ in each of these domains (See Table 1 and Box 2). For the health domain, Bhutan uses four indicators when collecting data (self-reports) from those surveyed: health status, healthy days, disability, and mental health. For a person to be categorized as ‘sufficient’ in self-reported health status, she or he must rate her or himself to be in “excellent health or very good health.” For health days, Bhutan set the sufficiency threshold at ‘26 healthy days per month’; for disability, it is ‘no long-term disability’; and for mental health, the threshold is ‘normal well-being’ (See Appendix 5: The 33 GNH indicators and their constructions, justifications, and sufficiency thresholds, p. 33, Ref. [12]).

Bhutan has also developed 22 ‘GNH determinants’ (causal factors) for evaluating the impact of specific policies on GNH domains. For the health domain, this means assessing the impact of a policy on GNH determinants that enhance actions for prevention and control of NCDs. For example, GNH determinants like ‘equity,’ ‘skills’ and ‘learning’ (education), ‘economic security,’ and ‘legal recourse’ impact the health domain [17]. Any adverse impact on these determinants would negatively affect the health domain (See definitions of terms in Box 2 and display of all domains with indicators and determinants in Table 1).

Bhutan uses this GNH Index to calculate overall GNH at any point in time by measuring the key conditions of well-being, which comprise the nine domains. The GNH Index uses a robust multidimensional methodology known as Alkire and Foster method (2011). The formula is as follows: the GNH Index is the rate or headcount ratio of happy people (H_H), plus the extent of sufficiency that not-yet happy people enjoy (\( A_{suff}^U \)). To calculate the extent of sufficiency, one multiplies the percentage of people who are not-yet-happy (\( H^U \)) which is 100% minus \( H_H \) by the average percentage of domains in which not-yet-happy people have achieved the sufficiency threshold (See Box 2 and Appendix 5, p. 123, Ref. [11]).

\[
\text{GNH Index} = H_H + \left( H^U \times A_{suff}^U \right)
\]

The GNH Index is a single number composite index ranging from zero to one with zero as the lowest and one as the highest possible value. GNH Index can be viewed one element at any time: by age, gender, regions, etc. This makes it particularly useful for prioritizing resources to increase population happiness. All details of GNH measurements and index appear online in the “An extensive analysis of GNH Index” [12, 18].
Strengthening non-communicable disease policy with lessons...

**Bhutan’s gross national happiness policy-screening tool: evaluating specific policies**

The GNH policy screening tool, a matrix (across the horizontal axis, ‘policy questions with scoring options’; across the vertical one, ‘determinants’) allows for systematic impact assessment of any policy within the GNH domains. Once users complete their analyses (players and process explained below), the tool displays the impact to be expected if the policy is implemented. Thus, it enables users to select GNH-enhancing policies and reject those likely to adversely affect the determinants of GNH [15].

**Bhutan’s Gross National Happiness Commission: the mechanism and scorecard**

Bhutan’s Gross National Happiness Commission (GNH Commission), known as the Planning Commission until 2008, is the highest government body mandated to formulate and monitor policies [19]. To carry out assessment of anticipated impacts of any new policy on GNH determinants (Box 2), the GNH Commission forms a 15-member GNH multisectoral committee representing agencies relevant to the policy. Each of the committee members scores the 22 GNH determinants (using the GNH policy-screening tool) as follows: 1 for negative impact, 2 for uncertain, 3 for neutral, and 4 for positive impact. The minimum score for policy approval is 66 points (3 points × 22 determinants). Policies scoring fewer than 66 points require changes if they are to be considered further; otherwise, they are rejected [13]. Final approval of any policy depends on acceptance by the Council of Cabinet Ministers. Figure 1 shows the implementation process of GNH policy-screening tool. Since 2010, Bhutan uses the GNH policy-screening tool for all policies except for ‘national exigencies’ (urgent needs as in case of national emergency or natural calamities) [20].

**Synergies between GNH and NCD prevention and control: an opportunity to strengthen policy making in Bhutan, and globally**

Using empirical evidence, researchers have shown health to be necessary for achievement of happiness, and that happiness has only occurred where health has been protected and promoted [21, 22]. Studies also show a strong correlation between NCDs and happiness [22, 23]. The prevalence of hypertension and the average country level of happiness ranking, for example, correlate negatively in the member countries of the Organization of Economic Cooperation and Development (OECD) [24]. Specific chronic physical health conditions like muscular-arthritis-rheumatism, heart attacks, and strokes reduce well-being [25]. The nationally representative GNH study from Bhutan showed that the health domain contributed 14% to people’s happiness [12]. There is, thus, an opportunity for improving health and
happiness by linking policies from multiple sectors with complementary objectives to reduce NCDs and enhance well-being.

Bhutan’s experience has relevance for many countries worldwide that now measure well-being in addition to economic performance to represent the overall well-being of the nation. In 2008, former French President Nicholas Sarkozy established the ‘Stiglitz-Sen-Fitoussi commission.’ It recommended a shift of emphasis from measuring economic production to measuring people’s well-being [26]. In 2013, the Organization for Economic Cooperation and Development (OECD) released the guidelines for measuring well-being [18]. In 2011, the European Parliament adopted a resolution: GDP and beyond: Measuring progress in a changing world. The government of the United Kingdom (UK) introduced its National Well-being Program in 2010. Canada created the Canadian Index of Well-being in 2009 [8, 27] and Australia established its Australian Unity Wellbeing in 2001 [18, 28].
<table>
<thead>
<tr>
<th>The six objectives of global NCD action plan [7]</th>
<th>Shared agenda between NCDs and GNH</th>
<th>Shared GNH determinants</th>
<th>Opportunities for strategic engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To raise the priority accorded to the prevention and control of NCDs in global, regional, and national agendas and internationally agreed development goals, through strengthened international cooperation and advocacy</td>
<td>Political priority to prevent premature death and disability due to NCDs</td>
<td>Health, Decision-making opportunities and Engagement in productive activities</td>
<td>Health: Does the policy support to raise awareness of NCDs in line with the Global NCD Action Plan?</td>
</tr>
<tr>
<td>2. To strengthen national capacity, leadership, governance, multisectoral action, and partnerships to accelerate country response for the prevention and control of NCDs</td>
<td>Strengthening leadership and governance across sectors for policy prioritization and implementation</td>
<td>Economic security, Decision-making opportunities, and skills and learning</td>
<td>Economic security: Does the policy consider resource mobilization to implement the policy?</td>
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<td>Decision-making opportunity: Does the policy recognize the role of multisectoral agencies in formulation, implementation &amp; evaluation of the policy?</td>
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<td>Skills and learning: Does the policy consider opportunities to enhance leadership, and national capacity for policy implementation?</td>
</tr>
<tr>
<td>The six objectives of global NCD action plan [7]</td>
<td>Shared agenda between NCDs and GNH</td>
<td>Shared GNH determinants</td>
<td>Opportunities for strategic engagement</td>
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<tr>
<td>3. To reduce modifiable risk factors for NCDs and underlying social determinants through creation of health-promoting environments</td>
<td>Prevention of premature death and disability due to NCDs</td>
<td>Health, Time use and balance and Legal recourse</td>
<td>Health: Does the policy promote healthy lifestyle for health and well-being?</td>
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<td>Time use and balance: Does the policy consider healthy environments, which promote physical activities, work–life balance, and healthy cities?</td>
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<td>Legal recourse: Does the policy comply with national health, NCD, alcohol, and tobacco control policies?</td>
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<tr>
<td>4. To strengthen and orient health systems to address the prevention and control of NCDs and the underlying social determinants through people-centered primary healthcare and universal health coverage</td>
<td>Mainstreaming the underlying social determinants of health in all policies</td>
<td>Material well-being, Skills and learning, Social support and Equity</td>
<td>Material well-being: Does the policy improve access to safe drinking water, basic education, food security, etc.?</td>
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<td>Skills and learning: Does the policy improve school enrollment, retention, and health literacy?</td>
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<td>Social support: Does the policy affect the social cohesion of the community, address social discrimination, stigmatization, hostility, and unemployment?</td>
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<td>Equity: Does the policy ensure equitable access to health services?</td>
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Table 2  (continued)

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<thead>
<tr>
<th>The six objectives of global NCD action plan [7]</th>
<th>Shared agenda between NCDs and GNH</th>
<th>Shared GNH determinants</th>
<th>Opportunities for strategic engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. To promote and support national capacity for high-quality research and development for the prevention and control of NCDs</td>
<td>A transdisciplinary national research agenda and improved public access to national research data</td>
<td>Health, Decision-making opportunities, Skills and learning, and Transparency</td>
<td>Health: Does the policy support interdisciplinary research linking social and health sciences?</td>
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<td>Decision-making opportunity: Does the policy involve relevant agencies, academics, and private institutions in the development of research agenda?</td>
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<td>Skills and learning: Does the policy consider strengthening human resource for research?</td>
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<td>Transparency: Does the policy increase public access to sectoral and national data?</td>
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<tr>
<td>6. To monitor the trends and determinants of NCDs and evaluate progress in their prevention and control</td>
<td>Monitoring policy impact on health, health inequalities, and GNH measurements</td>
<td>Health and Skills and learning</td>
<td>Health: Does the policy monitor the impact of the policy on the social determinants of health and well-being?</td>
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<td></td>
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<td></td>
<td>Skills and learning: Does the policy consider liaising with key national agencies to coordinate and strengthen research?</td>
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</table>
Identifying opportunities for strengthening policy action for NCDs, through integration with efforts to improve Gross National Happiness

To make it possible to pursue opportunities to strengthen policy to improve health and happiness, we identified elements in the six objectives of the Global NCD Action Plan (Table 2) and in the GNH that share the objective of strengthening outcomes applicable to both policy areas. We call these ‘shared agendas.’ We identified them by reviewing, synthesizing, and interpreting the GNH domains and determinants—and the NCD policy options listed in the Appendix 3 of the Global NCD Action Plan. We then reviewed the implementing process of GNH policy-screening tool (Fig. 1) and the GNH determinants (Table 1). We analyzed the GNH domains and the Global NCD Action Plan in conjunction with the ‘shared agendas’ to ascertain which GNH determinants would provide opportunities for the health sector to address NCDs by involving all of government.

As presented in Table 2, those working in the health sector are well positioned to take the first step: identifying shared agendas between objectives set out in the Global NCD Action Plan and the elements of GNH policies so that action on one can strengthen action also for the other. In a second step, health-sector players can identify specific GNH determinants suitable for strategic engagement of the health-sector players for improving GNH. In the final step, the health-sector players can articulate specific policy questions to raise in a multisectoral GNH committee to draw attention to the opportunities to strengthen NCD prevention and control, while also supporting achievement of GNH policy objectives.

Objective 1  To raise the priority accorded to the prevention and control of NCDs in national agendas.

This involves strengthening the ways stakeholders promote and support prevention of NCDs [29]—a prerequisite for delivering priority NCD interventions and for embedding NCDs into national development agenda [30]. Political priority for health is an explicit component of the GNH, because health is one of the domains and is essential to achieving GNH (Table 2).

NCDs prevent people from productive engagement such as working or seeking employment [3, 31]. The questions in Table 2 can increase awareness and promote dialogue on causes and potential impacts of NCDs among the policy makers.

Objective 2  To strengthen national capacity, leadership, governance, multisectoral action, and partnerships to accelerate country response for the prevention and control of NCDs.

This promotes governance and leadership to attain all 9 voluntary global targets outlined in the Global NCD Action Plan. Achieving these targets also contributes to ‘good governance,’ one of the nine domains of GNH, which implicitly includes strengthening health leadership, policy making, financing, and partnership [32].
Good governance provides conditions under which activities in the other eight GNH domains can thrive [12].

Evidence suggests that a major constraint for NCD prevention and control is inadequate funding and lack of national capacity [33]. Thus, the shared agenda and policy questions (Table 2) aim to strengthen policy coherence to support resource mobilization, intersectoral collaboration, and capacity building to address prevention and control of NCDs. They can also help to protect the health sector from the influence of vested interests by engaging health sector in the GNH policy formulation process [34].

**Objective 3**  *To reduce modifiable risk factors for NCDs and underlying social determinants through creation of health-promoting environments.*

The main modifiable risk factors for NCDs are tobacco use, harmful use of alcohol, unhealthy diet, and physical inactivity. Because the health sector alone cannot address the causes of NCDs, policy coherence to reduce these risk factors is a priority. (NCDs is responsible for 68% of all deaths in Bhutan [2]). The questions can help to accelerate tobacco control, reduce harmful alcohol consumption, and promote healthy diets and physical activity by mainstreaming prevention and control of NCDs into policies across all relevant sectors (not just at the level of individual behavior, but also that of marketing and regulating the products). Implementation should reduce disability and premature death due to NCDs.

**Objective 4**  *To strengthen and orient health systems to address the prevention and control of NCDs and the underlying social determinants through people-centered primary healthcare and universal health coverage.*

Strengthening the health system includes efforts to influence all underlying social determinants of health and implementing the direct health improving activities [35]. These social determinants are conditions in which people are born, grow, live, work and age, all of which affect the prevalence of NCDs and their risk factors [36]. GNH determinants share many of the same dimensions as the health determinants—for example, material well-being, equity, gender, education, culture, and stress among others [37]. For GNH, health is a determinant of happiness.

Therefore, we intend the question in Table 2 to increase consideration of social determinants of health in all policies across relevant sectors. Key ones including living standard, education, social support and equity promise to fulfill a ‘whole-of-government’ approach to address the causes of NCDs. The question can also promote integration of early detection and treatment of NCDs in the prevention and control programs.

**Objective 5**  *To promote and support national capacity for high-quality research and development for the prevention and control of NCDs.*
This includes research to generate knowledge and information to formulate evidence-based policies and projects [38]. The question in Table 2 can enhance interests and capacities of researchers in all agencies to work together. The aim is to support interdisciplinary research, linking social and health sciences, and to encourage academic institutes to collaborate with government agencies to conduct research and development. This can lead to development of intersectoral research agenda, strengthening institutional capacity for research and development and improve access to intersectoral data.

**Objective 6** To monitor the trends and determinants of NCDs and evaluate progress in their prevention and control.

Surveillance and monitoring refers to systematic collection and analysis of data to inform policy makers, for timely and appropriate action on NCDs. This can raise awareness and reinforce political commitments for stronger and coordinated multisectoral actions. The question in Table 2 can increase NCD surveillance, information exchange, and capacity development through highlighting shared responsibilities for NCD monitoring. It can support integration of monitoring and surveillance of social determinants that are beyond the health sector’s jurisdiction.

**Policy implications and relevance for other jurisdictions**

Our analysis identifies five key shared agendas between NCD policy priorities and GNH, spanning from prevention of premature deaths and disability to strengthening leadership, governance to research and strategic engagement during GNH policy formulation. No single sector can address the full range of NCDs risk factors [30]. A whole-of-government approach, therefore, is the key to addressing NCDs more effectively in any country [39, 40]. We argue that there is an opportunity to strengthen multisectoral governance for prevention and control of NCDs by identifying shared agendas across sectors that could improve health and happiness of the people. The protocols for GNH policy formulation (Fig. 1) and the GNH policy screening tool point to opportunities to identify shared agendas to integrate Global NCD Action Plan into policies across sectors.

Although we based our analysis on the specific processes implemented in Bhutan, growing interest in measuring happiness and taking a whole-of-government approach to policy making mean our analysis will be relevant to other jurisdictions. Strategic engagement by the health sector in the existing multisectoral policy mechanisms, such as GNH multisectoral committee in Bhutan, is a promising approach to integrate NCDs in policies across sectors. Other countries may find similar opportunities to bring NCDs’ prevention into their existing policy-development mechanisms. A shared policy agenda can support ‘win–win’ outcomes across policy sectors.
References


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Section III
Discussion and conclusion

This section has a discussion and a conclusion chapter. Paper 7 is the discussion chapter and is published in the Journal of Bhutan Health. It summarises how the research reported in this thesis answers my overarching research questions: how can the health sector strategically engage with GNH, and with the associated policy processes, to strengthen action on NCDs? The conclusion (Chapter 10) chapter provides the summary of the finding of this thesis and concludes by providing recommendations for future research.
Chapter 9: Discussion (Paper 7)

Taking action on prevention and control of noncommunicable diseases in Bhutan by strengthening gross national happiness

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ABSTRACT

Introduction: Noncommunicable diseases (NCDs) are major public health problem in Bhutan, accounting for 68% of total deaths. The growing epidemic of NCDs threatens the achievement of Gross National Happiness (GNH). NCDs are the results of complex interaction of social and economic risk factors and change in diet and lifestyle. Effective action to prevent and control these diseases requires a whole-of-government approach. In this paper we review new evidence to support political priority for NCDs in Bhutan. One third of the Bhutanese are overweight (33%) and hypertensive (35.7), and 6.4% are diabetic. The prevalence of modifiable risk factors is also very high. We also present the analysis of strategic policy opportunities for health sector to integrate the ‘Multisectoral national action plan for the prevention and control of NCDs, 2015-2020’ into policies across all relevant sectors. Our analysis has identified three specific opportunities for the health sector to engage strategically to strengthen action on NCDs and GNH, concurrently: 1) raising priority actions on NCDs within the existing GNH multisectoral committee, to achieve both health and happiness objectives; 2) identifying shared agenda between NCDs and GNH to achieve both health and happiness objectives; and 3) identifying shared GNH determinants between NCDs and GNH to enhance action on NCDs. Addressing NCDs aligns with the optimization of Gross National Happiness. It is imperative that the Government of Bhutan recognize that action on NCDs is an integral element for achieving GNH.

Keywords: Health policy; Global NCD action plan ;Gross national happiness; Noncommunicable diseases; Shared agenda.

INTRODUCTION

The increasing global burden of noncommunicable diseases (NCDs) is a major barrier to development and achievement of sustainable development goals1-3. To strengthen national efforts of addressing the burden of NCDs, the sixty-sixth World Health Assembly endorsed the ‘Global action plan for the prevention and control of noncommunicable diseases 2013-2020’ (here after referred as the global NCD action plan)4.

Concurrent to the global momentum of fighting NCDs and the growing concern of the adverse impact of NCDs within Bhutan, the Government of Bhutan endorsed the ‘national policy and strategic framework on prevention and control of NCDs’ in 20095, the ‘National health policy’ in 20116 and the ‘Multisectoral national action plan for the prevention and control of NCDs, 2015-2020’ (here after referred as national NCD action plan)7. Although the national NCD action plan identified strategic action areas and implementation mechanism, it falls short of identifying a sustainable policy approach to integrate the global, regional and the national NCD action plan into policies across all sectors to underpin actions addressing NCDs in Bhutan.

There is a global consensus that whole-of-government approach is an effective way to address NCD risk factors and the underlying social determinants of health8,9. Health sector alone cannot achieve the required reduction in NCDs as it has very little control over the risk factors of the NCDs1. Hence, strengthening policy coherence for resource mobilization, capacity building and advancing political commitment are essential to create an enabling environment to promote and support healthy behaviour and to enforce and regulate the control of alcohol, tobacco and substance abuse4,10.

In this paper, we summarise new evidence on epidemiological transition in Bhutan and identify specific strategies for the health sector to strengthen its policy response for prevention and control of NCDs. In particular, how health sector can strategically engage with other sectors to strengthen action on NCDs and GNH (Figure 1).

Major NCDs and their risk factors

NCDs are the leading cause of preventable deaths and premature mortality in Bhutan. They account for 68% of all deaths11 and an estimated 62% of the diseases burden12,13. We found that
the prevalence of modifiable risk factors namely; tobacco use, harmful use of alcohol and low fruits and vegetables intakes were 24.8%, 42.4% and 66.9% respectively. Similarly, the prevalence of overweight, hypertension and diabetes were 32.9%, 35.7% and 6.4% respectively. According to WHO report, Bhutan has the highest age-standardised death rates per 100,000 population for NCDs and second highest prevalence of overweight in adults in the South East Asia region.

Although these estimates provide evidence on the nature and scale of the NCD epidemic in Bhutan, there is little information on how sociodemographic factors influence NCDs in Bhutan. Mackenbach et al. highlighted the impact of socioeconomic factors such as health, education and income on health status. In this regard, Sithey et al. found that overweight was significantly associated with age, gender, marital status, area, occupation, tobacco use, physical activity and dietary habits. Similarly, hypertension was significantly associated with age, tobacco use and alcohol consumption while type 2 diabetes was significantly associated with age, area of living and tobacco use. The study also suggested that commonly known NCD risk factors may not fully account for the high prevalence of NCDs in Bhutan. This finding is in line with Dorji et al., who report high prevalence of modifiable risk factors with a strong tendency of clustering.

There is very limited information on mental health situation in Bhutan despite being recognized as an important risk factor for premature mortality in both industrialised, low and middle-income countries. Likewise, sleep duration is an emerging noncommunicable disease risk factor associated with perceived physical and mental health and is under-studied in Bhutan.

Sithey et al. investigated mental health and the association between sleep duration and health in Bhutan. It was found that the proportion of the population with the symptoms of common mental disorders (CMD) was (29.3%). Older age groups, being female, being divorced or widowed, illiteracy, occupation, low income, poor self-reported health status and having disability were identified as potential risk factors for CMD. Interestingly, increased spirituality and belief in karma was found to be protective factors for CMD. There is a U-shape association between sleep duration and self-reported health status. People sleeping less than and above the recommended sleep duration (7-8 hours) were more likely to have poor self-reported health status in Bhutan.

The increasing burden of NCDs is expected to accelerate due to demographic transition and high prevalence of modifiable NCD risk factors. With the reduction of death rates

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**Figure 1. Strategic engagement by health sector to strengthen prevention and control of NCDs through GNH**

<table>
<thead>
<tr>
<th>Policy Agenda</th>
<th>Strategic engagement by health sector</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raise commitment for NCDs within GNH multisectoral committee</td>
<td>GNH multisectoral committee reviews the policy impact on GNH. Raising awareness within the GNH committee:</td>
<td>Increased political priority for NCDs</td>
</tr>
<tr>
<td>Link NCDs and GNH through shared GNH determinants</td>
<td>Articulate the health impact and opportunities for GNH:</td>
<td>Whole-of-government approach to prevent &amp; control of NCDs</td>
</tr>
<tr>
<td>Identify shared agenda between NCDs and GNH</td>
<td>Strengthen multi-sectoral governance for prevention and control of NCDs by identifying shared agendas across sectors that could improve NCD &amp; GNH:</td>
<td>National NCD action plan integrated into GNH policy formulation process</td>
</tr>
</tbody>
</table>

1. Prevention of premature deaths
2. Strengthening leadership and governance for policy prioritization
3. Mainstreaming social determinants of health in all relevant policies
4. Encourage research and development
5. Monitor the policy impact on health domain through shared GNH governance and transparency.
and increase life expectancy, the ageing population in Bhutan (65 years and older) is expected to increase from 4.4% in 2000 to 7.3% by 2025. This will result in higher burden of NCDs, since prevalence of NCDs and their risk factors increase with age. In summary, overweight, hypertension, diabetes and common mental disorders are major public health problems in Bhutan. Alcohol consumption, poor diet and tobacco use are three most common modifiable risk factors. A country with high burden of NCDs cannot aspire to have a healthy and happy population.

To achieve GNH, prevention and control of NCDs must be prioritised. Priority action include 1) raising policy priority for whole-of-government approach to implement the national NCD action plan; and 2) to engage strategically with GNH through shared agendas and shared GNH determinants.

**Raising the policy priority accorded to the prevention and control of NCDs**

Evidence of the scale and severity of the NCDs problem in Bhutan is necessary, but not sufficient for policy change. Policy cohesion among sectors, ideas and political context are essential for realising policy priority for prevention and control of NCDs. Policy priority is defined as the degree to which national leaders, politicians and policy makers give attention to an issue, and back it up with the provision of financial, technical, and human resources.

Issues that have consensus among policy communities are more likely to get political support. Hence, the health sector can provide strategic leadership and build stronger links with seminal institutes, like the GNH Commission, National Statistic Bureau and Centre for Bhutan Studies and GNH Research, to mobilise consensus-building in addressing the NCDs.

Further NCD research, surveillance and monitoring must be strengthened to generate regular and credible information. This information must reach these policy communities, in order for health to effectively advocate NCDs as a policy priority (Figure 1).

Subsequently, the national health policy (2011), the global NCD action plan, and the national NCD action plan provide favourable political environment to engage national and international agencies in setting policy priority to address prevention and control of NCDs. Action on NCDs will also be fostered by proactive education of policy makers across sectors by the health sector, to ensure they understand and are equipped with a better understanding in developing relevant policies and response for NCDs prevention and control. For instance, health sector could provide estimates of financial implication of treating NCDs and productivity loss due to NCDs and premature deaths. Given that the Government of Bhutan has prioritised GNH, strategies to increase policy coherence for prevention and control of NCDs are most likely to succeed if they clearly show the link between NCDs and GNH. Health sector can 1) identify shared agendas between NCD and GNH, where action on one will strengthen the action on the other; and 2) identify specific GNH determinants that will enhance action on NCDs.

**Identifying shared agenda between NCD and GNH**

Although much of the NCDs are preventable through addressing modifiable risk factors, this will require a whole-of-government approach to tackle some of the deep-rooted social determinants of NCDs that are beyond the health sector’s jurisdiction.

Prevention and control of NCDs and GNH policies both prioritise reduction of premature deaths and increasing population well-being. These provides the premise for health sector and GNH to identify shared agenda. The shared agendas are the common policy objectives that the health sector can draw on to show how strengthening action on NCDs will also contribute to achieving GNH policy objectives. The health sector can support this through five shared agendas: 1) prevention of premature deaths and disability due to NCDs; 2) strengthening leadership and governance for policy prioritization; 3) mainstreaming social determinants of health in all relevant policies; 4) strengthen research and development through establishment of national research council and by formulating transdisciplinary national research agenda; and 5) monitoring the policy impact on health and GNH measurements. Advocating and strengthening these shared agendas can reduce NCDs as well as achieving the national goal of GNH (Figure 1). The opportunity to integrate these shared agendas into policies is provided by the protocol for GNH policy formulation.

**Link NCDs and GNH through shared determinants**

It is mandatory that all policies in Bhutan support the nine domains of GNH and health is one of domain. The 2010 GNH study showed that health domain contributes the most (14%) to happiness and that happy people enjoy highest sufficiency in disability and mental health. Therefore improving health will increase GNH.

Bhutan has developed 22 GNH determinants for monitoring and evaluating the likely impact of policies on the 9 GNH domains. 11 of these GNH determinants were identified as shared determinants between NCD and GNH. These are specific determinants of GNH that will also enhance action on NCDs. They are health, decision making opportunities, engagement in productive activities, economic security, skills and learning, time use and balance, legal recourse, material well-being, social support, equity and transparency. The health sector can review and monitor the policy impact on these shared determinants during the implementation of the GNH policy screening tool. This will strengthen the policy coherence for prevention and control of NCDs (Figure 1).

Therefore, identifying, monitoring and strengthening the shared determinants will ensure the integration of NCDs into policies across all relevant sectors (Figure 1).

**Integrating NCDs into policies across sectors**

The protocol for GNH policy formulation (Box 1) provides the opportunity to advocate and embed the shared agenda into policies across all relevant sectors and to review the policy
impact on shared determinants.

However, to assess the policy impact on NCDs and to embed NCD policy priorities into all relevant policies, the health sector has to be a member of the GNH Multisectoral Committee. This is important because, the GNH Multisectoral Committee provides an institutional arrangement and legitimate platform to participate in the GNH policy formulation process. Further, the GNH Multisectoral Committee’s primary task is to review the policy impact on GNH domains. At present, the health sector’s involvement in the GNH policy formulation process is not clear and is arbitrarily decided by the GNH Commission.

CONCLUSIONS

In conclusion, NCDs are major public health problem that can adversely impact on the health and happiness. First, strengthening NCDs surveillance for generating actionable evidence and advocating this measurable information to policy makers will raise policy priority for prevention and control of NCDs. Second, advocating and promoting the shared agenda and determinants will strengthen health sectors engagement with GNH Commission, the GNH Multisectoral Committee and the GNH policy formulation process. Third, the opportunity to address NCDs as a whole-of-government approach is embedded in the protocol for GNH policy formulation and the GNH policy screening tool. This analysis also suggests that other ministries can also identify shared agenda with GNH to bring their policy priorities into an existing policy development mechanism that support ‘win-win’ outcomes.

REFERENCES


25. World Bank. NCDs policy brief-Bhutan, Noncommunicable disease (NCDs) in Bhutan. 2011. [Full text]


Chapter 10: Conclusion

This chapter provides a summary of the findings of the research presented in this thesis, the learnings, and how this thesis has contributed to the literature regarding health and happiness in the context of Gross National Happiness (GNH), and the growing burden of NCDs in Bhutan. It concludes by providing recommendations for future research.
1. Main findings of this thesis

The main aims of my thesis were 1) to generate new evidence regarding NCDs, in the context of the current policy priority regarding Gross National Happiness and 2) to provide action-oriented recommendations to strengthen action on NCDs through strategic engagement with GNH framework. The immediate beneficiaries of the research outcomes are policy makers, particularly in the Ministry of Health (MOH), Bhutan. We pursued the research in close collaboration with the Policy and Planning Division and the Department of Public Health, MOH, Bhutan. Table 1 summarises the main findings of this thesis, the methodology, the data sources for the analysis, and outputs generated.

NCDs are the leading cause of preventable deaths and premature mortality in Bhutan. One third of the adult Bhutanese population are overweight, hypertensive and have symptoms of common mental disorders while 6.4% are diabetic. Several modifiable risk factors and socio-economic factors are associated with overweight, hypertension, diabetic and common mental disorders (Paper 1). This analysis confirms that NCDs are major public health problem in Bhutan. Prevention and control of NCDs require political commitment and policy priority (Paper 1, 2 and 3).

There is global interest in strengthening policy for both health and happiness. Health is necessary for achievement of happiness, and increasing happiness will only occur where health is protected and promoted (Paper 4). At present, there is no explicit consideration of NCD policy priorities as a necessity to achieving GNH. This has the potential to limit Bhutan’s ability to achieve its policy goals of improving GNH.
In this thesis, we established the link between health and happiness by analysing the synergy between GNH determinants and the domain ‘health’ of GNH. This provides the rationale for strengthening action on health, including NCDs as a critical determinant of happiness. We found that the health domain is intricately linked with all the GNH determinants (Paper 6, Table 1 and Table 2). Therefore, any policy that impact on one can affect the other. The interpretation of the GNH determinants from health policy perspective and the complete analysis of the linkage are presented in Paper 5.

Further, we identified five shared agendas and 11 shared determinants between global NCD action plan and GNH (Paper 6). Actioning on these shared agendas can address the NCD policy priorities as well as the GNH objectives. These shared agendas can be addressed as a whole-of-government approach by asking specific policy questions on each of the shared GNH determinants. We found that the protocol for GNH policy formulation and the implementation of GNH policy screening tool (Figure 1, Paper 6) provide the Ministry of Health with the opportunity and platform to embed the shared agendas into GNH policy process.

2. Contribution to the literature

Prevention and control of NCDs is a global development priority. Policy innovations linking NCDs with ongoing development agendas will accelerate the progress on NCDs prevention and control, for example, embedding NCDs in the Sustainable Development Goal 3, Target 3.4 - to reduce premature death due to NCDs by a third by 2030. (World Health Organization, 2016) The Lancet Taskforce on NCDs and Economics has linked NCDs to SDGs through exploring the common agendas between health, finance and other sectors. (Nugent et al., 2018) NCDs like heart diseases, strokes and diabetes have been linked to substantially higher economic burden at both national and household level. (Abegunde & Stanciole, 2006; Jan et al., 2018)
Table 1. The main findings from each step of the research

<table>
<thead>
<tr>
<th>Aim</th>
<th>Method</th>
<th>Data</th>
<th>Main Findings</th>
<th>Summary Citation</th>
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<tr>
<td></td>
<td></td>
<td>Gross National Happiness Survey 2010.</td>
<td>CMDs are significantly associated with the sociodemographic, health and spirituality.</td>
<td>Sithey et al., (2018). BMJ Open. 8(2), e018202</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gross National Happiness Survey 2015.</td>
<td>Both short (≤ 6 h) and long sleep duration (≥ 11 h) were independently associated with poor self-reported health status.</td>
<td>Sithey et al., (2017). Journal of clinical sleep medicine. 13(1), 33-38</td>
</tr>
<tr>
<td>2</td>
<td>Policy Analyses - Reviewing, synthesizing &amp; interpreting GNH domain, determinants &amp; policy process in conjunction with prevention &amp; control of NCDs.</td>
<td>GNH Index, Global NCD action plan for the prevention and control of NCDS, 2013-2020</td>
<td>There are shared agendas between NCDs and GNH (happiness). Identifying and actioning the shared agendas will reduce NCDs and contribute to fulfilment of GNH objectives.</td>
<td>Sithey et al., (2018). Journal of Public Health Policy. 1745-655X.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multisectoral national action plan for the prevention and control of NCDs, 2015-2020</td>
<td>There are shared determinants between NCDs and GNH. Policy impact on NCDs can be reviewed by monitoring these shared determinants.</td>
<td>Sithey et al., (2015). Bulletin of the WHO. 93(8), 514-514</td>
</tr>
</tbody>
</table>
However, there is no literature on how wellbeing or happiness relates to prevention and control of NCDs. As a case study, the research conducted in this thesis contributed to the literature by examining how strengthening of GNH can enhance the action on prevention and control of NCDs.

Although there has been a remarkable progress over the past decades in GNH, the effort is mostly geared towards global debates on happiness and the need for an alternative development paradigm. (Centre for Bhutan Studies & GNH Research, 2015) The screening tools for policies are inadequate, and not applied uniformly for all policies. (Kinley Dorji, 2013; Tshering Cigay Dorji, 2013) This thesis, through in-depth analysis of GNH policy process, also contributed to global literature on how strengthening GNH will benefit achieving NCD goals.

3. Contribution to global effort in the prevention and control of NCDs

Much of the literatures to date are on NCD burden, the modifiable risk factors, the underlying social determinants and their implication on health and development. (Sacco et al., 2013; World Health Organization, 2017b, 2017c) The available literature on NCD policies suggests that to accelerate national NCD response the national government needs to strengthening political leadership, building capacity of the stakeholders, enabling cross sectoral monitoring and increasing resource allocation. (World Health Organization, 2013 -a, 2013 -b, 2017a, 2017b) This makes the prevention and control of NCDs one of the most powerful examples for a whole-of-government approach and multisectoral collaboration. This research contributed to the literature on prevention and control of NCDs by presenting that the areas to address the reduction of NCDs are in harmony with the optimization of happiness. It promotes policy coherence between different spheres of policy making that have a bearing on NCDs. First, we identified those GNH determinants that can enhance and or adversely affect prevention and control of NCDs. Second, we articulated the shared agendas between action on NCDs and
advancement of GNH. We showed that the strategic policy opportunities to address health policy priority (particularly, NCD prevention) exists in countries where happiness is on the national agenda.

4. **Contribution to the strengthening prevention and control of NCDs in Bhutan**

While NCDs prevalence and risk factors are well researched and documented in affluent countries, there is very little information on NCDs in Bhutan. The only nationwide NCD study were the recent “National survey for NCD risk factors and mental health using WHO STEPS approach in Bhutan-2014’ (Ministry of Health, 2014) and the ‘Alarming prevalence and clustering of modifiable noncommunicable disease risk factors among adults in Bhutan: a nationwide cross-sectional community survey’ by Dorji et al. (Pelzom, Isaakidis, Oo, Gurung, & Yangchen, 2017)

This research for the first time presented the prevalence of independent NCD risk factors (modifiable, non-modifiable and metabolic) and their association with overweight/obesity, hypertension and diabetes (Paper 1). The thesis was the first to report the prevalence and socioeconomic, religious and spiritual, and health risk factors for symptoms of common mental disorders in Bhutan (Paper 2). Likewise, the thesis also examined sleep duration as a modern lifestyle factor and found both short (≤ 6hrs) and long (≥ 8hrs) durations are independently associated with poor self-reported health. (Paper 3).

One of the biggest challenges in the implementation of GNH is translating GNH into policy action. This research demonstrated how the national NCD action plan could be implemented as a whole-of-government by engaging and strengthening the GNH. All 22 GNH determinants were unpacked and their implication to health analysed (Paper 5). This work provided a practical guide for health policy makers not only in developing future health policy but also promoting health across other government sectors.
This thesis identified and articulated shared agendas, determinants and opportunities for health sector’s strategic engagement with other government sectors, and integration of NCD prevention and control in all relevant policies (Paper 6 and Paper 7). It further showed that GNH protocol for policy formulation is a legitimate platform to address the shared agendas.

5. Strengths and limitations of the research

A key strength of the quantitative analysis presented in this thesis is that the study samples were nationally representative. The dataset we used in this study, i.e. the GNH and the NCD surveys covered all 20 districts. A multistage cluster sampling method had been used with probability proportionate to size (PPS) and systematic random sampling to select the respondents.

The large sample size enabled us to examine a variety of potential factors associated with overweight/obesity, hypertension, diabetes and symptoms of common mental disorders. These results will help formulating intervention strategies. Another strength is the range of social, economic, religious and health factors included in the multivariable analysis.

This research also analysed the protocol for GNH policy formulation and its elements, like GNH domains, determinants and the GNH policy screening tool to identify strategic opportunities to engage with the GNH policy process. Comparing the objectives of reduction of NCDs with the GNH objectives, and conducting systematic analysis of the existing policy formulation process are also strengths of this thesis. We achieved this by firstly identifying the shared agendas, then the specific policy questions to address the shared agendas and finally identifying the shared determinants to review the policy impact on NCDs. Close collaboration was maintained with the MOH, Bhutan in this part of research.
Taking a mixed-method approach to this research was appropriate to address the research questions. The quantitative analysis showed that NCDs are major public health problem and requires policy priority. The in-depth analysis of the GNH tools and the GNH policy process identified the strategic opportunities to strengthen GNH as well as enhance prevention and control of NCDs.

There are several limitations of our study. First, the NCD STEPS survey and the GNH surveys were all cross-sectional study, so we couldn’t establish any causal relationship. A longitudinal study would shed more light on the cause and effect and the change overtime in the pattern of events occurring.

Second, General Health Questionnaire-12 item has not been validated in Bhutan, hence the prevalence of CMDs reported in this study needs to be viewed with caution. However, we compensated this limitation by analysing the GHQ-12 score as a continuous outcome in the multivariable analysis. Similarly, choosing 7 hours as the optimum cut-off for sleep duration was based on limited evidence. The large nationally representative data may outweigh some of these limitations.

Finally, it would have been ideal if the policy analysis could be complemented by qualitative research that engaged policy makers. For example, focus group discussion with health sector, GNH Commission and Centre for Bhutan Studies & GNH Research would have further strengthened the outcome of this thesis. Fortunately, we were able to engage with a number of policy makers and the key personnel from the MOH and Centre for Research Initiative, Thimphu in the analysis and writing of the publications to include their insights. The Director of Department of Public Health, the Senior Planning Officer, Policy and Planning Division, and the Nutrition Program Officer of the Ministry of Health were involved in Paper 1, Paper 5, and Paper 7.
6. Future research and recommendations

This study has given me an opportunity to better understand the nature of NCD risks in Bhutan, the link between ‘health’ domain and GNH, and how strengthening of GNH could enhance policy coherence for addressing NCD prevention and control. I identified one opportunity, that was to better equip and support Ministry of Health officials engaging with the GNH processes, in particular, to provide them with a clear understanding of the linkages and impact of the GNH determinants on ‘health’ domain and vice versa (Paper 5). However, the GNH policy screening tool has not been evaluated and the impact of ‘health’ domain on other domains and vice versa was not explored.

Future research should develop a GNH framework which clearly explains the linkages and impact of ‘health’ domain on other 8 domains and vice versa. Studies that can quantify the impact or contribution of ‘health’ domain to other domains would greatly enhance the role of health sector in GNH. It would enable policy makers to understand the relationship between the domains and strengthen the health sector’s engagement in GNH policy process.

In analysing NCD STEPS (2014) and the GNH data (2010 and 2015), we found that health indicators for GNH are not monitored and used by MOH. It is recommended that health indicators in GNH should be incorporated into regular data collection and reporting system of MOH, preferably through the District Health Information System to enable periodic monitoring of the ‘health’ domain by the health sector.

Similarly, the health indicators of GNH do not include any NCD indicators. We recommend that health indicators in GNH (i.e. self-reported health status, healthy days, disability and mental health) be reviewed to reflect current health priorities while consulting the World Health Organization’s core health indicators (World Health Organization, 2015) and the Sustainable Development Goals 3. (World Health Organization, 2016) One direction for the future research
is to study the relationship between GNH and NCDs and their risk factors namely, physical activity, nutrition, alcohol, mental health and etc. In addition, statistically valid thresholds for health indicators should be established. For example, the 12-item General Health Questionnaire (GHQ-12) has to be validated in Bhutanese setting to determine valid thresholds for mental distress.

While the GNH policy screening tool is an innovative tool to screen the policy impact on GNH domain. We found that there is only one determinant for health domain (Paper 6, Table 1). Further, the health determinant has not been defined and the effectiveness of the determinant in evaluating the policy impact on health is not known. An operational research to develop determinants to evaluate policy impact on health domain of GNH is recommended. For this task, we recommend an in-depth analysis of the social determinants of health.

Last but not the least, there is a significant opportunity to increase health sector’s engagement and influence in GNH processes through becoming a permanent member of the GNH multisectoral committee for GNH policy screening tool. This would also facilitate increased communication and collaboration between health sector, GNH Commission and the other government and non-governmental agencies.
References

http://www.who.int/chp/working_paper_growth%20model29may.pdf


Appendix A


Source: Gross National Happiness Commission. Thimphu, Bhutan.  
Hon’ble Secretary,
GNH Commission,
Tashichhodzong, Thimphu.

Sub: Revised Protocol for Policy Formulation of the Royal Government of Bhutan

Desho,

The Government has endorsed the revision of the Protocol for Policy Formulation of the Royal Government. A copy of the approved Revised Protocol is attached herewith.

The GNHC Secretariat is directed to have proper definition of the Government policy since sometimes the strategies and guidelines are also treated same in the current context. It may therefore be important to differentiate and define properly policy, strategy and guideline, and what they mean.

This letter has reference to the 67th Lhengye Zhungtshog held on 3rd March, 2015.

Yours sincerely,

(Dr. Phuntsho Namgyel)
Offtg. Cabinet Secretary

Copy for kind information to:
1. Hon’ble Minister, All Ministries, Thimphu
2. PS to PM, Gyalyong Tshogkhang, Thimphu
Royal Government of Bhutan

Protocol for Policy Formulation

All public policies in Bhutan, irrespective of their origin but with the exception of a Royal Command or national exigencies, shall be formulated/revised, approved and adopted in line with the following Protocol for Policy Formulation.

1. Proposals to formulate/review public policies in Bhutan can originate from the Lhengye Zhungtshog (Cabinet), sectors and the GNH Commission.

2. For purposes of proper planning the conception and formulation of policies will be undertaken periodically and revision of policies can be undertaken as and when required.

3. All Policies/concept notes originating from the Sectors must be routed through their respective Policy & Planning Divisions (PPDs), who shall be the focal points for policy coordination.

4. All Policy concept notes will be submitted to the Gross National Happiness Commission Secretariat (GNHCS) for review.

5. The GNHCS will submit all Policy concept notes and recommendations to the Cabinet for approval.

6. The Cabinet will approve/reject the Policy concept notes and accordingly forward it's comments to the proponent and the GNHCS.

7. The formulation/revision of any Policy will be undertaken in two stages.

   **Stage one**: Policy conception stage; and
   **Stage two**: Policy formulation and approval stage.

8. Proponents desiring to formulate or revise a Policy shall do so only after the approval of the Policy concept note by the Cabinet.

9. Only Policies endorsed by the GNH Commission will be submitted to the Cabinet for approval.
Stage One: Policy Conception Stage

1. The proposal to formulate/revise any Policy will begin with the preparation of a concept note of maximum 5 pages as per the format prescribed in Annex A, by the proponent.

2. The concept note will be submitted by the proponent to the GNHCS by the proponent.

3. The GNHCS will submit the concept note to the Cabinet for approval. The submission will include recommendations/views/comments on the concept note.

4. The Cabinet may either approve/reject the concept note or seek further clarifications from the proponent or GNHCS based on which approval/rejection can be made.

5. Approval/rejection of the concept note will be conveyed to the GNHCS and the proponent by the Cabinet Secretariat.

6. Upon approval of the concept note (with changes as directed by the Cabinet) the proponent may commence formulation/revision of the policy.

Stage Two: Policy Formulation and Approval Stage

1. The proponent shall commence formulation/revision of the draft Policy after receiving approval on the concept note from the Cabinet.

2. While formulating/revising the draft Policy, proponents should ensure that as a minimum:

   i) all policy alternatives have been considered;

   ii) all cross cutting issues such as Gender, Environment, Climate Change, Disaster, Poverty, Population and others are integrated within the policy;

   iii) all relevant stakeholders who may be affected by the policy are consulted; and

   iv) there is no conflict between the proposed policy and other existing policies, laws, and regulations.
3. After formulation/revision, the concerned proponent shall submit the proposed draft Policy to the GNHCS along with the Policy Protocol Report as per the Format specified in Annexure B.

4. The draft Policy shall also be made available for comments on a public domain (web-based or other means) and shared with relevant Research Institutes and key stakeholders including those mainstreaming cross-cutting issues.

5. With the formal submission of the above documents to the GNHCS, the relevant division of the GNHCS shall review the draft Policy and provide feedback/comments to the proponent. When required, the proponent will make a presentation of the draft policy to the GNHCS.

6. The proponent can either incorporate the comments/feedback or seek further clarifications from the GNHCS. If required, bilateral discussions can be held between the proponent, key stakeholders and GNHCS.

7. Upon incorporation of the comments agreed on between the sector and GNHCS, the revised draft Policy shall be subjected to the Gross National Happiness (GNH) Policy Screening Tool by the Proponent Sector and the GNHCS (as two separate exercises):
   
   i. Prior to screening of a draft Policy, a bilateral session shall be held between the proponent sector and the GNHC Secretariat on the relevance of certain GNH indicators against the policy in question.
   
   ii. The screening shall be undertaken individually by those participating in the screening exercise (The revised draft Policy and Screening Tool to be shared a few days prior to the meeting).
   
   iii. A diverse mix of stakeholders shall participate, numbering to at least 15 participants.
   
   iv. The sectoral focal points for gender, environment, and other cross cutting issues (if there are such focal points appointed) and other external key stakeholders shall be involved in the screening exercise.

8. The proponent will submit their individual and consolidated GNH Screening results to the GNHCS. All rationales and mitigation measures need to be duly completed.

9. The GNHCS will also conduct a GNH Screening of the policy.
10. The revised draft Policy document and the screening results shall be submitted to the GNHC through the GNHCS. The presentation of the draft Policy to the GNHC will be done by the proponent, the GNHCS will present both the GNH screening results and additional comments, if any.

11. The GNH Commission will either endorse the draft Policy as submitted, recommend further review which may be through the institutionalization of a task force, accord endorsement subject to revisions, or provide additional directives.

12. If instituted the task force shall present its recommendations to the GNHC for review.

13. If endorsed, the sector shall revise the draft Policy according to the directives received from the GNH Commission and submit a copy of the revised draft Policy to the GNHCS to ensure all directives of the GNH Commission have been considered.

14. The GNHCS will convey endorsement of the revised draft Policy to the proponent and Cabinet Secretariat.

15. The revised draft Policy endorsed by the GNHCS shall be submitted to the Cabinet by the proponent for approval.

16. The Cabinet shall convey approval of the draft Policy or issue further directives to the proponent with a copy to the GNHCS.

17. If approved, a copy of the approved Policy (after incorporation of Cabinet's directives) will be shared with the GNHCS by the proponent.

18. If there are major revisions to the draft Policy the Cabinet can subject the draft Policy to the following before according approval:
   
   i. The re-application of the entire Policy Protocol or
   ii. An additional review by the GNHC/S or other agencies or institutions or
   iii. A re-application of the GNH Policy Screening Tool

19. The approved Policy shall be implemented by the proponent/agency identified within the Policy.

20. The proponent/agency shall submit an action plan for implementation of the
Policy to the GNHCS.

21. The action plan should clearly spell out the responsible agency, indicative budget and timeframe, activities, outcomes, outputs, and associated indicators.

22. The GNHCS will endorse the action plan and seek clarifications if necessary.

23. Based on the endorsed action plan, policy will be monitored according to the GNHCS Policy Monitoring Framework.

24. The GNH Commission shall carry out post-adoption evaluation of Policies. The findings of the evaluations shall be used to refine Policies.
Annexure A: Format for Submission of Policy Concept Note

The formulation of any policy will begin with the approval of the Concept Note by the Cabinet.

The primary purpose of the concept note is to provide convincing arguments on the existence of pertinent issues that need to be resolved and to justify the need for a new policy/revision of an existing policy. The note should be succinct and understandable. As a minimum the Concept Note should clearly state the following:

i. Context and Background-The reason/rationale for proposing a new policy or revising an existing policy
   • Is the proposed policy an outcome of government directives, if so which directive?
   • What are the major issues the proposed new policy/policy revision intends to address? What are the root causes of the issues in question?
   • What are the implications if the issues are not addressed?

ii. Critique of current policy options and approaches:
   • Briefly explain the shortcomings/failing of the current approaches (policy/act/regulation/others) or the limitations posed by the absence of the policy in addressing the issue(s).

iii. Policy Recommendations
   • Briefly explain how the proposed new policy/policy revision will address the shortcomings of the current approaches/regulations/policy or the limitations posed by the absence of the policy.
   • Briefly explain the major costs and benefits that may arise out of the policy in terms of resources (physical, financial, human, and others) and processes that will result with the proposed new policy/policy revision.

iv. Integration of GNH and cross cutting issues
Royal Government of Bhutan

Protocol for Policy Formulation

- What are the opportunities and challenges pertaining to GNH, Disaster, Environment, Poverty, Climate Change, Gender, Population, Health, ICT, and other cross-cutting issues that may arise from the proposed new policy/policy revision?
- Briefly describe how the policy will make use of the opportunities or mitigate the challenges that may arise with respect to GNH, Disaster, Environment, Poverty, Climate Change, Gender, Population and other cross-cutting issues by adopting this policy.

v. **Process and indicative timeline**
- Provide details on the process and indicative timeline that will be followed developing the policy including likely need/use of TA. (If TA is to be used, the ToR must be shared with RED, GNHCS for comments)
- Briefly provide details on policies/acts/regulations that may conflict with the proposed new policy/policy revision and explain how the conflict will be resolved
- List of stakeholders who will be consulted.

vi. **Major impediments or risks foreseen in the development of the policy.**
Royal Government of Bhutan
Protocol for Policy Formulation

Annexure B: Format for Policy Protocol Report

1. Title Page
   a. Title of the Policy
   b. Name and contact details of the organization submitting the issue
   c. Name and Contact details of the focal point
   d. Date of submission

2. Background and Context
   a. Current situation: Provide a brief overview of major issues, their root causes, and implications if not addressed.
   b. Current approaches and options: Provide a brief overview of the existing approaches (rules/regulations/acts/policy) that currently exist.
   c. Critique of the current approaches/options: Provide a brief overview of the shortcoming or limitations of the current options or approaches in addressing the issue.
   d. Provide brief information on Prior Government Decisions/Orders. Kindly mention References, etc.

3. Policy Recommendations
   a. Provide a brief overview on how the proposed policy will address the issues in question.
   b. Briefly explain the major costs and benefits that may arise out of the policy in terms of resources (physical, financial, human, and others) and processes that will result with the proposed new policy/policy revision.

4. Research and Findings
   a. Mention any studies, appraisals, etc. carried out on issues related to the PP along with key findings and recommendations
   b. Attach copies of the studies and reports referred to under a.
5. Integration of GNH and Other Cross Cutting Issues

a. What are the opportunities and challenges pertaining to GNH, Disaster, Environment, Poverty, Climate Change, Gender, Population, Health, ICT, and other cross-cutting issues that may arise from the proposed new policy/policy revision?

b. Briefly describe how the policy will make use of the opportunities or mitigate the challenges that may arise with respect to GNH, Disaster, Environment, Poverty, Climate Change, Gender, Population and other cross-cutting issues by adopting this policy.

6. Other Implications

a. State any other implications (legislative, financial, social, administrative, political, institutional, etc.)

7. Consultations

a. Consultation Process with other Stakeholders/Organizations – Provide a list of the stakeholders and organizations consulted.

b. State controversial issues, key findings and recommendations from the consultation process.

8. Attach a copy of the proposed policy.
Appendix B

Gross National Happiness Policy Screening Tool.

Source: Gross National Happiness Commission. Thimphu, Bhutan.
**Gross National Happiness Policy Screening tool**

<table>
<thead>
<tr>
<th>Score</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>A score of 1 should be awarded if it the policy is perceived to <em>negatively impact</em> the variable.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>A score of two should be awarded if it is <em>uncertain</em> as to how the policy might impact the variable.</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>A score of 3 is awarded if it is certain that the policy will have <em>no negative impact</em> on the variable, even if it is <em>uncertain</em> whether the policy will have any <em>positive impacts</em>. In case the policy <em>does not have any linkage</em> to a variable, then a score of 3 should be awarded.</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>A score of 4 is awarded if the policy is perceived to have a <em>positive impact</em> on the variable</td>
</tr>
<tr>
<td>*******</td>
<td><em>Please note that rationales will have to be provided for all scores awarded. In the event a variable scores below 3 than, alternatives or mitigation measure will also have to be recommended.</em>***</td>
</tr>
</tbody>
</table>

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### Domain: Living Standard

<table>
<thead>
<tr>
<th>1. Equity</th>
<th>Will negatively impact the equity of income distribution</th>
<th>Do not know the differential effects on equity of income distribution</th>
<th>Will not have any negative effects on the equity of income distribution</th>
<th>Will positively impact equity of income distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Score Awarded

**Enter Score Here**

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>2. Economic Security</th>
<th>Will decrease economic security</th>
<th>Do not know the differential effects on economic security</th>
<th>Will not decrease economic security</th>
<th>Will increase economic security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Score Awarded

**Enter Score Here**

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>3. Material Well-being</th>
<th>Will decrease material well-being</th>
<th>Do not know the differential effects on material well-being</th>
<th>Will not decrease material well-being</th>
<th>Will increase material well-being</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
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</table>

#### Score Awarded

**Enter Score Here**

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>4. Engagement in Productive Activities</th>
<th>Will decrease opportunities to engage in productive activities</th>
<th>Do not know the differential effects on opportunities to engage in productive activities</th>
<th>Will not decrease opportunities to engage in productive activities</th>
<th>Will increase opportunities to engage in productive activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
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</tbody>
</table>

#### Score Awarded

**Enter Score Here**

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>Variable Score</th>
<th>(Enter Score Here)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Equity</td>
<td>(Enter Score Here)</td>
</tr>
<tr>
<td>2 Economic Security</td>
<td>(Enter Score Here)</td>
</tr>
<tr>
<td>3 Material Well Being</td>
<td>(Enter Score Here)</td>
</tr>
<tr>
<td>4 Engagement in Productive Activities</td>
<td>(Enter Score Here)</td>
</tr>
<tr>
<td>Domain Score (Living Standard)</td>
<td>0</td>
</tr>
</tbody>
</table>
## Domain: Good Governance

### 5. Participation in Decision Making

<table>
<thead>
<tr>
<th>Score</th>
<th>Will decrease opportunities to participate in decision making</th>
<th>Do not know the differential effects on opportunities to participate in decision making</th>
<th>Will not have any negative effects on opportunities to participate in decision making</th>
<th>Will increase opportunities to participate in decision making</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**Score Awarded:** (Enter Score Here)

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

### 6. Anti-Corruption

<table>
<thead>
<tr>
<th>Score</th>
<th>Will increase opportunities to engage in corruption</th>
<th>Do not know the differential effects on opportunities to engage in corruption</th>
<th>Will not increase opportunities to engage in corruption</th>
<th>Will decrease opportunities to engage in corruption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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**Score Awarded:** (Enter Score Here)

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

### 7. Legal Recourse

<table>
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<tr>
<th>Score</th>
<th>Will decrease the opportunities to seek legal recourse</th>
<th>Do not know the differential effects on the opportunities to seek legal recourse</th>
<th>Will not have any negative effects on the opportunities to seek legal recourse</th>
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</tr>
</thead>
<tbody>
<tr>
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**Score Awarded:** (Enter Score Here)

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

### 8. Rights

<table>
<thead>
<tr>
<th>Score</th>
<th>Will decrease protection of individual rights</th>
<th>Do not know the effects on protection of individual rights</th>
<th>Will not decrease protection of individual rights</th>
<th>Will increase protection of individual rights</th>
</tr>
</thead>
<tbody>
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**Score Awarded:** (Enter Score Here)

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

### 9. Gender

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<tr>
<th>Score</th>
<th>Will be detrimental to the advancement of gender equality</th>
<th>Do not know the effects on gender equality</th>
<th>Will not negatively affect gender equality</th>
<th>Will advance gender equality</th>
</tr>
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<tbody>
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**Score Awarded:** (Enter Score Here)

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**
### Rationale for awarding score:

### Suggested alternative/mitigation measure if score is 2 or below:

<table>
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<tr>
<th>10. Transparency</th>
<th>Will decrease transparency standards on government policies and programmes</th>
<th>Do not know the effects on the transparency standards on government programmes and policies</th>
<th>Will not decrease the transparency standards on government policies and programmes</th>
<th>Will increase the transparency standards on government policies and programmes</th>
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### Rationale for awarding score:

### Suggested alternative/mitigation measure if score is 2 or below:

<table>
<thead>
<tr>
<th>Variable Score</th>
<th>Score</th>
<th>Decision Making Opportunity</th>
<th>Anti-Corruption</th>
<th>Legal Recourse</th>
<th>Rights</th>
<th>Gender Equality</th>
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</tbody>
</table>
### Domain: Education

<table>
<thead>
<tr>
<th>11. Skills and Learning</th>
<th>Will decrease opportunities to enhance skills and learning</th>
<th>Do not know the effects on the opportunities to enhance skill and learning</th>
<th>Will not decrease opportunities to enhance skills and learning</th>
<th>Will create/increase opportunities to enhance skills and learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Score Awarded</td>
<td>(Enter Score Here)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>Variable score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Skills and Learning (Enter Score Here)</td>
</tr>
<tr>
<td>Domain Score (Education) 0</td>
</tr>
</tbody>
</table>

### Domain: Health

<table>
<thead>
<tr>
<th>12. Public Health</th>
<th>Will increase public health risks</th>
<th>Do not know the effects on public health risks</th>
<th>Will not increase public health risks</th>
<th>Will decrease public health risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Score Awarded</td>
<td>(Enter Score Here)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>Variable score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Public Health (Enter Score Here)</td>
</tr>
<tr>
<td>Domain Score (Health) 0</td>
</tr>
</tbody>
</table>
### Domain: Ecology

<table>
<thead>
<tr>
<th>13. Water and Air Pollution</th>
<th>Will lead to increase in water and air pollution</th>
<th>Do not know the differential effects on water and air pollution</th>
<th>Will not increase water and air pollution</th>
<th>Will lead to decrease in water and air pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Score Awarded</td>
<td>(Enter Score Here)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>14. Land Degradation</th>
<th>Will increase land degradation</th>
<th>Do not know the differential effects on land degradation</th>
<th>Will not increase land degradation</th>
<th>Will decrease land degradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Score Awarded</td>
<td>(Enter Score Here)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>15. Bio-Diversity Health</th>
<th>Will diminish the health of plant and animal diversity</th>
<th>Do not know the differential effects on the health of plant and animal diversity</th>
<th>Will not diminish the health of plant and animal diversity</th>
<th>Will improve the health of plant and animal diversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Score Awarded</td>
<td>(Enter Score Here)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>Variable Score</th>
<th>Water Pollution (Enter Score Here)</th>
<th>Land Degradation (Enter Score Here)</th>
<th>Bio diversity Health (Enter Score Here)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain Score (Ecology)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Domain: Community Vitality

<table>
<thead>
<tr>
<th>16.Social Support</th>
<th>Will decrease the available social support</th>
<th>Do not know the effects on the available social support</th>
<th>Will not decrease available social support</th>
<th>Will increase the available social support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Score Awarded**

(Enter Score Here)

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>17.Family Interaction</th>
<th>Will decrease the time available for family interaction</th>
<th>Do not know the differential effects on time available for family interaction</th>
<th>Will not decrease the time available for family interaction</th>
<th>Will increase the time available for family interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Score Awarded**

(Enter Score Here)

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>Variable Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Social Support</td>
</tr>
</tbody>
</table>

| 2 Family | (Enter Score Here) |

| Domain Score (Community Vitality) | 0 |

### Domain: Time Use and Balance

<table>
<thead>
<tr>
<th>18.Leisure</th>
<th>Will decrease opportunities for leisure</th>
<th>Do not know the differential effects on the opportunities for leisure</th>
<th>Will not decrease the opportunities for leisure</th>
<th>Will increase the opportunities for leisure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Score Awarded**

(Enter Score Here)

**Rationale for awarding score:**

**Suggested alternative/mitigation measure if score is 2 or below:**

<table>
<thead>
<tr>
<th>Variable Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Leisure</td>
</tr>
</tbody>
</table>

| Domain Score (Time use and Balance) | 0 |

189
## Domain: Culture

<table>
<thead>
<tr>
<th>19. Culture</th>
<th>Will decrease opportunities to participate in cultural traditions and practices</th>
<th>Do not know the differential effects on the opportunities to participate in cultural traditions and practices</th>
<th>Will not decrease the opportunities to participate in cultural traditions and practices</th>
<th>Will increase the opportunities to participate in cultural traditions and practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Score Awarded</td>
<td>[Enter Score Here]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Rationale for awarding score:

### Suggested alternative/mitigation measure if score is 2 or below:

<table>
<thead>
<tr>
<th>20. Values</th>
<th>Will undermine Bhutanese Values</th>
<th>Do not know the differential effects on Bhutanese Values</th>
<th>Will not weaken Bhutanese Values</th>
<th>Will promote Bhutanese Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Score Awarded</td>
<td>[Enter Score Here]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Rationale for awarding score:

### Suggested alternative/mitigation measure if score is 2 or below:

<table>
<thead>
<tr>
<th>Variable Score</th>
<th>1</th>
<th>Culture</th>
<th>(Enter Score Here)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Values</td>
<td>(Enter Score Here)</td>
<td></td>
</tr>
</tbody>
</table>

<p>| Domain Score (Culture) | 0 |</p>
<table>
<thead>
<tr>
<th>Domain: Psychological Wellbeing</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>21. Spiritual Pursuits</th>
<th>Will decrease opportunities to engage in spiritual pursuits</th>
<th>Do not know the differential effects on the opportunities to engage in spiritual pursuits</th>
<th>Will not decrease the opportunities to engage in spiritual pursuits</th>
<th>Will increase the opportunities to engage in spiritual pursuits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Score Awarded</td>
<td>(Enter Score Here)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rationale for awarding score:

Suggested alternative/mitigation measure if score is 2 or below:

<table>
<thead>
<tr>
<th>22. Stress</th>
<th>Will create conditions that lead to increase in stress levels</th>
<th>Do not know the differential effects on conditions that affect stress levels</th>
<th>Will not create conditions that lead to increase in stress levels</th>
<th>Will create conditions that lead to decrease in stress levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Score Awarded</td>
<td>(Enter Score Here)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rationale for awarding score:

Suggested alternative/mitigation measure if score is 2 or below:

<p>| Variable Score | |
|----------------||
| 1 Spiritual Pursuits | (Enter Score Here) |
| 2 Stress | (Enter Score Here) |
| Domain Score (Psychological wellbeing) | 0 |</p>
<table>
<thead>
<tr>
<th>Variables</th>
<th>Variable Scores</th>
<th>Domain</th>
<th>Domain Scores (Average)</th>
<th>GNH Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Equity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Economic Security</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Material Well Being</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Engagement in Productive Activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Decision Making Opportunity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Anti-Corruption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Legal Recourse</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Rights</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Transparency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Skills and Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Public Health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Water and Air Pollution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Land Degradation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Bio-diversity Health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Social Support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Family</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 Leisure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Culture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Values</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 Spiritual Pursuits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 Stress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C


Source: Global action plan for the prevention and control of noncommunicable diseases 2013-2020. See page 4 and 5).

http://apps.who.int/iris/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1
OBJECTIVES

1. To raise the priority accorded to the prevention and control of noncommunicable diseases in global, regional and national agendas and internationally agreed development goals, through strengthened international cooperation and advocacy.

2. To strengthen national capacity, leadership, governance, multisectoral action and partnerships to accelerate country response for the prevention and control of noncommunicable diseases.

3. To reduce modifiable risk factors for noncommunicable diseases and underlying social determinants through creation of health-promoting environments.

4. To strengthen and orient health systems to address the prevention and control of noncommunicable diseases and the underlying social determinants through people-centred primary health care and universal health coverage.

5. To promote and support national capacity for high-quality research and development for the prevention and control of noncommunicable diseases.

6. To monitor the trends and determinants of noncommunicable diseases and evaluate progress in their prevention and control.
A **25%** relative reduction in risk of premature mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases.

At least **10%** relative reduction in the harmful use of alcohol, as appropriate, within the national context.

A **10%** relative reduction in prevalence of insufficient physical activity.

A **30%** relative reduction in mean population intake of salt/sodium.

A **30%** relative reduction in prevalence of current tobacco use in persons aged 15+ years.

A **25%** relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure, according to national circumstances.

**Halt the rise** in diabetes and obesity.

At least **50%** of eligible people receive drug therapy and counselling (including glycaemic control) to prevent heart attacks and strokes.

An **80%** availability of the affordable basic technologies and essential medicines, including generics, required to treat major noncommunicable diseases in both public and private facilities.
Appendix D

Menu of policy options and cost effective interventions for the prevention and control of major NCDS.


http://apps.who.int/iris/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1
Menu of policy options and cost-effective interventions for prevention and control of major noncommunicable diseases, to assist Member States in implementing, as appropriate, for national context, (without prejudice to the sovereign rights of nations to determine taxation among other policies), actions to achieve the nine voluntary global targets (Note: This appendix needs to be updated as evidence and cost-effectiveness of interventions evolve with time).

The list is not exhaustive but is intended to provide information and guidance on effectiveness and cost-effectiveness of interventions based on current evidence1–2 and to act as the basis for future work to develop and expand the evidence base on policy measures and individual interventions. According to WHO estimates, policy interventions in objective 3 and individual interventions to be implemented in primary care settings in objective 4, listed in bold, are very cost-effective3 and affordable for all countries.4 However, they have not been assessed for specific contexts of individual countries. When selecting interventions for prevention and control of noncommunicable diseases, consideration should be given to effectiveness, cost-effectiveness, affordability, implementation capacity, feasibility, according to national circumstances, and impact on health equity of interventions, and to the need to implement a combination of population-wide policy interventions and individual interventions.

---

2 WHO-CHOICE [http://www.who.int/choice/en/].
3 Disease control priorities in developing countries [http://www.dcp2.org/pubsub/DCP].
4 Very cost-effective i.e. generate an extra year of healthy life for a cost that falls below the average annual income or gross domestic product per person.
### OBJECTIVE 1
- Raise public and political awareness, understanding and practice about prevention and control of NCDs
- Integrate NCDs into the social and development agenda and poverty alleviation strategies
- Strengthen international cooperation for resource mobilization, capacity building, health workforce training and exchange of information on lessons learnt and best practices
- Engage and mobilize civil society and the private sector as appropriate and strengthen international cooperation to support implementation of the action plan at global, regional and national levels
- Implement other policy options in objective 1 (see paragraph 21)

<table>
<thead>
<tr>
<th>Voluntary global targets</th>
<th>WHO tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribute to all 9 voluntary global targets</td>
<td>WHO global status report on NCDs 2010</td>
</tr>
<tr>
<td></td>
<td>WHO fact sheets</td>
</tr>
<tr>
<td></td>
<td>Global atlas on cardiovascular disease prevention and control 2011</td>
</tr>
<tr>
<td></td>
<td>IARC GLOBOCAN 2008</td>
</tr>
<tr>
<td></td>
<td>Existing regional and national tools</td>
</tr>
<tr>
<td></td>
<td>Other relevant tools on WHO web site including resolutions and documents of WHO governing bodies and regional committees</td>
</tr>
</tbody>
</table>

### OBJECTIVE 2
- Prioritize and increase, as needed, budgetary allocations for prevention and control of NCDs, without prejudice to the sovereign right of nations to determine taxation and other policies
- Assess national capacity for prevention and control of NCDs
- Develop and implement a national multi-sectoral policy and plan for the prevention and control of NCDs through multistakeholder engagement
- Implement other policy options in objective 2 (see paragraph 30) to strengthen national capacity, including human and institutional capacity, leadership, governance, multi-sectoral action and partnerships for prevention and control of non-communicable diseases

<table>
<thead>
<tr>
<th>Voluntary global targets</th>
<th>WHO tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribute to all 9 voluntary global targets</td>
<td>UN Secretary-General’s Note A/67/373</td>
</tr>
<tr>
<td></td>
<td>NCD country capacity survey tool</td>
</tr>
<tr>
<td></td>
<td>NCCP Core Capacity Assessment tool</td>
</tr>
<tr>
<td></td>
<td>Existing regional and national tools</td>
</tr>
<tr>
<td></td>
<td>Other relevant tools on WHO web site including resolutions and documents of WHO governing bodies and regional committees</td>
</tr>
</tbody>
</table>

### OBJECTIVE 3

#### TOBACCO USE
- Implement WHO FCTC (see paragraph 16). Parties to the WHO FCTC are required to implement all obligations under the treaty in full, all Member States that are not Parties are encouraged to look to the WHO FCTC as the foundational instrument in global tobacco control
- Reduce affordability of tobacco products by increasing tobacco excise taxes
- Create by law completely smoke-free environments in all indoor workplaces, public places and public transport
- Warn people of the dangers of tobacco and tobacco smoke through effective health warnings and mass media campaigns
- Ban all forms of tobacco advertising, promotion and sponsorship

<table>
<thead>
<tr>
<th>Voluntary global targets</th>
<th>WHO tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 30% relative reduction in prevalence of current tobacco use in persons aged 15+ years</td>
<td>The WHO FCTC and its guidelines</td>
</tr>
<tr>
<td>A 25% relative reduction in overall mortality from cardiovascular diseases, cancer, diabetes or chronic respiratory diseases</td>
<td>MPower capacity building modules to reduce demand for tobacco, in line with the WHO FCTC</td>
</tr>
<tr>
<td></td>
<td>WHO reports on the global tobacco epidemic</td>
</tr>
<tr>
<td></td>
<td>Recommendations on the marketing of foods and non-alcoholic beverages to children (WHO/MSH.14)</td>
</tr>
<tr>
<td></td>
<td>Global strategy on diet, physical activity and health (WHO/NA.17)</td>
</tr>
</tbody>
</table>

---

1. In addressing each risk factor, Member States should not rely on one single intervention, but should have a comprehensive approach to achieve desired results.
2. Tobacco use. Each of these measures reflects one or more provisions of the WHO Framework Convention on Tobacco Control (WHO FCTC). The measures included in this Appendix are not intended to suggest a prioritization of obligations under the WHO FCTC. Rather, these measures have been proven to be feasible, affordable and cost-effective and are intended to help countries to meet the agreed targets as quickly as possible. The WHO FCTC includes a number of other important provisions, including supply-reduction measures and those to support multisectoral action, which are part of any comprehensive tobacco control programme.
3. Some interventions for management of non-communicable diseases that are cost-effective in high-income settings, which assume a cost-effective infrastructure for diagnosis and referral and an adequate volume of cases, are not listed under objective 4, e.g., pacemaker implants for atrioventricular heart block, defibrillators in emergency vehicles, coronary revascularization procedures, and carotid endarterectomy.
4. Very cost-effective i.e. generate an extra year of healthy life for a cost that falls below the average annual income or gross domestic product per person.
<table>
<thead>
<tr>
<th>Menu of policy options</th>
<th>Voluntary global targets</th>
<th>WHO tools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OBJECTIVE 3</strong>—CONTINUED</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HARMFUL USE OF ALCOHOL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Implement the WHO global strategy to reduce harmful use of alcohol (see objective 3, paragraphs 42, 43) through actions in the recommended target areas, including:</td>
<td>➔ At least a 10% relative reduction in the harmful use of alcohol, as appropriate, within the national context</td>
<td>➔ Global recommendations on physical activity for health</td>
</tr>
<tr>
<td>➔ Strengthening awareness of alcohol-attributable burden, leadership and political commitment to reduce the harmful use of alcohol</td>
<td>➔ A 25% relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure according to national circumstances</td>
<td>➔ Global strategy to reduce the harmful use of alcohol (WHA63.13)</td>
</tr>
<tr>
<td>➔ Providing prevention and treatment interventions for those at risk of or affected by alcohol use disorders and associated conditions</td>
<td>➔ A 25% relative reduction in overall mortality from cardiovascular diseases, cancer, diabetes or chronic respiratory diseases</td>
<td>➔ WHO global status reports on alcohol and health 2011, 2013</td>
</tr>
<tr>
<td>➔ Supporting communities in adopting effective approaches and interventions to prevent and reduce the harmful use of alcohol</td>
<td>➔ WHO guidance on dietary salt and potassium</td>
<td>➔ Existing regional and national tools</td>
</tr>
<tr>
<td>➔ Implementing effective drink–driving policies and countermeasures</td>
<td>➔ Other relevant tools on WHO web site including resolutions and documents of WHO governing bodies and regional committees</td>
<td></td>
</tr>
<tr>
<td>➔ Regulating commercial and public availability of alcohol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Restricting or banning alcohol advertising and promotions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Using pricing policies such as excise tax increases on alcoholic beverages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Reducing the negative consequences of drinking and alcohol intoxication, including by regulating the drinking context and providing consumer information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Reducing the public health impact of illicit alcohol and informally produced alcohol by implementing efficient control and enforcement systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Developing sustainable national monitoring and surveillance systems using indicators, definitions and data collection procedures compatible with WHO’s global and regional information systems on alcohol and health</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UNHEALTHY DIET &amp; PHYSICAL INACTIVITY</strong></td>
<td></td>
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</tr>
<tr>
<td>➔ Implement the WHO Global Strategy on Diet, Physical Activity and Health (see objective 3, paragraphs 40–41)</td>
<td>➔ A 10% relative reduction in prevalence of insufficient physical activity</td>
<td></td>
</tr>
<tr>
<td>➔ Increase consumption of fruit and vegetables</td>
<td>➔ A 25% relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure according to national circumstances</td>
<td></td>
</tr>
<tr>
<td>➔ To provide more convenient, safe and health-oriented environments for physical activity</td>
<td>➔ Halt the rise in diabetes and obesity</td>
<td></td>
</tr>
<tr>
<td>➔ Implement recommendations on the marketing of foods and non-alcoholic beverages to children (see objective 3, paragraph 38–39)</td>
<td>➔ A 25% relative reduction in overall mortality from cardiovascular diseases, cancer, diabetes or chronic respiratory diseases</td>
<td></td>
</tr>
<tr>
<td>➔ Implement the WHO global strategy for infant and young child feeding</td>
<td>➔ A 50% relative reduction in mean population intake of salt/sodium intake</td>
<td></td>
</tr>
<tr>
<td>➔ Reduce salt intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Replace trans fats with unsaturated fats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Implement public awareness programmes on diet and physical activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Replace saturated fat with unsaturated fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Manage food taxes and subsidies to promote healthy diet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ Implement other policy options listed in objective 3 for addressing unhealthy diet and physical inactivity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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1 Very cost-effective i.e. generate an extra year of healthy life for a cost that falls below the average annual income or gross domestic product per person.

2 And adjust the iodine content of iodized salt, when relevant.
## OBJECTIVE 4

- Integrate very cost-effective noncommunicable disease interventions into the basic primary health care package with referral systems to all levels of care to advance the universal health coverage agenda
- Explore viable health financing mechanisms and innovative economic tools supported by evidence
- Scale up early detection and coverage, prioritizing very cost-effective high-impact interventions including cost-effective interventions to address behavioural risk factors
- Train health workforce and strengthen capacity of health system particularly at primary care level to address the prevention and control of noncommunicable diseases
- Improve availability of affordable basic technologies and essential medicines, including generics, required to treat major noncommunicable diseases, in both public and private facilities
- Implement other cost-effective interventions and policy options in objective 4 (see paragraph 48) to strengthen and orient health systems to address noncommunicable diseases and risk factors through people-centred primary health care and universal health coverage
- Develop and implement a palliative care policy using cost-effective treatment modalities, including opioids analgesics for pain relief and training health workers

### CARDIOVASCULAR DISEASE & DIABETES

1. **Drug therapy** (including glycaemic control for diabetes mellitus and control of hypertension using a total risk approach) and counselling to individuals who have had a heart attack or stroke and to persons with high risk (≥30%) of a fatal and nonfatal cardiovascular event in the next 10 years
2. **Acetylsalicylic acid for acute myocardial infarction**
3. **Drug therapy** (including glycaemic control for diabetes mellitus and control of hypertension using a total risk approach) and counselling to individuals who have had a heart attack or stroke, and to persons with moderate risk (≥20%) of a fatal and nonfatal cardiovascular event in the next 10 years
4. **Detection, treatment and control of hypertension and diabetes, using a total risk approach**
5. **Secondary prevention of rheumatic fever and rheumatic heart disease**
6. **Acetylsalicylic acid, atenolol and thrombolytic therapy (streptokinase) for acute myocardial infarction**
7. **Treatment of congestive cardiac failure with ACE inhibitor, beta-blocker and diuretic**
8. **Cardiac rehabilitation post myocardial infarction**
9. **Anticoagulation for medium and high-risk non-valvular atrial fibrillation and for mitral stenosis with atrial fibrillation**
10. **Low-dose acetylsalicylic acid for ischemic stroke**

- **A 25% relative reduction in overall mortality from cardiovascular diseases, cancer, diabetes or chronic respiratory diseases**
- **At least 50% of eligible people receive drug therapy and counselling (including glycaemic control) to prevent heart attacks and strokes**
- **A 25% relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure, according to national circumstances**

### WHO tools

- **WHO World health reports 2010, 2011**
- **Prevention and control of noncommunicable diseases: Guidelines for primary health care in low-resource settings; diagnosis and management of type 2 diabetes and Management of asthma and chronic obstructive pulmonary disease 2012**
- **Guideline for cervical cancer: Use of cryotherapy for cervical intraepithelial neoplasia**
- **Guideline for pharmacological treatment of persisting pain in children with medical illnesses**
- **Scaling up NCD interventions, WHO 2011**
- **WHO CHOICE database**
- **WHO Package of essential noncommunicable (PEN) disease interventions for primary health care including costing tool 2011**
- **Integrated clinical protocols for primary health care and WHO ISH cardiovascular risk prediction charts 2012**
- **Affordable technology. Blood pressure measurement devices for low-resource settings 2007**
- **Indoor air quality guidelines**
- **WHO air quality guidelines for particular matter, ozone, nitrogen dioxide and sulphur dioxide, 2005**
- **Cancer control: Modules on prevention and palliative care**
- **Essential Medicines List (2011)**
- **OneHealth tool**
- **Enhancing nursing and midwifery capacity to contribute to the prevention, treatment and management of noncommunicable diseases**
- **Existing regional and national tools**
- **Other relevant tools on WHO web site including resolutions and documents of WHO governing bodies and regional committees**

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1. Policy actions for prevention of major noncommunicable diseases are listed under objective 3.
2. Very cost-effective i.e. generate an extra year of healthy life for a cost that falls below the average annual income or gross domestic product per person.
<table>
<thead>
<tr>
<th>Menu of policy options</th>
<th>Voluntary global targets</th>
<th>WHO tools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OBJECTIVE 4—CONTINUED</strong></td>
<td><strong>DIABETES</strong></td>
<td><strong>WHO World health reports 2010, 2011</strong></td>
</tr>
<tr>
<td>→ Lifestyle interventions for preventing type 2 diabetes</td>
<td>→ A 25% relative reduction in overall mortality from cardiovascular diseases, cancer, diabetes or chronic respiratory diseases</td>
<td>→ Prevention and control of noncommunicable diseases: Guidelines for primary health care in low-resource settings; diagnosis and management of type 2 diabetes and Management of asthma and chronic obstructive pulmonary disease 2012</td>
</tr>
<tr>
<td>→ Influenza vaccination for patients with diabetes</td>
<td>→ At least 50% of eligible people receive drug therapy and counselling (including glycaemic control) to prevent heart attacks and strokes</td>
<td>→ Guideline for cervical cancer: Use of cryotherapy for cervical intraepithelial neoplasia</td>
</tr>
<tr>
<td>→ Preconception care among women of reproductive age including patient education and intensive glucose management</td>
<td>→ A 25% relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure, according to national circumstances</td>
<td>→ Guideline for pharmacological treatment of persisting pain in children with medical illnesses</td>
</tr>
<tr>
<td>→ Detection of diabetic retinopathy by dilated eye examination followed by appropriate laser photocoagulation therapy to prevent blindness</td>
<td></td>
<td>→ Scaling up NCD interventions, WH 2011</td>
</tr>
<tr>
<td>→ Effective angiotensin-converting enzyme inhibitor drug therapy to prevent progression of renal disease</td>
<td></td>
<td>→ WHO CHOICE database</td>
</tr>
<tr>
<td>→ Care of acute stroke and rehabilitation in stroke units</td>
<td></td>
<td>→ WHO Package of essential noncommunicable (PEN) disease interventions for primary health care including costing tool 2011</td>
</tr>
<tr>
<td>→ Interventions for foot care: educational programmes, access to appropriate footwear, multidisciplinary clinics</td>
<td></td>
<td>→ Prevention of cardiovascular disease: Guidelines for assessment and management of cardiovascular risk 2007</td>
</tr>
<tr>
<td><strong>CANCER</strong></td>
<td></td>
<td>→ Integrated clinical protocols for primary health care and WHO 15+ cardiovascular risk prediction charts 2012</td>
</tr>
<tr>
<td>→ Prevention of liver cancer through hepatitis B immunization</td>
<td></td>
<td>→ Affordable technology: Blood pressure measurement devices for low-resource settings 2007</td>
</tr>
<tr>
<td>→ Prevention of cervical cancer through screening (visual inspection with acetic acid [VIA] or Pap smear (cervical cytology), if very cost-effective), linked with timely treatment of pre-cancerous lesions</td>
<td></td>
<td>→ Indoor air quality guidelines</td>
</tr>
<tr>
<td>→ Vaccination against human papillomavirus, as appropriate if cost-effective and affordable, according to national programmes and policies</td>
<td></td>
<td>→ WHO air quality guidelines for particular matter, ozone, nitrogen, dioxide and sulphur dioxide, 2005</td>
</tr>
<tr>
<td>→ Population-based cervical cancer screening linked with timely treatment</td>
<td></td>
<td>→ Cancer control: Modules on prevention and palliative care</td>
</tr>
<tr>
<td>→ Population-based breast cancer and mammography screening (50–70 years) linked with timely treatment</td>
<td></td>
<td>→ Essential Medicines List (2011)</td>
</tr>
<tr>
<td>→ Population-based colorectal cancer screening, including through a fecal occult blood test, as appropriate, at age &gt;50, linked with timely treatment</td>
<td></td>
<td>→ OneHealth tool</td>
</tr>
<tr>
<td>→ Oral cancer screening in high-risk groups (e.g. tobacco users, betel-nut chewers) linked with timely treatment</td>
<td></td>
<td>→ Enhancing nursing and midwifery capacity to contribute to the prevention, treatment and management of noncommunicable diseases</td>
</tr>
<tr>
<td><strong>CHRONIC RESPIRATORY DISEASE</strong></td>
<td></td>
<td>→ Existing regional and national tools</td>
</tr>
<tr>
<td>→ Access to improved stoves and cleaner fuels to reduce indoor air pollution</td>
<td></td>
<td>→ Other relevant tools on WHO web site including resolutions and documents of WHO governing bodies and regional committees</td>
</tr>
<tr>
<td>→ Cost-effective interventions to prevent occupational lung diseases, e.g. from exposure to silica, asbestos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Treatment of asthma based on WHO guidelines</td>
<td></td>
<td></td>
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<tr>
<td>→ Influenza vaccination for patients with chronic obstructive pulmonary disease</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Policy actions for prevention of major noncommunicable diseases are listed under objective 3.

2 Very cost-effective i.e. generate an extra year of healthy life for a child that falls below the average annual income or gross domestic product per person.

3 Screening is meaningful only if associated with capacity for diagnosis, referral and treatment.
### OBJECTIVE 5

<table>
<thead>
<tr>
<th>Menu of policy options</th>
<th>Voluntary global targets</th>
<th>WHO tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ Develop and implement a prioritized national research agenda for noncommunicable diseases</td>
<td>→ Contribute to all 9 voluntary global targets</td>
<td>→ Prioritized research agenda for the prevention and control of noncommunicable diseases 2011</td>
</tr>
<tr>
<td>→ Prioritize budgetary allocation for research on noncommunicable disease prevention and control</td>
<td></td>
<td>→ World Health Report 2013</td>
</tr>
<tr>
<td>→ Strengthen human resources and institutional capacity for research</td>
<td></td>
<td>→ Global strategy and plan of action on public health, innovation and intellectual property (WHA61.21)</td>
</tr>
<tr>
<td>→ Strengthen research capacity through cooperation with foreign and domestic research institutes</td>
<td></td>
<td>→ Existing regional and national tools</td>
</tr>
<tr>
<td>→ Implement other policy options in objective 5 (see paragraph 53) to promote and support national capacity for high-quality research, development and innovation</td>
<td></td>
<td>→ Other relevant tools on WHO website including resolutions and documents of WHO governing bodies and regional committees</td>
</tr>
</tbody>
</table>

### OBJECTIVE 6

<table>
<thead>
<tr>
<th>Menu of policy options</th>
<th>Voluntary global targets</th>
<th>WHO tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ Develop national targets and indicators based on global monitoring framework and linked with a multisectoral policy and plan</td>
<td>→ Contribute to all 9 voluntary global targets</td>
<td>→ Global monitoring framework</td>
</tr>
<tr>
<td>→ Strengthen human resources and institutional capacity for surveillance and monitoring and evaluation</td>
<td></td>
<td>→ Verbal autopsy instrument</td>
</tr>
<tr>
<td>→ Establish and/or strengthen a comprehensive noncommunicable disease surveillance system, including reliable registration of deaths by cause, cancer registration, periodic data collection on risk factors, and monitoring national response</td>
<td></td>
<td>→ STEPwise approach to surveillance</td>
</tr>
<tr>
<td>→ Integrate noncommunicable disease surveillance and monitoring into national health information systems</td>
<td></td>
<td>→ Global Tobacco Surveillance System</td>
</tr>
<tr>
<td>→ Implement other policy options in objective 6 (see paragraph 59) to monitor trends and determinants of noncommunicable diseases and evaluate progress in their prevention and control</td>
<td></td>
<td>→ Global Information System on Alcohol and Health</td>
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<td>→ Global school-based student health survey, ICD-10 training tool</td>
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<td>→ Service Availability and Readiness (SARA) assessment tool</td>
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<td></td>
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<td>→ IARC GLOBOCAN 2008</td>
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<tr>
<td></td>
<td></td>
<td>→ Existing regional and national tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>→ Other relevant tools on WHO website including resolutions and documents of WHO governing bodies and regional committees</td>
</tr>
</tbody>
</table>
Appendix E

Author’s response to reviewers comments on Paper 2 (Chapter 4).

RESPONSE TO REVIEWERS: Submission 1

REVIEWER 1

Comment 1: This paper has the potential to advance the body of research on mental health in developing countries. In order to fulfil this potential, however, major revisions are needed. The one major strength of this paper is the knowledge gap on mental disorders in developing countries it intends to fill. Nevertheless, in its current form, the paper reads more like a report than a publishable article in a peer-reviewed journal. It focus mainly on the raw data and provides neither a theoretical framework nor a methodological justification. The rationale for the focus on the relationship between spirituality and mental health is largely missing.

Response: Thank you for this point. In the revision we have rephrased and added rationale with references. Page 4, 2nd Paragraph “Alternately, religion and spirituality are increasingly being examined as a factor in mental health but the results are not consistent. ………. While a study from mainland China report higher risk of mental disorders for those with religious affiliation but found positive association within different ethnic groups and some have found no association. In the light of the apparently inconsistent reports, this paper revisits the association between CMD and socio-economic, spiritual and health factors. The aim of this study is to identify factors associated with the symptoms of CMDs, using data from the Bhutan’s GNH Survey, 2015.”

Comment 2: It seems as though the paper deals with the societal antecedents of mental health in ‘developing’ countries. This also seems to be the way in which the study is framed in terms of its relevance: the introduction immediately starts with the fact that 75% of the 450 million people suffering from a mental disorder live in developing countries. A theoretical discussion is virtually absent in the paper. This leads to a general lack of focus. This lack of
focus also translates into poorly informed methodological choices. Take for instance, the sentence ‘We identified potential factors associated with CMD based on a review of global literature and on local concepts of mental illness in Bhutan.’ (page 6). Which ones?

Response: Thank you and this has been raised by reviewer no.3 also. We have inserted the relevant references from Bhutan and worldwide.

Comment 3: What did the review look like? It’s not as if there is no room for a theoretical discussion: the word count of this article is 2772, and the upper limit for this journal is 4000. I suggest the authors either focus on mental health in developing countries or on the relationship between spirituality and mental health, the Buddhist country of Bhutan being a solid case in point. The World Database of Happiness has an extensive database of correlational findings. In it, key articles on a particular relationship with happiness can be found. My guess is that spirituality is one of them. Since mental health and happiness are closely related, I suggest the authors have a look.

Response: Thank you for the suggestion. However due to the methodical differences in assessing common mental disorder and happiness. This particular suggestion is beyond the scope of this analysis. However, as advised, we have revised rationale to focus on the relationship between spirituality and mental health.

Comment 4: I must confess I am not as proficient in statistical analysis as the authors appear to be. Therefore, my criticism of the paper focuses mainly on the theory and argumentation of the paper. I do wonder, however, why the authors decided to recode the scores ‘fair’ and ‘poor health’ into ‘poor health’ (page 6). This strikes me as somewhat contradictory. The same applies for the combination of ‘not at all spiritual’ and ‘somewhat spiritual’ ‘due to low numbers in these categories’ (page 5). Also, what is a sandwich estimator?
Response: Thank you for pointing this. We have dichotomised self-reported health status and spirituality into binary to gain interpretability and simplicity consistent to previous studies. In addition we have added references for the SRH in the manuscript.

- Association between Sleep Duration and Self-Reported Health Status: Findings from the Bhutan's Gross National Happiness Study. JOURNAL OF CLINICAL SLEEP MEDICINE, 2017, Volume 13, Issue 1
- Sandwich estimator is tool used for robust covariance matrix estimator.

Comment 5: The authors should also be more precise in their formulation of (expected) statistical relationships. The expressions ‘associated with’ or ‘relationship with’ which are used throughout this paper are not very informative. What kind of association or relationship and in what direction?

Response: We thank the reviewer for this observation. Beta (β) denote the average change in GHQ-12 score (refer page 6, paragraph 4, last line) and the p-value gives the strength of association (Table 3). However as mentioned in page 14, the directional aspect is not possible due to cross-sectional nature of the study.

Comment 6: Furthermore, there has been some debate about which indicator of mental health is more reliable: the absence of mental illness, self-reported mental health or other indicators. The authors should at least engage in that discussion. Finally with regards to the methodology, the fact that the GHQ-12 is not validated in other Asian countries should also be cause for caution.
Response: GHQ-12 is validated in many Asian countries like Nepal, India, Indonesia, etc. However it is not validated in Bhutan. We have sighted that as limitation.

Comment 7: On page 4, the authors state that ‘[t]he aim of this study is to identify factors associated with the symptoms of CMDs, using data from the GNH Survey, 2015.’ This is the only mention of a clear research question I could detect. However, ‘to identify factors associated with’ is too vague. What factors? In what way are they associated?

Response: Thank you for your observation. The factors associated with CMD are given in multivariate model (Table 3).

Comment 8: Furthermore, judging by the expression ‘[o]ur study confirms…’ on page 13, it looks like the authors at least had a faint idea of what to expect. So it would make sense to mention this expectation and give some sound theoretical and/or empirical reasons for this.

Response: We thank the reviewer for pointing out this suggestion. As stated earlier, we have revised the rationale to on page 4, 2nd Paragraph. Further we have incorporated more discussion on these determinants. Page 14, 4th Paragraph: ‘Illiteracy is a preventable risk factor. This for Bhutan could mean enhancing the literacy level of the adults through non-formal education program. Bhutan’s literacy is higher among younger age group and begins to drop from 10-14 years. (16) At present adult literacy is only 55% About older age and low income as a risk factor, World Health Organization reports that CMDs are 1.5 to 2 times more prevalent among the low-income groups. (43) The report also suggest that people living in poverty lacks the financial means to educational and employment opportunities which perpetuate the negative cycle between poverty and CMDs. Similarly, older age is considered the single most important predictor for CMD as they are at risk of social isolation and more
susceptible to noncommunicable diseases. (44) This suggests the need to address the underlying factors affecting the mental health of elderly people and improving the economic well-being of the people. As with any cross-sectional study, the direction of the association is unclear.

Comment 9: The level of English is mostly sufficient, but there were several grammatical errors, stylistic lapses and typos. For instance, ‘Participants who are not spiritual and who does not belief in Karma…’ (page 10), ‘Lundin et.al' (page 5), ‘Our study did not find association between frequency…’ (page 14) ‘In Buddhist context’ (page 14), ‘Internal consistency for GHQ-12 score were checked…’ (page 6).

Response: We have corrected the grammatical errors, stylistic lapses and typos mentioned above.
REVIEWER 2

Comment 1: I would like to see more discussions on the potential perspective of spiritual practices protecting from mental illnesses.

Response: We thank the reviewer for this suggestion. We have added the following sections in the discussion:

We observed a progressive increase in the GHQ-12 score with the decreasing level of spirituality. Similar trend was observed with variable Karma. Those who occasionally and never believe in Karma report higher level of GHQ-12 score compare to who regularly believe in Karma. Similarly in Page 14, 2nd paragraph we have added – ‘Bhutan is predominantly a Buddhist (83.1%) country with more than 90% of its population reported being spiritual. (19) Under these circumstance, Spirituality….Spiritual beliefs and practices may enable people to face difficulties and provide conduct to live and work together. In other words, development policies may need to consider religious amenities like temples, monastic schools and access to local spiritual leader as a basic consideration. The GHN survey 2015 report that 97% of the respondents making visit to places of spiritual significances in the locality

Comment 2: The paper mentions that there is 4 psychiatrists and some nurses in Bhutan, but this is not correct at the time where the GNH survey took place in 2015. And the authors hint/put some emphasis on psychiatric services as a good response to mental diseases. But they should rather discuss mental health promotion as well as causes of mental illnesses in Bhutan. This would be more useful for the mental health strategies in the country. Psychiatry may only provide moderate mitigation of the high prevalence of mental illnesses recorded.
Response: Thank you for pointing out this oversight. We have revised the paper as follows:

“Although, the lack of specialised mental health workers in Bhutan is a limitation. (16) High prevalence of CMD calls for interventions promoting mental health literacy to aid recognition, management, prevention as well as reduce stigma and discrimination. (62, 63) A further consideration is to strengthen the district hospitals and basic health units which function as community based mental health services for remote communities.”

REVIEWER 3

Comment 1: In the abstract, the first sentence of the 'results' section lacks the time-lapse of measure associated with GHQ (lifetime, current...).

Response: Thank you for pointing this out. We have rephrased the abstract “The current prevalence of CMDs was 29.3% [95% CI 26.8, 31.8].

Comment 2: The term 'prevalence' seems to be used improperly regarding the measure that is involved, which does not provide any diagnosis. The authors should overall be more careful with shortcuts and use formulas such as 'having a higher score on the GHQ was associated with...'. Even the word 'common mental disorders' may be further discussed, since we cannot draw their presence/absence from the GHQ results, nor whether poorer mental health is associated with depression rather than schizophrenia or bipolar disorder, for example.

Response: As suggested, we have explained what Common mental disorder (CMD) refers to:

Page 4, 1st paragraph: (1) ‘Common mental disorder refers to ‘disorders which are commonly encountered in community settings, and whose occurrence signals a breakdown in
normal functioning. (2) World Health Organization refers CMD to a range of anxiety and depressive disorders that impacts on the mood or feeling of the affected person. (3)

As correctly pointed out by the reviewer, GHQ-12 is not a diagnostic tool. We have qualified GHQ-12 by adding the following sentence.

Page 5, 2nd paragraph: “GHQ-12 is a screening tool to detect minor psychological distress in the general population or in a non-clinical setting”. (20)

In regard to prevalence, thresholds have been used to estimate prevalence for policy decisions in many studies worldwide and we have included the references. (20, 21) However, for the model building we used GHQ as a continuous outcome. Refer page 6, 4th Paragraph “We analysed GHQ-12 scores as a continuous outcome and explored the association of each factor with GHQ-12 score”

Comment 3: It is not clear how the questionnaire addresses mental vs. non mental disorders; maybe the authors could explicit how these symptoms are derived from this general questionnaire;

Response: Thank you for your comment. Please refer page 5, paragraph 2 and 3 on how the GHQ-12 measure these symptoms.

Comment 4: the authors evoke the usual cut-off for the GHQ, however, it is unclear from their methods and results sections whether the score was used as a binary (high vs. low) or continuous variable. This is a very important point to address;
**Response:** Thank you for pointing it this. We have explained this is in the Analysis section, page 6, 4th paragraph “We analysed GHQ-12 scores as a continuous outcome and explored the association of each factor with GHQ-12 score through univariable and multivariable linear regression models”.

**Comment 5:** when the authors evoke a hierarchical order for the independent variables chosen for their GEE, they may specify how this hierarchy was chosen and explain the reference to the paper cited as #19.

**Response:** Thank you for pointing this, we have revised the section as follows:-

Page 6 last paragraph. “In our model, socio-economic factors were considered most distal factors (level one), followed by spirituality and religious factors (level two) and health related factors (level three). These factors were then entered in a hierarchical order into a multivariable modelling procedure. “and we cited references.

**Comment 6:** Accordingly, their mention to 'review of global literature' and 'local concepts' (p.6, lines 19-20) should be based on literature references, even from non-usual scientific sources (local writings, newspapers...);

**Response:** We thank the reviewer for this observation, This issues has also been pointed by reviewer 1. We have now inserted the references from Bhutan and worldwide. Refer page 6, 4th Paragraph.
Comment 7: the authors should ideally discuss if they were able to check for any differences between respondents and non-respondents and, if so, if there were any differences regarding their respective sociodemographic factors;

Response: Thank you for your suggestion. However, we don’t have information on the non-respondents.

Comment 7: the authors evoke that they would check for collinearity using variance inflation factors, which are not further provided. Please amend.

Response: Thank you again for pointing this out. We have rephrased the paragraph as follows:

Page 7, 1st paragraph: “Collinearity between variables was also checked using variance inflation factors and found to be < 10”

Comment 8: finally, it seems to me that the study design is not strictly suitable to address the links between the GNH policy and mental health. If the authors were to keep trace of this as a main objective or finding, they should describe at least 1/the concrete elements of this policy in the everyday life in Bhutan and 2/if there are differences in GHQ scores before and after this policy was decided and/or applied in the country. For instance, I noticed there have been previous papers with the same measures in Bhutan, which could thus be compared to the present one; and it a deeper penetration of the GNH policy in urban vs. rural areas may prevent the mental health issues generally associated with urbanicity to be seen in the study?

Response: We agree that the study is not design to address the link between GNH policy and Mental health. Thank you for pointing this out. In this regard, we have omitted the reference to GNH from the abstract and rephrased it as “CMDs affect a substantial proportion of the...
Bhutanese population. Our findings confirm the importance of established socio-economic factors of CMDs in Bhutan, and suggest a potential link between spiritualism and mental health in this setting.”

Comment 9: Finally, there is no mention of any consent given by the study participants, which should be stated clearly in the present paper.

Response: Thank you for your advice and this has also been raised by the editor also. We have added ethic statement to the method section, refer Page 7 (last paragraph).

“Ethic statement: The study protocol was reviewed and approved by National Statistics Bureau, Royal Government of Bhutan. Informed consent was obtained from the respondents. We used secondary data that has no identifying information.”
RESPONSE TO REVIEWERS: Submission 2

Editorial requests

Editorial request 1: Please revise your title so that it includes your study design. This is the preferred format for the journal.

Response: We have edited the title as requested. ‘Socio-economic, religious, spiritual and health factors associated with symptoms of common mental disorders: a cross-sectional secondary analysis of data from Bhutan’s Gross National Happiness Study, 2015.’

Editorial request 2: Please add an ethics statement to the methods section. If your study did not require approval from a local ethics committee then please state this in the paper, explaining why ethics approval was not required. Please also confirm in the methods section that you obtained written informed consent from participants.

Response: We have added an ethics statement (lines 243-245) to clarify that the Gross National Happiness Survey was reviewed and approved by the National Statistics Bureau, Royal Government of Bhutan, and that informed consent was obtained from the respondents.
REVIEWER 1

Comment 1: The one major strength of this paper is the knowledge gap on mental disorders in developing countries it intends to fill. Nevertheless, in its current form, the paper reads more like a report than a publishable article in a peer-reviewed journal. It focuses mainly on the raw data and provides neither a theoretical framework nor a methodological justification. The rationale for the focus on the relationship between spirituality and mental health is largely missing.

Response: In the revised manuscript we have emphasised the theoretical/analytical framework (a hierarchical framework drawing on the socio-ecological model) used in this study (lines 209-213). We have also added further rationale for our focus on the relationship between spirituality and mental health, with multiple references (lines 124-129). Specifically we describe how although religion and spirituality are association with mental health in some settings, these findings are not consistent and further research is needed to examine the relationship between religious factors and CMDs, especially in low-income settings.

Comment 2: It seems as though the paper deals with the societal antecedents of mental health in ‘developing’ countries. This also seems to be the way in which the study is framed in terms of its relevance: the introduction immediately starts with the fact that 75% of the 450 million people suffering from a mental disorder live in developing countries. A theoretical discussion is virtually absent in the paper. This leads to a general lack of focus. This lack of focus also translates into poorly informed methodological choices. Take for instance, the sentence ‘We identified potential factors associated with CMDs based on a review of global literature and on local concepts of mental illness in Bhutan.’ (page 6). Which ones?
Response: Thank you for these comments. Due to the lack of epidemiological research on risk factors for common mental disorders in Bhutan this study deliberately adopted a broad focus to explore different types of risk factor, i.e. socio-economic, religious and health factors. This is reflected in the choice of methods – a hierarchical framework that has been used in previous published papers (Line 207-211) to provide a structure to the analysis (1, 2). As suggested by the reviewer, we have clarified references reviewed for the selection of factors for the analysis - line 207-208 (3-7).

Comment 3: What did the review look like? It’s not as if there is no room for a theoretical discussion: the word count of this article is 2772, and the upper limit for this journal is 4000. I suggest the authors either focus on mental health in developing countries or on the relationship between spirituality and mental health, the Buddhist country of Bhutan being a solid case in point. The World Database of Happiness has an extensive database of correlational findings. In it, key articles on a particular relationship with happiness can be found. My guess is that spirituality is one of them. Since mental health and happiness are closely related, I suggest the authors have a look.

Response: Thank you for the suggestion. This paper aims to explore risk factors for CMDs in Bhutan, a country in which there is a dearth of mental health research. Our focus is therefore to establish to what extent risk factors identified in other settings, especially other low- and middle-income countries (LMICs), are relevant in Bhutan, and to identify potentially novel determinants. In line with this aim, the introduction to the manuscript focuses on CMDs and its risk factors in other LMICs, before identifying Bhutan as the setting for the research.
Comment 4: I must confess I am not as proficient in statistical analysis as the authors appear to be. Therefore, my criticism of the paper focuses mainly on the theory and argumentation of the paper. I do wonder, however, why the authors decided to recode the scores ‘fair’ and ‘poor health’ into ‘poor health’ (page 6). This strikes me as somewhat contradictory. The same applies for the combination of ‘not at all spiritual’ and ‘somewhat spiritual’ ‘due to low numbers in these categories’ (page 5). Also, what is a sandwich estimator?

Response: We coded self-reported health status and spirituality as binary variables because of low numbers of cases. In self-reported health status there are only 1% and 9% in ‘poor’ and ‘fair’ self-reported health status respectively. Similarly, there are only 0.2% and 8.6% cases in ‘not at all spiritual’ and ‘somewhat spiritual’ respectively.

The binary coding of self-reported health status is consistent with previously published paper on self-reported health status and sleep duration from Bhutan using similar data set.(8)

Sandwich estimator, often known as the robust covariance matrix estimator is a widely used method for estimating the covariance of parameter estimates. It yields robust standard errors. We have clarified this in the methods (lines 218-219).

Comment 5: The authors should also be more precise in their formulation of (expected) statistical relationships. The expressions ‘associated with’ or ‘relationship with’ which are used throughout this paper are not very informative. What kind of association or relationship and in what direction?

Response: We thank the reviewer for this observation. We have qualified the association (lines 288, 290, 303, 307, 309 and 318). However as mentioned in lines 408-410 the directional aspect is not possible due to cross sectional nature of the study.
Comment 6: Furthermore, there has been some debate about which indicator of mental health is more reliable: the absence of mental illness, self-reported mental health or other indicators. The authors should at least engage in that discussion. Finally with regards to the methodology, the fact that the GHQ-12 is not validated in other Asian countries should also be cause for caution.

Response: In common with many other epidemiological studies of risk factors for CMDs in LMICs, this study uses the GHQ-12 as an outcome. In reference to the GHQ-12 validation in Asian countries, we have added the following additional text ‘The GHQ-12 has not been validated in Bhutan, though it has been validated in other south Asian settings’ lines 166-167 (9),(10) (11). GHQ-12 is generally accepted as a tool with cross-cultural relevance. The GHQ-12 has not been formally validated in Bhutan, however we accounted for this by analysing the GHQ-12 as a continuous outcome, therefore avoiding the need to rely on a threshold score to indicate the presence or absence of CMDs (lines 215-217). We have cited the lack of validation in lines 85-87 and as a limitation in the discussion section (lines 435-437). As the reviewer notes, there are several approaches to assessing mental health. The GHQ-12 is a self-reported screening tool. Although it is not diagnostic of CMDs it is a feasible approach to assess mental health in a large national survey. This is also noted in the limitations section of the Discussion (lines 437-440).

Comment 7: On page 4, the authors state that ‘[t]he aim of this study is to identify factors associated with the symptoms of CMDs, using data from the GNH Survey, 2015.’ This is the only mention of a clear research question I could detect. However, ‘to identify factors associated with’ is too vague. What factors? In what way are they associated?
**Response:** We have clarified the aim of the study lines 131-132, with reference to the types of factors we aimed to assess in the analysis (religion and spirituality, socioeconomic and health) and whether or not these factors predict symptoms of CMDs.

**Comment 8:** Furthermore, judging by the expression ‘[o]ur study confirms…’ on page 13, it looks like the authors at least had a faint idea of what to expect. So it would make sense to mention this expectation and give some sound theoretical and/or empirical reasons for this.

**Response:** In the introduction section we identify some universal predictors of CMDs (e.g. poverty, lack of education, female sex marital discord and divorce (lines 117-123). We have revised the first sentence of the Discussion section to reflect this. It now reads: In line with previous research conducted in low resource settings, our study suggests that older age, being female, being widowed or divorced, illiteracy, occupation, low income, poor health status and disability predict symptoms of CMDs in Bhutan (lines 338-342). We have also incorporated further Discussion on these established determinants (lines 360-367) with reference to previous relevant studies.

**Comment 9:** The level of English is mostly sufficient, but there were several grammatical errors, stylistic lapses and typos. For instance, ‘Participants who are not spiritual and who does not belief in Karma…’ (page 10), ‘Lundin et.al’ (page 5), ‘Our study did not find association between frequency…’ (page 14) ‘In Buddhist context’ (page 14), ‘Internal consistency for GHQ-12 score were checked…’ (page 6).

**Response:** Many thanks for identifying these errors. We have corrected them and thoroughly reviewed the document to check for and address any additional grammatical problems.
REVIEWER 2

Comment 1: I would like to see more discussions on the potential perspective of spiritual practices protecting from mental illnesses.

Response: Thank you for your suggestions. In the Discussion section we have explored the widespread nature of spiritual practice across Bhutan’s population (lines 390-391) and why spiritual practices may protect against mental illness in this setting (lines 400-403), including how these practices may be incorporated into future mental health policy. We have also compared our findings with previous research on this topic (lines 386-389).

Comment 2: The paper mentions that there is 4 psychiatrists and some nurses in Bhutan, but this is not correct at the time where the GNH survey took place in 2015.

Response: Thank you for pointing this out. In 2015 (during the time of the survey) there were only two psychiatrists and no psychiatrist nurses in the country. At present there are four psychiatrists in the country (Source: Dr. Damber K. Nirola, JDWNRH)

Comment 3: And the authors hint/put some emphasis on psychiatric services as a good response to mental diseases. But they should rather discuss mental health promotion as well as causes of mental illnesses in Bhutan. This would be more useful for the mental health strategies in the country. Psychiatry may only provide moderate mitigation of the high prevalence of mental illnesses recorded.

Response: We agree with the reviewer on the importance of mental health promotion strategies. We have therefore added the following additional text to the Discussion section
Our study also identifies potential targets for mental health promotion strategies which could be delivered by non-specialised mental health workers. For example, provision of mental health support to older people, and mental health literacy programmes for health workers to aid recognition, management and prevention CMDs among individuals with poor general health. In rural settings, strengthening mental health in district hospitals and basic health units is necessary to provide community-based mental health services for remote communities.

REVIEWER 3

Comment 1: in the abstract, the first sentence of the 'results' section lacks the timelapse of measure associated with GHQ (lifetime, current...). The term 'prevalence' seems to be used improperly regarding the measure that is involved, which does not provide any diagnosis. The authors should overall be more careful with shortcuts and use formulas such as 'having a higher score on the GHQ was associated with...'. Even the word 'common mental disorders' may be further discussed, since we cannot draw their presence/absence from the GHQ results, nor whether poorer mental health is associated with depression rather than schizophrenia or bipolar disorder, for example.

Response: Thank you for pointing this out. We have added wording to the method section lines 55-56 of the abstract to clarify the time frame ‘past four weeks” specified in the GHQ-12 questionnaire.

We agree with the reviewer and made several edits to clarify our use of the term prevalence and CMDs. Specifically we have:

i) Defined Common mental disorder (CMDs) (lines 110-113): “Common mental disorders are ‘disorders which are commonly encountered in community settings, and
whose occurrence signals a breakdown in normal functioning (14) World Health Organization refers CMDs to a range of anxiety and depressive disorders that impact on the mood or feelings of the affected person (15).”

ii) We have clarified in the Strengths and limitations section that although we provide prevalence, given the nature of the GHQ-12 as a screening tool and not a diagnostic tool, and the lack of a validated threshold score to indicate the presence or absence of CMDs, the prevalence is an estimate and should be interpreted with caution (lines 437-440). We have also further described the GHQ-12 in the methods section, in the following sentence (line 160-161)“The GHQ-12 is a screening tool to detect psychological distress in the general population or in a non-clinical setting”(16)

iii) Where appropriate, in the text, we have incorporated the reviewer’s suggestion to use formulas such as 'having a higher score on the GHQ was associated with...'

Comment 2: it is not clear how the questionnaire addresses mental vs. non mental disorders; maybe the authors could explicit how these symptoms are derived from this general questionnaire;

Response: Despite its name, the GHQ-12 was specifically designed to assess minor mental disorders(16), and includes only questions related to the identification of symptoms of mental disorders (though these may be common to some non-mental disorders). We hope this clarifies the reviewer’s query but if we have misunderstood the comment we would be happy to provide further clarification.

Comment 3: the authors evoke the usual cutoff for the GHQ, however, it is unclear from their methods and results sections whether the score was used as a binary (high vs. low) or continuous variable. This is a very important point to address;
Response: We have clarified in the Analysis section (lines 215-217) that “We analysed GHQ-12 score as a continuous outcome and explored the association of each factor with GHQ-12 score through univariable and multivariable linear regression models”. We used a cut-off for the GHQ to estimate prevalence only, and have outlined the limitations of this estimate in the Strengths and Limitations section (lines 437-440).

Comment 4: when the authors evoke a hierarchical order for the independent variables chosen for their GEE, they may specify how this hierarchy was chosen and explain the reference to the paper cited as #19.

Response: The hierarchical order of variables chosen for the regression analysis was based on analytical frameworks used in previous studies conducted in Nepal(1) and in India (2), and as described above, draws on socio-ecological models of CMDs. Based on this, socio-economic factors were considered most distal factors (level one), followed by spirituality and religious factors (level two) and health related factors (level three) (lines 210-213).

Comment 5: Accordingly, their mention to 'review of global literature' and 'local concepts' (p.6, lines 19-20) should be based on literature references, even from non-usual scientific sources (local writings, newspapers.).

Response: We thank the reviewer for this observation, which was also highlighted by Reviewer 1. As described above, we have now inserted references to literature from Bhutan and worldwide which informed our selection of variables for the analysis (lines 207-208).
Comment 6: p8: the authors should ideally discuss if they were able to check for any differences between respondents and non-respondents and, if so, if there were any differences regarding their respective sociodemographic factors;

Response: We agree with the author that ideally it would be informative to check for differences between respondents and non-respondents, however unfortunately such data were not available.

Comment 7: the authors evoke that they would check for collinearity using variance inflation factors, which are not further provided. Please amend.

Response: Thank you for pointing this out. We have provided clarification (lines 240-241) as follows: “Collinearity between variables was also checked using variance inflation factors and found to be < 10”. (17)

Comment 8: finally, it seems to me that the study design is not strictly suitable to address the links between the GNH policy and mental health. If the authors were to keep trace of this as a main objective or finding, they should describe at least 1/the concrete elements of this policy in the everyday life in Bhutan and 2/if there are differences in GHQ scores before and after this policy was decided and/or applied in the country. For instance, I noticed there have been previous papers with the same measures in Bhutan, which could thus be compared to the present one; and it a deeper penetration of the GNH policy in urban vs. rural areas may prevent the mental health issues generally associated with urbanicity to be seen in the study?

Response: The reviewer is right that the study was not designed to address the links between GNH policy and mental health, although this would be a very interesting and important area
for a future study. The past GHQ -12 estimates were mentioned in lines 344-347 and lines 134-135.

We have described the GNH policy on lines 133-135 in order to provide context for the GNH Survey.

**Comment 9:** Finally, there is no mention of any consent given by the study participants, which should be stated clearly in the present paper.

**Response:** As described above, we have added an ethic statement to the Methods section (lines 243-245) which states that consent was given by study participants.
RESPONSE TO REVIEWERS: Submission 3

REVIEWER 2

Comment 1: Overall this study address and analyse a very important relationship between spirituality and mental health. However, the limitation is that the present study is performed two years after the population study that provided the data. It would therefore be very useful if the authors could be more specific as to the key research questions that could be addressed in future studies. The comments in the attached file should be reviewed and addressed.

Response: Although these analyses were performed two years after data were collected, this manuscript is one of the first to provide insight into mental health in Bhutan at a population level. Our findings are therefore novel and timely. In the revised manuscript (lines 460-462) we have emphasized key areas for future research, as per the reviewer’s suggestion. We state that: “Further studies are needed to understand causal pathways to CMDs and to provide evidence to support mental health policy decisions and investment.”

Specific comments from attached file.

Line 63: This line does not make sense – some wording must have dropped.

Response: Addressed

Line 83: Why is the population unique?

Response: The word ‘unique’ has been removed from this sentence to avoid ambiguity.

Line 91: A pity – because the GNH survey and this analysis was not associated

Response: Agreed.

Line 125: One sentence or two?

Response: For clarity, we have edited these sentences as follows: A meta-analysis of 147 studies that involved nearly 100,000 subjects from mainly high-income settings found that
religiousness was associated with fewer depressive symptoms (18). Conversely, a study from mainland China, a middle-income setting, reported a higher risk of mental disorders among religious individuals (19).

**Comment:** Line 128: Hardly a valid argument – comparisons across countries are bound to encounter differences.

**Response:** We agree. The purpose of these sentences is to outline the heterogeneity across countries.

**Comment:** Line 130: Bhutan is now a LMIC. In 2015 when the GNH survey was conducted it was on the verge of being promoted from LIC to LMIC.

**Response:** Many thanks. Rephrased.

**Comment:** Line 165: I wonder if this issue is very important. Bhutan has a unique culture, beliefs and values that distinguish it from other countries in the region. Ref 25 is from Iran – hardly a south Asian country.

**Response:** We agree with the reviewer that this issue is important and have therefore elaborated upon this point in the Strengths and Limitations section (lines 447-452).

**Comment:** Line 358: But this rate is rapidly decreasing due to high school attendance in the last two-three decades. This would change the situation significantly. On line 360 we have mentioned the declining rate of illiteracy among younger generations, as per the reviewer’s comment.

**Comment:** Line 371: I do not understand this sentence.

**Response:** We have removed this sentence.
Comment: Line 381: Comment on the impact of the massive rural-urban migrations in Bhutan would be welcome here.

Response: Thank you. We have commented on rural-urban migration (line 372-374).

Comment: Line 404: Is this already foreseen in the recent national mental health strategy?

Response: Many thanks. The national mental health strategy titled “Mental health for all: Bhutan mental health strategy and action plan (2015-2023)” includes a section on partnership with monastic and religious institutions under strategic priority 3 (20). We have added a sentence on this to the Discussion section (line 402-403).

Comment: Line 412: That is definitely not correct – lay people meditate and perform religious practices and retreats in large number – often more frequent with advanced age.

Response: Thank you for your comment. GNH 2015 shows high religious participation (59% praying, 97% having visited spiritual places) but when it comes to meditation; only 7.5% acknowledged meditating and more than 80% reported never practising meditation (21). There seems to be a clear distinction between religious participation (e.g. visiting monasteries or reciting prayers) and actually practising meditation.

Comment: Line 434: I would like to see comments on the 1) increase in suicide and in alcoholism and 2) the extent to which recent national mental health strategies (including these on alcoholism and suicide prevention) actually include spirituality in its strategies.

Response: Thank you. Whilst we acknowledge the importance of suicide and alcoholism research and intervention in this setting, our focus is on symptoms of CMDs. Comment on these topics would therefore be beyond the scope of the paper. We have however commented on the incorporation of spirituality in the national mental health strategy on lines 402.
Reviewer-3

Comment 1: at the end of the 'analysis' subsection, VIF is described to be below 10 and we understand that the authors found this to be satisfactory. However, this value may indicate collinearity issues, although it is not systematic (see O'Brien 2007 in 'Quality and Quantity' journal, 41:673–690, DOI 10.1007/s11135-006-9018-6). Ideally, it would be useful to (i) cite this paper as a caution justifying to keep all variables despite moderate to high VIF values and (ii) provide a list with the 1 to 5 variables showing the highest VIF and a global result of the resulting model if they were removed (possibly in supplementary material).

Response: Thank you for pointing this out. We have made changes to address your concern (Line 239 ) “Collinearity between variables was checked using variance inflation factors and found to be <2 for all variables”.

Comment 2: following the preceding remark, the authors evoke the use of residual plots to check for their models fit, however, they never mention this further in the manuscript. Please inform whether model fit was good according to this procedure, and when variables with the highest VIF are removed.

Response: To address this comment we have added the following sentence: “The fit of the final model was checked using residual plots, which indicated model assumptions were adequately satisfied (lines 240-241).
References


Appendix F

Authors response to reviewers comments on Paper 3 (Chapter 5).

Manuscript: Association between sleep duration and self-reported health status: findings from the Bhutan’s Gross National Happiness study.
RESPONSE TO REVIEWERS

REVIEWER 1

Comment 1: Greater discussion of sleep differences between this population and developed populations in particular, the finding that average sleep time was 8.5 hours which is more than the average reported in other studies.

Response: Thank you for your advice, we have added this paragraph in the discussion. “In addition, Bhutan’s average sleep time of 8.5 hrs is high when compared to other nationally representative studies from Finland (7.5 hrs), Austria (7 hrs), Korea (6.7 hrs) and United States (7.18 hrs).19, 41-43 High proportion of long sleepers in Bhutan could be because the majority of the respondents were from the rural areas without formal education. Furthermore, only 20% and 51% had access to internet and television respectively, and 42% of the respondents were drinking alcohol.” Refer to page 13

Comment 2: On page 14, >6 should probably be <6 in the sentence ".... found that only short sleep duration (> 6 hrs and < 7hrs, respectively) was associated with poor self-reported health status".

Response: We apologize for the typographical error. It has been corrected. “….found that only short sleep duration (< 6 hrs and < 7hrs, respectively)”.

REVIEWER 2

Comment 1: The authors state in the introduction that “the results were inconsistent”, but then mostly report the consistent finding of a u-shaped association between sleep duration and health.
This is clarified in the conclusion that the inconsistency has been with self-reported health status, and it would be helpful to have this in the introduction to make the point clear.

Response: We thank you for your advice; we have moved the section from the conclusion into the introduction as advised. “For example, large nationally represented studies from Korea (>19yrs)\textsuperscript{29}, Australia (45-74yrs)\textsuperscript{30} and United States (>18yrs)\textsuperscript{31} found that both short (< 5 hrs, < 6hrs and < 6hrs, respectively) and long (> 9hrs, > 9hrs and > 8hrs, respectively) sleep durations were associated with poor self-reported health status. Conversely, a study conducted among elderly population (>60yrs) in Lima, Peru and a large multi-country study among university students aged 17-30 years found that only short sleep duration (< 6 hrs and < 7hrs, respectively) was associated with poor self-reported health status\textsuperscript{32, 33}. Whereas Jean-Louis et al. found no association between sleep duration and the health-related quality-of-life score in a small sample size (273 respondents) study\textsuperscript{34}.” Refer page 4

Comment 2: The p-values in Table 1 are confusing, since their placements vary; though seem to indicate overall associations.

Response: We apologize for the typographical error. We have now corrected the placement of the p-values. Refer to page 8.

Comment 4: P13: Confusing, as these sentences fall after the report that 42% of respondents were currently drinking at the time of the survey: “These factors were found to be the strongest predictors of long sleep duration 33. However the significant association was found only for those sleeping > 6 hrs or < 11 hrs in this study.”

Response: We have deleted these sentences from the paragraph. “These factors were found to be the strongest predictors of long sleep duration 33. However the significant association was found only for those sleeping > 6 hrs or < 11 hrs in this study.” Refer to page 13.
Comment 5: Abstract-Results: missing capital letter: “…hours. only…”  
Response: This has been corrected, Refer to page 2.

Comment 6: P4: “highlighted that sleep problem might represent…” should be problems, plural. Same sentence: “health issues”, depending on prior correction, should be issue, singular.  
Response: Thank you for the suggestions, we have corrected them. “In addition a large-scale, multi-national study among eight countries in Asia and Africa highlighted that sleep problems might represent a significant and unrecognized public health issues in low income settings.” Refer to page 5.

Comment 7: P4: “…the sample size is nationally represented” should be “representative”  
Response: This has been corrected as advised “Also, the sample size is nationally representative encompassing all age groups above 15 years of age.” Refer page 5

Comment 8: P5: “In general, would you say your health is excellent, very good, good, fair and poor?” Did the questionnaire actually ask “or” poor?  
Response: Thank you, we have revised this. “In general, would you say your health is excellent, very good, good, fair or poor?” Refer to page 6.

Comment 9: P13: “with universities students” should be “university students”  
Response: Thank you, corrected as advised. Refer to page 13

Comment 10: P14: Francesco P. Cappuccino et al. is misspelled. See ref #20.  
Response: This has been corrected “Francesco P. Cappuccio” Refer to page 14
Comment 11: P14: check English: “Sleep duration is an emerging life style related to public health concern. Currently there is little public health awareness program or intervention on adequate sleep duration internationally, including Bhutan.”

Response: We thank you for the advice; we have revised the paragraph as follows:

“As the evidences suggest, sleep duration is an emerging public health problem which is related to life style. In addition, awareness among general public and health care providers on the importance of sleep is low. Therefore, public health interventions to raise awareness of sleep health may play an important role in promoting health and well-being of the population.” Refer to page 14.

Comment 12: P15: “higher proportion of illiterate” should be “high proportion of illiterate respondents”.

Response: Thank you this has been corrected as advised, “high proportion of illiterate respondents”. Refer to page 15.
Appendix G

Authors response to reviewers comments on Paper 6 (Chapter 8).

**Manuscript:** Strengthening non-communicable disease policy with lessons from Bhutan: linking Gross National Happiness and health policy action
Comment 1: Overall this paper explores some interesting concepts of the comparison of objectives related to the reduction of chronic diseases (non-communicable diseases) with the Gross National Happiness (GNH) index in Bhutan. While this represents an interesting perspective, the paper does not provide an explanation to the naïve reader the quantitative/qualitative nature of the GNH to allow a fuller appreciation of the scale for the comparisons that are made.

Response: Thank you for the suggestion. In the revised manuscript we have emphasized the quantitative and qualitative aspect of the GNH as follows (lines 32-40):

“Bhutan is also known for its global leadership in the prioritization and measurement of Gross National Happiness (GNH), which was introduced in 1972 as a developmental philosophy. It is a holistic approach to development which seeks to increase the “well-being” of the population. It is defined as the “measure of the quality of a country in more holistic way [than GNP] and believes that the beneficial development of human society takes place when material and spiritual development occur side by side to complement and reinforce each other”. GNH is measured by a multidimensional unit known as GNH Index, which captures the essence of GNH. Further details of GNH measurements and index are described in the “An extensive analysis of GNH Index”.

Comment 2: That said however, the paper highlights that the reduction of chronic diseases require inter-sectoral behavioral change approaches and population based changes of environment which would juxtapose with areas related to increase “happiness”. This is an important concept that can be highlighted in that chronic disease reduction involves much more than a biomedical approach but a societal/environmental approach which requires far more governmental and political support. I think this is the critical message which can be highlighted.

Response: We appreciate the reviewer’s suggestion. We have rephrased the introduction to emphasize societal/environmental approach to NCDs (lines 20-24)

The global action plan emphases the importance of societal and environmental approaches to achieve the nine voluntary global targets and 25% relative reduction in premature mortality from NCDs by 2025.
Further in lines 289, we have mentioned “It is clear that no single sector or actor can address the multifactorial NCDs risk factors. A multi-sectorial approach, therefore, is the key to addressing NCDs in any country.”

**Comment 3:** GNH is not clearly defined, nor is happiness.

**Response:** Thank you for pointing this out. In the revised manuscript we have now defined the GNH (lines 35-38); “measure of the quality of a country in more holistic way [than GNP] and believes that the beneficial development of human society takes place when material and spiritual development occur side by side to complement and reinforce each other”.

**Comment 4:** It is difficult to judge the utility of this index which appears more as a qualitative rather than quantitative metric of individuals and populations. Table 1 provides a listing of the domains and determinants, but the terminology, methodology and units of measure are vague to a medical or public health community.

**Response:** The reviewer is right that, it is unlikely that the GNH Index will be a fully comprehensive measure to entirely capture the diversity and significance of Gross National Happiness. However, GNH studies has shown that GNH Index captures the essence of GNH. We have added lines 38-40 “GNH is measured by a multidimensional unit known as GNH Index, which captures the essence of GNH. Further details of GNH measurements and index are described in the “An extensive analysis of GNH Index”.

As suggested by the reviewer, we have included the definition of GNH (lines 35-38) and GNH policy screening tools (97-98) in the manuscript. Although it would be beneficial to define the GNH determinants and GNH index calculation. It is beyond the scope of this paper. We have cited “An extensive analysis of GNH Index” for further details.

**Comment 5:** The term non-communicable diseases is frequently used interchangeably with chronic diseases. I prefer the later as many chronic diseases may have communicable causes and therefore are not technically non-communicable.

**Response:** We apologise for the inconsistent use of the terminology ‘chronic diseases’ and ‘NCDs’. We appreciate the reviewer’s perspective, but in this manuscript we have opted to now consistently use the term NCDs. This is because, the WHO action plan ‘Global action
plan for the prevention and control of noncommunicable diseases 2013-2020\textsuperscript{6} and Bhutan’s NCD policy ‘The Multi-sectoral National Action Plan for the Prevention and Control of Noncommunicable Diseases’\textsuperscript{7-9} uses the term NCD.

**Comment 6:** Overall, the paper could be summarized more succinctly and written as an essay rather than as a scientific manuscript as it does not flow as such. It is an interesting commentary that the areas to address the reduction of chronic diseases are in harmony with the optimization of happiness. That seemed to be what the author was driving at but it did not flow in specific quantitative ways as one might have hoped the way this was written.

**Response:** Thank you for your kind suggestion. As advised we have reworked the manuscript as viewpoint. The marked manuscript shows the detail editions.

**Comment 7** Page 3 “Gross National Happiness Policy Screening Tool (GNH-PST) “Is there a reference for this?

**Response:** Thank you for pointing this out. We have now added the following two references:

1. Ura K, Penjore D. GNH Tools: Gross National Happiness Policy and Project Screening Tools. Centre for Bhutan Studies and GNH2008.\textsuperscript{10}

**Comment 8:** Page 7 shows the usefulness of some of the overlapping goals of the GNH determinants.

**Response:** Thank you for point this out. We have now summarised the overlapping goals in the lines 284-289, “Our analysis (table 2) has identified five key-shared agendas between NCD prevention and control program and GNH. They are 1) prevention of premature death and disability due to NCDs 2) strengthening leadership and governance for policy prioritization & implementation 3) mainstream the social determinants of health in all policies 4) encourage research and development through establishment of national research council and 5) monitoring the policy impact on health and GNH measurements.”

Lines 293-297 “This is achieved by identifying shared agenda across sector that would improve health and well-being of the people. The opportunity to identify shared agendas and
integrating them into policies is provided by the protocol for GNH policy formulation (Figure 1) and GNH policy screening tool.”

**Comment 9:** Reference 9 refers to a happiness study, but it is unclear how good a study that is.

**Response:** This happiness study titled “An Extensive Analysis of GNH Index” is the first nationally representative GNH study (N=7142), conducted in Bhutan in 2010. The study was approved by the National Statistic Bureau of Bhutan and had been extensively referred. A shorter version of the study was published in the first World Happiness Report, 2012 edited by John Helliwell, Richard Layard and Jeffrey Sachs, 2010.³ We have cited both the publications in the manuscript.
RESPONSE TO REVIEWERS: Submission 2

Comment 2: It is an interesting commentary that the areas to address the reduction of chronic diseases are in harmony with the optimization of happiness. That seemed to be what the author was driving at but it did not flow in specific quantitative ways as one might have hoped. It is difficult to judge the utility of this index which appears more as a qualitative rather than quantitative metric of individuals and populations.

Table 1 provides a listing of the domains and determinants, but the terminology, methodology and units of measure are vague to a medical or public health community.

That was the reviewer’s gentle way of saying that this is essential and we concur. Simply adding references is not adequate. If all readers were already well acquainted with GNH—that would be in a specialized journal. JPHP is for public health generalists, not specialists in any one topic or public health area.

Response: Thank you for the suggestion. As advised, we have now explained the genesis of Gross National Happiness and its quantitative aspect in addition to explaining its core components as follows (lines 58-94):

Gross National Happiness

Bhutan is a global leader in pursuing GNH. GNH is holistic development model developed in Bhutan, which shifts emphasis from measuring economic production to measuring happiness. It recognises that material, spiritual and emotional needs of the individuals must be fulfilled. The phrase was first coined by the 4th King of Bhutan, King Jigme Singye Wangchuck, in 1972.

Since then, GNH has evolved from a mere developmental philosophy to quantitative GNH measurements (GNH Index) and policy formulation tools (Gross National Happiness policy screening tool).

GNH is composed of ‘four pillars’, sustainable and equitable economic development, conservation of the environment, preservation and promotion of culture and good
governance. These pillars are further divided into nine domains (Refer Table 1 and Box 2) and each domain is measured by specific number of indicators (Table 1). GNH is measured by GNH Index, which is calculated using the formula ‘\( GNH\ Index = 1 - HA \)’. Where ‘H’ is the percentage of people who are not-yet-happy and ‘A’ is the percentage of domains in which people who are not-yet-happy enjoy sufficiency (Refer Box 2). Further details of GNH measurements and index are described in the “An extensive analysis of GNH Index”.2,3

*The Gross National Happiness Policy Screening Tool*

The GNH policy screening tool is a matrix that systematically assesses impacts of any policy on the population, based on expected impact on the GNH determinants (Table 1), thereby simultaneously selecting GNH enhancing policies and rejecting policies that adversely affect key determinants of GNH.13

The policy impact on the GNH determinants are assessed by a 15 member GNH multisectoral committee formed by the Gross National Happiness Commission (GNH Commission) from all relevant agencies (Box 2). Each of the committee members will score the 22 GNH determinants from 1 to 4. 1 denotes negative impact, 2 uncertain, 3 neutral and 4 denotes positive impact. The minimum score for the policy to be approved is 66 point (3x22), below which the policy would require changes to acquire the minimum points to be considered or result in rejection.14

Those policies which attain the minimum required score are submitted to the council of cabinet ministers for approval. Figure 1 shows the diagrammatic representation of the implementation process of GNH policy screening tool.

Since 2010, all policies in Bhutan with the exception of a Royal Command or national exigencies are reviewed using the GNH policy screening tool.15 This approach ensures that
all nine domains of GNH are protected and promoted to support a holistic approach to policy development. It also provides a platform for all stakeholders to work a consensus about a policy impact. Further details of the GNH policy screening tools are given in these documents ‘Gross National Happiness Policy Screening Tool’ \(^{14}\) and ‘GNH Tools: Gross National Happiness Policy and Project Screening Tools’. \(^{10}\)

**Comment 2:** I emphasize again--the specific quantitative nature of measuring GNH requires presentation IN the paper; just adding references does nothing to explain to readers who need to learn this from within the paper. And all terms you use related to it must be defined as precisely as possible. Often that will require you to note the source of your definition and to cite it—so that readers may learn more by following your guidance to the relevant references.

**Response:** Thank you for emphasizing the need mentioned the quantitative nature of measuring the GNH (Line 69-73).

GNH is measured by GNH Index, which is calculated using the formula ‘\(GNH\) Index = 1-HA’. Where ‘H’ is the percentage of people who are not-yet-happy and ‘A’ is the percentage of domains in which people who are not-yet-happy enjoy sufficiency (Refer Box 2). Further details of GNH measurements and index are described in the “An extensive analysis of GNH Index”\(^{2,3}\).

**Comment 3:** JPHP also requires every author to define (and often again, to give sources) for every term used in a paper. Many of those you use would not appear in any standard English language dictionary. Many JPHP readers work in the field, and do not have easy access to academic libraries—thus it is the authors that need to do the work to ease that of readers. Authors often find they can make do with fewer terms. Many authors, in early versions of papers submitted to JPHP, use jargon familiar to those working in the field discussed in the paper—but those terms may not be thoroughly understood by many potential readers. As journal Editors, it is our job to assure that all readers are able to follow every aspect of each paper.
We list just below many of the terms that appear in your paper—usually without any, or at least adequate, definition. Some of them you would do well to eliminate—as they are not necessary to the paper and it may take too many of your 4000 words to define them. Some are absolutely essential—like ‘happiness’, etc. Often there is more than one definition of a term in circulation—and you must decide and clarify for readers which you intend in your paper. Some terms are closely related and you will find you can reduce the variations you use—to make it clearer to readers when terms refer to the same concept.

· Happiness- Happiness is defined as the degree to which an individual judges the overall quality of his/her own life as a whole.¹-six Happiness and well-being are used interchangeably in this paper. (Refer Box 2)

· Global National Happiness (GNH) and the GNH Index: how has it been developed, over what period of time, by who/what groups, what is the current definition? Refer line 58-73.

· Population ‘well-being’Box 1 Happiness and well-being are used interchangeably in this paper. (Refer Box 2)

· Policy sector (and you need to identify who are the ‘actors’ you refer to within the sectors—is it always government, also industry? Others?) We have specified the sectors throughout the manuscript.

· Multi-sectoral policy action: action on one issue area – for example, health – that requires policy responses across multiple sectors – for example, social welfare, trade, education etc

· The Gross National Happiness Policy Screening Tool (is there only one? Who created it, who uses it, does anyone work to improve it over time?) Refer Line 74-94

· the 22 GNH determinants (Table 1): These are 22 subjective and objective factors that influence the GNH domains and the GNH Index. They were developed by the Centre for Bhutan Studies and GNH research in 2010. The list of determinants are given in table 1. (Refer Box 2)

· social determinants : The social determinants of health are the conditions in which people are born, grow, live, work and age.¹-seven (Refer Box 2)

· health system [how do you mean this—there are many definitions: medical services for individuals? Medical services for individuals AND government measures to protect health of communities and prevent ill health, injuries, etc? Government only—or government, non profit, charitable, and for profit elements—where they exist?] A health system consists of all
organizations, people and actions whose primary interest is to promote, restore or maintain health. 18 (Refer Box 2)

- health inequalities Health inequalities are avoidable differences in health status or in the distribution of health determinants within countries and between countries. 19 (Box 2)

- NCD determinants Amended

- socioeconomic determinants of developmental issues [this is a very awkward term—can you replace it?] Replaced

- health jurisdiction Amended: refer line 282

- multifactorial NCDs risk factors

- I may have missed others—and I will check carefully on any revisions

**Comment 4:** For some that you choose to continue using, you may find it efficient to create a Box with certain concepts and terms—and refer readers to it rather than digressing in the text each time you come to one of these terms/concepts.

**Response:** As advised we have created two Boxes- Box 1 and Box 2.

**Comment 5:** Some elements of your paper are almost impossible for those new to GNH to follow. I found I could find some of what you refer to online—sometimes by using your references—but this sort of information must be within the paper:


The 9 domains to which you refer—but do not name—of GNI: (psychological wellbeing, time use, community vitality, cultural diversity, ecological resilience, living standard, health, education, good governance)

GNH Index, and the four categories of people – unhappy, narrowly happy, extensively happy, and deeply happy. Also, be sure to name the sectors involved in the multi-sectoral committee; and to distinguish sector from government spheres of action when these two are not the same. Also be clear to distinguish when you refer to Bhutan, and when you refer to global sources for background information about GNH, the GNH Index, etc.
Response: We have now mentioned the:

Four pillars of GNH (refer lines-66-67)
The nine domains are mentioned in Box 2.
GNH domains are defined in Box 2.
GNH Index formula is explained and mentioned (lines 69-73). Also refer Box 2.
Not yet happy and happy people are defined in Box 2.

Comment 6: Your paper often leaves unsaid who/what bodies you expect to take the actions implied. We require that policy papers clearly identify who are the sorts of actors-not the individuals-as well as what actions are contemplated. You will see my questions in comments to the text attached asking about this.

Response: Thank you for the comments in the manuscript. We have made all the amendments-refer the manuscript with track changes.

Comment 7: Your text about the Objectives includes a great deal of redundancy—at the level of words (for example, you don’t need to say ‘policy question’ when the question itself a few words later includes the word policy). You don’t need to repeat ‘determinant’ sentence after sentence if you have made clear that you are referring to these. I have tried to show you some ways to save words in the attachment.

Response: Thank you for your comments. We have edited the manuscript.

Comment 8: Your text also is redundant in repeating in the text information you already have in Tables—and you do not have sufficient space to do both. Thus, I suggest you rethink your ‘objectives’ text to make much more use of cross references to Table 2.

Response: We have revised the whole manuscript considering the advice from the editors.

Comment 9: When you get to the Objectives part of the paper—many times you introduce the ‘determinants’ in a different order than they appear in the text that follows. Be sure to fix this so that the introductory sentence always lists them in the SAME order in which they
appear in the text following. Otherwise the readers have to do that extra work to follow your meaning—it is better the job of authors (and editors).

Response: Thank you again for your comments. Changes have been made as advised.

Comment 10: Many of your references are incomplete and/or not in standard JPHP format. Please follow the guidance on the JPHP website under Instructions for Authors—examples for every sort of publication are there to assist you.

Response: References are corrected and edited.
Reference: