

**Assessing the Role of the Private Sector in Non-Communicable Disease Prevention,
Management, and Control: A Systematic Review**

by

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A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Science
in
Public Health and Health Systems

Waterloo, Ontario, Canada, 2022
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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any require final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Background: Due to the high mortality rates globally, addressing non-communicable diseases (NCDs) is a priority included in the Sustainable Development Goals (SDGs). Because the private sector is growing as a provider of health-related goods and services in many places, especially where public sector programs are weak, it has been identified as a significant stakeholder in health systems' management of NCDs. Yet the contributions of the private health sector to addressing NCDs has not been systematically evaluated.

Research Question: This study aims to identify and assess the private sector's role in the prevention, management, and control of NCDs. More specifically, this study will evaluate existing frameworks that have been applied to identify key themes that need to be considered in evaluating the contribution of the private sector in addressing the global burden of NCDs.

Methods: A systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) process. Three types of databases were consulted: health and medicine, multidisciplinary, and business focused, and grey literature searches were also conducted using a search plan template.

Results: A total of 30 articles were included, which were used to identify the six themes that outlined the roles that the private sector plays in NCD management and control. The thematic areas that emerged as important included healthcare provision, innovation, knowledge mobilization, health system investment and financing, public-private partnerships (PPPs), and governance and policy.

Conclusion: This study provides insights on the role of the private sector in controlling and monitoring NCDs. The findings suggest substantial work is needed across sectors for the private sector to effectively manage and control in NCDs. These areas include healthcare provision, PPPs, knowledge mobilization, direct investment and finance, innovation, and governance and policy.

Acknowledgements

Bismillah-ir-Rahman-ir-Rahim

Completing an MSc thesis through the COVID-19 pandemic was incredibly difficult and could not have been done without the support from a number of people. First, I would like to thank my supervisor, Dr. Craig Janes, for introducing me to the field of global health, and for your continued guidance and flexibility during my undergrad and MSc thesis. Thank you for taking me on as a student, I am honoured to have worked with you. I would like to thank my committee members Dr. Zahid Butt, Dr. Zulfiqar Bhutta, and Dr. Rohit Ramchandani. I am appreciative of your invaluable feedback on my work and am grateful for the kindness you all extended to me. Thank you, Dr. Butt, for your guidance, advice, and time through this process. Thank you, Dr. Bhutta, for providing me with opportunities to contribute to work that is meaningful to me, and for being an inspirational role model. Lastly, thank you to Dr. Ramchandani for your mentorship over the last several years and for helping me realize that my passion lies within global health.

A very special thank you to Melissa Santo, Dr. Laura Ingram, Doris Makowich, Dr. Aman Haji, and Zahra Bhimani for your kindness and encouragement through some of the hardest years of my life. Thank you for being there to share both very happy and also low moments with me, and for taking time out from your busy schedules to listen to my rambles and give me such genuine advice. I am so incredibly grateful for the relationships I have developed with each of you.

To my incredibly kind-hearted and caring friends, thank you for cheering me on, for trying to understand what it means to write a thesis, and for knowing when and when not to ask “have you finished your thesis yet?”. Thank you for all the FaceTime, Zoom, and phone calls during all hours of the day and night, and for always reassuring me that I am “almost done” even when you had no idea if that was actually true. Special thank you to my cohort for showing me that grad school can be so fun when you’re surrounded by the right people.

Thank you to my work colleagues at St. Michael’s Hospital for helping me realize that working full-time while writing my thesis was possible, with the support of the most wonderful team. Thank you to my team on the Aga Khan Health Board for Canada, especially Shellyza, Saira, and Azaad for being patient with me as I transitioned through many changes over the last several months and for inspiring me with your dedication to the work we have been doing together.

Lastly, thank you to my family for your love, prayers, for picking me up when I felt like I couldn’t continue, and for the ‘London incentives’. Thank you for instilling in me the importance of education and hard work from a very young age. To my dad, thank you for brightening my days with dad jokes, for the constant reminders to finish my thesis, and for showing me what it means to have faith while pushing through some of the most difficult problems in life. To my mom, for somehow managing to take on the role of a mother, best friend, sister, and mentor all at once. Thank you for always feeding me, comforting me, motivating me, and for taking care of our family – we are incredibly grateful to have you around. I also want to thank my Nana, Nani, Daada, and Daadi for all their love and prayers from across the world. Recently, my Daada passed away, but I know he would have been very happy to hear that I have completed my Master’s. I am incredibly lucky for all your unwavering love and support. Thank you.

Dedication

I would like to dedicate this thesis to His Highness Prince Karim Aga Khan, the 49th hereditary Imam (spiritual leader) of the Shia Ismaili Muslims. The guidance that His Highness has provided and continues to provide to the global Ismaili community has shaped me into the person I am today. His Highness has always emphasized the importance of continuous education, regardless of one's gender, or age, and has emphasized the importance of not losing any opportunity to benefit from the knowledge that can serve our everyday lives. I would not have decided to pursue graduate school without these values instilled in me from a very young age. Thank you, Mawlana Hazar Imam, for your blessings, and for the work that you do to improve the lives of Ismailis and their communities globally. Lastly, thank you for the reminders to be regular in our prayers and to be true to the ethics of our faith. You have been a pillar of strength, motivation, inspiration, and spiritual love and guidance in my life and for that I am eternally grateful.

Shukar Alhamdulillah

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List of Abbreviations

Abbreviation	Meaning
AIDS	Acquired immunodeficiency syndrome
BeHEMOTH	Behavior of interest, health context, exclusions, models, and theories
COVID-19	Coronavirus disease
CVD	Cardiovascular disease
FDA	Food and drug administration
HIC	High-income country
HIV	Human immunodeficiency virus
ICT	Information and communication technologies
LMIC	Low- and middle-income country
MDG	Millennium Development Goal
NCD	Non-communicable disease
NGO	Nongovernmental organization
OOP	Out-of-pocket
PPP	Public-private partnership
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analysis
PTSD	Post-traumatic stress disorder
SDG	Sustainable development goal
SES	Socio-economic status
UCI	Unhealthy commodity industries
WHA	World Health Assembly
WHO	World Health Organization

1.0 Introduction

In the last several years, there has been a significant increase in the recognition of the burden non-communicable diseases (NCDs), particularly in low- and middle-income countries (LMICs) (1). This shift has been driven by changes that impact the several modifiable and non-modifiable risk factors that cause NCDs (1). NCDs are heterogeneous and complex, and therefore require complex solutions that balance a variety of issues which include the prevention of risk factors, as well as the delivery of quality, cost-effective healthcare. A multisectoral approach involving collaboration between diverse stakeholder groups including private sector entities is especially important to prevent, manage, and control NCDs and their risk factors (2). It has been suggested that private sector involvement in addressing NCDs is to support work by government and other entities (3). Yet, the nature of this involvement, including specific details of the potential roles that can be played by private sector actors, has not been systematically evaluated. This is the primary goal of this review.

2.0 Literature Review

2.1 Introduction to NCDs

NCDs are the leading cause of death globally, but disproportionately impact people in LMICs (4). In 2019, NCDs caused over 42 million deaths (74.4% of all deaths globally) out of the total 56 million deaths that year (5). The four major NCDs responsible for these deaths were cardiovascular diseases (CVDs) (32.8% of global deaths), cancers (17.7% of global deaths), chronic respiratory diseases (7.0% of global deaths), and diabetes (2.7% of global deaths) (5). Addressing NCDs has been prioritized globally in the Sustainable Development Goals (SDGs) (target 3.4), which calls for measures to reduce premature NCD-related mortality by one third through prevention and treatment and promote mental health and wellbeing (6). The integration of mental health in NCD and other health programming, and improving access to mental health care will reduce policy fragmentation and therefore will be synergic to achieving SDG target 3.4 (6).

2.2 Risk Factors Causing NCDs

The risk factors for NCDs fall into two categories: modifiable risk factors, and non-modifiable risk factors. Modifiable risk factors are often referred to as being related to lifestyle or behavior, for example smoking or having an unhealthy diet, but are also linked to commercial activities, referred to as the “commercial determinants of health,” insofar as the interests of major corporations and industries, propelled by globalization and liberal trade rules, may constrain or influence lifestyle behaviours at the level of the community (7). Non-modifiable risk factors are those which cannot be reduced or controlled through clinical or public health interventions. Non-modifiable risk factors for NCDs include age, gender, genetics/family history, race, and ethnicity (8,9). Given that these cannot be changed, the focus on NCD prevention, management, and control is centred on modifiable risk factors.

The four most common modifiable risk factors that are linked to NCDs include harmful use of alcohol, tobacco, unhealthy diet, and insufficient physical activity (10). The impacts of these risk factors have been increasingly damaging to the lives of those in LMICs where over 75% of NCD deaths occur, as well as within other poor communities globally (10,11). Those facing poverty are more likely to experience the risk factors for NCDs, which may in turn exacerbate poverty (11). This cyclical relationship between risk factors that cause NCDs, and poverty is accelerated and more evident in LMICs, and among populations of low socio-economic status (SES) (11).

2.3 Prevention of NCDs

Although preventing all NCDs is unrealistic, a large portion of them can be prevented through primary, secondary, or tertiary prevention strategies (8). For the purpose of this study, the definition of ‘prevention’ will focus on activities that reduce individuals’ risks for adverse health outcomes. Prevention of NCDs focuses on management of NCD risk factors, which can span across the individual level, society level, country level, and global level (8). Examples of these prevention strategies can include knowledge dissemination, innovation, governance and

policy implementation, multi-sectoral partnerships, and lifestyle management (8). The implementation of policies at society, country, and global levels have the ability to largely mitigate NCD risk factors through the creation of environments that are conducive to NCD prevention (12). Creating and further improving these environments will play a key role in encouraging and maintaining healthy lifestyles in communities, which are generally strategies implemented by the public sector to help reduce the impact of systemic barriers (12). The focus of this review is on private sector involvement in the prevention of NCDs. This typically involves screening activities as well as individual-level counseling and treatment interventions. Examples might include screening activities for cervical cancer, hypertension, and diabetes. Screening offers an opportunity for effective early treatment, and also helps reduce lifetime risk for diseases like cervical cancer (13). Healthcare providers can also prompt changes to risk behaviours (diet, smoking, exercise).

2.4 Control and Management of NCDs

Within the context of this study, the terms ‘management’ and ‘control’ will be used synonymously and will refer to either of the three following criteria: (1) management of NCD risk factors such as diet, smoking, physical activity, and hypertension; (2) strategies to manage NCDs, related symptoms, and complications after diagnosis; (3) activities undertaken to decrease exposures to various risk factors such as the promotion of activities aimed at the workforce including use of stairs, healthy canteens and sporting events (7,8,12,14,15).

One example of effective NCD control and management strategies includes detection and screening processes (e.g., screening for hypertension, or cervical cancer) to detect diseases in earlier stages (8). Hypertension is a big risk factor for NCDs like CVD and stroke, especially in LMICs like India, where health systems are weak and healthcare workers are overburdened addressing communicable diseases (16,17). Screening for hypertension in the private sector can contribute to the effective control and management of NCDs (16,17). Early detection strategies like screening can help manage and minimize morbidity and mortality rates of NCDs (16,17).

NCDs are known to be silent killers which progress to advanced stages before showing any symptoms (8). Thus, screening and the provision of early or timely treatment is required to effectively address the NCD pandemic, is especially important (8,11,18). However, many countries lack adequate resources to provide appropriate NCD care in a timely manner (11,18). Many scholars argue that a focus of global level NCD-related discussions on individuals’ responsibility to manage behavioral risk factors is misplaced insofar as powerful private interests, such as the international tobacco industry, are implicated in encouraging unhealthful behaviours. Discussions around moving beyond the individual level to address NCDs at higher policy levels is growing (8,19,20). In addition to individual factors, numerous interconnected risk factors such as environmental factors and availability of healthy foods contribute to the development of NCDs (19,20).

Given the multi-level and multi-layered factors that increase risks for NCDs, taking a holistic approach by working across the entire health system is required to effectively tackle NCDs (1,20). It is argued that there needs to be more focus on social, economic, and policy level factors that contribute to the development of NCDs (19). Those predisposed to NCDs and those

with NCDs, generally require personalized, proactive, sustainable care, which are typically high in cost (8). Implementing effective management strategies can significantly minimize cost-related challenges in the health system, while reducing NCD burden globally (8,16).

Because the private sector plays an integral role in health systems globally and is a significant driver of the NCD pandemic, substantial support from private sector stakeholders is essential to prevent, manage, and control NCDs (21,22).

2.5 Defining a Health System

Before evaluating the role which the private sector plays in health systems, it is important to clearly define what a health system encompasses. Although there has been an increase in health system research in the recent years, there is no consensus on one universal definition of a health system or health sector (23). For this paper, the terms ‘health system’ and ‘health sector’ will be used interchangeably. The World Health Organization’s (WHO’s) definition of a health system will be used, which uses the concept of ‘building blocks’ by categorizing different components of a health system into themes or blocks (23). These include service delivery, governance, workforce, information, finance, and technology (23,24). These building blocks work individually and collectively to deliver health services which aim to maintain, improve, or restore the health of individuals as well as their communities (23,24). Despite the interconnected nature of these building blocks, the overall quality of care delivered to individuals and their communities can vary based on the specific characteristics of the healthcare workers, the organizations which they work in, and whether they aim to prevent, manage, or control health conditions.

2.6 Role of Private Sector in Health Systems

Private sector involvement in health systems takes many forms globally, which the WHO categorizes into the following categories: not-for-profit and for-profit, formal and informal, domestic and international (3,21). Private organizations may include small businesses, nongovernmental organizations (NGOs), national/multinational corporations, and private practitioners/providers (3,21). Given the diversity of the private health sector, it may occupy numerous roles in the health system and provide different services or functions. These may include research and development of medicines and technologies, provision of health-related goods and services, management of healthcare institutions, financing of health services, training of health workers, and provision of information technology (21). Many countries use a mixed-model approach where both private and public stakeholders are involved in delivering health-related goods and services in order to meet population needs (21). In countries where there is low private sector capacity, this mixed-model approach may not meet the country’s health goals and targets (21). To address this issue, more research needs to be done to understand the role of the private sector, and how it can be leveraged to enable countries to meet their health goals and targets.

2.7 Establishing a Need for Private Sector Involvement in Addressing NCDs

Because the risk factors for NCDs are multisectoral, a comprehensive approach involving entities from the private sector, as well as the food, agriculture, health, pharmaceutical, finance, planning, education, and transportation sectors are needed to effectively address NCDs (2).

Established in 2000, the Millennium Development Goals (MDGs) highlighted the importance of collaborating and partnering with responsible businesses to reduce high poverty rates (1). MDG 8 specifically called for a ‘global partnership for development’, incorporating the private sector, new technologies, and the pharmaceutical industry (1,25,26). Additionally, MDG 4 and 5 focused on women and children’s health, and MDG 6 acknowledged diseases like malaria, tuberculosis, and human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) (27,28). A significant gap of the MDGs was the lack of goals or targets related to NCDs. The increasing burden of NCDs globally led to the realization that targets and goals should be set to tackle NCDs, which resulted in a cascade of events to tackle NCDs (29).

In 2011, the United Nations High-level Meeting on NCDs took place, during which Heads of State and Government and representatives of States and Governments, gathered to address the prevention and control of NCDs globally (1,3,22,26,30). During this meeting, the private sector was called on to provide support in five specific areas to contribute towards the prevention and control of NCDs (3). These five areas included: (1) reducing the impact of the marketing of unhealthy foods; (2) reformulating and increasing the production of food products to make them healthy, affordable and accessible; (3) promoting and creating healthy workspaces; (4) reducing the use of salt in the food industry; (5) improving affordability and access to medicines (3). In 2013, the World Health Assembly (WHA) endorsed the WHO Global Action Plan for the Prevention and Control of NCDs 2013-2020 which highlights the importance of multi-stakeholder engagement with the aforementioned industries in order to effectively prevent, manage, and control NCDs (2). Following these events, in 2014, the UN General Assembly, ministers noted that limited progress was made in those areas (3). This was followed by the creation of a Working Group at the 67th WHA to develop more granular recommendations for governments (3). The Working Group noted several impediments in achieving prior goals and recommendations made to address NCDs (3,31). These impediments included: (1) lack of awareness around the potential role of the private sector; (2) a lack of supporting regulation and legislative capacity; (3) conflicting public and private objectives; (4) constrained government capability to engage with the wide range of private sector entities; (5) inadequate use of data to support action, target setting, and monitoring processes (3,31,32).

Following these events, the SDGs were established in 2015, recognizing the overlap between NCDs and global development (29). SDG 3 specifically called to “ensure healthy lives and promote well-being for all at all ages”, and target 3.4 called to “reduce by one-third premature mortality from NCDs through prevention and treatment and promote mental health and well-being” (29). In addition, three of the nine health-related targets also focused on NCDs (29). The SDGs also filled a longstanding gap of NCD-related goals and targets by including mental health and well-being, and the prevention and treatment of substance abuse within the targets, an area that has previously not been acknowledged and prioritized (29).

Following this, in 2019 at the UN High-level Meeting, NCDs were acknowledged as significant and complex issues which cannot be adequately addressed by governments alone (33). The meeting voiced the need for public-private partnerships among other recommendations to effectively address the NCD pandemic (33).

2.8 Private Sector Influence on NCD Prevention, Management, and Control

Private sector entities are key players in global health, including NCD prevention, management, and control, as providers of services and products which can have important effects on health (32). When engaging private sector entities in addressing NCDs, there is a need to be discerning when navigating roles and responsibilities as there are both positive and negative implications (3). Distinctions should be made between industries that promote products that contribute to the NCD pandemic versus those that contribute to the solution and rules of engagement must be clearly known (3). Clear rules will help navigate potential conflicts of interest which may rise if objectives of commercial entities do not align with NCD prevention, management, and control (3).

2.8.1 Positives

A few positive implications of private sector engagement include improvements in advocacy and global policies, strengthening healthcare system capacity, increasing innovation in therapies and healthcare delivery, as well as increasing and supporting research and development of products and services (1,32). Private companies can influence leaders within government and nongovernmental organizations to develop measurable outcomes, targets, and reporting mechanisms which facilitate progress and provide accountability in addressing NCDs (1,32). These types of discussions could particularly be important within UN High-Level Meetings and General Assemblies where private and public entities are present and actively looking to set goals (3). Private sector entities can also play a key role in strengthening healthcare system capacity through increasing health education of patients and healthcare professionals (1,32). Public health facilities are typically overcrowded and healthcare workers are not able to spend sufficient time with patients to educate them on disease management and treatment choices (1,32). Private sector entities can provide supplementary educational resources to help inform their care (1,32). Additionally, training healthcare workers can help increase access to NCD treatments and therapies, which is especially important in trying to mitigate the impact of healthcare worker shortages across the health system (1,32). Furthermore, private sector investment in innovative technologies that cost less can help increase access to NCD-related care in the private sector (1,32). For example, investments in tools such as mobile health solutions can facilitate patient-follow up and help patients in remote areas access treatment and care (1,32). Research and development in products that contribute to addressing NCDs is another key area of private sector engagement, and can span across industries (1,32). Private sector entities involved in the food industry are commonly discussed particularly when providing recommendations to governments to address NCDs (3). Three specific examples include reduction of marketing and lobbying of unhealthy food and non-alcoholic beverages to children, product reformulation or salt reduction, and nutrition labelling to support healthier diets (3).

2.8.2 *Negatives*

Although there are several positive impacts of private sector involvement in NCD management and control, there are also many negative implications, some of which include high cost, inequity, and the commercial determinants of health (1,7,15,32,34,35).

Private healthcare services are typically very high in cost compared to those available in the public sector, as the private entities are motivated to make a profit out of medical fees (1,32,35). This poses the issue of inequity of services, accessibility, and quality of care between those who can or cannot afford to pay out-of-pocket for timely and quality care, which is especially important in early stages of contracting NCDs, in order to effectively control and manage them (1,32,34).

Globalization in recent years has led to an increased focus on commercial determinants of health (7,34,35). Recent focus on commercial determinants of health has been around unhealthy commodities which include tobacco, alcohol, sugar, and ultra-processed foods (7,15,34). These ultra-processed foods are high in saturated fats, trans-fatty acids, free sugars, and salt, which lead to the development of NCDs (7,15,35,36). Aggressive marketing of ultra-processed foods, tobacco, and alcohol by the private sector increase risk of young people developing NCDs as the younger population can be especially influenced by advertisements and celebrity promotions (15,34,35). Examples of the global promotions of brands in the private sector include Coca-Cola and McDonald's, which contribute to the rapid surge of obesity rates and related health consequences (34). Though as mentioned above, recommendations have been made in recent years to minimize marketing and lobbying of unhealthy foods and to increase the implementation of strategies like salt reduction and nutrition labelling to promote healthier diets (3,36). Because the private sector is implicated in causing NCDs as it is in offering opportunities in NCD management and control, holistic strategies are needed to effectively address the burden of NCDs globally.

2.9 Examples of Successful Private Sector Engagement to Manage NCDs

When evaluating the private sector's role in health systems, it is important to look at examples of the private sector's current involvements in addressing NCDs globally, to understand key lessons which can then be customized and implemented in other countries. For example, in countries like Lebanon, community pharmacies are generally affordable and trusted, and are therefore generally an individual's first point of interaction with the health system, for testing, screening, and treating NCDs (37). Community pharmacists in Lebanon are implementing initiatives with the support of private pharmaceutical companies and are also responsible for the management of NCDs by improving treatment adherence, as well as empowering patients, and counselling them on medical therapy and interventions (37). Additionally, private-public partnerships in other contexts have also successfully demonstrated the effective prevention, access, and delivery of care for communicable diseases by providing complementary strengths (38). Another example of this is the provision of sexual and reproductive health and HIV products and services by private medical facilities, pharmacies, medicine shops, and NGO/donor funded programs in Zambia (39). In particular, in Zambia, private sector pharmacies are able to supply public-sector provided free products, undercutting

the ability of commercial products to enter the market and compete with existing products, thus increasing accessibility and affordability of products (39). Research has suggested that lessons from models of partnerships to address communicable diseases have the potential to transform the existing solutions in combatting NCDs (38).

3.0 Research Questions

This study examined the following question: “What role does the private sector have in non-communicable disease prevention, management, and control?” To answer this question, I addressed the following sub-questions:

- 1) What key themes could be considered when providing recommendations for areas of private sector involvement in addressing NCDs?
- 2) What are the existing theories, conceptual models, or frameworks related to the private sector’s role in non-communicable disease prevention, management, and control?

4.0 Methods

This systematic review is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA).

4.1 Search Strategy

To retrieve a comprehensive set of results, three types of databases were used: health and medicine, multidisciplinary, and business focused. The databases that will be used include PubMed, EMBASE, Cochrane Library, Web of Science, Business Source Premier, and Proquest/ABI Inform. These databases were searched, using terms related to (i) NCDs; (ii) private sector; (iii) framework/model/theory. The search was limited to articles published in the year 2000 onwards. The full search strategy proposed for databases that were used is presented in Appendix A.

For the grey literature searches, a search plan template was adapted to develop an organized approach to find relevant grey literature (40). The first phase of this template was used, which entails a targeted website browsing process that starts off by listing relevant organizations that have previously or currently been working to address NCDs. The list of organizations was selected through group discussions with a research expert, who was also be the third reviewer on the project¹. Once the list of organizations was developed, each website was searched specifically for reports that highlight NCD prevention, management, and control in the private sector (40). These websites were searched using terms related to (i) NCDs; (ii) private sector; (iii) framework/model/theory, for grey literature published from 2000 onwards.

4.2 Selection Criteria

The BeHEMoTH (behavior of interest, health context, exclusions, models and theories) technique was used to search for research studies as it provides a multi-stage, systematic approach to identifying relevant models and theories (41,42). The BeHEMoTH strategy guided the development of clear and organized set of inclusion criteria (41,42). The types of research studies included were qualitative research studies, and mixed methods studies, however, only qualitative data were extracted from the mixed methods studies. The behavior of interest was the prevention, management, and control of chronic diseases, and was classified as institutional behavior, as opposed to individual behavior. The health context was the private sector. Reference lists of included studies were also screened for relevant articles. Exclusions were any literature that only focused on the public sector. The final component of the inclusion criteria was that any models, theories, frameworks, or concepts that assessed the role of the private sector in NCD prevention, management, and control were included. These general search terms were then adapted to fit the format of each database and then used to conduct the searches. Non-English publications were excluded from the study. Other exclusion criteria included articles without a description of private sector roles, no frameworks/theories/models, no mention of NCDs, empirical studies, presentations, interviews, press releases, newspaper/magazine articles, only abstracts available, duplicates, and articles that are unavailable online. Through group

discussions and guidance with the third reviewer and expert on the project¹, it was agreed that these articles would likely not include the specific frameworks or themes relevant to the research questions, which informed the specific exclusion criteria.

4.3 Data Extraction

The data extraction process began with the creation of a data extraction form in Covidence Software (2021), which was used to extract relevant information from the selected academic articles. The characteristics of included studies was divided into three sections: general information, methods, and findings. The general information section of the extraction form included the title, DOI, first author name, year of publication, and location of the research study. The methods section of the extraction form included the identification of study aim, study design, specific area of focus, and disease/illness. The findings section of the extraction form included key findings (framework components), gaps, and recommendations. This form was used to independently conduct title and abstract screening, and full text review to determine if each article met the required criteria to be included in this project. A second reviewer was recruited to screen the articles to avoid biases¹. Any discrepancies between both reviewers' decisions were addressed through discussion, or by a third reviewer when necessary.

Data extracted from the grey literature publications included: title, author, year of publication, study design, study setting, study aims, and themes/subthemes. A similar approach was applied to the grey literature, with the same reviewers independently screening the title and full text of each publication to determine eligibility to be included in this review. Discrepancies between both reviewers' decisions were addressed by a third reviewer.

4.4 Quality Assessment

Following the extraction process, the same two reviewers independently assessed the quality of the each included study, through the quality assessment tool for qualitative studies developed by Hawker et al. (2002). The tool has nine questions assessing the quality of the following article elements: (1) abstract and titles; (2) introduction and aims; (3) method and data; (4) sampling; (5) data analysis; (6) ethics and bias; (7) results; (8) transferability and generalizability; (9) implication and usefulness, where each section is ranked as good, fair, poor, or very poor. For this review, the questions on ethics and bias, and sampling were excluded as they were not relevant to the included studies and would have skewed the quality assessment outcomes by impacting the final scores. Details outlining the specific quality assessment questions for each section of the article are outlined in Appendix E. Each response was assigned a numerical score between 1 and 4, where 1 = very poor, and 4 = good. The scores for each study will be added up to provide a total score. The total scores will correspond to a letter grade which indicate the quality of the study: A (22-28) = high quality; B (16-21) = medium quality; C (7-16) = low quality. Any discrepancies in quality assessment between both the reviewers were resolved via discussion. However, quality scores were not used to inform analysis of the selected articles and are presented here for reference only.

¹ The second and third reviewers on the project were health researchers from the SickKids Centre for Global Child Health, who were colleagues with the author of this review.

4.5 Data Synthesis

A thematic analysis approach was used for the synthesis of the data, as it is a well suited type of inductive analysis (41). The first step was to identify similarities and differences between the frameworks, models, or theories extracted from each article during the data extraction phase, group them, name them, and organize them into a table as themes and subthemes (41). These themes were identified as factors that affect or explain the private sector's role in monitoring and controlling NCDs. The second step was to define each theme, based on the content from the included papers (41).

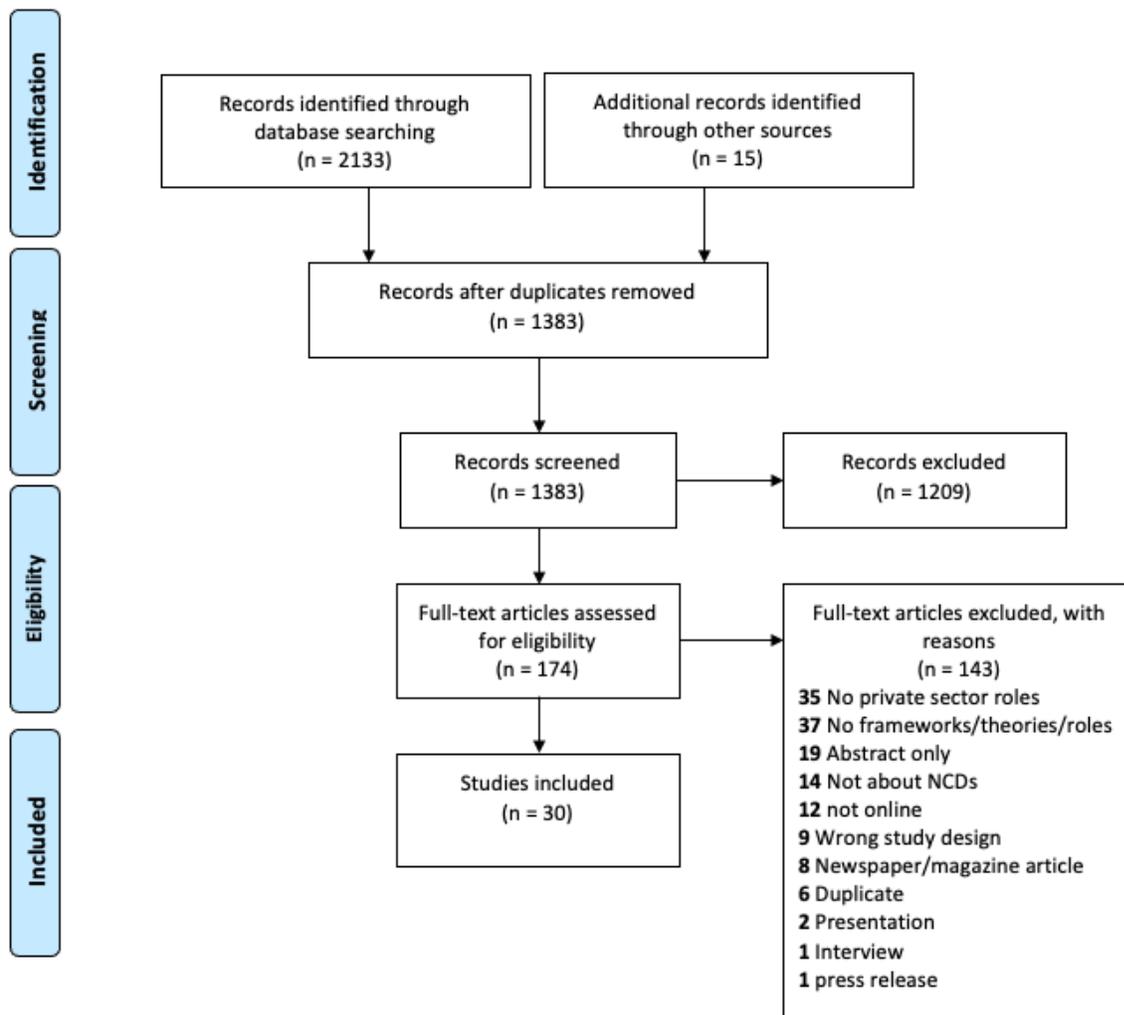
5.0 Results

5.1 Characteristics of Included Publications

Following the removal of duplicates, 1383 unique records (including 15 grey literature publications) were identified through the database and grey literature searches. Full texts of 174 articles were screened and 30 articles were included (figure 1). Key characteristics of each included article are presented in Appendix C and Appendix D.

From the analysis of the final 30 articles, a total of six themes were identified as key pillars that influence the role that the private sector has on NCD management and control. These included public-private partnerships (PPPs) (2,22,25,27,43–49), knowledge mobilization (28,30,49–56), direct investment and finance (28,44,49,50,55–62), healthcare provision (28,46,53,57,59,60,63), innovation (1,30,45,48,58,59,63), and governance and policy (2,26,27,30,44,64). Each theme entails specific subthemes, which are all defined based on the final articles used for synthesis.

Figure 1: PRISMA Flowchart



5.1.1 Quality Assessment

The quality assessment was conducted for best practices as typically recommended for systematic review methodologies. As noted, the quality of the studies did not impact or change the analyses conducted, nor the interpretation of the data.

Thirteen studies were awarded a grade of A for high quality (25–27,30,43–46,49,54,57,62,64), 15 had a grade of B for medium quality (1,2,28,47,50–53,55,56,59–61,63,65), and three had a grade of C for low quality (22,48,58).

The four studies deemed to have low quality had poor or incomplete abstracts, descriptions of methodology, disorganized results, or a combination of the three (22,48,58). The study by Willis et al. (2016) was deemed to be the highest quality, and the study by Subramaniam (2020) was awarded the lowest quality rating. The differences between the quality of both articles were observed across all seven assessment criteria. The study by Willis et al. (2016) was awarded scores of 4 for all questions aside from that for data analysis where it was awarded a 3 (43). In contrast, Subramaniam (2020) was awarded scores of 2 for four questions, and scores of 1 for the questions regarding data collection, data analysis, and results (48).

5.2 Key Themes

5.2.1 Healthcare Provision

The provision of healthcare generally includes four main components: diagnoses, treatments, and the delivery of quality supplies, and products. The private sector is a major healthcare provider for people with NCDs (59). Primary care specifically sets the foundation for disease management programs and other types of care in order to effectively respond to NCDs as it provides sustainable, proactive, community-based care (46,60).

The private sector commonly offers healthcare goods and services such as diagnostic and specialist services that are not readily available in the public sector (57). These services have been provided through private polyclinics which act like small hospitals and house a wide variety of general and specialist examinations, and treatments for a various health conditions including NCDs (57). In addition to polyclinics, another type of private healthcare provider includes small private practices which provide individualized, patient-centered chronic care (57). Private stakeholders have also introduced patient-centered pharmacies, where traditional medicine dispensing responsibilities shift from pharmacists to pharmaceutical technologists, and other healthcare professionals (53). These changes enabled pharmacists to build capacity by providing direct care in outpatient and inpatient contexts, including chronic care provision, therefore increasing access to NCD-related diagnoses and treatment options (53).

5.2.1.1 Quality of Care and Accessibility

In addition to the direct provision of healthcare goods and services, the private sector also plays an important role in the indirect provision of healthcare which are critical in providing quality chronic care. These indirect roles include creating and maintaining health facilities,

providing and maintaining equipment, cleaning services, utilities including power, waste and water management services (28). An example of this is the provision of transportation services support to health facilities, which helps provide healthcare to populations in remote areas where chronic care may be inaccessible (28). Without support from the private sector to provide healthcare, the burden falls on public sector, which has limited finances, human resources, and capital to meet the health needs of populations. Absence of the private sector would result in the weakening of health systems unable to provide adequate care to chronic patients. Private sector involvement in the evaluation, marketing, manufacturing, and distribution of health products contributes to improvement of the entire health system and indirectly improves chronic healthcare provision when done ethically and in an evidence-informed manner (63).

A key aspect of healthcare provision is accessibility, insofar as a well-functioning health system ensures that the population has equitable, safe, and quality access to medicines, vaccines and health services (28). Restructuring health services includes scaling up professional capacity and improving basic infrastructure of healthcare facilities in order to improve the availability and accessibility of all levels of care (52). Accessibility can be divided into three components: physical accessibility, economic accessibility or affordability, and information accessibility (66). Physical accessibility generally refers to the availability of goods and services, within safe physical reach, and allows all sections of the population to receive services as needed (66). Availability is seen as a common barrier to accessing medicines in emerging markets (61). Economic accessibility or affordability involves a person's ability to pay for goods and services without financial hardship (61). This component of access is very closely tied to the provision of and access to high-quality healthcare (61). This is because in areas where healthcare is poor, unaffordable, or unavailable, medical resources are not maximized, thus making related health outcomes and cost savings below optimal levels (61).

Economic accessibility and affordability has the biggest impact on those with NCD comorbidities, their families, their health systems, and national economies (55). These patients are generally prescribed a variety of medicines and more than one type of treatment, and inadequate access to all required care and medicines cause significant negative health consequences, poor quality of life, and reduction in any financial stability (50). Availability of generic branded medicines in the private and public sectors helps increase accessibility to patients, especially in LMICs, as these medicines are usually more affordable (50). However, unavailable medicines in the public sector lead to individuals purchasing the same medications at higher prices through the private sector, or being left without any medicines at all (50). In order to improve access to NCD medicines, national essential medicine lists, policies, quality and prescription-related guidelines need to be updated (50,67). Using these steps as a foundation to create an NCD Drug Information Facility that provides information on medicines, their prices, quality, suppliers, would also increase accessibility of NCD medicines (50,67).

Accessibility of medicines goes beyond the availability and affordability of supplies. Good quality diagnostic tools required for healthcare workers to appropriately screen for NCDs also need to be available (50). Additionally, community involvement is also essential in the accessibility of healthcare, as individual patients need to be complying with prescribed medications and treatments (50). Providing individuals with adequate information related to health issues, and individuals receiving adequate medication for the required duration of

treatments, at the lowest possible cost is also essential in increasing accessibility (50,66). When navigating the challenges associated with accessibility, contextualization is critical to ensure that local barriers are addressed, rather than trying to implement solutions directly from high-income countries (53). These challenges can be addressed through the involvement with local private partners like healthcare workers and clinics.

5.2.2 Innovation

Innovation in the health sector is important for identifying or improving health services, delivery methods, products, systems, policies, and technologies that improve health and wellbeing. Health innovation addresses gaps in healthcare, by creating and demonstrating new perspectives, with an emphasis on responding to the needs of vulnerable populations, including chronic care patients. The private sector plays a major role in health innovation through the provision of innovative technologies that improve affordability, safety, sustainability, efficiency, quality, and/or effectiveness of healthcare, including chronic care (28,45,63).

Medical devices, eHealth solutions, and assistive devices are all examples of health technologies that can be used to manage NCDs as they have the ability to improve wellbeing, quality of life, and provision of care (50,59,68). Leveraging the private sector to create effective life-saving products and increase health literacy education improves distribution, access, and enables health systems to provide quality chronic care (50,63). Innovative technologies developed by private stakeholders have also been consolidated to create disease management programs such as patient registries, evidence-based decision support protocols, and datamining features to create visuals, to inform and engage patients to manage NCDs (48). Private sector stakeholders enable compatibility between disease management programs and smartphones, enhances access to NCD care and supports NCD management and control (48). Technologies can also be used to identify and support centres with expertise in NCD prevention, and also serve as comprehensive extensions of primary care (30,58). Aside from manufacturing technologies, the private sector's work in NCD prevention includes manufacturing of innovative medicines (1,63). One specific example of this is the development of the polypill, which is a pill that combines numerous generic drugs to prevent NCDs (1). The polypill reduces risk for stroke and ischemic heart disease by 80% and 88% respectively, and has been manufactured by private partners for as little as \$1 (1). Two other examples of how the private sector is applying innovation in healthcare includes health technology and insurance incentivization.

In the private sector, information and communication technologies (ICTs) play a large role in the continuous development and dissemination of care, especially for chronic diseases (48,59). Some examples of ICTs in healthcare include telecare, electronic health records, and communication systems. ICTs have been used to improve quality of care, and foster patient-centered care, and educate patients and healthcare workers especially in remote communities which face challenges in delivering NCD care (48,59). In order to tackle challenges, improve NCD-related outcomes, and inform healthcare providers, private sector stakeholders have leveraged ICTs such as augmented reality and artificial intelligence (48).

In addition to providing innovative technologies, the private sector's work in NCD prevention and management includes incentivizing healthy lifestyles through health insurance

companies (1). Innovative incentivized private health insurance programs provide benefits including discounts on healthy products, with further reductions for individuals who have completed health checks (1). Incentivized private health insurance programs have effectively lowered hospital admission rates for NCDs and reduced risks of developing NCDs (1).

5.2.3 Knowledge Mobilization

The theme of knowledge mobilization/translation is another key pillar describing private sector involvement in NCD control and management, as it demonstrates the significant impact health education has on how people manage their health behaviors. One foundational component of the knowledge mobilization/translation theme is capacity building through educating healthcare workers. Many LMICs have a shortage of human resources such as doctors and specialists, and do not have the capacity to hire and train more staff to provide timely care for chronic conditions (50). A resourceful and efficient way to tackle this capacity issue has been through private sector provision of training to nurses, pharmacists, and other health personnel to provide appropriate chronic care (49,51,53,56). Private stakeholders have educated and trained healthcare workers to detect, screen, and manage chronic health cases (i.e., appropriate delivery of medicines, perform basic consultations, and provide appropriate educational materials) (50,53,54). In addition, some training has been developed through private stakeholders establishing post-graduate training programs that focus on local health priorities, especially chronic care (53). A common example of private sector education to address NCDs is through training pharmacists and other healthcare workers to provide chronic care in clinics and hospitals (53). Private educational programs, when integrated into local contexts, have improved the capacity of healthcare systems through shifting dependency from private donors, to being locally sustained with government support (53). Other advantages of these educational programs include a reduction of the load on hospitals and doctors, and increased chronic care provision, as these programs maximized pharmacists' impact through the creation of new learning opportunities (53).

In addition to educating healthcare workers, population-level health promotion strategies are key to increase NCD prevention and awareness within communities, provide opportunities to make lifestyle changes, and minimize the risk of developing NCDs (51). The private sector has been leveraged in various ways to promote positive change in population health behaviors (30,52,55). One example of private sector involvement includes promoting physical activity to reduce risks of developing NCDs, through the creation of recreational spaces and investments in sports and leisure facilities (28). Another example is the involvement of the food industry to promote healthy diets by reducing or eliminating sugar, salt, and trans-fatty acids, which increase risks of developing NCDs (28,30). Private sector involvement to facilitate these changes has helped individuals prevent or self-manage existing chronic conditions and improve health outcomes and quality of life.

A priority of knowledge exchange and training is to build capacity of health systems, which in turn helps in NCD management. Human and institutional capacity are precursors for the effective function of a health system, but are generally overlooked (65). Private sector involvement through educating healthcare workers and providing training programs, has been

effective in building capacity of health systems, to enable them to meet local populations' chronic care needs and manage NCDs (52,53,65).

In the long term, building capacity of health systems, providing training for healthcare workers, and increasing awareness of chronic diseases through private sector involvement, are all essential to provide sustainable solutions to NCD control and management.

5.2.4 Direct Investment and Finance

The private sector is involved in the financing of NCD control and management in several ways, some of which include treatment prices, supply chain costs, health insurance, and direct investments (49,50,59–61). Investment and financing from the private sector have provided the funds required to support the provision of NCD care and ensured that care is financially accessible, especially in resource-poor communities (60). Limited funds and capacity of the public sector create barriers to achieving NCD-related goals and SDG targets, thus emphasizing the need for the private sector to address the barriers (44).

Economic accessibility and affordability are major barriers to accessing quality healthcare as they determine an individual's ability to pay for goods and services without financial hardship, and is closely tied to the provision of and access to quality chronic care (61). In the private sector, the prices and out-of-pocket (OOP) expenditures for chronic care are generally much higher compared to the public sector (50,55,57,62,65). These high prices are attributed to high manufacturer pricing and add-on costs throughout the supply chain (28,46,50,61). One way the private sector addresses financial barriers and increases accessibility is by providing generic branded medicines which are typically more affordable (50). The private sector also finances NCD care through the provision of private health insurance which makes NCD care more affordable and accessible (28,60).

The private sector contributes to the control and management of NCDs through direct investments. One example of direct investment by the private sector includes investment in training centres to increase health service provider education in NCD control and management, producing human resources, and providing capital to establish accredited educational institutions (28,56,58). The private sector also invests in infrastructures like polyclinics, which are facilities that provide health care for a wide variety of diseases including NCDs, and help them manage and control their conditions (57). In areas with minimal health infrastructure and limited health services, private sector investments in cost-effective interventions targeting NCDs helps ensure equitable and affordable provision of chronic care (56). Direct investments strengthen the health system's ability to provide chronic care that meets population needs.

5.2.5 Public-Private Partnerships

Partnerships with the private sector are generally interdependent in nature and involve sharing mutually beneficial support, work, power, finances, and/or information with others, and work towards achieving a common goal, including tackling NCDs (2,25,43). Partnerships with diverse private sector stakeholders are beneficial as they help public healthcare providers mitigate barriers in addressing NCDs, such as lack of health systems capacity for innovation, and

low public sector budgets to provide care (45,46,48,49). PPPs also support the use of technology to reduce NCDs, which is key to improve health outcomes, which further highlights the need to form partnerships with the stakeholders in the private sector (48).

The formation of PPPs are effective in tackling the NCD pandemic, when a diverse range of stakeholders are involved and bring forward various perspectives and resources, as well as when objectives of private sector bodies support the improvement of NCD control and management (22,46). An advantage of partnering with the private sector includes a reduction of financial barriers and challenges associated with NCD treatments (22,45). In addition, collaborating with the private sector increases the accessibility to NCD-related goods and services and improves the capacity of various healthcare workers who provide NCD-related goods and services through education (2,22). Finally, partnerships with the private sector allow for the provision of innovative technologies used to address NCDs (2,22,45).

Despite the benefits of PPPs in the health sector, the global health community is resistant to collaborating with private industry entities (44,47). Partnerships between public entities and private corporations in the alcohol, tobacco, and processed food and drink industries, also referred to as unhealthy commodity industries (UCIs), typically raise controversies as these industries benefit from health-damaging behaviors and are risk factors for NCDs (27). In particular, collaborations with UCIs raise concerns over conflicts of interest between selling private company products that increase NCD-related health issues, and addressing NCD-related needs of communities (43,44,49). Additional concerns include UCI's interests being prioritized over goals to reduce NCDs (43,44). These types of UCIs generate profit by undermining efforts to regulate and tax consumption of their products, and from consumers who buy profit-generating products which increase NCDs, like alcohol (27). Therefore, to address the NCD pandemic, public sector partners have avoided the formation of PPPs with UCIs due to a lack of clear evidence proving the benefits of these partnerships (27)

5.2.6 Governance and Policy

There have been significant shifts in global health governance in recent years due to a surge in global health platforms, increase of transnational commercial actions as a determinant of poor health, and a change from governance in international organizations and states, to private and hybrid public-private authority are a few examples of such shifts (44). The strengthening and/or establishment of global health platforms involved the development of clear guidelines to address conflicts of interest in governance and policymaking between health platforms and the private sector (44). These guidelines have enabled the promotion of clear actions to address factors influencing risk and illness, which is critical to achieve NCD-related goals and SDG targets (2,44). Additionally, understanding the complexities associated with private sector collaboration requires incorporating and governing the complex range of interactions and engagements to successfully address NCDs (44).

In order to effectively manage and control NCDs, a critical dimension of governance that needs to be considered is policymaking (2,64). Private stakeholders involved in health and NCD policymaking include corporations in the alcohol, tobacco, and ultra-processed food and drink industries, also referred to as unhealthy commodity industries (UCIs) (27,64). UCIs generally

have interests that conflict with the health of populations, as they use strategies to promote consumption of unhealthy products that increase the risks of developing NCDs (27,64). More specifically, UCIs use strategies to undermine effective policies and public health programs, including NCD programs, to generate profit from increased consumption of their products (27,30,64). As a result of the conflicting interests between UCIs and government and other organizations to address NCDs, global and public health stakeholders strongly oppose UCI participation in NCD and other health-related policymaking (27,64). The strong opposition for UCI involvement in policymaking is due to the evidence that UCI involvement clearly benefits private stakeholders, but shows no clear mechanisms for public health benefits (26,44).

6.0 Case Studies

Globally, many private sector entities work within health systems to address NCDs. The nature of this work can depend on the NCDs being addressed, the context which the private groups are working in, and specific challenges related to the intervention being implemented. To understand the complexity of factors involved in private sector in addressing NCDs, two case studies below have been developed. The objectives of these case studies are to: (1) demonstrate the role of the private sector in addressing NCDs; (2) specifically illustrate how private entities have been successful in using innovative methods to have a positive impact in the NCD space; (3) understand how addressing NCDs including diabetes, hypertension, CVD, and mental health in specific communities; (4) explore two examples demonstrating current practices and lessons learned in addressing NCDs in order to guide future work and direction for private entities working in the space; (5) to get an overview of how private entities addressing NCDs may differ between HICs and LMICs. The two different case studies that have been developed, are a mix of country focus and specific innovation for a particular NCD focus. The first case study is on a group called Ilara Health, working to address diabetes, hypertension, and CVD in Kenya, and the second is on a group called Delix Therapeutics, working to address mental health conditions in the USA. The topic of mental health was specifically selected as the focus for the second case study due to the increasing acknowledgement in the burden of mental health conditions, as illustrated by the inclusion of mental health and well-being in the SDGs.

6.1 Country #1: Kenya – Ilara Health

6.1.1 Background/Situation

Kenya is undergoing an epidemiological shift in its disease burden from communicable diseases to NCDs, along with many other LMICs (69–71). This transition is increasingly straining the health system, as deaths caused by NCDs increased to 39%, from 27% in 2014, and will continue to increase to 55% by 2030 (69,71). CVD and diabetes are two of the major NCDs that are impacting the Kenyan population (69). CVD-related deaths in Kenya are at 13.8% and include hypertension, heart attacks, stroke, cardiomyopathy, valvular heart disease, and pericarditis (69). The nationally adjusted prevalence of diabetes is estimated to rise to 4.4% in 2035, from 3.1% in 2019, in Kenyan adults, if changes are not made to address the rising cases of diabetes (69). Effective management of NCDs requires a systematic approach to the provision of care including

In Kenya, NCDs have demonstrated a significant decrease in household income by 28.6%, resulting in substantial expenditure leading families into poverty (69). The burden of paying for healthcare is exceptionally taxing on a large portion of the Kenyan population. Included is the difficulty in accessing affordable, preventative healthcare, including basic blood tests and hypertension screening, thus making it more common for Kenyans to seek curative care and treatments if it is affordable and accessible as opposed to preventative care (70,72). The high rates of total health expenditure on NCDs further emphasizes the critical role that health care financing plays in the social and economic development of the country (69,70). In 2017/18, USD \$494.34 million, (11% of the total health expenditure) went towards NCDs in Kenya (69). The Kenya Non-Communicable Diseases and Injuries Poverty Commission Report states that

interventions to mitigate the impact of NCDs necessitates 17% of total health expenditure, and should include interventions like outpatient services for NCDs, comprehensive mental health services, and population-based prevention efforts (69).

6.1.2 Innovation

An exemplary company in the private sector that has been successful in preventative and screening methodologies for NCDs is Ilara Health, a Kenyan e-health start-up. Ilara's work is driven by three main goals: (1) ensure affordable healthcare for all; (2) accessible preventative and detective healthcare services; (3) improve health outcomes across Africa, in line with the SDG 3 (73).

Ilara provides affordable point of care diagnostic tools that can be used for preventative NCD screening, specifically diabetes, hypertension, and CVD (74). Ilara has partnered with other diagnostic technology providers to develop a health data platform and service that provides primary health care in Kenya, specifically in rural and peri-urban areas (74,75). The start-up has also partnered with over 200 clinics across the country (reported in December 2020), to increase access to technology which integrates various diagnostic tools into tablets and mobile phones that are accessible and require minimal training to use (74). Ilara's health diagnostic devices include a portable ultrasound, a hemoglobin test, a hematology analyzer, and a system to screen for diabetes, CVD, and other NCDs (76). These innovative tech-powered diagnostic devices enables health providers to diagnose patients within five minutes of the test (75). Another added advantage of these devices is the ability to store results on the Cloud, which support sharing of results between healthcare providers when necessary (75). These features play an important role in increasing access to preventative care by eliminating wait times to process tests and schedule follow-up appointments to discuss next steps in patients' treatment plans.

Ilara has implemented an innovative financing option for informal clinics that are unable to afford the significantly subsidized equipment (72). This option allows clients to pay a small deposit upon initial purchase, followed by small payments over the 24 month subsequent period, thus reducing the burden of one-time payments (72). To increase patient access to local health services and clinics, Ilara also offers marketing assistance to facility partners through support including marketing materials, exposure on social platforms, and assistance in running medical camps by the host facility (75).

6.1.3 Results and Impact

Ilara's impact has largely been demonstrated by the success in obtaining significant funding, and high number of clinic partners, as it is too early for the health impact results, and preliminary statistics are not available to the public yet.

In 2019, Ilara raised a seed funding round from investment firms and angel investors to help scale its offering (77). This was followed by the securing of a US \$1.1 million grant from the Bill & Melinda Gates Foundation, and a Series A funding round which helped raise a total of US \$3.75 million (74). The funding helped develop plans to grow on-the-ground presence and invest in additional types of technology to increase the screening and delivery of improved health

services, which would later expand across Kenya and the wider East African market (74). A combination of Ilara's funding, media presence, flexible financing options, and accessible technological devices have all played pivotal roles in enabling Ilara to partner with over 600 clinics as of November 2021 (75).

6.1.4 Challenges and Lessons Learned

Despite its innovative business model, and products, Ilara faced several challenges throughout their journey (72). The first challenge was to learn and understand the healthcare services and health system of the context they were working in (72). This was an especially important step in order to gain a sense of familiarity to the local context of the various communities they would be working in. The next challenge was to provide extensive training to healthcare professionals on how to operate the devices, as the medical professionals lacked knowledge in these areas (72). The last challenge was the cash flow barriers faced by the medical clinics, which impacted their ability to pay for the devices despite the innovative financing system that Ilara had implemented (72).

Ilara's implementation and dissemination plan had to cater to addressing the combination of these challenges made it difficult in order for the start-up to be successful in achieving their goals of providing affordable and accessible healthcare to improve health outcomes for all (72). This is a common challenge that tech-enabled companies face across Africa when working in this space (72).

6.2 Country #2: USA – Delix Therapeutics

6.2.1 Background/Situation

In May 2012 at the 65th World Health Assembly (WHA), resolution WHA65.4 on the global burden of mental health disorders was adopted, emphasizing the need for a coordinated response to address mental health challenges (78). As a result, a comprehensive Mental Health Action Plan was developed in consultation with Member States, taking a multisectoral and coordinated approach, emphasizing prevention, promotion, rehabilitation, treatment, care, and recovery (78). The action plan covered an array of mental health topics including various disorders, and was designed to provide guidance for national action plans (78).

In 2019, over 19% of American adults experienced a mental illness, and over 24% of adults with a mental illness reported an unmet need for treatment (79). Since then, the prevalence of depression and anxiety has seen a substantial increase globally, and ~40% among U.S. adults in 2020 due to the COVID-19 pandemic (80,81). This massive increase in the prevalence of mental health problems globally has overlapped with major disruptions to mental health services, further growing the gaps in care (80). As a result, the WHO Mental Health Action Plan has been updated and extended to 2030 and includes targets for the inclusion of mental health into primary health care, and mental health research (80,82). One form of treatment for mental health conditions that has significantly grown since then is the use of psychedelic drugs to treat depression and various other mental disorders, and the market size is projected to reach \$10.75 billion by 2027 (83). Preliminary studies by researchers at Johns Hopkins Medicine have

demonstrated the promise of psychedelic substances to significantly reduce major depressive disorder and post-traumatic stress disorder (PTSD) (84,85). Several clinical trials exploring psychedelics are ongoing at Hopkins, one of which received the Breakthrough Therapy Designation from the U.S. Food and Drug Administration (FDA) (84,85). This designation is granted by the FDA if preliminary clinical evidence indicates promise for substantial improvement over existing therapies, and also demonstrates FDA guidance to design and conduct an efficient development program, to further explore preliminary results (84).

6.2.2 Innovation

Headquartered in Massachusetts, Delix Therapeutics is a preclinical biotech start-up company developing disease-modifying therapeutics to address neurological and psychiatric conditions (86,87). Delix aims to develop neuropsychiatric drugs that are similar to psychedelic compounds, but to not have side effects such as hallucinations, causing patients to “trip” (88). In comparison, other companies like Field Trip Health, in the psychedelic drug space, offer ketamine treatments which can be effective to address mental health conditions like depression, anxiety, and PTSD, but have psychedelic-like effects (88).

Delix has leveraged modern neuropharmacology tools and innovative technologies like a psychLight biosensor to build a platform to advance a suite of novel neuroplasticity-promoting compounds with disease-modifying properties, without the effects of hallucinogens and other safety concerns, which is still being researched as the existing results are preliminary (86). Preliminary studies exploring these compounds have demonstrated neuroplasticity-promoting properties, without producing hallucinations (86). Delix is developing these compounds through preclinical and clinical trials with the goal of materializing the compounds into FDA-approved medicines that will meet the needs of patients facing various mental health challenges (86).

6.2.3 Results and Impact

Delix’s impact thus far has largely been exhibited by the success in obtaining substantial funding, as it is too early for the health impact results, and several clinical trials and other research studies are still underway.

In 2021, Delix was titled one of Fierce Biotech’s “Fierce 15” biotechnology companies, designating it as a highly promising early-stage biotechnology company in the industry, alongside other global emerging companies across various disciplines (89). Delix was given this title due to its rapid development of orally-bioavailable, fast-acting, and long-lasting take-home medicines which have the ability to re-wire the brain to treat psychiatric and neurodegenerative disorders at scale without any risk or safety concerns according to preliminary research studies (89).

In Q3 2021, Delix raised a total of \$70 million Series A financing while continuously growing and strengthening their investor and partnership interests (86). In early 2022, it was reported that Delix closed over \$30 million in a convertible note financing, mainly led by investors, and also secured a \$10 million Strategic Credit Facility in partnership with Comerica Bank’s Technology and Life Sciences practice (87). These funds are said to be used to grow

Delix’s drug development program and platform of therapeutics, as well as the greater team globally (86).

6.2.4 Challenges and Lessons Learned

Like most other groups working in the psychedelic space, one of the biggest challenges faced is the significant degree of stigma that exists around psychedelic drugs and their use to address mental health conditions (88). The stigma is mainly due to people’s fears around “tripping” and other concerns for those with a family history of psychosis or schizophrenia (88). Additionally, the use of psychedelic drugs typically require at least six hours of supervision from a trained therapist, which also adds challenges to scaling up use of these drugs, however, a take-home medication without the trip, like Delix is developing will not have these challenges (88). A combination of significant education efforts and advocacy from scientists and mental health professionals is slowly helping increase awareness of the effectiveness and safety of psychedelic therapies (90). While psychedelic-like therapies are not typically covered under insurance plans, some companies in the space, like Field Trip Health, note that a few benefit plans have started including coverage for psychedelic therapy for their partners (90). In contrast, Delix’s focus is on take-home medicines that only need to be taken once in a while, which will increase accessibility and affordability of treatments for mental health conditions (90).

7.0 Discussion

7.1 Summary of Main Findings

The role of the private sector in controlling and managing NCDs is multifaceted and involves several factors, as demonstrated by the key themes identified. The primary takeaway is that the private sector needs to be included as a stakeholder in NCD control and management as it is the driving force that can provide major contributions to healthcare provision, innovation, knowledge mobilization, finance, as well as governance and policy.

This review contributes to the global understanding of the private sector's role in NCD management and control and supports increased involvement of the private sector. In comparison with other studies that explore the private sector's role in this context, this review has several strengths. The first strength is the use of a search strategy generalized to include articles on HICs, LMICs, and all NCDs. This gives a high-level overview of the global NCD situation, which could be a good starting point when trying to explore a specific NCD globally, or in a specific context. A second strength is the use of 6 databases to cover a variety of areas including health and medicine, multidisciplinary, and business. The diverse range of databases allowed for a multi-sectoral approach to identifying key themes, that goes beyond the field of medicine. The broad search strategy adapted from well-developed methodology ensured that all relevant articles were captured to highlight the most important concepts. The 30 articles used for the analysis of this review demonstrated interactions between the private sector and other pillars that highlight the foundation of NCD control and management. A strength of the themes identified is that they can be applied to different country and income settings. For example, the themes identified can be applied to explore the role that the private sector plays in controlling and managing a specific NCD or can be contextualized for a specific country. Additionally, the themes identified provide policy makers and other stakeholders with important pillars that need to be considered when developing strategies to control and manage NCDs. Finally, the review process involved two primary reviewers to screen articles, and a third reviewer to resolve any conflicts, which improves reliability, validity, and quality of the articles included, and reduces bias. This study fills a large gap in existing literature as there are no other recent studies that include frameworks clearly demonstrating the private sector's role in controlling and managing NCDs. The themes identified were based on the most common areas from the articles in this study and were carefully chosen to clearly show the role that the private sector and other pillars play in controlling and monitoring NCDs. Each theme was clearly defined and was divided into sub-themes to make the definitions more holistic, and applicable to other contexts.

In a study similar to this review, a framework was developed for the prevention and control of NCDs using a primary health care approach (91). In the study by Demaio et al. (2014), the critical topics identified in controlling and preventing NCDs included: intersectoral collaboration and private sector involvement, use of technology, and community participation (through individual behavior changes) (91). They also stressed the importance of implementing healthy lifestyle choices and health promotion strategies such as increased physical activity to reduce risks of developing NCDs (91). The use of technologies like medical equipment and health records systems to manage NCDs was also highlighted in both reviews. However, this review described how new and innovative technologies are used to manage NCDs, whereas

Demaio et al. (2014) simply stated that the use of technology in this context has proven to be beneficial. Another similarity between this review and the framework developed by Demaio et al. (2014) is the identification of alcohol, tobacco, and ultra-processed food and drinks as risk factors for NCDs, which should be addressed across all sectors. More specifically, Demaio et al. (2014) emphasizes the need to enforce policies and legislation for private sector stakeholders to minimize the chronic health impact of alcohol, tobacco, and ultra-processed food and drinks. In contrast, the current review highlights the complexities associated with partnering with private corporations in the alcohol, tobacco, and processed food and drink industries, and underlines the resistance from the public sector to collaborate with these industries to address NCDs. The main difference between the findings of Demaio et al. (2014) and the current review was in how the private sector was mentioned. Although Demaio et al. (2014) mentioned how the private sector impacts NCD control and prevention, the review lacked detailed descriptions of the specific roles private sector, as the focus of the framework was primary health care, and not the private sector (91). In comparison, this study identified various roles that the private sector plays in managing and controlling NCDs, with respect to each of the six pillars identified. Another difference between the two reviews was that Demaio et al. (2014) stated the need for a focus on equity across health systems, to address NCDs effectively, especially among poorer populations, whereas the current review focused more on affordability as a barrier to accessing quality healthcare.

Another study developed a framework to improve the local, national, and international primary healthcare responses to NCDs (92). Similar to this review, the framework developed by Maher et al. (2009) highlighted the importance of identifying and addressing modifiable risk factors such as smoking and alcohol in order to effectively manage and control NCDs (92). The importance of financial investments in health systems including human resources and health care infrastructure to enable the appropriate control and management of NCDs was another similarity highlighted both frameworks (92). The framework by Maher et al. (2009) highlighted critical topics in controlling and preventing NCDs such as political commitment, and standardized diagnostic treatment protocols. The major difference between both reviews is the lack of mention of the private sector and the roles it can play in controlling and preventing NCDs by Maher et al. (2009), which is the central focus of this review. This review also emphasized the role of innovation in improving quality, efficiency, and effectiveness of chronic care, which was not mentioned by Maher et al. (2009). The use of innovative technologies was highlighted to explain the use of disease management programs including patient registries to track and manage chronic patients' records. In contrast, Maher et al. (2009) suggested the use of record keeping systems that are either paper-based, paper-based with a computer-based system, or entirely computer based to track and manage patient records. Maher et al. (2009) further elaborated that despite the method of record keeping used, strategic data could be used to evaluate progress towards NCD management.

7.2 LMIC and HIC Comparison

When exploring the private sector's role in NCD prevention, management, and control, it is important to distinguish how the impact of NCDs varies between LMICs and HICs, as this impacts the private sector's role in each context.

7.2.1 NCDs in LMICs

In LMICs, the burden of NCDs including CVDs, cancers, chronic respiratory disease, diabetes, and mental illnesses has been increasing over several years, disproportionately impacting people of low SES (63). In 2011, studies showed that NCDs caused 2 out of 3 deaths globally, and 80% of these deaths occurred in LMICs (63). These high mortality rates are due to the fact that many LMICs have limited capacity for NCD control and prevention, with limited experience in developing partnerships and integrated models conducive to NCD prevention in low resource settings (52). Health disparities between countries can also be attributed to multiple factors including a lack of awareness of NCDs among health professionals, and the general public, scarce preventative and early detection services, and little availability of essential treatments (50,65). Out of these factors, accessing treatments for NCDs is a significant limiting challenge for LMICs, particularly as availability and use of medicines for NCDs are often unaffordable, or cause catastrophic financial burden to health systems, patients, or patients' families (50,61). For example, in South Asia, the shift in burden of diseases to NCDs has led to an increase in healthcare costs which has resulted in significant OOP health expenditures, disproportionately impacting low SES populations (44). Similarly, in Iran, there is a high proportion of OOP payments from those in the healthcare system (62). Studies have shown that efforts by national and global health communities to address these challenges in LMICs have been ineffective thus far (61). As such, the inability to address these challenges in LMICs has particularly resulted in impairment of younger people's ability to work, or the removal of them and their carers from the workforce, as they are mainly affected by NCDs (1). Additionally, many LMICs lack the ability to enforce regulations due to insufficient technical experience, and low administrative capacity and information systems (24). As a result, few types of regulation exists in LMICs, and any existing enforcement is generally uneven and influenced by corruption and favoritism (24). In particular, there is little regulation of the private sector in LMICs which leaves many patients to face unregulated hospitals, clinics, doctors, and pharmacies (24). Suggestions have been made which dictate the need for health systems in LMICs to be reoriented and strengthened, however these suggestions lack the description of specific strategies that can be used to implement effective evidence-based policies and interventions for NCD prevention and control (65). Some studies have suggested that successful management of healthcare services for patients with NCDs should be tailored to focus on national and regional facilities, as well as strategies to encourage intersectoral partnerships to improve treatment accessibility (62).

7.2.2 NCDs in HICs

NCDs in HICs impact the population differently compared to in LMICs. In HICs, medical innovations have decreased morbidity and premature mortality rates from NCDs, coupled with notable reductions in healthcare costs and health-related expenditures (61). Another notable difference between the two contexts is the impact that commercial determinants of health have on health (27). Transnational corporations in HICs are known to be major drivers of the nutritional shift of traditional diets comprised of whole foods, to highly processed foods and drinks (27). In HICs, these corporations have saturated the market, and the high global average of income that people spend on food (approximately 20% reported in 2013) has further enabled the alcohol and ultra-processed food and drink industries to follow the tobacco industry's path in rapidly penetrating emerging global markets (27). Although these shifts have resulted in an

increase of NCDs such as obesity and diabetes globally, it has been argued that HICs have not been as significantly impacted as LMICs (27).

Another significant difference between the impact of NCDs in HICs versus LMICs is the difference in how businesses can and should continue to respond to NCDs. In HICs, evidence has shown the importance of business's investment in tackling NCDs, through high returns on investment to keep the workforce healthy (1). Studies have focused specifically on employers covering healthcare costs, and implementing workplace health programs to increase NCD prevention (1). The implementation of these strategies have in turn, demonstrated a decrease in employees' time off from work and under-performance at work due to illness, therefore keeping the workforce healthy, increasing profit, and improving performance (1). Additionally, HICs generally regulate various aspects of their healthcare systems such as medical quality, controlling monopolistic prices, and diffusion of medical technology and investments by health facilities (24). These regulatory abilities are enabled due to sufficient technical and legal infrastructures available in HICs (24).

7.3 Limitations

Although this study provides an overview of literature that highlights the private sector's role in addressing NCDs, it is not without limitations. One limitation of this review is the lack of literature on models, theories, and frameworks relevant to the role of the private sector in controlling and managing NCDs. This limitation was evident through the results as the inclusion of the word "framework" and other similar terms within the search criteria significantly reduced the number of articles that were included in the study.

Additionally, the focus of the final 30 articles differed, as NCDs were the primary outcome in some articles, and a secondary or tertiary outcome for other articles. This limitation was evident as some articles only briefly mentioned NCDs or a specific theme, whereas other articles provided detailed explanations of the theme and context of the study. Another limitation of the selection articles was the lack of specific private sector differences between LMICs and HICs. This gap made it difficult to give a holistic picture of how private sector involvement differs between various contexts globally.

Publication bias is another limitation of this study as unpublished articles and opinions that could have provided different perspectives to the results were not included. Finally, it should be noted that this study was limited to English publications only, which may have further restricted the results. To address these limitations, 6 databases were used to cover a variety of areas including health and medicine, multidisciplinary, and business and broaden the scope of the results. Additionally, two case studies developed for this review to provide specific and contrasting examples of ways private sector entities are addressing NCDs within a focused LMIC and HIC context.

7.4 Directions for Future Research

The findings of this review can guide future policy decisions with regards to the role of the private sector in NCD control and management worldwide. While this study identifies 6 key

pillars that are essential to address the NCD pandemic globally, it is important to note that the policy implications can be broken down into 3 levels: global, national, and local. It is also important to note the differences between the private sector's role in LMICs and HICs as populations and individuals are impacted differently in each context. Future studies should compare and contrast the differences in each of these contexts in order to get a more holistic and global picture of how the private sector impacts NCDs.

At the global level, the private sector should be considered as a key player to unite governments and other organization across countries. The private sector can also play a critical role in creating policies and establishing appropriate governance structures to guide decision-making processes when working with stakeholders with similar goals, to address NCDs. The private sector should also be involved in the development of globally sustainable financing mechanisms used to reduce financial barriers in accessing NCD care. At a national level, private sector involvement in financing plays a key role as it can provide funds for country wide NCD management programs, training and educational capacity of chronic care providers, and infrastructure. Partnerships with multi-sectoral private sector stakeholders from the agricultural, business, and media industries should also be leveraged at the national level to maximize collaborative opportunities, inform evaluations, effectively integrate technological innovations, and reach targeted populations. Increasing private sector involvements at the global and national levels will help improve provision of chronic care, increase knowledge and awareness of NCDs, and ease the process of implementing innovative approaches to address NCDs at the local level.

8.0 Conclusion

NCDs increasingly account for the majority of deaths worldwide, thus it is essential to increase the work being done in this area to prevent these deaths. This review suggests that as the private sector plays a critical role in the provision of healthcare, it should be leveraged to control and monitor NCDs. This study provides an updated insight on literature that explores the role of the private sector in controlling and monitoring NCDs. The findings suggest substantial work is needed across sectors for the private sector to effectively manage and control NCDs. These areas include PPPs, knowledge mobilization, direct investment and finance, healthcare provision, innovation, and governance and policy. While this review has identified these critical pillars, there is a need for in-depth analysis of each pillar and its relationship with the private sector. Progress made to advance these areas and build or improve their capacities will facilitate the ability to control and monitor NCDs globally.

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Appendices

Appendix A: Syntax for Database Searches

Appendix B: Data Extraction Form

Appendix C: Descriptive Thematic Table

Appendix D: Summarized Thematic Table

Appendix E: Quality Assessment Table

Appendix A: Syntax for Database Searches

Syntax for PubMed Search

((“Private sector” [MeSH] OR “Private sector”[tw] OR “Private sectors”[tw] OR “Private-sector”[tw] OR “Private enterprise” [tw] OR “Private health sector”[tw]) AND (“Chronic disease”[MeSH] OR “Noncommunicable diseases”[MeSH] OR “Chronic disease”[tw] OR “Chronic diseases”[tw] OR “NCD”[tw] OR “NCDs”[tw] OR “Noncommunicable disease”[tw] OR “Noncommunicable diseases”[tw] OR “Non-communicable disease”[tw] OR “Non-communicable diseases”[tw]) AND (“Model*”[tw] OR “Theor*”[tw] OR “framework*”[tw] OR “Concept*”[tw] OR “Component*”[tw]))

Syntax for EMBASE Search

('private sector' /exp OR 'private sector':ti,ab,kw OR 'private sectors':ti,ab,kw OR 'private-sector':ti,ab,kw OR 'private health sector':ti,ab,kw) AND ('Chronic disease' /exp OR 'Noncommunicable disease' /exp OR 'Chronic disease':ti,ab,kw OR 'Chronic diseases':ti,ab,kw OR 'NCD':ti,ab,kw OR 'NCDs':ti,ab,kw OR 'Noncommunicable disease':ti,ab,kw OR 'Noncommunicable diseases':ti,ab,kw OR 'Non-communicable disease':ti,ab,kw OR 'Non-communicable diseases':ti,ab,kw) AND ('Disease management' /exp OR 'Patient care' /exp OR 'Health care delivery' /exp OR 'Health service' /exp OR 'Management':ti,ab,kw OR 'control':ti,ab,kw OR 'Role':ti,ab,kw OR 'Healthcare':ti,ab,kw OR 'Health care':ti,ab,kw OR 'Health system':ti,ab,kw OR 'Health systems':ti,ab,kw OR 'Health provider':ti,ab,kw OR 'Health providers':ti,ab,kw OR 'Health practitioner':ti,ab,kw OR 'Health practitioners':ti,ab,kw OR 'Medical care':ti,ab,kw OR 'Health clinic':ti,ab,kw OR 'Health industry':ti,ab,kw OR 'Health service':ti,ab,kw OR 'Health services':ti,ab,kw) AND ('conceptual framework'/exp OR 'Model':ti,ab,kw OR 'Theory':ti,ab,kw OR 'Framework':ti,ab,kw OR 'Concept':ti,ab,kw OR 'Concepts':ti,ab,kw OR 'Component':ti,ab,kw OR 'Components':ti,ab,kw)

Syntax for Cochrane Search

((exp “Private sector”[MeSH]) OR (private sector* OR private-sector* OR private enterprise* OR private health sector*):ti,ab,kw) AND ((exp “Chronic Disease”[MeSH]) OR (chronic disease* OR noncommunicable disease* OR non-communicable disease* OR NCD*):ti,ab,kw) AND ((framework* OR model* OR their* OR concept* OR component*):ti,ab,kw)

Syntax for Web of Science Search

TS=(private sector\$ OR private-sector\$ OR private enterprise\$ OR private health sector\$) AND TS=(chronic disease\$ OR noncommunicable disease\$ OR non-communicable disease\$ OR NCD\$) AND TS=(model\$ OR theory OR theories OR framework\$ OR concept\$ OR component\$)

Syntax for Business Source Premier Search

(TI (framework* OR model* OR theory OR theories OR concept* OR component*) OR AB (framework* OR model* OR theory OR theories OR concept* OR component*) OR KW (framework* OR model* OR theory OR theories OR concept* OR component*)) AND (SU chronic disease OR SU noncommunicable diseases OR SU non-communicable diseases OR TI (chronic disease* OR noncommunicable disease* OR non-communicable disease* OR NCD*) OR AB (chronic disease* OR noncommunicable disease* OR non-communicable disease* OR NCD*) OR KW (chronic disease* OR noncommunicable disease* OR non-communicable disease* OR NCD*)) AND (SU private sector OR AB (private sector* OR private-sector* OR private enterprise* OR private health sector) OR KW (private sector* OR private-sector* OR private enterprise* OR private health sector) OR TI (private sector* OR private-sector* OR private enterprise* OR private health sector))

Syntax for Proquest/ABI Inform Search

(MAINSUBJECT(Private sector) OR noft("private")) AND (MAINSUBJECT(chronic disease OR noncommunicable diseases) OR noft("chronic disease*" OR "noncommunicable disease*" OR "non-communicable disease*" OR "NCD*")) AND (noft("framework*" OR "model*" OR "theor*" OR "concept*" OR "component*"))

Appendix B: Data Extraction Form

Main Category	Subcategory	Description
Basic information:	Author	
	Title	
	Journal	
	Funder(s)	
	Year of Publication	
Context & participants:	Participants	Characteristics of the participants
	Context	Context in which the study was embedded (i.e., where issue of interest emerged, setting of study sites, etc.)
Study focus & methods	Aim/objectives	
	Research questions	
	Study design	Methods used by the study (for qualitative studies, for example, interview, focus groups, observations, document analysis, etc.)
	Sampling approach	The way the sample was selected, size of sample, etc.
	Data collection methods	
	Data analysis approach	
	Theoretical model (if applicable)	
Findings:	Example of PPPs	
	Roles of PPPs	
	Additional findings (if applicable)	

	Conclusions	
	Discussion or opinions	What the author(s) argues
	Implications for practice/policy with respect to PPPs	
	Study strengths & limitations	

Appendix C: Descriptive Thematic Table

Title:	DOI:	Author:	Year:	Study design:	Study Setting:	Study Aims:	Themes & Subthemes:
Systems and Capacity to Address Noncommunicable Diseases in Low- and Middle-Income Countries	DOI: 10.1126/scitranslmed.3005121	Ali et al.	2013	Commentary	LMICs	Conduct an analysis of the challenges faced in LMICs and discuss realistic strategies to understand and develop capacity needs and systems to sustainably optimize NCD prevention and care in LMICs.	PPPs (multi-sector collaboration) Knowledge mobilization (capacity building) Governance & policy (taxes, align interests) Direct investment & finance
Engaging the private sector to strengthen NCD prevention and control	DOI: https://doi.org/10.1016/S2214-109X(16)30216-9	Allen & Bloomfield	2016	Comment	Global	Develop more granular recommendations for governments to take action in areas such as promoting healthy workplaces, improving affordability and access to medicines, and reformulating unhealthy food products, as proposed by the Global Coordination Mechanism on NCDs working group for engaging private sector in NCD control.	PPPs (multi-sector collaboration, regulatory frameworks) Governance & policy (taxes, align interests)

Access to essential medicines to treat chronic respiratory disease in low-income countries	http://dx.doi.org/10.5588/ijtld.15.0734	Bissell et al.	2016	Qualitative research	LIC	The present paper aims to describe 1) the global NCD frameworks and targets, in particular the target for availability of affordable NCD medicines; 2) the availability and affordability of medicines for CRDs; and 3) guidance for countries to improve their health systems for the management of CRDs.	Knowledge mobilization (capacity building, medical training, patient education) Direct investment & finance (OOP spending, high costs, mark-ups) Healthcare provision (service delivery, quality, accessibility, affordability) Innovation (technology development)
Transformational trends confounding the South Asian health systems	doi:10.1016/j.healthpol.2008.10.008	Bonu et al.	2009	Qualitative research	South Asia region, consisting of Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka	Discuss 6 trends that may impede the ability to achieve MDGs, and suggest/propose the use of a transformational trends framework to investigate opportunities and challenges to design effective policy responses.	Direct investment & finance (OOP spending) Healthcare provision (service delivery, quality) Innovation (technology development)

Healthy people and healthy profits? Elaborating a conceptual framework for governing the commercial determinants of non-communicable diseases and identifying options for reducing risk exposure	DOI 10.1186/s12992-017-0255-3	Buse et al.	2017	Qualitative research	LMICs	We use a conceptual framework to review three models of governance of NCD risk: self-regulation by industry; hybrid models of public-private engagement; and public sector regulation. We analyse the challenges inherent in each model, and review what is known (or not) about their impact on NCD outcomes.	PPPs Governance (taxes, conflicts of interest)
A new funding model for a chronic-care focused healthcare system in Australia	https://doi.org/10.1016/j.jhpt.2018.07.007	Garcia-Goni et al.	2018	Qualitative research	Australia	Examine how the Australian health system is responding to significant increases in health expenditures due to emerging healthcare technologies, aging populations, and increased burdens of noncommunicable and chronic diseases.	Direct investment & finance (insurance, OOP spending) Healthcare provision

Partnerships To Provide Care And Medicine For Chronic Diseases: A Model For Emerging Markets	doi: 10.1377/hlthaff.2009.0896.	Goroff & Reich	2010	Qualitative research	MIC	Discuss a business model for cooperation between public health and private businesses to address the emerging problem of chronic diseases in emerging markets	PPPs (align interests, multi-sector collaboration) Direct investment/finance (OOP spending, high costs) Healthcare provision (accessibility, quality, availability, affordability) Governance & policy
Changing the future of obesity: science, policy, and action	doi: 10.1016/S0140-6736(11)60815-5	Gortmaker et al.	2011	Qualitative research	Global	Identify several cost-effective policies that governments should prioritize for implementation for the prevention of obesity.	PPPs (multi-sector collaboration) Knowledge mobilization (capacity building, training) Direct investment & finance Innovation (technology development)

The private sector, international development and NCDs	https://doi.org/10.1186/1744-8603-7-23	Hancock et al.	2011	Qualitative Research	Global	Innovative products can help address NCDs, implementing incentives to make healthy choices can also help address NCDs	Innovation
Gender blind? An analysis of global public-private partnerships for health	DOI 10.1186/s12992-017-0249-1	Hawkes et al.	2017	Qualitative research	Global	Analyse how the Global Public Private Partnerships for Health (GPPPH) address gender, both as a determinant of health, and as an influence on health system priorities. We use the methodology of gender analysis to systematically identify and critically appraise gender policies and commitments of GPPPH to assess key gaps and address gender-related health inequities	PPPs (multi-sector collaboration, align interests) Governance & policy

Systems Thinking as a Framework for Analyzing Commercial Determinants of Health	https://doi.org/10.1111/1468-0009.12339	Knai et al.	2018	Original Scholarship	Global	Explore the value of a systems approach to understanding NCDs as an emergent property of a complex system, with a focus on commercial actors.	Governance & policy (regulation, conflict of interest, policymaking)
Guiding Principles And A Decision-Making Framework For Stakeholders Pursuing Healthy Food Environments	http://dx.doi.org/10.1377/hlthaff.2015.0635	Kraak et al.	2015	Qualitative research	USA	Offer six guiding principles and a decision-making framework that stakeholders can use to ensure that partnerships are accountable and effective in their pursuit of health-related goals.	PPPs (multi-sector collaboration, mobilize resources) Innovation
Taking on the challenge of noncommunicable diseases: We all hold a piece of the puzzle	https://doi.org/10.1016/S0020-7292(11)60016-7	Lohse et al.	2011	Qualitative research	LMICs	Describe how social determinants and intergenerational NCD transmission could be addressed in whole-of-systems response broader than healthcare system	PPPs (multi-sector collaboration, trust) Healthcare provision (quality) Innovation (technology development) Governance & policy (accountability)

Framework legislation for non-communicable diseases: and for the Sustainable Development Goals?	doi:10.1136/bmjgh-2017-000385	Magnusson, Roger S.	2017	Other:		Review some of the issues countries might consider when developing framework legislation for NCDs.	PPPs (multi-sector collaboration) Direct investment & finance (funding) Governance & policy (accountability, legislation, conflicts of interest)
Leveraging the power of partnerships: spreading the vision for a population health care delivery model in western Kenya	https://doi.org/10.1186/s12992-018-0366-5	Mercer et al.	2018	Qualitative research	Western Kenya	Describe how AMPATH built on its collective experience as an academic partnership to support the public-sector health care system, with a major focus on scaling up HIV care in western Kenya, to a system poised to take responsibility for the health of an entire population. Highlight a novel, collaborative tool to communicate our vision and achieve strategic alignment among stakeholders at all levels of the health system	PPPs (align interests) Healthcare provision (service delivery, quality, accessibility)

India's NCD strategy in the SDG era: are there early signs of a paradigm shift?	https://doi.org/10.1186/s12992-018-0357-6	Mondal & Van Belle	2018	Other: Debate	India	Building community awareness and active mobilization, using already existing community platforms. Risk factors can be categorised as modifiable/behavioural risk factors and non-modifiable/individual risk factors	Knowledge Mobilization
Profits and pandemics: prevention of harmful effects of tobacco, alcohol, and ultra-processed food and drink industries	http://dx.doi.org/10.1016/S0140-6736(12)62089-3	Moodie et al.	2013	Other: Qualitative study	Global	Explore the role of tobacco, alcohol and ultra-processed food/drink industries in NCD prevention and control	PPPs (self-regulation) Governance & policy (legislation, regulation, taxes)
Comparative Study on Health Management for Chronic Patients and Design of a Health Management Model for Iran	DOI: 10.5152/jarem.2017.1067	Motaghi et al.	2017	Qualitative research	Iran	Design a health management model for chronic patients in Iran	PPPs Direct investment & finance (OOP spending) Healthcare provision (service delivery)

Prevention of non-communicable diseases in Pakistan: an integrated partnership-based model	doi:10.1186/1478-4505-2-7	Nishtar	2004	Commentary	Pakistan	Discuss strengths and limitations of WHO Pakistan's NCD PPP initiative and highlight the value partnership arrangements bring to facilitate missions and mandates of various partners.	Knowledge mobilization (behaviour change, capacity building) Direct investment & finance (funding) Healthcare provision (service delivery, availability, accessibility) Governance & policy
Framework and case study for establishing impactful global health programs through academia - biopharmaceutical industry partnerships	https://doi.org/10.1016/j.sapharm.2020.07.018	Pastakia et al.	2020	Qualitative research	Kenya	Provide a framework for developing successful partnerships around five central principles. This framework will then be applied to two representative pharmacy collaboration case studies focused on training and donations.	PPPs Knowledge mobilization (patient education, capacity building, medical training) Healthcare provision (accessibility, service delivery, quality)

Health system challenges of NCDs in Tunisia	DOI: 10.1007/s00038-014-0616-0	Romdhane et al.	2015	Qualitative research	Tunisia	Assess Tunisia's national policies for managing CVD and diabetes, and the preparedness and capacity for managing them in the Tunisian health system	PPPs (multi-sector collaboration) Knowledge mobilization (capacity building) Direct investment & finance (OOP spending, private spending)
Africa's health: could the private sector accelerate the progress towards health MDGs?	doi: 10.1186/1755-7682-4-39.	Sambo & Kirigia	2011	Debate article	Africa	Provide an overview of the state of public health, summarize 2010-2015 WHO priorities, and explore the role that the private sector could play to accelerate efforts towards health MDGs in the African Region.	Knowledge mobilization (behaviour change, medical training, capacity building) Direct investment & finance (funding, insurance) Healthcare provision (accessibility, quality, service delivery)

The relevance of the public-private partnership paradigm to the prevention of diet-associated non-communicable diseases in wealthy countries	http://dx.doi.org/10.1080/17441692.2015.1012528	Stevenson, Michael A.	2015	Qualitative research	Wealthy Countries	Assess the relevance of PPPs to prevent diet-associated NCDs	PPPs (trust) Innovation Governance & policy
Public-Private Partnerships Delivering Smart Health to Combat the Tsunami of Noncommunicable Diseases	doi:10.3233/SHTI200573	Subramaniam	2020	Case report	LMICs	Present three case studies of smart health deployed through PPP to try improving outcomes.	PPPs (multi-sector collaboration) Direct investment & finance Innovation (technology development)
Introducing a model of cardiovascular prevention in Nairobi's slums by integrating a public health and private-sector approach: the SCALE-UP study	http://dx.doi.org/10.3402/gha.v6i0.2510	van de Vijver et al.	2013	Qualitative research	Nairobi	To develop and introduce a model of cardiovascular prevention in the slums of Nairobi by integrating public health and private sector approaches	PPPs Knowledge mobilization (capacity building, medical training)

Partnering Private Primary Care Practices With Federally Qualified Health Centers In The Care Of Complex Patients	DOI: 10.1377/hlthaff.2010.0377	Weinkle et al.	2010	Analysis & Commentary	USA	Explain how new delivery and payment models following health reform may lead to small practices and federally qualified health centers forming partnerships	Knowledge mobilization (capacity building) Direct investment & finance Innovation (technology development)
Understanding and improving multi-sectoral partnerships for chronic disease prevention: blending conceptual and practical insights	https://doi.org/10.1332/174426417X15090122455415	Willis et al.	2017	Qualitative research	Global	Summarise existing conceptual frameworks related to multi-sectoral partnerships using system mapping process Explore any adaptations of these systems maps with federal government practitioners involved in brokering multi-sectoral partnerships Propose how these system maps may be used for informing multi-sector partnership theory, methods and practice	PPPs (multi-sector collaboration, align interests, trust) Knowledge mobilization (knowledge exchange) Direct investment & finance (funding)

Strengthening the evidence and action on multi-sectoral partnerships in public health: an action research initiative	doi: 10.24095/hpcdp.36.6.01.	Willis et al.	2016	Qualitative research	Canada	Describe the development and initial priorities of an action research project (a learning and improvement strategy) that aims to facilitate continuous improvement of the CCDP, Ås partnership initiative and contribute to the evidence on multi-sectoral partnerships	PPPs (multi-sector collaboration, mobilize resources) Innovation
Addressing NCD Co-Morbidities: Shared Opportunities for Action		NCD Alliance	2016	Policy brief	Global	Highlight shared opportunities to address NCD co-morbidities	Knowledge mobilization Finance
Barriers and the Opportunities at the Base of the Pyramid - The Role of the Private Sector in Inclusive Development		United Nations Development Programme	2014	Report	Global	Understand the role of the private sector to build more inclusive and equitable markets for human development	Knowledge mobilization (training and education) Governance & policy

Global Action Plan for the Prevention and Control of Noncommunicable Diseases		World Health Organization	2013	Report	Global	Recognize governments' primary role and responsibility to respond to NCDs and recognize the role of international collaboration to support national efforts	PPPs Governance & policy
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Appendix D: Summarized Thematic Table

Study:	Themes and Subthemes:					
Ali et al.	PPPs Multi-sector collaboration Align interests	Knowledge mobilization Capacity building	Direct investment & finance			Governance & policy Taxes
Allen & Bloomfield	PPPs Multi-sector collaboration Align interests					Governance & policy Taxes
Bissell et al.		Knowledge mobilization Capacity building Training Patient education	Direct investment & finance OOP spending High costs Mark-ups	Healthcare provision Service delivery Quality Accessibility Affordability	Innovation Technology development	
Bonu et al.			Direct investment & finance OOP spending	Healthcare provision Service delivery Quality	Innovation Technology development	
Buse et al.	PPPs					Governance Taxes Conflicts of interest
Garcia-Goni et al.			Direct investment & finance Insurance OOP spending	Healthcare provision		

Goroff & Reich	PPPs Align interests Multi-sector collaboration		Direct investment & finance OOP spending High costs	Healthcare provision Accessibility Quality Availability Affordability		Governance & policy
Gortmaker et al.	PPPs Multi-sector collaboration	Knowledge mobilization Capacity building Training	Direct investment & finance		Innovation Technology development	
Hancock et al.					Innovation	
Hawkes et al.	PPPs Multi-sector collaboration Align interests					Governance & policy
Knai et al.						Governance & policy Regulation Conflicts of interest Policymaking
Kraak et al.	PPPs Multi-sector collaboration				Innovation	
Lohse et al.	PPPs Multi-sector collaboration Trust			Healthcare provision Quality	Innovation Technology development	Governance & policy Accountability

Magnusson, Roger S.	PPPs Multi-sector collaboration		Direct investment & finance Funding			Governance & policy Accountability Legislation Conflicts of interest
Mercer et al.	PPPs Align interests			Healthcare provision Service delivery Quality Accessibility		
Mondal & Van Belle		Knowledge mobilization				
Moodie et al.	PPPs					Governance & policy Legislation Regulation Taxes
Motaghi et al.	PPPs		Direct investment & finance OOP spending	Healthcare provision Service delivery		
Nishtar, S		Knowledge mobilization Behaviour change Capacity building	Direct investment & finance Funding	Healthcare provision Service delivery Availability Accessibility		Governance & policy

Pastakia et al.	PPPs	Knowledge mobilization Patient education Capacity building Training		Healthcare provision Accessibility Service delivery Quality		
Romdhane et al.	PPPs Multi-sector collaboration	Knowledge mobilization Capacity building	Direct investment & finance OOP spending Private spending			
Sambo & Kirigia		Knowledge mobilization Behaviour change Training Capacity building	Direct investment & finance Funding Insurance	Healthcare provision Accessibility Quality Service delivery		
Stevenson, MA	PPPs Trust				Innovation	Governance & policy
Subramaniam	PPPs Multi-sector collaboration		Direct investment & finance		Innovation Technology development	
van de Vijver et al.	PPPs	Knowledge mobilization Capacity building Training				
Weinkle et al.		Knowledge mobilization Capacity building	Direct investment & finance		Innovation Technology development	

Willis et al.	PPPs Multi-sector collaboration Align interests Trust	Knowledge mobilization	Direct investment & finance Funding			
Willis et al.	PPPs Multi-sector collaboration Mobilize resources				Innovation	
NCD Alliance		Knowledge mobilization	Finance & affordability			
United Nations Development Programme		Knowledge mobilization (training and education)				Governance & policy
World Health Organization	PPP					Governance & policy

Appendix E: Quality Assessment Table

Section Evaluated	Evaluation Question(s)
Abstract & titles (did they provide a clear description of the study?)	<p>Good: structured abstract with full information and clear title.</p> <p>Fair: abstract with most of the information.</p> <p>Poor: inadequate abstract.</p> <p>Very poor: no abstract</p>
Introductions & aims (Was there a good background section and clear statement of the aims of the research? full but concise background to discussion/study containing up-to-date literature review and highlighting gaps in knowledge; clear statement of aim AND objectives including research questions.)	<p>Good: full but concise background to discussion/study containing up-to-date literature review and highlighting gaps in knowledge; clear statement of aim AND objectives including research questions.</p> <p>Fair: some background and literature review; research questions outlined.</p> <p>Poor: some background but no aim/objectives/questions OR aims/objectives but inadequate background.</p> <p>Very poor: no mention of aims/objectives; no background or literature review.</p>
Method & data (Is the method appropriate and clearly explained?)	<p>Good: method is appropriate and described clearly (e.g. questionnaires included); clear details of the data collection and recording.</p> <p>Fair: method appropriate, description could be better; data described.</p> <p>Poor: questionable whether method is appropriate; method described inadequately; little description of data.</p> <p>Very poor: no mention of method AND/OR method inappropriate AND/OR no details of data.</p>
Data analysis (Was the description of the data analysis sufficiently rigorous?)	<p>Good: clear description of how analysis was carried out; description of how themes derived/respondent validation or triangulation.</p> <p>Fair: descriptive discussion of analysis.</p> <p>Poor: minimal details about analysis.</p> <p>Very poor: no discussion of analysis.</p>
Results (Is there a clear statement of the findings?)	<p>Good: findings explicit, easy to understand and in logical progression; tables, if present, are explained in text; results relate directly to aims; sufficient data are presented to support findings.</p>

	<p>Fair: findings mentioned but more explanation could be given; data presented relate directly to results.</p> <p>Poor: findings presented haphazardly, not explained and do not progress logically from results.</p> <p>Very poor: findings not mentioned or do not relate to aims.</p>
<p>Transferability & generalizability (Are the findings of this study transferable (generalizable) to a wider population?)</p>	<p>Good: context and setting of the study are described sufficiently to allow comparison with other contexts and settings.</p> <p>Fair: some context and setting described but more needed to replicate or compare the study with others.</p> <p>Poor: minimal description of context/setting.</p> <p>Very poor: no description of context/setting.</p>
<p>Implication & usefulness (How important are these findings to policy and practice?)</p>	<p>Good: contributes something new and/or different in terms of understanding/insight or perspective; suggests ideas for further research; suggests implications for policy and/or practice.</p> <p>Fair: two of the above.</p> <p>Poor: only one of the above.</p> <p>Very poor: none of the above.</p>

Appendix F: Quality Assessment Results

Study	Abstract / title	Introduction / aims	Data collection	Analysis	Results	General - izeability	Implica - tions	Tota l	Grad e
Ali et al., 2013	3	3	1	1	3	4	4	19	B
Allen & Bloomfield, 2016	1	3	1	1	3	3	2	14	C
Bissell et al., 2016	3	4	1	1	4	4	3	20	B
Bonu et al., 2009	3	3	2	2	4	3	3	20	B
Buse et al., 2017	4	4	3	3	4	4	4	26	A
Garcia-Goni et al., 2018	4	4	1	1	3	4	4	21	B
Goroff & Reich, 2010	3	3	1	1	3	3	3	17	B
Gortmaker et al., 2011	4	4	1	1	4	4	4	22	A
Hancock et al., 2011	3	4	1	1	3	4	4	20	B
Hawkes et al., 2017	4	4	3	3	4	4	4	26	A
Knai et al., 2018	4	3	3	3	4	4	4	25	A
Kraak et al., 2016	4	3	2	2	4	4	4	23	A
Lohse et al., 2011	3	2	1	1	3	4	3	17	B
Magnusson 2017	4	4	1	1	4	4	4	22	A
Mercer et al., 2018	4	4	2	1	3	4	4	22	A
Mondal & Van Belle, 2018	4	4	2	1	2	4	4	21	B
Moodie et al., 2013	4	4	1	1	4	4	4	22	A
Motaghi et al., 2017	4	3	4	2	3	3	3	22	A
NCD Alliance, 2016	1	2	1	1	4	4	4	17	B
Nishtar, 2004	3	4	1	1	3	4	3	19	B
Pastakia et al., 2020	4	3	1	1	3	4	4	20	B
Romdhane et al., 2015	3	4	3	3	4	3	4	24	A
Sambo & Kirigia, 2011	4	4	1	1	2	4	2	18	B

Stevenson, 2015	4	4	1	1	4	4	3	21	B
Subramaniam, 2020	2	2	1	1	1	2	2	11	C
UNDP, 2014	1	2	1	1	4	4	4	17	B
van de Vijver et al., 2013	4	4	3	2	2	4	4	23	A
Weinkle et al., 2010	4	1	1	1	3	2	1	13	C
Willis et al., 2017	2	4	4	3	4	4	4	25	A
Willis et al., 2016	4	4	4	3	4	4	4	27	A
World Health Organization, 2013	1	3	1	1	4	4	4	18	B