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'Nudging' health behavioural change: Behavioural economics, Tobacco Control and Innovative Finance for Cancer Control

A Dissertation

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by

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Contents

Abbreviations

WHO	World Health Organisation
LMICs	Low-middle income countries
FCTC	Framework Convention on Tobacco Control
NCDs	non-Communicable diseases
COPD	Chronic obstructive pulmonary disease
IARC	International Agency for Research on Cancer
CTPEDSB	Control of Tobacco Products and Electronic Delivery Systems Bill
PTSD	post-traumatic stress disorder
SBST	Social and Behavioural Sciences Team
REEP	Research Unit in the Economics of Excisable Products
CANSA	Cancer Association of South Africa
UCT	University of Cape Town
U.S	United States
PC	Paul Chilwesa
REC	Research ethics committee
PPPs	Public private partnerships
DLPFC	dorsolateral prefrontal cortex
vmPFC	ventromedial prefrontal cortex

Abstract

Tobacco smoking is the leading cause of preventable death globally. Despite the existing traditional economic approaches like taxation, recent progress in tobacco control has plateaued compared to control efforts in nutrition, sexual reproductive health and alcohol. This discrepancy can be attributed to better nudging efforts in these areas compared to tobacco control. This study aimed to determine the knowledge of tobacco-related health and social problems, applications of behavioural economics in tobacco control amongst tobacco-control stakeholders, and to identify innovative ways of funding for treatment of tobacco-related cancers.

This exploratory, cross-sectional, qualitative study was conducted between January 2020 and December 2022. The data collection involved semi-structured interviews and a focus group meeting. Data analysis was done using the thematic semantic analysis approach, with the initial step including verbatim transcription of the interviews followed by the listing of emerging ideas, code generation and sorting of themes.

The results demonstrated participants' extensive knowledge of tobacco-related health and social problems and their minimal understanding of behavioural economics including nudging in this space. A few behavioural economics principles were identified which included incentives, bounded rationality, goal gradient theory, gamification, hyperbolic discounting, and herd mentality. Findings also revealed innovative ways to fund the control of tobacco-related cancer, which included public-private partnerships, taxation and occupational health compensations.

Despite substantial efforts in the field of tobacco control, existing measures have not yielded the desired results in curbing tobacco smoking and behavioural economics may be an effective tool to bridge the gap. This study highlights the lack of knowledge on nudging as an effective tool for tobacco control. It is imperative to allocate increased funding to further explore the role of nudging in tobacco control and generate additional data in this area.

Keywords: Tobacco control, behavioural economics, nudging, tobacco-related cancers, smoking prevention, qualitative study, thematic analysis, public-private partnerships, taxation, hyperbolic discounting, incentives.

Chapter 1: Introduction

Introduction

Unhealthy behaviours are responsible for a large proportion of health care costs and poor health outcomes (Edwards et al., 2013). Tobacco smoking is a costly health behaviour, both for individuals who smoke and for the broader community who bear the cost burden of tobacco-related diseases. According to the World Health Organization (WHO), smoking is the number one contributor to preventable death in the world (Chung-Hall et al., 2018). To reduce smoking prevalence, many countries have implemented new policies, regulations and laws for tobacco control including public smoking bans, increased taxes on tobacco products, and text warnings on cigarette packaging, which are often accompanied by graphic images. Tackling these problems could mitigate costs across the globe, improve people's health and well-being, and allow people to make better decisions (Peruga et al., 2021).

Despite the existing traditional economic approaches of imposing taxes to reduce smoking, the success scored in the last two decades has since plateaued in some regions. For example, research assessing how tobacco taxes influence smoking rates in African nations found that smoking prevalence rose in Algeria, Botswana, and the Republic of Congo following the implementation of these taxes, while only slight reductions were observed in other countries (Immurana et al., 2021). Another study, which included 27 European Union Member States, observed no correlation between cigarette affordability and smoking prevalence (Bogdanovica et al., 2012). The current strategies to reduce smoking with visual and graphic warnings have also been shown to wane overtime (Borland et al., 2009). Scientific evidence exists that shows that people take in information of what they want to hear more than what they do not, and neurologically the human brain freezes when presented with uncomfortable information: the so-called boomerang effect (Moutsiana et al., 2013a). Behavioural economics offers a window into the possibility of improving healthy lifestyles by combining traditional economic approaches with psychology. The last three decades have produced credible evidence from behavioural economics on how its interventions can be successful in encouraging health-seeking behaviours (Hanoch et al., 2017).

Behavioural economics, unlike traditional economics, does not assume that people are fully rational beings, or that they can make decisions that always maximize their expected well-being (Hanoch et al., 2017). It works from the assumption that people exhibit limitations in their

computational abilities, do not possess full information stored in their memory, lack perfect willpower, make decisions that are often affected by small differences in their immediate environment, and are said to frequently make decisions that deviate from their best self-interest (Kahneman et al., 1991). People are thought to be more successful at achieving their health goals when they have access to a manageable amount of information, presented in a way that emphasizes the most important points, and in a simplified manner.

Despite the broad recognition of cancer as a global public health problem, it receives disproportionately low funding in low to middle income countries (LMICs) (Sylla & Wild, 2012). Non-communicable diseases, including cancer, are projected to become the major contributor to morbidity and mortality in LMICs by the year 2030 (Prager et al., 2018). Sub-Saharan Africa is projected to contribute 70% of the global cancer mortality by 2030 (Prager et al., 2018). Regardless of the increasing burden of non-communicable diseases, infectious diseases remain the top priority for healthcare expenditure in the majority of LMICs. Between 2000 and 2018, the distribution of development assistance recorded for non-communicable diseases accounted for only 2% of funding (Allen, 2017).

While there have been decades of research and success in health-seeking modification interventions using behavioural economics, these principles are not widely employed in the campaigns against smoking, the number one contributor to non-communicable diseases' (e.g., cancer) morbidity and mortality. This dissertation seeks to investigate why such a gap exists and make recommendations on ways to bridge this gap by providing evidence-based results. These results would subsequently inform innovative forms of tobacco control collaborative practices and government policies.

Research Question

- Are tobacco control stakeholders aware and knowledgeable of the health and social impact of tobacco smoking?
- Why are behavioural economics interventions that target health behaviours missing in the current tobacco control strategies?
- What are the perceptions of stakeholders regarding behavioural economics interventions and their effect on changing smoking behaviour?

- What economic and innovative finance mechanisms exist in the funding space for tobacco-related cancers?

Research Aims and Objectives

The research aims to interrogate why behavioural economics interventions that target healthy behaviours are missing in the existing tobacco control strategies and provide recommendations for their inclusion in anti-smoking.

Aims:

1. To explore the awareness of "nudging" in promoting health behavioural change, specifically in the context of tobacco control and cancer prevention amongst key stakeholders.
2. To examine the potential of behavioural economics and innovative finance in supporting cancer control efforts.

Objectives:

1. Conduct an extended literature review on nudging interventions in health care, tobacco control and cancer prevention, including their effectiveness and potential limitations.
2. Review the behavioural economics principles underlying nudging interventions and their potential application to cancer control efforts, and explore innovative finance mechanisms towards cancer control
3. Develop a set of recommendations for the design, implementation, and evaluation of nudging interventions in the context of cancer control, considering the perspectives of key stakeholders and the principles of behavioural economics and innovative finance.

In Chapter 2, an extended review of the literature is presented. Specifically, the health- and social-related effects of tobacco control are explored, and the various strategies for the control of tobacco control are presented. The challenges with these available methods are discussed and behavioural economics is presented as a tool that can be used to optimise tobacco control strategies.

Chapter 3 provides an extended version of the research methodology, followed by Chapter 4 which presents the methods and results of the study in the form of a ready-to-publish

manuscript. Finally, Chapter 5 concludes the research.

Chapter 2: Extended literature review

This Chapter will introduce the global burden of tobacco use, its impact on health, current measures to control the use of tobacco and the challenges associated with tobacco control. In addition, the chapter will explore the literature on behavioural economics and how it can be leveraged in tobacco control.

Global burden of disease attributable to tobacco use

Tobacco use is a major public health issue with well-documented detrimental effects on individuals and society. Whilst the prevalence of tobacco smoking has decreased globally by 27.5% in males and 37.7% in females respectively, there is still a significant proportion of individuals smoking tobacco (Reitsma et al., 2021). As of 2019, there were 1.14 billion smokers globally with a prevalence of 33% and 6.6% in males and females aged 15 years and older respectively (Reitsma et al., 2021). Tobacco smoking is the leading cause of preventable death globally, resulting in over 8 million deaths (Institute of Health Metrics, 2019). The impact of smoking extends beyond the smoker, with 1.3 million deaths due to second-hand smoking (Institute of Health Metrics, 2019).

Smoking is the leading preventable cause of cancer-related deaths. Figure 1 below shows the proportion of all-cause deaths that are attributable to tobacco smoking with variations in proportion by geographical area. Tobacco contains multiple carcinogens with tobacco smoking being the leading cause of cancer-related deaths globally (Capelletto & Novello, 2019). Smoking is associated with cancer of the lung, larynx, oral cavity, pharynx, oesophagus, pancreas, bladder, kidney, cervix, and stomach, and acute myeloid leukaemia. For lung cancer specifically, smoking accounts for 12% of all cancers and contributes to 18% of global mortality (Capelletto & Novello, 2019; UICC, 2018). 85% of lung cases are associated with tobacco use (World Health Organisation, 2020).

In addition to increasing cancer risk, heart disease and stroke are serious health outcomes linked to tobacco use. Smoking is a major risk factor for both conditions, increasing the risk of heart attack and stroke by 2-4 times (Johns Hopkins Medicine, 2023). Tobacco use contributes to about 17% of deaths from cardiovascular disease globally (Rivas-Ruiz et al., 2019). Figure 2 shows that about one million ischaemic heart disease deaths are attributable to tobacco smoking. The nicotine in tobacco products further elevates the risk by increasing heart rate and blood pressure. Tobacco use significantly impacts respiratory health, being a major cause of chronic obstructive pulmonary disease (COPD). COPD is a progressive lung disease that leads to disability and death. Smoking is also associated with respiratory conditions like asthma and bronchitis, further contributing to disability and reduced quality of life (American Lung Association, 2023).

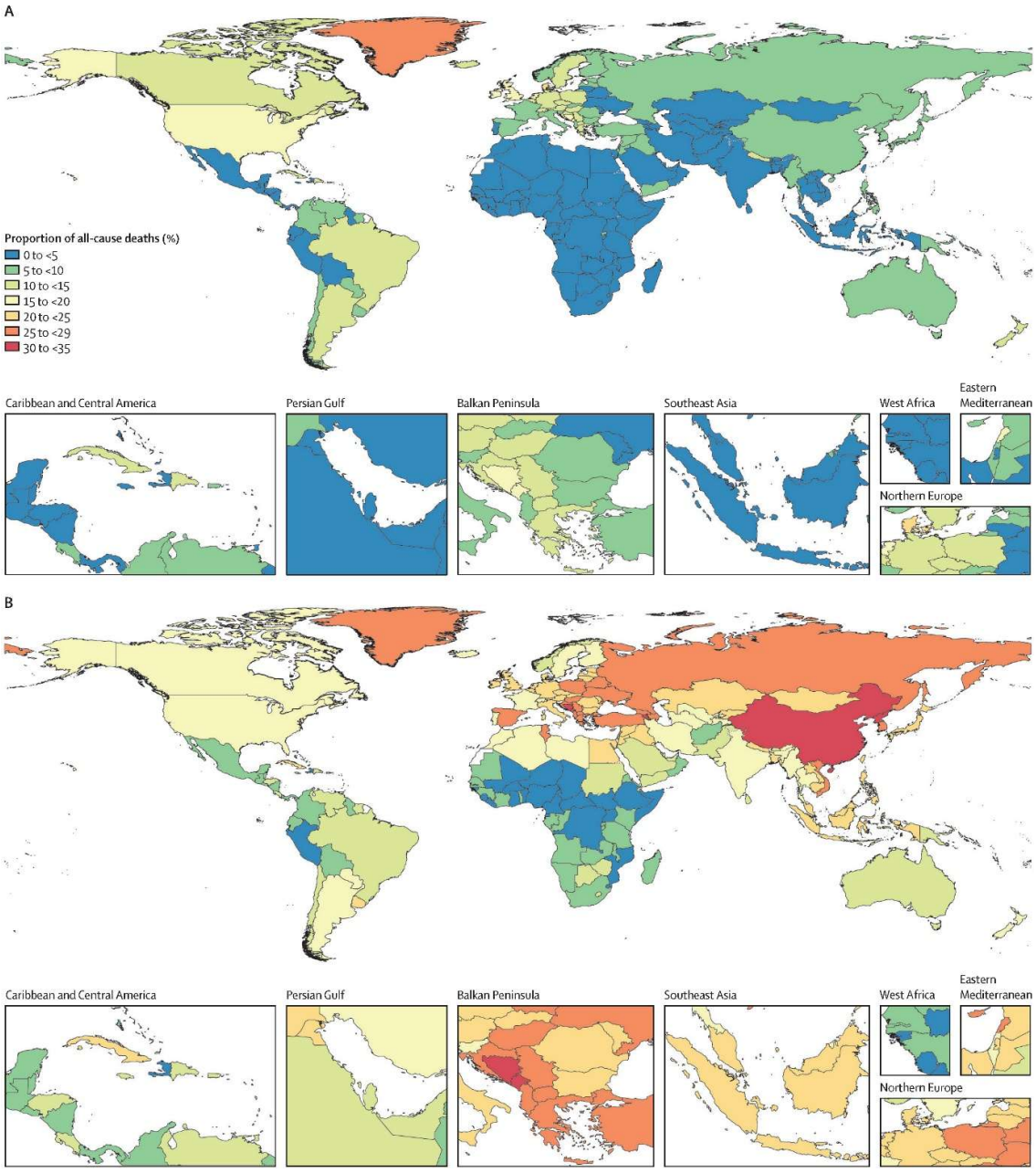

Figure 1: Proportion of all-cause deaths that were attributable to smoking tobacco use among females (A) and males (B) of all ages in 2019 (Reitsma et al., 2021)

Reproductive health is also affected by tobacco use, with smoking during pregnancy leading to negative outcomes such as low birth weight, premature birth, and infant death (World Health Organisation, 2020). Both men and women who smoke may experience infertility issues, impacting the health and well-being of families and communities (World Health Organisation, 2020). Tobacco use is also linked to mental health problems, including depression, anxiety,

schizophrenia, and bipolar disorder (National Alliance on Mental Illness, 2023). These conditions have a significant impact on affected individuals' quality of life and can contribute to increased disability and poverty rates.

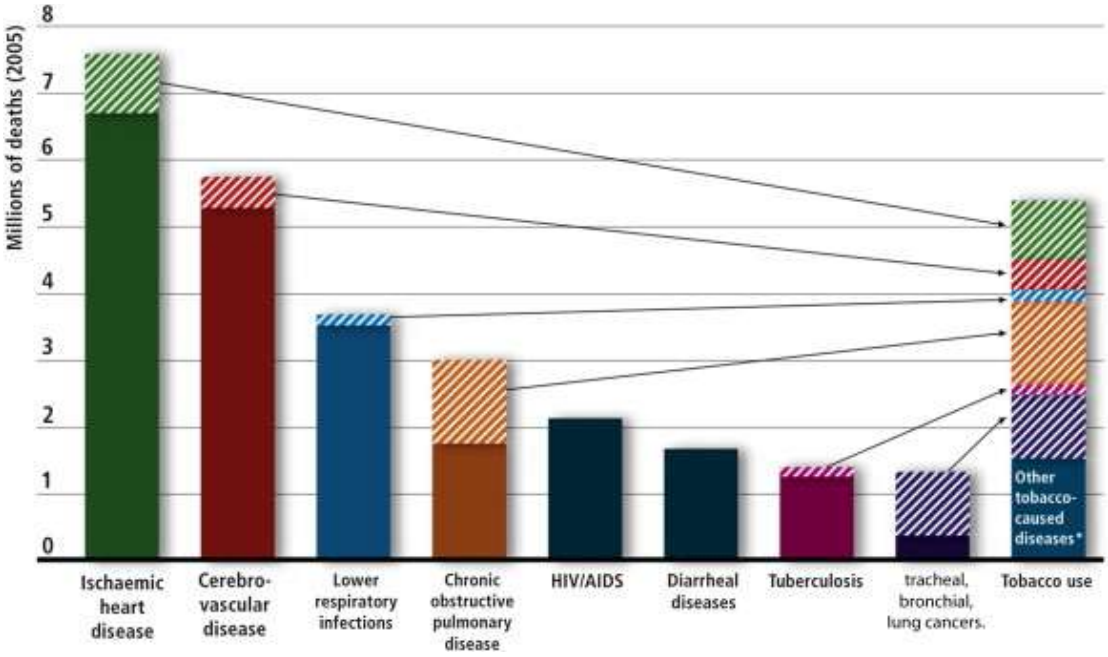

Figure 2: Tobacco use is a risk factor for six of the eight leading causes of death in the world. (World Health Organization, 2008)

The detrimental effects of tobacco use extend beyond individuals to society as a whole. The economic costs of tobacco-attributable diseases are estimated at over $1 trillion annually, causing lost productivity and increased healthcare expenses globally, with 40% of these costs observed in developing countries (Goodchild et al., 2018). Despite efforts by the World Health Organization to halve the number of adult smokers by 2025, the Framework Convention on Tobacco Control (FCTC) estimates that approximately one-third of the global adult population still actively smokes (Global Cancer Control, 2016; World Health Organization, 2005).

Global Economic size of the tobacco industry

The tobacco industry is a powerful global economic force, generating billions of dollars in revenue annually. Despite the well-known health risks associated with tobacco use, tobacco products remain popular worldwide. Additionally, the industry provides employment for millions of people, particularly in developing countries where job opportunities are limited. It

also plays a significant role in international trade, with tobacco products being exported and imported globally. However, the industry has faced criticism for its negative impact on public health, including marketing practices targeting vulnerable populations and downplaying the risks of tobacco use.

The economic size of the tobacco industry presents challenges for tobacco control programs, including its political influence, economic impact, and marketing strategies. The industry's financial resources enable it to influence government officials and impede the implementation of effective tobacco control measures. Moreover, the industry's contribution to national economies through job creation and tax revenue complicates efforts to implement measures that could harm its interests (Ross, 2018). Marketing strategies that target specific groups and integrate tobacco into popular culture further hinder smoking reduction efforts.

Addressing these challenges requires a comprehensive approach, including measures like increased cigarette taxes, restrictions on advertising, alternative economic and public health interventions, and support for tobacco farmers seeking alternative livelihoods (Husain et al., 2021). While tobacco control programs have been implemented in many countries, the economic power of the tobacco industry poses significant obstacles to their success. Overcoming these challenges necessitates navigating the industry's political influence, economic impact, and marketing tactics to protect public health effectively.

The economic costs of tobacco use are staggering. The direct costs of healthcare for tobacco-related illnesses and the indirect costs of lost productivity due to illness and premature death can result in billions of dollars in economic losses. For example, in the United States, the annual economic cost of smoking is over $300 billion, including both direct medical expenses and lost productivity (Xu et al., 2015).

Furthermore, the economic costs of tobacco use are not limited to healthcare and productivity losses. The tobacco industry also has a significant impact on the economy, both in terms of the resources required to produce and distribute tobacco products and on small businesses and local economies. It employs millions worldwide, not only in cultivation and manufacturing but also in distribution and retail. Governments benefit from substantial tax incomes derived from tobacco products, which often support public services. Additionally, the industry supports a vast supply chain, impacting agriculture and retail sectors. For instance, in countries like

Zimbabwe and Malawi, tobacco exports are a major source of foreign exchange, contributing to economic stability and development (Ruckert et al., 2022). According to a report by the International Labour Organization, the tobacco sector employs millions of people globally (International Labour Organization, 2014). These jobs are not only in farming but also in processing, logistics, retail, and marketing, underscoring the sector's role in employment generation.

However, it is essential to balance these economic benefits against the significant health costs associated with tobacco use, including healthcare costs and lost productivity due to tobacco-related illnesses. In addition, the industry has been known to use tactics such as marketing to vulnerable populations, lobbying against regulations, and funding research that presents their products in a favourable light, which can have negative consequences on the economy.

Tobacco control measures overview

In response to all the health-related risks of tobacco use, several strategies have been applied to reduce the burden of tobacco and smoking-related diseases. The WHO FCTC is an international treaty ratified by 182 countries as of May 2023 (World Health Organisation, 2021). The FCTC serves as a framework for tobacco control policies and has proven effective in reducing the costs of tobacco-related cancer (World Health Organization, 2005). In addition, to combat the devastating effects of tobacco smoking, efforts are guided by recommendations from the International Agency for Research on Cancer (IARC) report. The IARC report provides a comprehensive overview of the health effects of tobacco use and second-hand smoke exposure, along with recommendations for tobacco control. Strategies to reduce smoking rates can include financial incentives, education on the economic effects of smoking, social marketing campaigns, regulation and laws, behavioural economics, and the use of technology.

Strong Legislation

A key recommendation in tobacco control is the implementation of robust legislation to regulate the marketing, promotion, and sale of tobacco products. This includes comprehensive bans on advertising, promotion, and sponsorship (TAPS), restrictions on point-of-sale product displays, and the introduction of higher excise taxes to reduce affordability.

Evidence from multiple countries demonstrates the effectiveness of such measures. For example, Australia's Tobacco Plain Packaging Act (2011) - combined with stringent advertising bans—resulted in a significant decline in smoking prevalence and tobacco consumption. A study published in BMJ Open reported a 7.5% reduction in tobacco use following implementation (Scollo et al., 2015).

Similarly, Uruguay implemented some of the world's strongest tobacco control laws, including graphic health warnings, advertising restrictions, and limitations on cigarette variants. These measures contributed to a decline in adult smoking prevalence from 39% in 2005 to 23% in 2017 (WHO, 2019).

The World Health Organization's Framework Convention on Tobacco Control (WHO FCTC) reinforces the effectiveness of such legislative approaches. Countries that have adopted and enforced comprehensive tobacco control laws show consistently lower smoking rates and tobacco-related mortality (WHO, 2021).

Overall, strong legislation - when supported by enforcement and public awareness - proves essential in reducing tobacco initiation, consumption, and associated health burdens.

Raise taxes on tobacco

Increasing tobacco prices through taxation is a highly successful measure of tobacco control. Compared to value-added taxes (VAT), excise taxes are the most effective as they increase both absolute and relative prices whilst VAT does not increase relative prices because it applies to all products (U.S. National Cancer Institute & World Health Organization, 2016). Taxation therefore works by increasing the overall price of tobacco, relative to other products, thus making it unaffordable. Economic research has shown that increasing the price of cigarettes through taxes can be an effective way to reduce smoking rates (Gruber & Koszegi, 2001). Research revealed that a 10% price increase reduces cigarette consumption by approximately 4% and 5% among adults in high- and low-income countries respectively (Chaloupka et al., 2011). This reduction in smoking rates leads to a decline in smoking-related illnesses, resulting in decreased direct and indirect costs.

Smoke-Free Environments

A study looking at the global burden of disease attributable to second hand smoking observed that it contributed to 12% of smoking-related deaths. About 28% and 47% of all deaths attributable to second hand smoking occur in children and women respectively. This shows the potential impact of smoke-free environments: enforcing smoke-free environments, such as workplaces, restaurants, and bars, has been shown to reduce exposure to second-hand smoke and encourage smoking cessation. Studies conducted in the United States found that smoke-free workplace laws were associated with a 15% reduction in hospital admissions due to heart attacks (Allemani et al., 2018). Similar results were observed in Australia, Canada, Germany and Switzerland (Levy et al., 2018). This reduction in hospitalizations contributes to decreased direct medical costs of smoking-related illnesses. In addition, various studies also reported reductions in the prevalence of smoking amongst the youth after the introduction of clean air laws (Levy et al., 2018).

Tobacco advertisement bans

The tobacco industry invests billions in marketing its products to lure new users by associating tobacco use with excitement, success and desirability (Saad, C. et al., 2025). This type of advertisement is particularly appealing to young people who are likely to keep smoking into adulthood if they initiate smoking at a young age. Enforcing bans on tobacco advertising, promotion, and sponsorship is another critical tool in controlling tobacco use. This involves prohibiting tobacco product advertisements across various media platforms and implementing plain packaging for cigarettes to eliminate branding. These policies have demonstrated success in reducing smoking rates and motivating smokers to quit (World Health Organization, 2013).

Packaging and labelling of tobacco products

Studies have shown that conspicuous health warnings are associated with better awareness of the adverse effects of tobacco use. Plain packaging is one strategy that has been used to highlight the adverse effects of tobacco and potentially reduce the demand for tobacco products. In 2012, Australia became the first country to have legislation on plain packaging requirements. The main purpose of plain packaging is to reduce the appeal of tobacco products, help remove the effects of advertisements and improve the visibility of health warnings. Studies have shown that graphic warning labels increase knowledge about the health risks of smoking and encourage smokers to quit (Hammond et al., 2006). Specifically, graphic warning labels on

cigarette packs are attention-grabbing and convey the harms of smoking more effectively than text-based labels.

Surveillance of tobacco use

Tracking tobacco use trends and evaluating the effectiveness of different policies and interventions informs the development and implementation of effective strategies, such as targeted anti-smoking campaigns for specific groups and the enhancement of anti-smoking interventions.

Raising public awareness

Public education about the health risks of tobacco use is important in achieving tobacco control. Education systems and smoking are closely linked, as studies consistently demonstrate that education plays a significant role in determining an individual's likelihood of smoking. Mass media campaigns and the inclusion of tobacco-related information in school curricula are crucial for raising awareness and ensuring that young people are well-informed about smoking dangers. Targeted mass media campaigns reach high-risk groups like young people and women (Schar & Gutierrez, 2001). The media plays a role in shaping public perceptions of smoking and media literacy programs can teach individuals to critically assess the information they get. Social marketing campaigns targeting at-risk populations can effectively communicate the risks and negative economic effects of smoking (Diehr et al., 2011). Technology, such as mobile apps and text messaging programs, can provide tailored information and support to smokers (Do et al., 2018). Access to effective treatments for nicotine addiction, such as nicotine replacement therapy and medications, is another important intervention. These treatments assist smokers in quitting and reducing the risk of tobacco-related diseases. Protecting non-smokers from second-hand smoke exposure is a priority. Smoke-free laws, ventilation systems, and other measures are essential to reduce exposure in public places and workplaces.

Global initiatives and frameworks

The Framework Convention on Tobacco Control (FCTC)

The Framework Convention on Tobacco Control (FCTC) represents a milestone in global public health efforts directed at reducing the prevalence of tobacco use and its associated health risks. Adopted by the WHO in 2003, the FCTC became the first international treaty negotiated under the support of the WHO (World Health Organization, 2005). The primary objective of

the FCTC is to reduce tobacco consumption and mitigate its harmful effects by providing guidelines for tobacco control policies and programs. It came into force in February 2005 and has since been ratified by over 180 countries, signifying a broad commitment to control the use of tobacco for health benefits (World Health Organization, 2005). It was developed in response to the growing evidence of the health, social, economic, and environmental impacts of tobacco. The convention's creation was driven by the need for a comprehensive, coordinated approach to address the complex and transnational nature of tobacco control. The negotiation process involved extensive consultations with governments, non-governmental organizations, and public health experts, culminating in a legally binding treaty that established a global framework for tobacco control.

The FCTC is grounded in several core principles aimed at reducing tobacco use and its harmful effects as summarised in the table below. The core principles can largely be divided into three principles: demand reduction, supply reduction and protection of the environment (World Health Organization, 2005).

Table 1: Main principles of the FCTC

Action	Strategies
Demand Reduction Measures	• Price and tax measures • Protection from exposure to tobacco smoke • Regulation of tobacco products and product disclosures • Packaging and labelling • Advertisement, marketing and sponsorship
Supply Reduction Measures	• Illicit trade in tobacco products • Sale to and by minors • Support for economically viable alternatives
Protection of the environment	• Protect the environment and health of all persons

Adapted from: WHO Framework Convention on Tobacco Control, (World Health Organization, 2005)

One key behavioural economics strategy recommended by the FCTC is using graphic warning labels on tobacco packaging. These labels leverage the emotional impact of graphic images and warnings to deter smoking initiation and encourage cessation. Research has shown that such warnings are more effective than text-only warnings in conveying the health risks of smoking and prompting behavioural change (Hammond, 2011). Another strategy is using taxation to increase the price of tobacco products. Higher prices can discourage smoking by making it less affordable, particularly among price-sensitive groups like young people and low-income individuals. Studies have demonstrated that tobacco taxes are one of the most effective measures for reducing tobacco consumption (Chaloupka et al., 2011). In addition, the FCTC aims to limit the availability and accessibility of tobacco products, such as restricting sales to minors and reducing the number of retail outlets. These measures can disrupt habitual purchasing behaviours and reduce impulse buying.

The MPOWER package

In recent years, the WHO has introduced the MPOWER package as a public health initiative to address the global burden of tobacco use. The main aim of the MPOWER package is to implement existing strategies to reduce tobacco consumption. This package is based on six evidence-based policies known to effectively reduce tobacco use and its associated harms. These policies include some strategies discussed above; monitoring tobacco use, protecting people from second-hand smoke, aiding users in quitting tobacco, warning about tobacco dangers, enforcing bans on tobacco advertising, promotion, and sponsorship, and raising tobacco taxes.

Challenges of implementing tobacco control measures

Tobacco control is a complex challenge that requires a comprehensive and coordinated approach. Whilst many strides have been made in tobacco control, many challenges exist that result in the persistent use of tobacco despite well-documented health risks and available interventions to help smokers quit. These challenges include the emergence of new tobacco products, social behaviours, the powerful and well-funded tobacco industry, and the lack of public education.

Emergence of new tobacco products

New tobacco products can renormalize smoking and create a new generation of nicotine addiction. These products include electronic cigarettes (e-cigarettes), waterpipes (shisha) and smokeless alternatives such as snus.

Vaping, also known as electronic cigarette use, has gained popularity as a smoking cessation tool and an alternative to traditional cigarettes. However, its long-term health effects are largely unknown, and the safety and effectiveness of vaping as a smoking cessation aid are subjects of ongoing debate. Proponents argue that vaping offers a similar smoking experience without the harmful chemicals found in traditional cigarettes. By heating and vaporizing a liquid containing nicotine, flavouring, and other chemicals, users can satisfy their nicotine needs while avoiding tar and carbon monoxide (Farsalinos et al., 2019). Vaping also allows for a customizable experience, enabling users to gradually reduce nicotine intake and eventually quit. However, concerns exist regarding vaping's safety and efficacy as a smoking cessation tool. One concern is that it may serve as a gateway to traditional smoking, especially among young individuals (Martinelli et al., 2023). A recent meta-analysis indicated that e-cigarettes were not significantly more effective than nicotine replacement therapy for smoking cessation (Quigley et al., 2021). There has also been evidence of second-hand exposure to nicotine and carbon monoxide with the use of e-cigarettes. Many users of these alternative tobacco products are misinformed about the contents: they believe these products do not contain tobacco, which is not true.

Nevertheless, many experts believe that vaping can still aid smoking cessation when used correctly. The Royal College of Physicians asserts that e-cigarettes are significantly less harmful than traditional cigarettes and can be a useful tool for smokers trying to quit (Royal College of Physicians, 2016). Advancements in vaping technology, such as heat-not-burn devices, are promising for further harm reduction (Farsalinos et al., 2019). Despite the potential benefits and drawbacks, more research is needed to fully understand the long-term effects of vaping. It is important to consider the potential risks and monitor youth usage to prevent it from becoming a gateway to traditional smoking. The "Vaping Fix" podcast, hosted by Dr. Michael Siegel and Dr. Brad Rodu, provides valuable insights into the vaping industry, discussing the latest news, developments, and research (Siegel & Rodu, 2019). The podcast emphasizes the

importance of harm reduction, highlighting that vaping, while not risk-free, is significantly less harmful than smoking. It also emphasizes the need for accurate and unbiased information about vaping, addressing misconceptions and misinterpretations. The podcast covers various vaping-related topics, including health effects, regulations, and industry trends, making it a valuable resource for those interested in vaping science and policy.

The tobacco industry

The tobacco industry is a powerful global economic force, generating billions of dollars in revenue annually. Despite the well-known health risks associated with tobacco use, tobacco products remain popular worldwide. Additionally, the industry provides employment for millions of people, particularly in developing countries where job opportunities are limited. It also plays a significant role in international trade, with tobacco products being exported and imported globally (International Labour Organization, 2014). However, the industry has faced criticism for its negative impact on public health, marketing practices targeting vulnerable populations, and downplaying the risks of tobacco use.

The economic size of the tobacco industry presents challenges for tobacco control programs, due to its political influence, economic impact, and marketing strategies. The industry's financial resources enable it to influence government officials and impede the implementation of effective tobacco control measures. Moreover, the industry's contribution to national economies through job creation and tax revenue complicates efforts to implement anti-tobacco measures (Montez et al., 2020; Steel et al., 2018).

Lack of public awareness

Efforts to prevent smoking through education are hindered by several challenges. Insufficient funding for anti-smoking campaigns and educational programs is a major obstacle, limiting their reach and impact (Abinaya et al., 2017; B. Naik, 2012). Additionally, there is often a lack of political will to implement policies and regulations that could reduce smoking rates, as they are sometimes viewed as unpopular or infringing upon individual rights. Nonetheless, research shows that providing students with accurate information about the health risks associated with tobacco use effectively prevents or reduces its initiation (Dobbins et al., 2008). A study conducted in the United States found that students receiving comprehensive tobacco education

were less likely to start smoking compared to those who did not receive such education (Bunnell et al., 2015).

Health disparities and passive smoking

Another challenge is the need to reach at-risk populations, particularly low-income individuals who may have limited education and resources and are more prone to smoking (Huisman et al., 2005; Mahdaviazad et al., 2022; Nagelhout et al., 2012). Addressing this requires targeted outreach and education tailored to their specific needs. Furthermore, social and cultural factors that contribute to smoking, such as peer pressure and societal acceptance, must be addressed. The burden of tobacco-related illness and death is unequally distributed, with lower socio-economic backgrounds and certain ethnic minorities being disproportionately affected (Hiscock et al., 2012; Mahdaviazad et al., 2022). Implementation and enforcement of tobacco control policies can be difficult, especially in low- and middle-income countries with limited resources (Huisman et al., 2005; Mahdaviazad et al., 2022).

Marketing strategies

Marketing strategies that target specific groups and integrate tobacco into popular culture further hinder smoking reduction efforts (Kong et al., 2024). The powerful and well-funded tobacco industry also opposes public health measures through marketing to vulnerable populations and lobbying against regulations (Hawkins, B., 2024). Anti-tobacco advertising efforts have limitations, such as limited reach, lack of funding, limited effectiveness compared to other interventions, counter-marketing by tobacco companies, limited regulation, lack of a global approach, and limited evaluation (Cummings et al., 2002; Savell et al., 2016).

Funding tobacco control

Securing sufficient funding for tobacco control encounters numerous challenges, despite its crucial necessity. One primary challenge is the absence of political determination to prioritize tobacco control. In many countries, tobacco control is not considered a top-priority matter, making it arduous to allocate resources to related programs (Mohamed et al., 2018). Additionally, competition for resources from other healthcare initiatives often restricts the available funding for tobacco control. Another obstacle lies in the influence wielded by the tobacco industry. Historically, the tobacco industry has opposed tobacco control endeavours, leveraging its political sway and financial capabilities to impede or dilute tobacco control

policies. Moreover, the tobacco industry has employed corporate social responsibility initiatives to undermine tobacco control efforts and cultivate favour with policymakers (Matthes et al., 2023).

Economic strategies on tobacco control, and tobacco control

This section examines the status of tobacco control in South Africa, a middle-income country, and New Zealand, a high-income country, presenting them as case studies to highlight diverse strategies and outcomes.

The South Africa case study

Smoking and lung cancer significantly impact healthcare costs in South Africa, comprising a quarter of cancer-related expenditures (National Department of Health (NDoH) et al., 2016). Traditional economic approaches, such as price elasticity of demand and market regulation, have been effective in modifying smoking behaviour and tobacco control. Despite efforts to reduce smoking rates through legislation and taxation, the decline has stagnated in the past decade, with an estimated 8 million adult smokers in South Africa. Smoking prevalence is particularly high in the Western Cape, with 42% of men and one in four women identified as significant smokers (Chelwa, 2015; Chelwa & Van Walbeek, 2019; National Department of Health (NDoH) et al., 2016). Alarming rates of smoking among adolescents also raise concerns.

South African Tobacco Bill

The South African government has implemented policies and legislation to reduce tobacco use and its associated harms. The Control of Tobacco Products and Electronic Delivery Systems Bill (CTPEDSB), also known as the South African Tobacco Control Bill, was introduced in 2019 to address this public health crisis. The bill aims to reduce tobacco-related deaths and illnesses by implementing stricter regulations on the sale, advertising, and packaging of tobacco products (Tobacco Products and Electronic Delivery Systems Control Bill (B33-2022) - Parliament of South Africa, 2022). It also introduces new laws on electronic cigarettes and other electronic nicotine delivery systems.

A significant provision of the bill is the requirement for plain packaging of all tobacco products. This means that tobacco products must be sold in standardized packaging without branding or

advertising. The purpose is to make smoking less appealing, especially to young people, and reduce the number of new smokers. The bill also introduces regulations for electronic cigarettes and other electronic nicotine delivery systems, which are currently unregulated in South Africa. The aim is to protect young people from the potential harms associated with these devices. This includes restrictions on their sale to minors and regulations on nicotine content.

Furthermore, the bill addresses the advertising and promotion of tobacco products. It bans tobacco advertising in all forms of media, including television, radio, and the Internet. This measure aims to reduce young people's exposure to tobacco advertising and discourage them from starting smoking. The bill includes measures to support smokers in quitting. It establishes a national quit-line that offers free advice and support to smokers who want to quit. Additionally, the bill provides funding for quit-smoking campaigns and offers free nicotine replacement therapy to those trying to quit.

The South African tobacco control bill has several benefits that are consistent with the benefits stipulated by the FCTC. Firstly, it will help reduce tobacco-related deaths and illnesses, resulting in saved lives and decreased strain on the healthcare system; and secondly, it will contribute to reducing the number of young people who initiate smoking (Filby et al., 2022; Zhou et al., 2019).

Challenges in Implementing the CTPEDSB

The South African tobacco control bill has potential downsides that must be considered. One concern is the possibility of a black market for tobacco products emerging if the regulations are overly strict and prices become prohibitively high, leading to an increase in illegal trade. Another challenge is the lack of political will from the South African government: despite clear evidence of the harmful health effects of tobacco use, the government has been slow to enforce the bill due to pressure from the tobacco industry. The industry has lobbied against the bill, arguing that it will have negative economic consequences and result in job losses. Consequently, the government has been hesitant to take decisive action against the industry, impeding the effective implementation and enforcement of the CTPEDSB (Das, 2023).

The inadequate allocation of resources by the South African government poses another challenge. The bill requires the establishment and maintenance of a system to monitor and enforce compliance, which demands significant financial and human resources (South African

National Department of Health, 2018). Insufficient resource allocation has hindered the government's ability to effectively implement and enforce the bill. Furthermore, there is a lack of public awareness and education regarding the health risks of tobacco use and the provisions of the CTPEDSB (Department of Health, 2016). Many South Africans are unaware of these issues, making it challenging for the government to effectively communicate the importance of the bill and garner public support for its implementation and enforcement.

Until 2019, emerging tobacco products like heated tobacco and e-cigarettes were not subject to excise taxes. However, in February 2020, the Ministry of Finance announced in the 2020 National Budget that heated tobacco would be taxed at a rate equal to 75% of the cigarette tax rate starting April 1, 2020 (FY 2020/21)(South African Revenue Authority, 2024). Heated tobacco is taxed specifically based on the number of sticks. As of April 1, 2023, the excise tax for heated tobacco is ZAR 15.6 per 20 sticks. Cigarettes are also taxed under a pure specific excise system, with a rate of ZAR 20.8 per pack of 20 cigarettes effective April 1, 2023 (South African Revenue Authority, 2024). Additionally, all imported tobacco products incur an import duty of 45% of their cost, insurance, and freight (CIF) price (South African Revenue Authority, 2024).

Implications of Challenges for Public Health

The challenges faced by the South African government in implementing and enforcing the CTPEDSB have significant implications for public health. To address these challenges, several recommendations can be made. Firstly, the government needs to demonstrate strong political will and take action against the tobacco industry. Implementing the bill is crucial in addressing the public health burden caused by tobacco use, which is the leading cause of preventable deaths in the country. A key provision of the bill is the ban on smoking in public places, which would greatly reduce exposure to second-hand smoke. Adequate resources should be allocated to enforce this provision, including training and equipping enforcement officers. Public involvement in reporting violations should be encouraged.

Another important provision is the requirement for graphic warning labels on cigarette packs. Designing informative and impactful labels with the involvement of experts is crucial. Effective monitoring and enforcement mechanisms, including penalties for violators, should accompany these restrictions.

The New Zealand Case study

Tobacco control laws are essential for public health and reducing the harm caused by tobacco use in New Zealand. The country has a long history of implementing such legislation, starting in the early 20th century. However, it wasn't until the 1990s that the government adopted a more comprehensive approach, introducing various laws and policies to reduce smoking rates and tobacco-related harm. The Smoke-free Environments Act 1990 is the primary legislation governing tobacco control in New Zealand. It prohibits smoking in enclosed public spaces and workplaces, except for designated smoking areas in specific settings like prisons and mental health facilities. The act also bans tobacco product advertising and promotion, and mandates health warnings on cigarette packaging.

Besides the Smoke-free Environments Act, other laws and policies are contributing to New Zealand's tobacco control efforts. For example, the Sale of Liquor Act 1989 prohibits the sale of tobacco products to minors, while the Medicines Act 1981 regulates the sale and advertising of e-cigarettes. The government also operates programs such as Quitline service and the Smoke-free Homes and Cars campaign to reduce smoking rates and associated harm.

The effectiveness of New Zealand's tobacco control laws and policies is evident in the decline of smoking rates over the past few decades. According to the Ministry of Health, adult smoking rates have decreased from around 24% in 1996 to approximately 14% in 2019 (Edwards et al., 2021). Similarly, smoking rates among secondary school students dropped from around 21% in 2001 to about 5% in 2019. Despite these achievements, challenges remain, such as higher smoking rates among certain population groups like Māori and Pacific Islanders (Smokefree, 2023).

To address these challenges, New Zealand must continue reviewing and updating its tobacco control laws and policies. This could include implementing further restrictions on the sale and marketing of e-cigarettes and developing targeted interventions to reduce smoking rates among high-risk populations. Continuous research is also necessary to better understand the harms associated with non-combustible tobacco products and inform effective policies.

In December 2021, the New Zealand Ministry of Health published a new tobacco control program to reduce smoking prevalence to less than 5% by 2025 (Agrawal & Britton, 2022).

The plan aims to achieve this target across all population groups, including Māori, through intensified application of conventional policies recommended by the World Health Organization Framework Convention on Tobacco Control (Agrawal & Britton, 2022). These policies involve increasing investment in smoking cessation treatments; employing health promotion measures to discourage smoking and promote quitting; countering tobacco industry interference; restricting tobacco product availability through vendor licensing; and reducing the appeal of tobacco products.

The program deviates from convention by focusing on tobacco smoking rather than nicotine use. Proposed legislation aims to reduce nicotine content in tobacco products to very low levels, making them non-addictive to new users and unsatisfying to current smokers. Vaping is also encouraged as a reduced-harm option for smokers who cannot quit nicotine use. A particularly radical proposal in the plan is to prohibit the sale of tobacco products to individuals born after 2008, preventing future uptake of smoking. This legislation would render tobacco products permanently inaccessible to children under 14 at the time of enactment, and all future generations. It reflects more than a decade of public health campaigns, and the country aims to reduce smoking levels to below 5% of the population by 2025 (Agrawal & Britton, 2022).

The new laws have resulted in a decline in smoking rates overall, with the national smoking rate among adults halving in the past decade. By the end of 2025, 90% of the country's tobacco retailers will have lost their licenses. The legislation also requires significant reductions in nicotine levels in tobacco and vaping products to make them less addictive. Violators of the rules could face fines of up to 150,000 New Zealand dollars. To ensure success, Māori and Pacific Island communities must be engaged and supported, as they have been disproportionately affected by tobacco use. Adequate resources and programs are necessary to assist these communities in quitting smoking.

While the new laws have been criticized, particularly by right-wing lawmakers concerned about a potential black market and the impact on convenience store owners, the government acknowledges the possibility of increased smuggling by organized crime groups. To address this issue, import controls will be strengthened. New Zealand joins other countries like Ireland, Brazil, Norway, and Uganda that have implemented laws to drastically reduce smoking. These initiatives have shown success in improving public health, and New Zealand's comprehensive tobacco control approach aligns with global efforts.

Overall, New Zealand has made significant progress in reducing smoking rates and the harm caused by tobacco use through its comprehensive tobacco control approach. Ongoing review and updates to laws and policies are crucial to effectively address remaining challenges and safeguard the health of New Zealanders.

Behavioural economic theories and tobacco control

Human decision-making and behaviour are driven more by emotions than rationality, as reflected in studies (Moutsiana et al., 2013b). Smoking, a learned behaviour, is addictive due to the brain's pleasure centres. Current interventions to reduce smoking fail to consider these well-established human behavioural traits, focusing instead on traditional economic principles like price elasticity of demand and graphic warnings on tobacco packages (Sharot et al., 2009a). Vaping, previously considered a safer alternative, is now under scrutiny due to unknown lung conditions leading to deaths (Cao et al., 2020; Layden et al., 2020). Before expanding on behavioural economics, it is important to understand the physiology of human decision-making.

Physiology of human decision-making

The human brain is a complex organ: when we receive bad news or encounter scary information, the brain releases stress hormones like cortisol and adrenaline. These hormones, released by the hypothalamus, prepare the body for a fight or flight response, resulting in increased heart rate, blood pressure, and breathing rate (Chu, B. et al., 2024).

Neuroscience underpins economic decision-making through neuroeconomics, an interdisciplinary field integrating brain processes into classic economic models. In essence: economic models of valuation, utility, risk, and intertemporal choice are now calibrated to neural mechanisms - brain signals instantiate the computations assumed by traditional economic theory, grounding abstract models in measurable physiology (Camerer, C.F., 2008).

Distinct brain systems for valuation: Functional MRI reveals that the medial orbitofrontal cortex (mOFC) tracks subjective value across different rewards (e.g., food, money), aligning with utility functions in economic theory.

Dual-process models: Neuroeconomics supports economic "dual-system" models by showing neural competition - between impulsive reward systems (e.g., striatum) and deliberative control regions (e.g., prefrontal cortex) - driving decisions under risk, time delay, or social contexts

Emotion, embodiment, and decision biases: The somatic marker hypothesis links bodily emotional feedback (via vmPFC and the amygdala) to economic decisions under uncertainty, documenting how emotions steer risk-taking and loss aversion The amygdala, a small structure deep in the brain, is responsible for processing emotional information. It activates when we encounter bad news or disturbing facts, generating feelings of fear and anxiety. This activation is crucial for our survival, allowing us to quickly respond to potential threats. Additionally, the prefrontal cortex, situated at the front of the brain, influences how we emotionally process distressing news and alarming information. It enables us to evaluate the situation and make decisions on how to respond. The brain also releases chemicals that impact our emotional response. Dopamine, responsible for pleasure and reward, decreases when we receive bad news, leading to feelings of sadness and despair. Serotonin, a mood-regulating chemical, also decreases, resulting in anxiety and depression. Overall, the human brain responds to distressing news and frightening information through the release of stress hormones, the activation of the amygdala and prefrontal cortex, and the release of chemicals like dopamine and serotonin. Understanding these processes can aid in handling difficult situations and inform interventions for individuals struggling with emotional responses to such stimuli (McGaugh, J.L., 2013).

The amygdala processes emotions, including fear. Scary information triggers the activation of the amygdala, releasing chemicals like adrenaline and cortisol, which prepare the body for the fight or flight response. This response, known as the "fear response," is essential for our survival. While the fear response can be beneficial in dangerous situations, it can hinder our ability to learn if it occurs too frequently or intensely. For instance, experiencing a traumatic event may lead to post-traumatic stress disorder (PTSD), affecting the processing of new information and learning (McGaugh, J.L., 2018).

Another way the brain responds to distressing information is through encoding and consolidation. Encoding refers to the process of absorbing new information, while consolidation involves stabilizing that information in long-term memory. Frightening information tends to be encoded and consolidated more effectively than other types of information. The brain recognizes the significance of remembering potentially dangerous

information. However, excessive exposure can lead to desensitization, reducing its effectiveness in triggering the fear response, and hindering processing and consolidation.

The brain also regulates emotions in response to frightening information. Emotional regulation involves managing emotional responses to different types of information. When faced with distressing information, the brain may employ coping mechanisms like avoidance or rumination. However, these coping mechanisms can impede learning. Avoidance may result in missing important insights, while rumination can trap individuals in negative thought patterns, hindering progress and learning. Understanding how the brain reacts to different types of information is crucial for managing and handling it effectively.

Summary Table

Component	Brain Structure/Chemical	Function
Emotional detection	Amygdala	Processes fear, triggers hormonal response (adrenaline & cortisol)
Regulation	Prefrontal Cortex	Evaluates threats, modulates amygdala response
Memory processing	Amygdala & Hippocampus	Stress hormones enhance emotional memory encoding
Trauma impact	Amygdala (↑), PFC (↓), Stress chemicals	Drives hypervigilance, intrusive memories, mood dysregulation

Understanding these neural and biochemical mechanisms provides a basis for designing interventions (e.g., trauma-focused therapies, stress-regulation strategies) that support healthier emotional processing, targeted memory consolidation, and adaptive coping under distress.

Tali Sharot, a neuroscientist and cognitive psychologist, has researched the “boomerang effect”: referring to the phenomenon where warnings and persuasion can have unintended consequences on human behaviour. According to Sharot, this effect is driven by the brain's tendency to rely on prior experiences and beliefs when making decisions (Sharot & Sunstein, 2020). People evaluate the credibility and relevance of information based on their existing beliefs. Heuristics, or mental shortcuts, and confirmation bias further contribute to this effect.

The presentation of warnings and persuasion also influences their impact, with overly negative or threatening messages often being rejected. Sharot's theory highlights the complex nature of decision-making and learning, emphasizing the need for the careful design and presentation of messages to influence behaviour effectively.

Exploring the interplay between the Emotional and Rational Brain

The human brain is a complex organ comprising various regions responsible for distinct cognitive functions. Among these, the emotional and rational brain regions play pivotal roles in shaping human behaviour, decision-making, and overall mental well-being. The emotional brain is primarily associated with structures such as the amygdala, hippocampus, and hypothalamus. These regions orchestrate emotional responses and are crucial for survival instincts. The amygdala is critical for its involvement in fear responses and emotional memories (Phelps, 2005). Emotions, often considered spontaneous and instinctive, are integral to human experience, influencing perceptions, decision-making, and social interactions. The hippocampus is cardinal in forming memories of emotional events. Contrastingly, the rational brain involves the prefrontal cortex and associated structures, responsible for executive functions, logical reasoning, and decision-making. The prefrontal cortex, especially the dorsolateral prefrontal cortex (DLPFC), plays a crucial role in planning, problem-solving, and inhibiting impulsive responses. The rational brain enables individuals to analyse information, weigh consequences, and make deliberate decisions based on logic and evidence.

Recent neuroscientific research highlights the dynamic interaction between the emotional and rational brain in various cognitive processes. Emotions can significantly influence decision-making, with emotional signals influencing the evaluation of risks and rewards. The ventromedial prefrontal cortex (vmPFC) serves as a key interface between these two systems, integrating emotional information into decision-making processes (Sharot & Sunstein, 2020). Emotions act as a critical factor in decision-making, influencing individuals to prioritize certain choices over others. The somatic marker hypothesis posits that emotions, through bodily sensations, serve as markers that guide decision-making (Bechara et al., 2000). Emotional signals from the limbic system can influence the evaluation of options, biasing decisions toward emotionally salient outcomes (Ledoux, 2000).

The use of tobacco is an emotionally influenced decision to reduce anxiety. Understanding the connections between the emotional and rational brain has significant implications for mental

health interventions. Disorders such as anxiety and depression often cause dysregulation in emotional processing, emphasizing the need for holistic therapeutic approaches that consider both emotional and rational aspects of brain function. The intricate connections between the emotional and rational brain underscore the complexity of human cognition and behaviour. Ongoing research continues to unveil the nuanced interplay between these systems, providing valuable insights into decision-making, emotional regulation, and mental health. A comprehensive understanding of these connections holds great promise for advancing therapeutic interventions and enhancing our comprehension of the human mind. Rather than existing in isolation, these cognitive domains collaborate, shaping our perceptions, decisions, and overall cognitive experience. A nuanced understanding of this interplay offers insights into human behaviour and lays the groundwork for future exploration in fields ranging from psychology to neuroscience.

Anti-smoking campaigns, as previously alluded, play a pivotal role in public health efforts to reduce tobacco consumption and mitigate the associated health risks. One intriguing aspect of communication psychology is the “framing effect”: a phenomenon where the presentation of information influences decision-making. Identified by Tversky and Kahneman, the framing effect is a cognitive bias wherein individuals react differently (drawing from the emotional side of the brain) to the same information depending on how it is presented (Gong et al., 2013). In their experiment, Tversky and Kahneman observed that individuals took less risks if information was presented positively but when information was presented negatively they took more risks (Tversky & Kahneman, 1981). As such, positive framing emphasizes gains, while negative framing highlights losses. In the context of anti-smoking campaigns, one might expect that framing messages in terms of health gains or loss avoidance could significantly influence individuals' perceptions and behaviours.

In anti-smoking strategies, graphic warning labels on cigarette packages exemplify the framing effect by using powerful images to convey the severe health risks associated with smoking. These labels aim to create an emotional response that makes the dangers of smoking more immediate and personal, thereby influencing behaviour. Research has shown that graphic warnings are more effective than text-only warnings in increasing awareness and reducing smoking rates. Noar et al. (2016) found that smokers exposed to graphic warnings perceived higher risks and demonstrated a stronger intention to quit than those exposed to text-only

warnings (Noar et al., 2016). Graphic warnings leverage this by framing the health risks of smoking as significant losses, making them more salient and immediate in the minds of smokers. Hammond (2011) noted that these labels enhance the perceived severity and personal relevance of smoking-related health risks (Hammond, 2011). This illustrates how framing smoking through vivid, negative imagery can alter perceptions and motivate behavioural change.

Surprisingly, numerous studies indicate that the traditional framing effect is less pronounced in anti-smoking campaigns compared to other health-related communication efforts (Miller et al., 2022; Yang, 2018). Research has shown that the effectiveness of message framing—whether using gain-framed (emphasizing benefits of quitting) or loss-framed (highlighting the dangers of smoking) messages—can vary significantly depending on the audience. For example, smokers often exhibit lower responsiveness to both positive and negative frames due to factors like nicotine dependence and counter-arguing tendencies, which diminish the overall impact of these messages. This is less commonly seen in other health domains, where framing effects tend to be more straightforward and effective (e.g., promoting healthy eating or exercise). Unlike issues such as vaccination or healthy eating, where framing can substantially influence attitudes and behaviours, anti-smoking messages often exhibit a muted impact. Yang et al found that framing a message with a positive message was more persuasive in prodding smoking cessation than a negative one (Yang, 2018). A study by Cartocci et al., which examined the perception of anti-smoking messages among high school students, highlighted that traditional message framing, typically persuasive in promoting health behaviours, did not significantly alter students' attitudes towards smoking (Cartocci et al., 2018). This indicates that younger audiences might be desensitized to conventional framing techniques in the context of smoking, possibly due to their frequent exposure to various anti-smoking messages.

The decreased effectiveness of message framing to reduce smoking is attributed to a variety of factors. Traditional framing effects assume a level of rational decision-making that may not be present in addictive behaviours like tobacco use. The addictive nature of nicotine significantly impacts smokers' ability to respond to framed messages as they might in other health contexts. It may lead individuals to rationalize their behaviour, making them less susceptible to the framing effect. Studies have noted the complex interplay between addiction and the cognitive

processing of health warnings (Hammond, 2011). Smokers may employ defence mechanisms to justify continued tobacco use despite negative health consequences.

Another potential explanation for the reduced impact of traditional framing methods in tobacco control is the negative effect of repetitive exposure to health warnings. Over time, smokers may become desensitized to health warnings, particularly if these messages are consistently framed similarly. A study by Brennan et.al. that evaluated the impact of graphical warnings in Australia between 2005 and 2006 observed a decline in the responsiveness to graphic warnings among smokers over time (Brennan et al., 2011). Cultural norms and social influences might mitigate the framing effect in anti-smoking campaigns. The social acceptance or normalization of smoking in certain contexts could outweigh the impact of framing. However, the culture around smoking has also changed from being socially acceptable to an undesirable behaviour.

The cultural background, age and smoking history of individuals can result in a difference in the effectiveness of framed messages. For example, a study in the U.S evaluating differences in the outcome of an educational campaign on tobacco use by smoking status observed that the programme was more effective in reaching non-smokers than smokers (Harris et al., 2011). Another study investigated the characteristics of individuals with message fatigue and observed that they were younger, often male and with a higher income, with non-smokers also presenting with less message fatigue compared to current smokers (So & Popova, 2018). Therefore, generic framing might not resonate as strongly as personalized or tailored messages. Individualized approaches that consider a person's unique circumstances and motivations may be more effective in influencing behaviour change.

Behavioural economics across space and time

When implementing behavioural nudges, it is also essential to consider the population context. Specifically, it is important to design interventions that are adjusted to where people live, work and socialise. Clinical interventions have the disadvantage of not considering these aspects. To optimise them, details of the spatial (geographic) and temporal (time-specific) contexts are essential. Whilst it is challenging to scale effective implementation strategies to a non-homogenous population, interventions should be adaptable to different environments; for example low-income countries and high-income countries (Barber et al., 2023). The same applies to behavioural interventions - differences in people's attitudes towards health choices,

even those living in the same environment should be taken into account. People's activities and behaviours change depending on the environment they are in. For instance, people living in environments promoting physical activity are more likely to be physically active than those in environments not prioritizing physical activity. Differences in health behaviour across time should also be accounted for when designing behavioural change interventions. These include day-to-day routines, time management, and changes in activities that individuals engage in daily. The figure below demonstrates the spatiotemporal interaction with specific behaviours and why it is important to integrate these aspects into behavioural interventions (Barber et al., 2023).

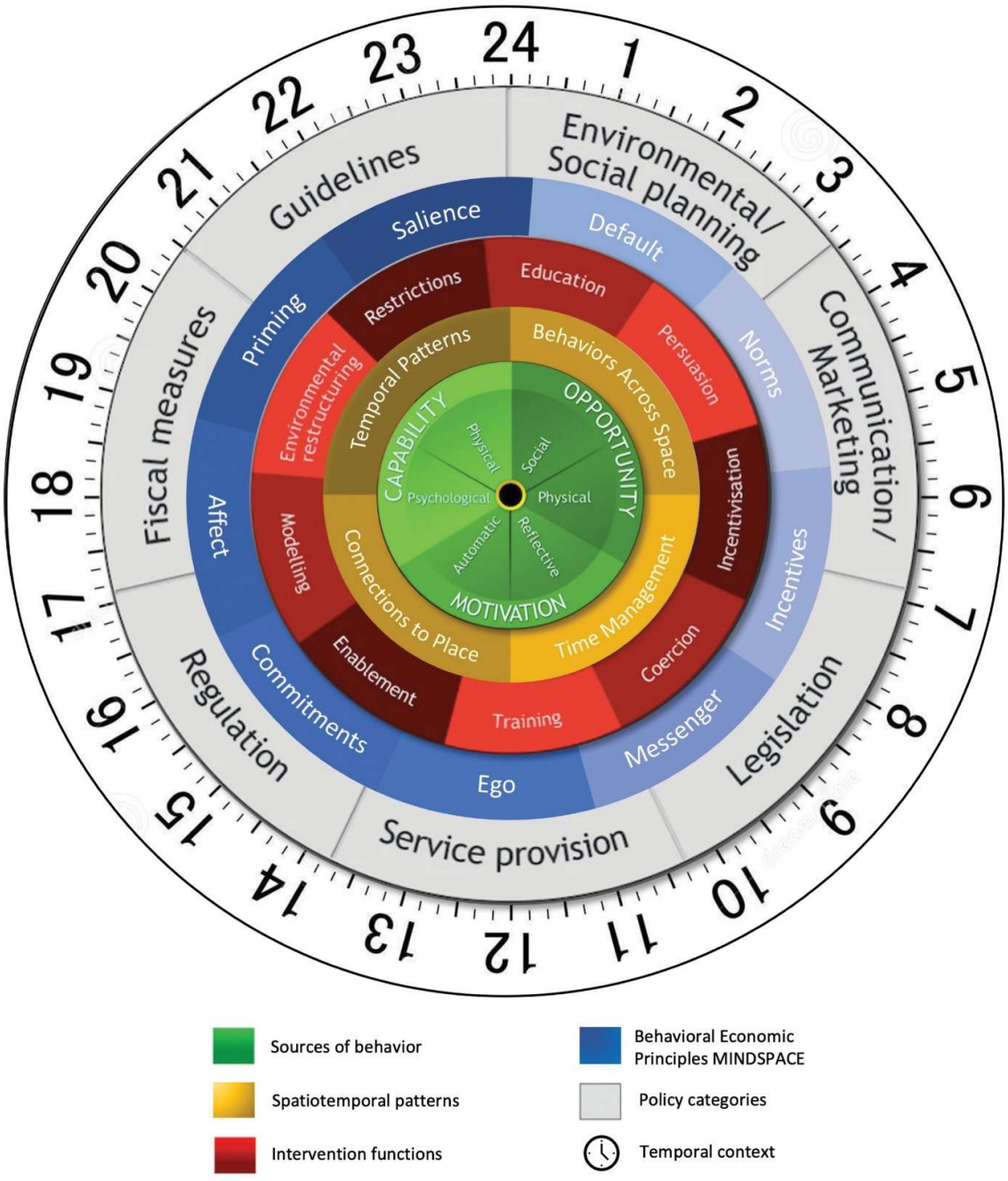

Figure from: Barber, B. V., Kephart, G., Martin-Misener, R et.al. (2023). Integrating health geography and behavioural economic principles to strengthen context-specific behaviour change interventions. *Translational Behavioural Medicine*. https://doi.org/10.1093/TBM/IBAD065

Behavioural challenges in tobacco control

Considering the limitations of human decision-making, it is crucial to employ strategies that empower individuals to associate smoking with negative economic effects. These strategies include financial incentives, behavioural economics, social norms, media literacy, parental influence, access to cessation resources, community involvement, and restrictions on tobacco product advertising and promotion. Behavioural economics is a multidisciplinary field, which includes economics, psychology and cognitive science. It challenges the traditional economic model of perfect rationality by recognizing cognitive biases and their influence on decision-making (Hanoch et al., 2017; Kahneman et al., 1991; Moutsiana et al., 2013b). Behavioural economics offers theories that could contribute to anti-smoking efforts. These theories include cognitive biases, heuristics, libertarian paternalism, and hyperbolic discounting (Oullier et al., 2010; Rubinstein, 2003; Thaler & Sunstein, 2003).

Hyperbolic discounting explains the preference for immediate rewards over delayed ones (Jarmolowicz et al., 2016). Present bias, status quo bias, and hyperbolic discounting suggest that behaviour is driven by using the present situation as a reference point. The current strategy of graphic warnings is largely ineffective due to hyperbolic discounting, with smokers prioritizing the present pleasure and anxiety relief over the uncertain future risk of lung diseases.

Cognitive biases refer to an irrational way of processing information because of preconceived ideas or beliefs (Ehrlinger & Kim, 2016). Punitive measures alone do not necessarily lead to the desired outcomes (Burgess, 2012; LaVoie et al., 2017). Although reductions in smoking have been observed in some countries, the overall global impact falls short of expectations. Utilizing cognitive biases and entrenched behaviours in efforts to reduce smoking could be a viable alternative to current approaches (Hoek et al., 2017; Wells et al., 2017). Involving smokers in the campaign through a collaborative platform can be a more promising intervention. According to Forbes and Duffy (2013), messages that are co-created with the target audience are more likely to address their specific concerns and perspectives. This participatory approach can help design messages that resonate more deeply, thereby increasing their impact.

Heuristics (mental shortcuts) on the other hand refer to the simple decision-making tactics that enable individuals to make quick decisions (Gigerenzer & Gaissmaier, 2010). These tactics include the availability heuristic, which refers to decision-making based on the most recent

information (Reed et al., 2021). Present bias is also another heuristic that puts present concerns before the future risk of disease (Reed et al., 2021). An Australian study observed that colour was a key visual heuristic aiding individuals in making decisions on which brands of cigarettes to purchase (Greenland, 2015). As a result, substituting colour with plain packaging for cigarettes would alter purchasing decisions and potentially reduce the appeal of cigarette smoking. It is important to consider the individual's daily routines and the environment in which they live as well as their cognitive biases when introducing behavioural interventions (Barber et al., 2023).

Current anti-smoking advertisements are often ineffective due to a lack of understanding of the behavioural economics of smoking. Addiction and present bias are important factors to consider. Anti-smoking campaigns that solely focus on health effects may not effectively reduce smoking rates due to nicotine addiction. Present bias may make the immediate pleasure of smoking more compelling than potential future health risks. Moreover, fear appeals used in current advertisements can backfire and lead to resistance to change. It is crucial to recognize that people are not always rational decision-makers, and messages tailored to cognitive biases and heuristics may be more effective. Future research should also explore the use of commitment devices in anti-smoking strategies and their impact on decision-making.

Behavioural economics and tobacco control; knowledge gap and action

Contrary to standard economics, behavioural economics acknowledges that human decision-making is not always rational, with instances of poor decision-making even when individuals are well-informed about a particular risk. Behavioural economics acknowledges that human behaviour is influenced by bounded willpower, bounded rationality and bounded selfishness (Thorgeirsson & Kawachi, 2013).

The intention-behaviour gap is a recognized phenomenon in behavioural economics. It refers to the disconnect between a person's knowledge or understanding of a topic and their subsequent actions related to that topic (Conner & Norman, 2022). This gap can be explained by cognitive dissonance, where conflicting beliefs or values cause mental discomfort and hinder motivation to act accordingly. Another factor is self-control, which is a limited resource that can be depleted, making it harder to engage in desired behaviours. Decision-making relating to warning labels on tobacco packaging is influenced by heuristic limitations such as anchoring bias, normalcy bias, confirmation bias, availability heuristic, familiarity bias, the inoculation

effect, perceived susceptibility, and default bias. Environmental and societal factors, such as lack of resources or societal norms, also contribute to this gap. Addressing the gap requires the consideration of psychological and environmental factors.

It is essential to comprehend the influence of these factors on behaviour and develop targeted interventions. Cognitive biases, such as the availability heuristic, can be addressed through interventions to enhance individuals' understanding of health risks. Similarly, interventions targeting social norms, particularly related to body image, can promote healthy conformity within groups. Interventions focused on the environment, such as increasing access to healthy food and safe exercise options, can make healthy choices more appealing and accessible. The MPOWER package incorporates insights from behavioural economics. It recognizes that individuals do not always make rational choices and are influenced by factors like social norms, emotions, and cognitive biases. The MPOWER package leverages these insights to modify behaviour and alleviate the burden of tobacco use.

Nudging

Nudging provides a practical perspective that challenges the assumption that more negative information will lead to improved behaviours (Burgess, 2012). Thaler and Sunstein have defined nudging as "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2003). The nudge theory is based on the philosophy of libertarian paternalism introduced by Thaler and Sunstein. Libertarian paternalism refers to guidance in decision-making without removing the freedom of choice. Apart from preserving choice, nudging interventions are often cost-effective and do not require large continuous budgets to sustain. Whilst the benefits of nudges are numerous, there are ethical issues that surround their use. Some researchers' question whether nudges are a form of manipulation, disregarding an individual's autonomy (Ghesla et al., 2019; Oullier et al., 2010). If nudges manipulate choice, they are therefore not compatible with modern democracies. The use of nudges would then likely be abused by autocrats. To avoid this, nudges have been characterised by the maintenance of freedom of choice, transparency and effectiveness as well as evidence and testing (Sunstein, 2014). Building on freedom of choice, transparency is essential to avoid coercion, manipulation or deception towards the population.

Examples of nudges are software applications that inform individuals of their calorie intake, and alarm clock applications. In the Tobacco control field, a nudging technique that has been used is graphic warning labels in the form of terrifying vivid images and foreboding text-based messaging (Hammond et al., 2006, 2007). This is intended to deter consumers from purchasing tobacco products by reminding them of the effects of tobacco smoking. A meta-analysis by Noar et.al. observed that graphic warning labels increased awareness of the health risks linked to tobacco smoking (Noar et al., 2016). However, information gaps were noted for its effect on actual smoking behaviour.

The limited visibility and accessibility of tobacco-related products in retail stores is another nudging technique that has been used in the tobacco control space. A study in Ireland evaluated the compliance and effect of removing point-of-sale tobacco products and observed that this measure reduced the normalisation of smoking (McNeill et al., 2011). Offering financial incentives, like health insurance discounts or other benefits, to motivate smokers to quit is also a viable approach (Donatelle et al., 2004; Sigmon & Patrick, 2012). Personalized cost analysis, such as calculating the amount of money saved by quitting smoking over a specific period can be useful to illustrate tangible economic benefits. Highlighting the economic benefits of quitting, such as increased productivity and reduced absenteeism, to demonstrate the financial advantages is also another approach that can be used. However, studies have demonstrated few long-lasting effects on smoking cessation rates because of incentives, with any gains being lost after the incentives stop (Hey & Perera, 2005).

Behavioural nudges have been endorsed and implemented in various governments. In the United Kingdom (UK), Prime Minister David Cameroon made reading the Thaler and Sunstein book “Nudge” obligatory before the 2008 election. During his premiership, a Behavioural Insights Team was established with the main mandate to support the government in drafting policies that are aligned with how people behave (Cabinet Office Behavioural Insights Team, 2010). The teams set up initiatives and used behavioural nudges to tackle problems around smoking, organ donation, teenage pregnancy, and alcohol abuse amongst other problems. Regarding smoking, the nudge unit centred its initiatives around marketing campaigns to quit smoking, ending tobacco product display, and looking for alternative products for nicotine addicts. The nudge team also set up a cluster-randomised trial that combines behavioural and pharmacological approaches to encourage individuals to quit smoking using well targeted

incentives. The UK's behavioural initiatives have shown positive results by presenting more beneficial information without removing choices (Burgess, 2012). However, this UK example also highlighted the complexity of maintaining transparency when it comes to behavioural nudges.

In the United States, under the Obama administration, behavioural nudges were implemented across various initiatives. A Social and Behavioural Sciences Team (SBST) was established in 2015 as part of the White House Office of Science and Technology, with the mandate to optimise the government's programs and policies. An example of how behavioural nudges were used was the automatic enrolment into retirement plans to improve retirement savings. The SBST worked to improve access to federal programs like student loan repayments and health insurance enrolment by simplifying communications and procedures necessary for this. In response to the climate change crises, behavioural barriers were identified as key in deterring individuals from choosing renewable energy. Regarding health-related initiatives, the SBST aimed to support health insurance plan choice by providing target information and decision-making support tools.

Types of behavioural nudges

Default rules

Default rules can be defined as an automatic choice that is made if no other specifications are given to the decision-maker (Thaler & Sunstein, 2009). Default rules offer cost-effective and successful pathways to aid individuals in making good choices, which is why policymakers prefer them. Examples of default rules include automatically enrolling individuals into health insurance programmes or pension funds. Default rules have been shown to improve green energy contracts uptake, charitable donations, and increased retirement savings (Ghesla et al., 2019).

Simplification, increase in ease and convenience

As a rule, behavioural nudges should be simple and easy to follow to avoid confusion and unnecessary additional costs. Similarly, given that individuals prefer making easy choices, it is important to decrease barriers, such as the time needed to understand the instructions.

Incentives/Penalties

Offering financial incentives, like health insurance discounts or other benefits, to motivate smokers to quit is another approach that can be used. Personalized cost analysis, such as calculating the amount of money saved by quitting smoking over a specific period can be essential to illustrate tangible economic benefits. In addition, highlighting the economic benefits of quitting, such as increased productivity and reduced absenteeism, to demonstrate the financial advantages is an effective approach.

Social Influences

Social norms, which are the unwritten rules of behaviour expected within a group or society, contribute to the gap between knowledge and action. Social norms work by the logic of "many people are doing this…" These norms can influence individuals to adopt behaviours that are not in their best interest to conform to group expectations. For instance, societal body image norms can lead individuals to engage in unhealthy practices like extreme dieting or excessive exercise. The environment also plays a role in this knowledge-action gap. Environmental factors can prompt unhealthy behaviours by making healthy choices more difficult or less appealing. Limited access to nutritious food or safe exercise spaces, for example, can hinder individuals from adopting healthy behaviours. Conversely, the presence of fast-food restaurants and convenience stores can encourage unhealthy choices.

Communicating social norms that indicate that the majority of people do not smoke or desire to quit can foster a sense of community and normalize non-smoking behaviour and help with smoking cessation. Creating relatable narratives like sharing real-life stories of individuals who successfully quit smoking and experienced positive financial changes, can also aid current smokers to quit.

Warnings, graphical or otherwise

Warnings in the form of brightly coloured, large and bold letters can grab an individual's attention, counteracting unrealistic optimism. The disadvantage is that people may still choose to discount the warnings. An alternative would be to present more positive imaging with specific instructions on what people should do. Warning in the form of letters and graphics are a widely used strategy in tobacco control. Research has shown that graphic warnings are more

effective than text-based warnings in tobacco control whilst plain packaging has also been found to reduce the attractiveness of smoking.

Reminders

Reminders are meant to bring a specific task to an individual's attention, thereby controlling forgetfulness. Reminders are useful for medication adherence, electricity consumption, and the uptake of social benefits, amongst other uses. Presently, due to advancements in technology, reminders can be implemented at low costs. A systematic review of the effectiveness of behavioural nudges in improving chronic diseases' self-management demonstrated that reminders improve self-management (Möllenkamp et al., 2019). In tobacco control, a study evaluating smoking cessation in relation to electronic health record reminders observed a higher uptake of smoking cessation medication in individuals who received the reminder compared to those who did not receive the reminders (Bae et al., 2018). However, reminders can also lead to negative participation rates. In a study done to evaluate the hidden costs of reminders in the context of donations, researchers observed that whilst reminders improved donations, they also led to increased rates of cancelled subscriptions (Damgaard & Gravert, 2017).

Loss aversion

Loss aversion suggests that people are more motivated to avoid losses than to achieve gains. Thus, emphasizing potential losses like poor health and premature death is more effective than highlighting potential gains like improved health and longer life. This theory has been utilized in anti-smoking campaigns to evoke negative emotions and discourage smoking.

Commitment devices

Commitment devices are tools that aim to enforce self-imposed restrictions or penalties to help individuals achieve their goals. The theory of present bias suggests that people tend to prioritize immediate rewards over long-term benefits, leading to a lack of self-control in behaviours like smoking. Commitment devices address this bias by increasing the presently perceived costs of smoking, making it harder to deviate from the desired behaviour and increasing the likelihood of adherence. However, these devices are currently underutilized (Rogers et al., 2014)(Rogers et al., 2014). To maximize their benefits for population health, it is important to increase both the usage and effectiveness of commitment devices (Giné et al., 2010; Rogers et al., 2014). Financial incentives are one commitment device used in anti-smoking efforts. Research has

shown that offering smokers monetary rewards significantly increases quit rates (Glynn, 2014). Additionally, when individuals commit to a specific goal, like quitting smoking, and make a deposit that is returned upon achieving the goal, they are more likely to succeed (Thaler & Benartzi, 2004). Another commitment device is leveraging social norms. People are more likely to conform to behaviour if they perceive it as the norm within their group. For example, informing smokers that most of their community has quit smoking increases the likelihood of them quitting (Reno et al., 1993). Publicly committing to a behaviour, such as quitting smoking, also enhances adherence (Reno et al., 1993). Combining financial incentives and social norms can create a powerful commitment device. Programs that offer incentives for quitting and publicly recognize successful quitters establish a financial motivation while fostering a non-smoking social norm within the community.

Small environmental changes that guide healthier choices are another form of commitment device. For instance, making cessation support the default option for smokers and placing reminders on cigarette packs can reinforce the decision to quit and its benefits. Using commitment devices in anti-smoking strategies is most effective when combining various approaches. Financial incentives, social support, behavioural nudges, and graphic warning labels can work together to make quitting more compelling and difficult to ignore.

Commitment devices have limitations, as they may not be effective for all smokers, particularly those heavily addicted to nicotine or lacking necessary resources. Accessibility is also a concern, particularly for low-income or minority groups. Anti-smoking strategies must be inclusive and accessible to all populations. Despite these limitations, commitment devices have the potential to be powerful tools in the fight against smoking. By providing tangible incentives and support, commitment devices can motivate smokers to quit and help them overcome addiction challenges.

It is important to ensure inclusivity and accessibility when designing anti-smoking initiatives, as not all strategies may be effective or accessible to all populations. These strategies should be used in combination and targeted to specific populations. Collaborative teams have been proven to optimize outcomes in various fields, including healthcare and social settings. One advantage of forming and joining such teams is the ability to access diverse resources from multiple partner organizations to accomplish complex objectives, such as innovation. By integrating these teams with insights from behavioural economics, more acceptable and effective

commitment devices can be developed, considering the local context (Davis, 2016; Phillips et al., 2019; Volpp & Asch, 2017).

Financing cancer care through tobacco control: A Nudging Tool to Reduce Tobacco Use

Allocating revenue from tobacco taxes to fund healthcare costs related to tobacco use can amplify the nudge effect. This approach not only raises the economic burden on smokers but also visibly links tobacco consumption with its detrimental health impacts. For example, countries like Australia have implemented policies where tobacco tax revenues are earmarked for healthcare services and smoking cessation programs (Borland et al., 2009). This visible reinvestment of tobacco taxes into health services can enhance public awareness about the harms of smoking and foster a social environment that discourages tobacco use. By reinvesting tobacco tax revenue into health programs, policymakers create a feedback loop that continually reinforces the nudge against tobacco use.

As described before in this chapter, cancer continues to be a prominent global public health issue, significantly affecting human well-being, societal dynamics, and economic stability. It stands as the primary cause of mortality worldwide, with approximately 10 million deaths recorded in 2020. Addressing cancer has been a pivotal aspect of public health efforts, encompassing diverse strategies aimed at diminishing the morbidity and mortality associated with this disease. Early detection of cancer significantly improves survival rates and reduces treatment costs (American Cancer Society, 2020). Allocating tobacco tax revenue to subsidize cancer screening and treatment programs makes these services more accessible and affordable. By providing financial support for these programs, governments can encourage smokers to seek early detection and treatment, indirectly nudging them towards quitting to avoid further health complications

Direct Costs of Tobacco-Related Cancer

Direct costs encompass expenses associated with diagnosing, treating, and caring for cancer patients. These include hospitalization, surgeries, chemotherapy, radiation therapy, and palliative care. A study conducted in the United States estimated that the direct medical costs of lung cancer attributable to smoking amounted to $12.1 billion in 2010 (Henley et al., 2015).

Similarly, an Australian study estimated the direct costs of smoking-related lung cancer to be AUD 309 million in 2004 (Banks et al., 2019). These costs are likely higher in low- and middle-income countries where the burden of tobacco-related cancer is rapidly increasing (World Health Organisation, 2021).

Indirect Costs of Tobacco-Related Cancer

Indirect costs refer to the economic impact resulting from premature mortality and disability associated with smoking-related cancer. These costs include lost productivity due to illness, disability, and premature death. In the United States, a study estimated the indirect costs of smoking-related cancer to be $53.4 billion in 2010, primarily attributed to lost productivity (Henley et al., 2015). Similarly, an Australian study estimated the indirect costs of smoking-related lung cancer to be AUD 680 million in 2004, with lost productivity accounting for 97% of these costs (Whetton et al., 2019).

Direct Medical Costs of Tobacco-Related Cancer

The direct healthcare expenses related to cancer resulting from tobacco smoking are substantial and projected to rise in the future. In the United States alone, the estimated direct medical costs of smoking-related cancer amounted to $17.5 billion in 2015 (Chand et al., 2023). These costs encompass various aspects, including cancer treatment procedures like surgery, chemotherapy, and radiation therapy, as well as post-treatment care and support services.

The US government shoulders a significant portion of the direct medical costs associated with tobacco-related cancer, primarily through public health insurance programs such as Medicare and Medicaid. In 2015, the estimated cost of smoking-related cancer to Medicare was $3.7 billion, with Medicaid incurring an estimated cost of $3.3 billion (Muhammad, 2021). Private health insurers and individual patients also bear a substantial portion of the direct medical costs related to tobacco-induced cancer.

Cancer Control

Cancer control has witnessed remarkable advancements in recent decades, leading to noticeable declines in cancer incidence and mortality rates in certain nations. These achievements can be attributed to a range of cancer control strategies, which encompass primary prevention, early detection, and treatment. Primary prevention endeavours to minimize exposure to cancer risk factors like tobacco use, unhealthy diet, physical inactivity, and alcohol consumption. Early

detection aims to screen individuals at risk of cancer, facilitating the identification of the disease at its initial stages. Screening programmes are instrumental in detecting cancer at its early stages, leading to more successful treatment outcomes. Commonly employed screening programs target breast, cervical, and colorectal cancers. These initiatives have demonstrated the potential to decrease cancer incidence and mortality rates, especially in breast and colorectal cancer cases (Bretthauer et al., 2023; Hulvat, 2020). Tertiary prevention or treatment encompasses various interventions, including surgery, chemotherapy, radiation therapy, and other approaches, aimed at effectively managing the disease. Public health campaigns play a vital role in cancer prevention, with a particular emphasis on tobacco control. Anti-smoking campaigns have proven effective in reducing smoking rates and preventing tobacco-related cancers. Moreover, these campaigns raise awareness about other cancer risk factors and promote healthy lifestyle behaviour, such as maintaining a balanced diet and engaging in physical activity.

Despite the strides made in cancer control, significant challenges persist, particularly in low- and middle-income countries. Inadequate resources pose a significant obstacle to cancer control, including insufficient funding for prevention, early detection and treatment services, inadequate cancer registries, and insufficient cancer research, as well as limited healthcare infrastructure and human resources. This leads to restricted access to cancer care, particularly for vulnerable populations. Cancer registries are crucial for monitoring cancer trends, evaluating the effectiveness of control programs, and informing research efforts. Many countries lack comprehensive cancer registries, resulting in limited data on cancer incidence, mortality, and survival.

Opportunities for Improvement in Cancer Control

The field of cancer control presents several opportunities for improvement, with a focus on strengthening cancer prevention, early detection, and treatment services. These improvements can be achieved through increased funding for cancer control programs, enhanced collaboration among stakeholders, and greater investment in cancer research.

Enhancing primary prevention strategies involves implementing evidence-based policies and interventions to reduce exposure to cancer risk factors. This includes tobacco control policies, healthy food policies, promotion of physical activity, and alcohol control policies. Governments can also invest in public education campaigns to promote healthy lifestyles and raise awareness about the importance of cancer prevention. Improving early detection strategies requires

increased investment in cancer screening programs, particularly targeting high-risk populations. These programs should be evidence-based to ensure effectiveness and cost-efficiency. Additionally, training healthcare workers can enhance the quality of cancer diagnosis and treatment. Enhancing treatment strategies involves greater investment in cancer research and innovation. This includes developing new and more effective cancer treatments, improving the overall quality of cancer care, and investing in cancer-related infrastructure.

Tobacco Control Sources of Funding

The World Health Organization (WHO) developed the Framework Convention on Tobacco Control (FCTC) in 2003 as an international treaty. The primary objective of the FCTC is to reduce tobacco consumption and mitigate its harmful effects by providing guidelines for tobacco control policies and programs. Within the FCTC, one crucial aspect is the provision for financing tobacco control, which is vital for the effective implementation of the convention. Recognizing the significance of financing for tobacco control, Article 26 of the FCTC states that "Parties shall provide financial support in respect of tobacco control activities in developing country Parties and Parties with economies in transition." (World Health Organization, 2005). The FCTC urges Parties to allocate resources for tobacco control through various means, including taxation, public funding, and contributions from the private sector.

Taxation

Taxation stands as one of the most impactful approaches to financing tobacco control efforts. The FCTC advises Parties to raise tobacco taxes to diminish tobacco consumption and generate funds for tobacco control programs. Numerous countries have adopted tobacco taxes as a means of financing tobacco control. For instance, in 2015, the Philippines raised its tobacco tax by 80%, resulting in an estimated revenue of US$1.5 billion (Ho et al., 2018). This revenue was allocated to support various health programs, including tobacco control initiatives.

Public funds

Public funds serve as an additional means of financing tobacco control efforts. The FCTC promotes the allocation of public funds by Parties towards tobacco control programs. In numerous countries, government budgets are utilized to fund tobacco control initiatives. As an illustration, in the United States, the Centers for Disease Control and Prevention (CDC) takes the lead in implementing tobacco control programs, with its funding stemming from the federal

budget. The CDC's tobacco control initiatives prioritise prevention, cessation, and policy development.

Private sector contributions

Private sector contributions present another viable funding option for tobacco control. The FCTC urges Parties to collaborate with the private sector in financing tobacco control programs. Nonetheless, the FCTC acknowledges the potential conflict of interest that arises between the tobacco industry and tobacco control endeavours. Consequently, the FCTC advises Parties to accept private sector contributions only if they do not undermine the implementation of the convention.

Securing financing for tobacco control is indispensable for effectively implementing the FCTC. The FCTC acknowledges the significance of funding tobacco control and advises Parties to allocate resources through various means, including taxation, public funds, and private sector contributions (World Health Organization, 2005). Challenges included in securing adequate funding are a lack of political will and the pervasive influence of the tobacco industry. Despite these challenges, it remains imperative for Parties to prioritize funding for tobacco control to reduce tobacco consumption and mitigate its detrimental effects.

Governments should receive guidance on implementing industry-specific taxes to fund cancer care, such as tobacco or sugar taxes. Access to affordable advanced cancer treatment in sub-Saharan Africa is limited for publicly funded patients and middle-income families. Even in the private healthcare sector, patients are unaware of treatment costs and insurance limitations. State-run treatment facilities face challenges due to insufficient budgeting, equipment downtime, and funding restrictions. However, public-private partnerships have shown promise in addressing treatment gaps. This session aimed to propose strategies, including public-private partnerships, for financing cancer treatment. Opportunities exist to accelerate investment in cervical cancer treatment, as evidenced by the COVID-19 pandemic. Government reforms can improve national planning, taxation, procurement, spending efficiency, oversight, and investment cases. Success in financing can be achieved through increased awareness, advocacy, and collaboration among global partners, finance institutions, and ministries of finance and health. Financing advanced treatment in sub-Saharan Africa faces challenges of planning, political complexities, inadequate contextualized approaches, and a failure to translate investments into measurable impact. Cancer is not prioritized in global health expenditure,

leading to insufficient government spending. Limited facilities, policy frameworks, procurement processes, private investor interest, and market players contribute to high cancer treatment costs in low- and middle-income countries.

Innovative finance mechanisms for cancer care through tobacco control

Financing cancer care through tobacco control is an innovative way of tackling cancer control. It can be viewed as an integrated approach, aiming to reduce the prevalence of cancer by targeting one of its major risk factors whilst generating funding for cancer treatment and prevention programs. Increasing the taxes on tobacco products is a common approach to raise funds for tobacco control efforts and discourage consumption. A study in Guam observed the successful funding of the Guam Cancer Registry using revenues from tobacco taxes. The study also observed a decrease in tobacco use in young people (David, A.M. et al., 2017).

Other ways of funding cancer care from tobacco include:

- Social Impact Bonds: Social impact bonds are a type of outcome-based financing in which private investors provide funding for a social programme and are repaid by the government if the programme achieves specified social outcomes.
- Health Impact Bonds: Health impact bonds are similar to social impact bonds but specifically focus on improving health outcomes. They can be used to fund tobacco control programs.
- Cap-and-Trade: A cap-and-trade system would place a limit on the total amount of emissions (in this case, the total amount of tobacco products sold) and allow companies to buy and sell emissions allowances. The revenue generated from the sale of allowances could be used to fund tobacco control efforts.
- Philanthropic funding: Philanthropic foundations and organizations also play a role in funding research, education, and advocacy efforts related to tobacco control.
- Corporate Social Responsibility: This would involve encouraging tobacco companies to fund cancer research

These funding methods can subsequently be used to promote cancer research and development, public awareness campaigns, and cancer prevention programmes.

Study rationale

As presented in this chapter, tobacco smoking accounts for a large proportion of the burden of disease in many countries. However, the control of tobacco is still far from optimum worldwide. This is partially attributed to poor legislative control, lack of education and awareness of the effects of tobacco smoking, poor funding for tobacco control programs, the tobacco industry and individuals' inability to make informed decisions. Whilst there has been some progress in reducing smoking rates, more work needs to be done to achieve target smoking rates. Behavioural science can assist in bridging this gap. Behavioural economics explains factors affecting decision-making and this information can be leveraged to assist individuals in making decisions that benefit their health, particularly smoking cessation. Behavioural nudges in particular offer a way of creating an environment where individuals are encouraged to make decisions that benefit their health while maintaining their freedom of choice. This study aims to explore the current awareness and knowledge of such techniques to control tobacco smoking.

Chapter 3: Methods

Research strategy and design

This was an exploratory, cross-sectional, qualitative study conducted between January 2020 and December 2022. An exploratory study is usually done as a first step to provide information that guides further research. Exploratory studies do not aim to provide conclusive evidence but rather preliminary information that can help develop future studies.

An exploratory, cross-sectional, qualitative study is a research design used to gain insights into a particular phenomenon by collecting non-numerical data at a single point in time. This type of study is particularly useful when the goal is to explore new areas where little is known or to develop hypotheses for future research.

A cross-sectional study collects data from participants at a single point in time, rather than over an extended period. This design is efficient for capturing a snapshot of the current state of the question being studied. In cross-sectional studies, researchers can compare different variables simultaneously and identify potential relationships and patterns (Levin, 2006). However, because the data is collected at one point in time, it cannot establish causality or changes over time.

The qualitative approach in this context involves collecting and analysing non-numerical data such as interviews, focus groups, and observations. This approach is ideal for exploring complex phenomena that are difficult to quantify. It allows for an in-depth understanding of participants' experiences, perceptions, and social contexts. Qualitative research is inherently flexible, enabling researchers to adjust their methods as new insights emerge throughout the study (Creswell & Poth, 2018).

Data Collection and Analysis Methods

Semi-structured interview

The data collection method involved semi-structured interviews and a focus group meeting. Semi-structured interviews are a qualitative data collection method where the interviewer follows a guide but has the flexibility to explore topics in-depth as they arise. This approach balances structure and flexibility, allowing the researcher to cover predetermined questions while also probing interesting responses in more detail (Adeoye-Olatunde & Olenik, 2021). Semi-structured interviews are conducted to gain in-depth insights into participants'

experiences, thoughts, and feelings about a particular topic. They are particularly useful when exploring complex issues that require detailed understanding. This method allows researchers to gather rich, detailed data that can uncover new themes and insights that might not emerge in more structured approaches (Adams, 2015).

Focus group meeting

Focus group meetings involve a group of participants discussing a specific topic under the guidance of a moderator. The moderator uses a discussion guide to keep the conversation focused, but participants are encouraged to interact with each other and discuss their views freely. This method is designed to generate diverse perspectives and ideas within a group setting (Nyumba et al., 2018). Focus groups are used to explore collective views and generate discussions that might not occur in one-on-one interviews. They are particularly useful for understanding group norms, cultural values, and consensus on specific issues. The interactive nature of focus groups can stimulate participants to share ideas and experiences that they might not reveal in individual interviews, providing a broader understanding of the topic.

Both semi-structured interviews and focus group meetings are conducted to gather rich, qualitative data that can provide deep insights into participants' perspectives. These methods are chosen when researchers need to explore complex, nuanced issues that cannot be fully captured through quantitative methods alone. They allow for flexibility, adaptation to participants' responses, and the discovery of new insights during the data collection process (Creswell & Poth, 2018).

Before both meetings, the primary investigator Paul Chilwesa (PC) sought informed consent from the participants. The semi-structured interviews were done to assess participants' knowledge of the social and economic effects of tobacco smoking and to assess the awareness and knowledge of behavioural economics in tobacco control amongst key stakeholders. The participants were a diverse group of stakeholders from the following organisations: Research Unit in the Economics of Excisable Products (REEP), University of Cape Town (UCT), Cancer research initiative, UCT FHS, Cancer association of South Africa (CANSA), Department of Health, Tobacco control bill, WHO Framework Convention on Tobacco Control (FCTC), City of Cape Town Health Department and the Western Cape Department of Health. Individual interviews were conducted via videoconference and each session lasted for 30 minutes. For four participants, repeat interviews were conducted to address points of clarification.

The focus group meeting was from a previous meeting co-designed and facilitated by PC (Chilwesa & Cazier, 2021). The focus group session was part of a two-day meeting to discuss the acceleration of cervical cancer treatment services in low-income countries. The meeting had a five-point agenda including a discussion around innovative funding for advanced cervical cancer treatment. The focus group meeting consisted of a diverse group of stakeholders. This included representatives from national ministries of health of countries from Eastern and Southern Africa, affected communities and cancer survivors, activists, advocates, multilateral organizations, United States (U.S.) government agencies, international and local nongovernmental organizations, health care providers, program implementers, and the private sector.

Data analysis was done using the thematic semantic analysis approach of Braun and Clarke (Braun & Clarke, 2006). The initial step involved the verbatim transcription of the interviews followed by the listing of emerging ideas. After this, codes were generated and grouped into potential themes with the supporting data by PC. The themes were reviewed whilst subthemes were developed and finalised according to their relation to the research question. Descriptive statistics were used to report on the characteristics of the research participants.

Sample

A convenience sample of 10 participants was selected for the semi-structured key informant interviews (KIIs) based on their expertise, availability, and relevance to the topic across different regions. This broader geographical spread was intentional to capture diverse policy perspectives and contextual experiences beyond South Africa, thereby enriching the cross-country insights.

In contrast, the focus group discussion (FGD) involved approximately 100 stakeholders, primarily drawn from South African-based organizations, including civil society, public health agencies, and academic institutions. This focus was guided by the country-specific implementation lens of the study, particularly in relation to policy design and local systems engagement.

Furthermore, the interview questions were developed based on the study objectives and refined through a review of existing literature and relevant policy frameworks. They were piloted with two experts to ensure clarity and relevance before final administration.

Research Ethics

Ethical approval was granted by the Commerce Research Ethics committee (REC) of the University of Cape Town (Ethics certificate number: REC 2021/08/012).

Chapter 4: Study Results

Research Results

Description of participants

In this study, a total of 10 participants participated in the semi-structured interview whilst 100 participants were included in the focus group discussion. Upon examination of the responses, three main themes were identified in the analysis with various subthemes.

Knowledge of tobacco-related challenges and anti-tobacco interventions

Participants reported an extensive knowledge of tobacco-related health problems (Figure 1). Of the ten participants, nine were aware that pulmonary, cardiovascular, and heart diseases were tobacco-related. Eight participants were aware of tobacco-related lung and respiratory diseases/ breathing problems. There was limited knowledge of the role of tobacco on oral cerebrovascular accident; nervousness, osteoporosis, and hearing/vision problems. Apart from these health challenges, participants also identified social challenges associated with tobacco use. These included the negative stigma that smokers receive in society, environmental pollution, poverty and inequality as well as an impact on personal finances.

When discussing knowledge of successful anti-tobacco interventions, two participants mentioned health taxes, banning advertising/commercial sponsorships, restricting smoking in public places, and nicotine replacement products/patches. Other responses that were mentioned included: raising the legal minimum age for smoking, policies to stop smoking, public education on the dangers of smoking, and placing visible impact of tobacco on packaging.

Regarding participants' awareness of sin taxes, participants identified various types that are commonly implemented to discourage the consumption of unhealthy products and behaviours. Tobacco taxes were the most frequently mentioned, with six participants highlighting their significance, followed by taxes on sugary products and alcohol, with five participants referring to each (Supplementary figure 1). Upon further exploration of tobacco taxation, whilst there was awareness of tobacco taxation there was limited understanding of the concept, with four participants either fully or partially knowledgeable about tobacco taxation. Only two participants were aware of the South African Tobacco bill in the study.

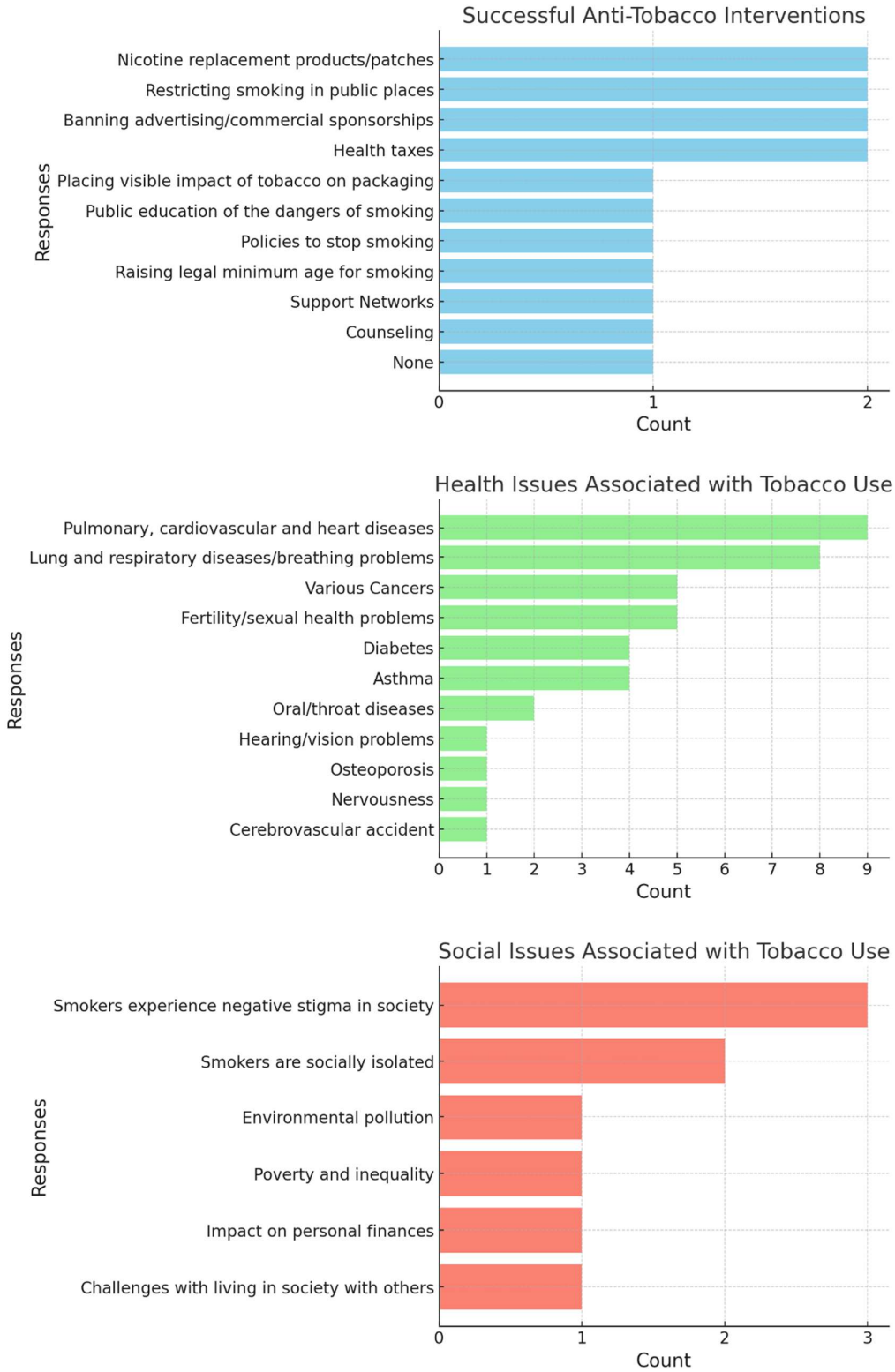

Figure 1: Knowledge of health and social effects of tobacco smoking as well as anti-tobacco interventions amongst tobacco control stakeholders

Figure 2: Quotes from participants regarding social effects of tobacco smoking and knowledge ofanti-tobacco interventions

Behavioural economics and tobacco cessation

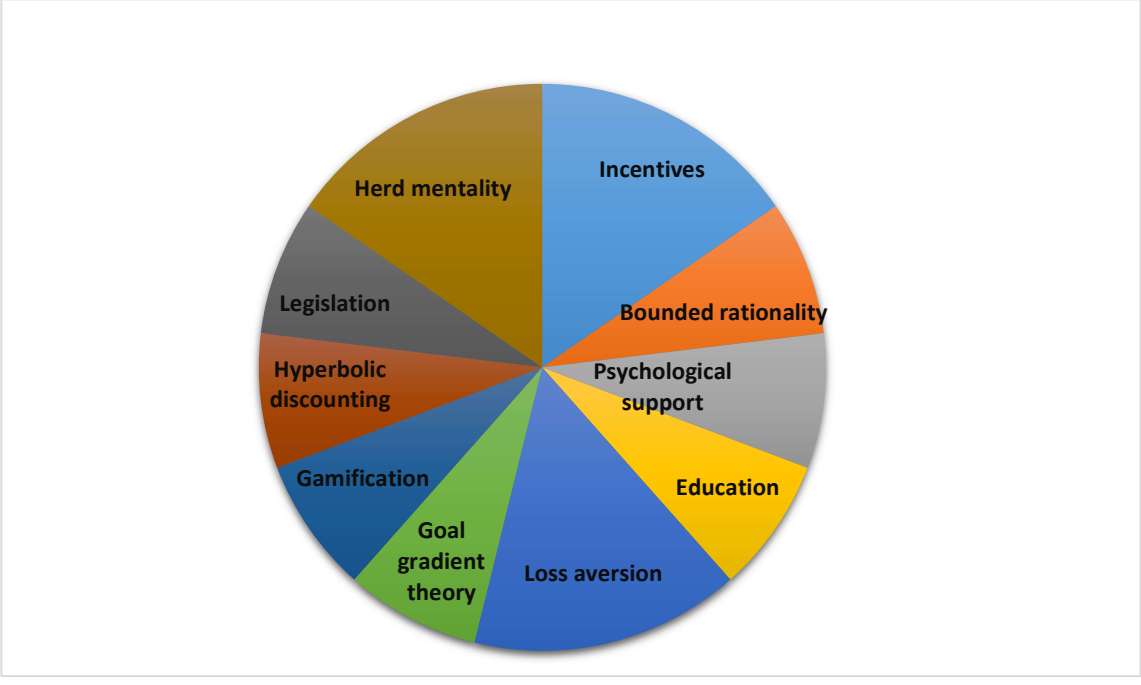

Figure 3: Behavioural economics principles contributing to successful antismoking campaigns

Results revealed that participants' knowledge of behavioural economics principles was varied, with certain themes emerging more frequently than others. The most mentioned principle was that of herd mentality with one participant saying:

"Countries such as New Zealand are now aiming at raising an entire generation that is free of smoking. In such a generation where most peers are not smoking it is not likely that an individual would take up the habit."

The behavioural economics principle of loss aversion was also identified in this study. One participant mentioned higher health insurance payments for smokers compared to non-smokers and another participant mentioned the removal of smokers from health interventions or treatments in clinical trials as an example. Incentives were also mentioned as a nudging technique to quit smoking. Specifically, one participant mentioned that a money back/ point system for individuals who quit smoking was a strategy that was used. Participants also highlighted how behavioural economics provides valuable insights into spending patterns in healthcare, its significance in understanding why individuals make certain healthcare spending choices, and that the knowledge of health risks alone does not necessarily deter individuals from making poor health decisions.

Knowledge of cancer funding sources and innovative cancer funding solutions

When questioned on the knowledge of cancer funding sources, participants mentioned the government as the main source of cancer funding. One participant mentioned co-operating partners and another participant was unaware of the sources of cancer funding in South Africa. Regarding innovations in the funding space for tobacco-related cancers, two participants did not know of any of these innovations. Other participants mentioned sin taxes, health revenue taxes, and partnerships like public-private partnerships. In addition, one participant mentioned,

"*Occupational health risks through workman's compensation commissioner. I am not aware of any in South Africa*"

Barriers and facilitators for cancer control funding

Results on participants' knowledge of cancer funding solutions, facilitators, and opportunities, revealed that there were diverse perspectives and ideas. In the discussion around facilitators and innovative solutions for cancer funding, eight participants mentioned funding from strategic initiatives. One participant specifically said.

"There have been some strategic initiatives from the summit development bank, which is bringing new development financing on the orders. Hundreds of millions of dollars into women's cancers. We're seeing strategic investments from partners in other areas like in childhood cancer."

Economies of scale were also mentioned as potential solutions for cancer financing. Specific examples included: central procurement for all of the cancer centres, pooling of resources to purchase collectively, and bundling costs of reagents. Cancer prioritization was also a common subtheme. Participants particularly referenced the importance of governments prioritizing cancer and the redirection of funding from other areas, such as maternal projects, as potential solutions to the cancer funding problem. Financial planning was also observed to be key. Specifically, improvements in forecasting and quantification of cancer burden and costs, identifying clear budgeting pathways and management of debt by governments. Other suggestions included normative financing, social impact investment and philanthropy (Figure 3). It was also suggested that cancer be invested in at a reasonable per-capita with a participant saying

"We can in fact, invest in cancer at a reasonable per capita cost, $2 and 70 cents for a low-income country, $3 and 95 cents for the lower middle-income countries. And we can save millions of lives from cancer, and specifically in cervical cancer."

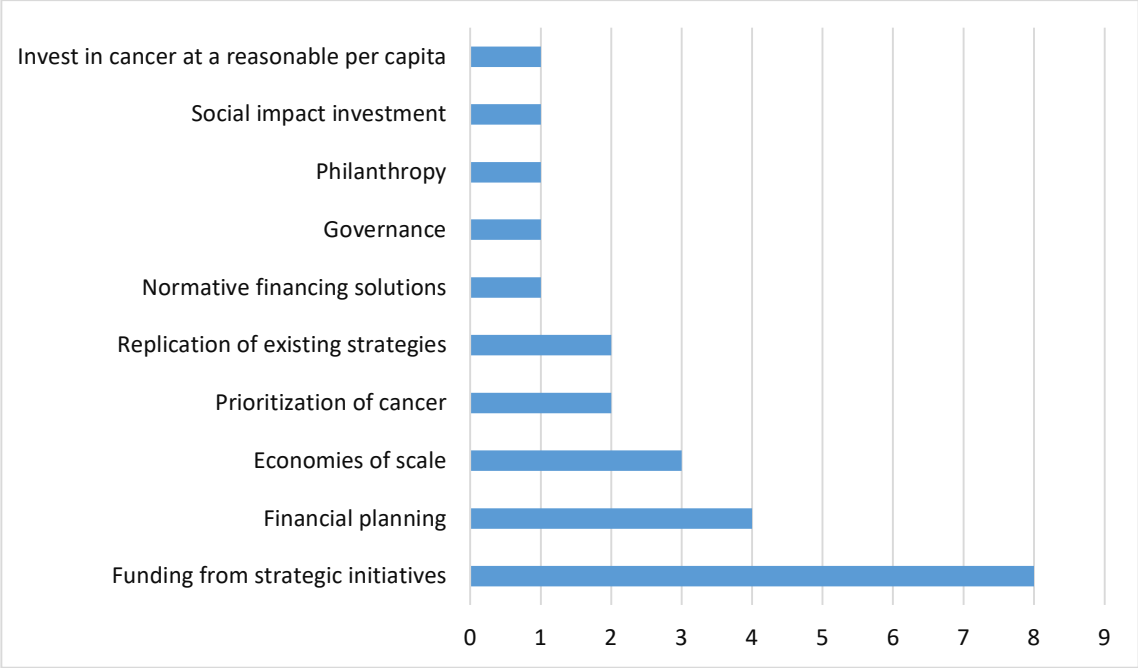

Figure 4: Cancer funding solutions, facilitators and opportunities

During the discussions on participants' knowledge of the role of partnerships and collaborations in enabling the success of cancer financing, several ideas and suggestions were shared. The role of partnerships and collaborations in enabling the success of cancer financing was brought up. One participant mentioned the potential of public-private partnerships (PPPs) to resolve health challenges, including the need for a strong understanding of PPP contractual obligations and technical advice to governments to manage the risks associated with PPPs. Another participant emphasized the inclusion of NGOs to build sustainability. Similarly, one participant mentioned the role of private companies in implementing mechanisms that work in conjunction with the government. Two participants mentioned the collaboration between the World Health Organization (WHO) and pharmaceutical companies to tap into primary preventative funding for vaccines.

Figure 5: Barriers to comprehensive and sustainable cancer funding in low-income countries

The word themes present the barriers to comprehensive and sustainable cancer funding in low-income countries. The main barrier identified was challenges with implementing cancer guidelines such as policy constraints and inadequate dissemination of the policies. One participant said

"A lack of policy also makes it difficult for some of the partners to come in because they don't know where do you want to go? Where are you? And how can they help you?"

Another barrier identified was the lack of cancer treatment prioritization. Participants commonly mentioned that governments did not prioritize cancer financing as a whole. In addition, of the little cancer funding available, cancer screening was prioritized over cancer treatment, leading to the subtheme of selective funding. Poor governance was also an issue, with corruption, constant changing of leadership roles, and political commitments not materialising into something concrete referenced as examples. Participants also mentioned as a barrier the lack of a return through out-of-pocket payments, free cancer services and treatment of cancer patients. Other barriers included less investment in cancer, regulatory barriers and a lack of contextualization of funding approaches.

Participants shared their knowledge regarding partnership barriers to cancer funding, and the responses highlighted several key points. One participant mentioned the lack of platforms for engagement among partners as a barrier. The setup and implementation of Public-Private Partnerships (PPPs) were identified as a barrier by two participants. Similarly, two participants

mentioned the lack of a proper definition or understanding of PPPs as a barrier. One participant mentioned that there is no PPP mechanism in place whilst another highlighted that governments may be hesitant to enter into PPPs.

Discussion of Findings

This study aimed to determine the knowledge of tobacco-related health and social problems. It explored the awareness and knowledge of behavioural economics, including nudging, as tobacco control strategies and innovative ways of funding tobacco-related cancers. We observed that participants had substantial knowledge of tobacco-related problems. However, the awareness of behavioural economic strategies in controlling tobacco use was limited.

Strengths and limitations

To the researcher's knowledge, this is the first study done in South Africa to assess the knowledge of behavioural economics, particularly the principle of nudging in tobacco control. A diverse population of stakeholders in the tobacco control space were included to obtain a diverse perspective. However, the study had its limitations. The sample size included was very small and this could limit the scope of our results. This research might be limited by the personal opinions of individuals and not necessarily generalizable across a larger population. This study is cross-sectional in nature, which means that data was collected at a single time point and cannot necessarily be extrapolated to the future. Tobacco control is a sensitive topic in most countries as the tobacco industry is also key to the economy. As a result, participants might not have been comfortable enough to share their true perspectives on the issue. Moreover, individual responses could be biased by participants' own opinions on tobacco, cancer, or a lack of understanding regarding economic behavioural theories.

Results in context

Stakeholders in the fight against tobacco must be well informed about its negative effects. In this study, participants revealed extensive knowledge of the health and social effects of tobacco smoking. In contrast, a previous study by Biener et.al observed limited knowledge of the health and social impact of tobacco control by professionals in the tobacco control field (Biener et al., 2014). Advances in tobacco control might explain the difference in knowledge in this study and Biener et al.'s study. Regarding the awareness and knowledge of successful tobacco control interventions, our participants demonstrated limited knowledge of these interventions. Previous

studies have also highlighted a limited knowledge of the effect of taxation and informative health warnings on tobacco control. Strategies to reduce smoking rates can include financial incentives, education on the economic effects of smoking, social marketing campaigns, regulation and laws, behavioural economics, and the use of technology. Taxation specifically works by increasing the overall price of tobacco thus making it unaffordable. Economic research has shown that increasing the price of cigarettes through taxes can be an effective way to reduce smoking rates (Gruber & Koszegi, 2001).

Human decision-making and behaviour are driven more by emotions than rationality, as reflected in studies. Current interventions to reduce smoking fail to consider these well-established human behavioural traits, focusing instead on traditional economic principles like price elasticity of demand and graphic warnings on tobacco packages (Sharot et al., 2009b). In this study, the awareness and knowledge of behavioural economics principles amongst tobacco control stakeholders was explored. While various opinions were shared during the discussions, the participants frequently emphasized the need for healthcare workers to improve their understanding of behavioural economics. ome behavioural nudges were identified, specifically incentives, loss aversion and gamification. Under incentives, participants pointed out that individuals who pay for healthcare out-of-pocket are more likely to adhere to therapies. This highlights the influence of financial responsibility in motivating individuals to prioritize their health and comply with prescribed treatments. The concept of providing monetary rewards or loyalty points for individuals who successfully quit smoking was mentioned by a participant. This incentive-based approach aims to reinforce positive behaviour change by offering tangible benefits to those who achieve their smoking cessation goals. Research has shown that offering smokers incentives increase quit rates amongst smokers. Monetary rewards significantly increase quit rates (Glynn, 2014). Additionally, when individuals commit to a specific goal, like quitting smoking, and make a deposit that is returned upon achieving the goal, they are more likely to succeed (Thaler & Benartzi, 2004). Meanwhile, by making the process of quitting smoking more engaging and rewarding, gamification strategies can enhance motivation and adherence to smoking cessation efforts.

Nudging should not only be aimed at smokers but also key stakeholders in the fight against tobacco use. By providing accurate and compelling information about the health risks of smoking, the addictive nature of nicotine, and the benefits of quitting, educational efforts can empower individuals to make informed decisions and take action towards quitting.

Additionally, presenting studies and effective tobacco control strategies such as taxes to key stakeholders and policymakers can also nudge them towards evidence-based decision-making. Knowledge nudging can also be introduced to healthcare providers to aid their patients in their smoking cessation efforts.

Apart from these behavioural nudges, other key behavioural economics principles were identified for successful tobacco cessation programmes. The concept of herd mentality was mentioned, and this principle underscores the influence of social norms and the tendency for individuals to adopt behaviours observed in their social circles. Leveraging this principle, anti-smoking campaigns can promote smoke-free environments and create a collective sense of responsibility towards quitting smoking. The goal gradient theory, which suggests that individuals become more motivated as they approach their goal, was mentioned by one participant. This principle can inform the design of interventions that recognize and leverage individuals' increasing motivation as they progress towards quitting smoking. Furthermore, one participant expressed that the knowledge of health risks alone does not necessarily deter individuals from making poor health decisions. This observation, echoed by another participant, underscores the complex nature of decision-making in healthcare, where individuals may still opt to allocate their resources towards unhealthy habits, such as spending on smoking rather than investing in healthcare (Carminati, 2020).

Limited research has been done to ascertain innovative methods for funding cancer prevention, including tobacco-related cancers. In this study, participants mentioned taxation as a potential way to fund cancer prevention and treatment. Taxation stands as one of the most impactful approaches to financing tobacco control efforts. The FCTC advises Parties to raise tobacco taxes to diminish tobacco consumption and generate funds for tobacco control programs (World Health Organization, 2005). An example is the reform in the sin tax legislation in the Philippines which resulted in a tax revenue growth to $6.6 billion in 2020 from $0.99 billion in 2012, a 32.5% drop in tobacco cigarette sales and a doubling of the national health budget (Diosana, 2020; Phuong & Lo, 2023).

Conclusion and Future Recommendations

African countries, including South Africa, have significant untapped potential to use tobacco taxation as an effective tool for tobacco control. According to the 2023 WHO Global Tobacco

Epidemic Report, excise taxes in Africa account for less than 30% of the retail price of cigarettes - far below the WHO recommendation of 70%, and much lower than the 56% seen in the European region (World Health Organization, 2023). At the same time, youth smoking rates remain high across several African countries, signalling both the urgency and opportunity for stronger fiscal measures. Drawing lessons from European countries, where higher tobacco taxes have helped drive down smoking rates, African governments could enhance tax effectiveness by integrating behavioural economic insights - such as hyperbolic discounting, which highlights how immediate costs (like price hikes) can deter impulsive behaviours like youth smoking. If well-designed and regularly adjusted for inflation, tobacco taxes can deliver sustained health and revenue gains, while helping curb future smoking-related burdens (Benton, D., 2024). It is imperative to allocate increased resources to further explore the role of nudging in tobacco control and generate additional data in this area. Future studies should consider including geographic and temporal information when evaluating behavioural intervention. Geography and temporal patterns affect decision-making and including this information could lead to better tailored interventions.

Chapter 5: Overall conclusions

This study aimed to determine the knowledge of tobacco related- health and social problems as well as the awareness of available tobacco control initiatives. The work aimed to determine the awareness and knowledge of behavioural economics, including behavioural nudges, in the tobacco control space. The first chapter presented the project proposal. The second chapter presented an extended review of the literature and in this chapter the health and social-related effects of tobacco control were explored and the various strategies for the control of tobacco control presented. The challenges associated with these available methods were discussed and behavioural economics was presented as a tool that can be used to optimise tobacco control strategies.

Implications for policy and research

Reassessment of Current Tobacco Control Measures

This study observed the inadequacy of current tobacco control measures in reducing tobacco smoking and tobacco-related health effects. Especially in the context of tobacco-related cancer, it is essential to implement comprehensive policies that address the impact of tobacco and other risk factors on cancer-related outcomes.

African countries, including South Africa, have significant untapped potential to use tobacco taxation as an effective tool for tobacco control. According to the 2023 WHO Global Tobacco Epidemic Report, excise taxes in Africa account for less than 30% of the retail price of cigarettes - far below the WHO recommendation of 70%, and much lower than the 56% seen in the European region (World Health Organization, 2023). At the same time, youth smoking rates remain high across several African countries, signalling both the urgency and opportunity for stronger fiscal measures. Drawing lessons from European countries, where higher tobacco taxes have helped drive down smoking rates, African governments could enhance tax effectiveness by integrating behavioural economic insights - such as hyperbolic discounting, which highlights how immediate costs (like price hikes) can deter impulsive behaviours like youth smoking. If well-designed and regularly adjusted for inflation, tobacco taxes can deliver sustained health and revenue gains, while helping curb future smoking-related burdens (Benton, D., 2024).

Most public health policies are created to change an individual's beliefs and alter their decision-making. By so doing, they focus on the metrics that speak to the accuracy and effectiveness of a particular intervention, in this case, the effectiveness of the different tobacco control measures. However, people's beliefs are not motivated by their accuracy but rather by what outcomes they get from these beliefs, be it emotional or material (Sharot et al., 2022). Therefore, designing policies based on accuracy may need to be reassessed and integrated with the no-accuracy-based outcomes. In addition, the framing of messages around tobacco control should be more personalized to ensure better uptake of the tobacco control measures.

Incorporation of Nudging Strategies

This thesis also highlighted the usefulness of nudging to encourage behavioural change in Chapter 1, however, from the results, there was minimal awareness of behavioural economics as an effective tool for tobacco control. Going forward, policymakers should consider integrating behavioural economics strategies, such as nudging, into tobacco control policies. An example would be placing tobacco products in less easily accessible positions in stores or using graphic warning labels. The alteration of social norms around tobacco smoking would also be useful. For example, changing the conversation from the dangerous effects of tobacco smoking on one's body to the pleasant and life-saving effects of not smoking, as has been done in the field of nutrition.

Research and Data Collection

This work demonstrated the need for more education on current behavioural economics-based initiatives towards the control of tobacco smoking. From the results, stakeholders in the tobacco control space had limited awareness of behavioural economics. To implement these strategies, key stakeholders, including policymakers, should understand the benefits. However, in the South African context, the lack of conclusive data on the effectiveness of nudging and other behavioural economics tools in tobacco control hinders this understanding and indicates a need for more research in this area. Policymakers may need to invest in or encourage studies that assess the impact of various nudging interventions on tobacco usage and population health. This could involve long-term studies and data collection efforts to build a solid evidence base, including collaboration between policymakers and behavioural scientists to effectively implement nudging strategies. Whilst nudging has been proven to be a viable option for tobacco control, the ethical issues surrounding potential manipulation and lack of autonomy need to be

researched further. Since there is a lack of data on the long-term impact of these interventions, any new policies or strategies should include a strong component of monitoring and evaluation. This would help in understanding the effectiveness of the interventions over time and adjusting strategies as needed.

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Annexures

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12 08 2021

Paul Chilwesa

Graduate School of Business

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REF: REC 2021/08/012

Nudging' Health Behavioural Change: Behavioural Economics,

Tobacco Control and Innovative Finance for Cancer Control

We are pleased to inform you that your ethics application has been approved. Unless otherwise specified this ethical clearance is valid until 30-Jun-2023 .

Your clearance may be renewed upon application.

Please be aware that you need to notify the Ethics Committee immediately should any aspect of your study regarding the engagement with participants as approved in this application, change. This may include aspects such as changes to the research design, questionnaires, or choice of participants.

The ongoing ethical conduct throughout the duration of the study remains the responsibility of the principal investigator.

We wish you well for your research.

2021.08.12
18:28:40 +02'00'

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Graduate School of BUSINESS
UNIVERSITY OF CAPE TOWN

MASTER OF PHILOSOPHY IN INCLUSIVE INNOVATION

INTERVIEW QUESTIONS TEMPLATE

1. What tobacco health-related harms do you know?

2. What smoking related social problems do you know?

3. What anti-tobacco interventions do you consider most successful in the last decade?

4. What organizations does yours collaborate with in the smoking cessation campaigns? If none, do you know any other organizations/groups working in this space? Why doesn't your organization collaborate?

5. What are your opinions on behavioral economics and health-care?

6. What behavioral economic principles do you think would have some success in anti-smoking campaigns

7. Do you think the world will ever be tobacco free?

8. How acquitted are you with the South African Tobacco bill?

INNOVATIVE FINANCE FOR CANCER TREATMENT [workshop]			
	Key Takeaways [themes]	**Quotes from Workshop 2: Innovative Finance - Proposed Solutions**	**Notes**
1	New **trends** and **emerging opportunities** to build sustainable and comprehensive **funding** for complex conditions like cancer	in a post COVID environment, looking at the global macro world out there and look at where inflation is at the moment, there's a lot of stimulus floating around. And if we just look at how that stimulus is sort of seeped into society and how China's growing, the U S is growing, India is growing, et cetera. We can see that governments like South Africa have benefited from a huge sort of balance of payments. the trading balance or their trading account at the moment, it's sitting with an excess of 300 billion, there's opportunity to fund infrastructure. if we earmark education and healthcare as number one and two, I think there's an opportunity to approach governments with opportunities in Africa to expand again on high incidents, low penetration government backed by world health organization, through very regulated structure. - Lynn	
		So what we have in South Africa is a private equity fund and the category two license. And we say we have the ability to raise capital if we have the proper proposal and opportunity packaged to put in front of pension funds, retirement funds in South Africa. listening to on the ground numbers from the world health organization, there's a case to be made for huge funding to go into the space. - Lynn	
		from the perspective of local solution not being sufficient, but I think. I would say is that they might not be sufficient today, but we cannot afford anymore not having them for tomorrow. So one thing that I've noticed is that across the continent, we have very strong national cancer institutes that could serve as centers of excellence and, and actually getting us where we should be in terms of also the human resources for this, because we've been very focused on the cost of equipment and cost of items that need to be established, but that the human resources will be also difficult to obtain or from the perspective of education, but also from the perspective of who can provide that education on the continent - unitaid	
		one thing that we have seen with COVID, is that it demonstrated to the countries that some solutions and some health, activities can be done much faster than we than we thoughtcould be done. And I've seen many organizations and donors actually reprogram some of their funding towards COVID. and that was possible from the perspective of the pandemic - unitaid	
		walking outside of just the framework of providing these services for women living with HIV only, and, and thinking about general population and building those structures that could be built through the money of HIV or TB or malaria or whatever is very well-funded by other donors and, actually building the structures that can be used, in a kind of more integrated universal healthcare way, would be also, opportunistic way of, of using earmarked funding for greater good.	
		the U S government is already a really critical funder of cervical cancer with UNITAID. I think between the two of them, they cover 80 to 90% of the current cervical cancer investment, but the U S government also has shown through investments of PEPFAR and malaria that they can commit game-changing amounts of funding that actually make a change. And so I think it would be really profound, as a next step of what the US government is able to do, if the investment in cervical cancer prevention and screening would expand to treatment, and making that part of it. And I think the same call would go to unitaid.	
		we now have a major partner St. Jude children's research hospital that is willing to put a significant sum of money to fully subsidize or partially subsidize medicines for every child with cancer and the question that's allowed us to ask is how can such a significant change in the horizon of childhood cancer also transform the broader cancer agenda.	
2	Consensus on the importance of **new funding models** to increase access to cancer care through **comprehensive UHC packages**	what we've found in some of our work with diagnostics companies for HIV related indications is bundling the costs together of reagents, service and the equipment can be a sustainable payment model and can improve availability for patients because it improves the uptime of the machines, the availability of the service of diagnostics….it also can be very beneficial for government because rather than paying for a machine, a stream of diagnostics and one-off maintenance costs, they can actually pay for everything at once and ensure that the service will be available. - Emily	
		funding exists, you know, innovatively, whether it's within the region or outside the region, capital is out there. I talked about this yesterday in terms of innovative financing. I talked about the work that we've done as a pharmaceutical company to raise capital in the sustainable bond segments. We need to go a bit out of our comfort zones to think about steps that we can take to structure and deploy financing that will actually deliver on the goal that we're trying to achieve in this sort of therapeutic area. - Emmanuel	
		WHO as a convening force and with the ability to put together pools of different types of funding. So the WHO can bring in bilateral funding from governments, they've set up new mechanisms to take contributions from private sector companies in a way that protects the neutrality of the WHO and then they've also started partnerships with philanthropy. So they have this very strong partnership with St Jude hospital. St. Jude's global initiative on children's cancer is actually enabling a very new focus on children's cancer. So I really want to highlight the opportunity of using the WHO in this new way to convene resources and that ambition was there by setting elimination agenda and what needs to happen. As we get past COVID emergency partners need to come forward and the WHO needs to build that pool and direct it in ways that make sense for resources.	
		private philanthropy. we're sending our billionaires into space now.	
		St. Jude has has been able to commit a game-changing amount of money on children's cancer. We have the new initiative on breast cancer, and that has generated a large amount of philanthropy, at least in the U S. And so I don't think we should be afraid of looking at those large pots of philanthropic money that are becoming more flexible and more focused on impact over time and bringing those in either through the WHO mechanism or in other ways	
		the innovative financing area there is a strong push in the private sector for social impact investing. I think saving a woman's life who would otherwise have died, and partnerships with private companies be the diagnostic radiotherapy, pharmaceutical, or health service delivery. Those can be very attractive for innovative financing mechanisms. So I think it would be good in our report to sort of highlight where, where the expansion could actually come from.	
		taxing the the alcohol companies and the tobacco companies risk factors for,cancer and other health matters.	
		conversant when it comes to cancer treatment is very importantly is the technical space. There's very limited human resource, when it comes to	
3	Consensus on the role **partnership** plays in enabling success	one of the bottleneck that we noticed in the region is that there is no PPP mechanism happening. there is that fear from government to jump on PPP. there's no proper mechanismof how a PPP should look like, everybody proposes a PPP, but no one comes up with an idea of what is a true public private partnership. Now it's up to the private entities to actually put together a mechanism to be able to work with government because government want our help. They cannot do it. So that's the bottleneck that I've seen in our industry with regard to a triple Ps [Terry from Elekta]	
		of the contractual obligations, the financial models, and also capacity to manage the contracts once they're in place.	
		because in the PPP structure, government is asked to mitigate the risk to the private company through guaranteeing certain levels of payment. So	
		understand that it's actually less expensive to Subsidize and make available some services so that treatment and … screening is available so that	
		think about these partnerships that actually starts at home first and then builds out as opposed to coming from the outside	
		conversation, the ability of the local stakeholders to deliver the kind of momentous change or impacts that we're looking for by themselves is	
		preventative funding, but the primary preventative funding for the vaccine, there could be an opportunity that could be funded by government	
		have proven that they have the political will to be able to roll out vaccination in their countries. However, we need to be able to get the other	
		maybe one of the points we should try and aim to kind of narrow down is where is the starting point for us because I think there's many, many partners with good intentions , Roche can bring its power in diagnostics and treatments and work and do the same be it vaccinations. But if we, unless we get to some point where we can say this is the starting point, we can actually start engaging on the ground with the governments and driving these true public private partnerships…whether it's even in a particular country or region where we think, let's make a start over there and approach as a United front, when it comes to the partnership- David from Roche	
		there is an improvement on the construction sectors as an innovative financing approach. we may follow that practice, what they are doing on the construction sectors.	
		Well, I think I, for sure, the partners to the government have a relationship to build off and I think can be very useful. it's important to have neutral Advisors for government. PPPs are very complex. technical advisors that understand the structures that can also understand the government's interests and the risks that governments could be taking in the context of a PPP would be very critical…I think the IFC plays that role…I think it's important that any advisor would have that specialized expertise, but also would have the interest of the government at heart, and not just the interest of the deal or the interest of other partner.	
4	The role the **private sector** can play in developing and implementing innovative financing approaches	They may not rise to the level of being a full PPP, but it is more about the payment mechanism, the offering from the private sector provider, and then the ability of government to pay for those services in one payment, rather than a separate streams of funding.	
		So basically through COVID we saw how the private sector had a lot to lose by not being invested in health. And I think that we could leverage that	
		Because I think what we've all struggled with are some of the specificities for how we can translate these concepts into practice. And with this	
5	Misguided policy directives curtail funding priorities / government / governance	when it comes to procurement of materials or diagnostics materials in countries. And when you have a situation where a distributor, for example, is not able to fully participate in meeting the needs of the country because of something as simple, as ability to have credit, to be able to buy reagents and machinery in the first place to be in the country. So being able to even participate within the landscape of services that is available, that is one angle we spoke yesterday with regards to the prioritization of being able to enable governments to prioritize and provide budgetary arrangements that will lead to the availability of some of these services.	
		the table, but to present. it's okay for them to be observers, but we might also probably want them to be at the table with, viewpoints to share	
		health sector or procurement, gateways is limited or changes so frequently. So it's hard to give one set solution because it's a multi faceted	
		they're not as involved from the beginning, fully understanding the challenge and building a solution for it. They often brought in at the last	
		outcome is so daunting that the cancer program Usually don't know even where to start from. So what we're saying as a prioritization and maybe	
		ministries of finance, if we are not focused on what would be the priorities in investments, I think we will not be getting far just because of the	
		important also that these health conversations need to be had in terms of the ministry of finance can understand. So we've heard about return	
6	Miscellaneous	The maintenance costs over the year for over five years for these machines (radiotherapy) would require an excess of a million dollars and I will	
		we've got fixed expertise in place to service those oncology centers, talking about on the ground oncologists and we've got Relationships with	
		about action. - emmanuel	
		outside our comfort zones to take a bite out of that sort of proverbial apple, to move the needle of cancer, um, without any of the fluff, without	
		versus others and this is not to say that a case has not been made already. It's not to say that there are people out there that are constantly trying	
		And as you speak to your stakeholders of the government angle, and, and you hear the same sentiments, you know, we were in a pandemic it's,	
		that allows us to do this for 16 cancers and over 200 different interventions. We're just now finalizing. We're piloting.	

INNOVATIVE FINANCE FOR CANCER TREATMENT			
	Key Takeaways [themes]	**Quotes from Workshop 1: Finance Challenges**	**Notes**
1	New **trends** and **emerging opportunities** to build sustainable and comprehensive **funding** for complex conditions like cancer	cancer screening, increasingly we find that governments are including even low-income countries are including them, their benefit packages. But when you start getting into this question of treatment, it is simply not there. Radiotherapy not covered in low-income countries, selectively covered in middle and middle income countries.	
		we can in fact, invest in cancer at a reasonable per capita cost, $2 and 70 cents for a low-income country, $3 and 95 cents for the lower middle income countries. And we can save millions of lives from cancer, and specifically in cervical cancer, 1 million lives of women who have invasive cervical cancer	
		"I do believe that there is another way that we can also look at this. And that is, through deployment of innovative financing solutions that don't necessarily plug into the government's budget, but generate capital from a plethora of stakeholders who are interested in. Intervening to eradicate this disease. And the reason I say so is because we've seen a number of global healthcare players take advantage of instruments like bonds, specific healthcare deployment infrastructure, um, specific financing tools." - Emmanuel	
		Impact investors: There is a lot of appetite out there in the world to identify governments and healthcare stakeholders that are interested in deploying these normative financing solutions. They have to be tailored in order for them to be sort of transparent enough for those investors to see that the, the impact has been, been delivered on achieved. Novartis, ourselves have taken advantage of this kind of instruments. last year I led my team towards issuing the healthcare industry's first Sustainability linked bond. We raised about $2 billion and this is going to go towards driving up access, not just in Sub-Saharan Africa, but other parts of the lower middle income world where we operate. - Emmanuel	
		there is a role for the global public sector to play, there is a role that that will allow specific countries where the burden of disease is high or where we see the right level of interest, to be able to use their credit standing, to generate specific capital that can actually resolve some of these significant healthcare challenges. - Emmanuel	
		government reimbursement: I think that that is one of the major areas that we need as a community explore because I think reimbursement, which takes away a lot of the capital requirement on governments to have a sustainable ecosystem around treatment, is something that if explored will really help to capitalize foreign investment and its financing, establishing clinical services, provision of medicine, et cetera. If the foreign investors and providers are at least somewhat comforted that some of their investments can be underpinned through some reimbursement models that are appropriate and commensurate, obviously with the investments that are going in country.	
2	Consensus on the importance of **new funding models** to increase access to cancer care through **comprehensive UHC packages**	if we look at the ratio of general government expenditure on cancer per capita to total health expenditure in that country, it's 30 cents for cancer against $70 for the country....we are currently experiencing one 10th of the investments in cancer that are needed in most lower middle income countries and low income countries.	
		There have been some strategic initiatives from the summit development bank, which is bringing new development financing on the orders....We're seeing strategic investments from partners in other areas like in childhood cancer.	
		the primary cost driver is in fact workforce. So how do we catalyze investments in the workforce? Because that in fact will predict our success and our ability to scale up to ensure that cervical cancer treatment services and broader cancer treatment services are available.	
		we've seen in governments that have invested in cancer success breeds success	
		How can we set priorities and reach achievable goals? Because if we do it in fact, will improve cancer care for all.	
		we need to look at the entire ecosystem been supported. So that's equipment been financed. It's service contracts been included in the planning from the very beginning and accounted for in the financials, not thinking in the short term.	
		we need to find out how to finance the workforce capacity building in the acute short term. But we have to look at the longer term delivery of cancer care ...prioritizing financing and the ability to look at long-term initiatives.	
		we see a little bit better response when there's central procurement for all of the cancer centers in the country. but you know, we see worse availability in worse pricing when, cancer centers are procuring individually in cases where there are multiple cancer centers. And then again, when there's a large out-of-pocket market, we see patients buying both from private sector pharmacies, some reputable, some unreputable	
		even though we propose a mechanism by which governments don't become a bottleneck, we do still see the government as a supporting party, example, if a country like Rwanda, by the way, where we are currently having conversations at the very early stages, using the Rwandan government's credit rating to issue a healthcare debt instruments, a bond specific to addressing some of the needs in the heart disease, segments, or diseases sort of therapeutic area, I don't see why we can't do the same thing for cancer.	
		How do we put models in place which pay for actual outcomes? So where women are actually surviving, when they're getting cured of cervical cancer, they have longer progression, free survival or whatever sort of promise of a medicine or screening project could be. Let's reward that. .... ultimately if we can get governments to pay for an outcome, which benefits the patient and it benefits the government, I think that's where we're going to get to the base point.	
		low and middle income countries, whether they're all in Subsaharan, Africa, are not made the same. So there's no way that people can develop a package for LMICs and it's uniform...certain structures just are not the same and you can't address it in the same way. [lombe]	
3	Consensus on the role **partnership** plays in enabling success	And this again is where we can take a role as community. And in fact, respond by stabilizing markets by developing more effective pricing approaches and by relying on key partners to support procurement and mark achieving it.	
		for cancer and the WTO children's EML....our intervention doesn't bring new resources to the table necessarily. But what it does do is try to improve the utilization of existing	
		prices,thereby improving forecasting and quantification, so that we're actually buying what we need and spending our money on medications that will reach the most patients.	
		transform the landscape	
		So when you approach them, there is no way of working because there's no fundamentals on public private partnerships.	
4	in developing and implementing	*Above, under Theme #3.*	
5	Misguided policy directives curtail funding priorities / government / governance	We know that the political commitments that have been made, but we haven't really seen the progress that's needed and how can we accelerate strategic investments in cancer	
		whether it's from a public health program or directorate or clinical services facilities, et cetera. So we don't have a good sense, but there are some examples.	
		government expenditure for cervical cancer patients and cancer patients more broadly is simply inadequate at this point.	
		country. Now, when we look at other countries, of course, we have to ask what's the epidemiological profile, but cancer is a consistent public health priority in many settings, a	
		for NCDs, because we don't have it for cancer, many of these advocacy and high-level political commitments are not materializing into something concrete, which is one of the	
		Many governments are simply not able to engage in a priority setting exercise because the needs in cancer are so broad, but that doesn't need to be the case.	
		ethical challenges that underpins these priority setting exercises	
		guidelines are unavailable or guidelines are being replicated for high-income countries and not being contextualized to particular setting.	
		loudest, gets awarded that....if you don't have a plan and the resources come, then whoever is giving you that money is able to drive the agenda towards what they want to	
		today....they're all facilities that are already set up for NCDs and those facilities, while some were converted to COVID response centers, some of them were reserved for	
		some of the barriers are education training, economy problems, and the lack of staff to oncology facilities included the radiotherapy facilities	*Other aspects of funding: training,*
		So I think at the very basic level, we really need to drive, that support of countries to have greater awareness, understanding knowledge for what the tools are to address the	
		a plan to say, I want to introduce Roche products in Zambia within the next two years, it just won't work because we already have a budget set for the next 10 years, you	
6	Miscellaneous	structured way to track expenditure in cancer.	
		realization.	
		their entirety because of the indirect costs of cancer, because of low-quality care because of delays and diagnostic barriers that threaten the ability to provide a full package of	
		certainly seeing higher prices and lower income settings is [a market failure] - Emily CHAI	
		where we see countries start to prioritize cancer treatment is when someone who has some authority as a personal experience that creates urgency and suddenly it's a	
		hard currency, right? At the end of the day, uh, foreign exchange hard currency is a massive limiting factor.	
		on the one hand, we're showing the world that we've got a robust program we can do on paper, but in reality right now, cancer patients having a very raw deal [zambia]	
		provision of healthcare services in Sub-Saharan Africa. And I feel like we can sit at the table with everyone.	
		impact in terms of the provision of healthcare services in Sub-Saharan Africa. And I feel like, you know, we can sit at the table with everyone.	