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A Comparative Study on the Effectiveness of Sugar Tax Policy in Public Health: France (Developed Nation) and Chile (Developing Nation)

by

Presha Cakravarti Kuppan

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DECLARATION

I, Presha Cakravarti declare that this dissertation has been composed by myself, that the work contained herein is entirely my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or qualification, in whole or in part, except as specified.

Signed: Presha Cakravarti Kuppan

Date: 6 October 2025

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Abstract

Background: The increasing prevalence of obesity and obesity-related NCDs have prompted governments to enact policies to target sugar-sweetened beverages. This dissertation aims to address the varied policy designs in France, a developed nation and Chile, a developing nation on the impact of the tax on their consumption, obesity prevalence, social determinants of health and the barriers and enablers to effective tax implementation.

Method: A systematic literature review was conducted according to the PRISMA guidelines through searching through databases such as PubMed, Google Scholar, Cochrane Library, EBSCOhost, JSTOR and UWTSD online library and 15 studies were chosen. These articles were critically appraised through the Joanna Briggs Institute Checklist (JBI) and were synthesised according to Braun and Clark thematic analysis methodology. The analysis focused on four domains which were public health outcomes of sugar taxation, social determinants affecting policy effectiveness, consumer behaviour and substitution effects and policy design and implementation.

Findings: Findings showed that modest reductions were observed in France and Chile with higher reductions from higher tax thresholds. In Chile, the purchases of high-sugar SSBs reduced by around 3 per cent while the purchases of substitutions increased by 10 per cent. The reductions in France were smaller but was equally supported through reformulation efforts. However, the overall impact on obesity was limited. Individuals of high-income groups were more responsive of the tax compared to low-income groups who displayed weaker behavioural shifts.

Conclusion: The study concludes that SSB taxes alone were useful but insufficient to reduce sugar consumption. Policymakers should prioritise higher tax thresholds, reinvestment of tax revenues and education campaigns. Future research should also include long-term evaluations, inclusion of rural populations and the industrial response to the tax.

Keywords: Sugar-sweetened beverages, Sugar tax, Public health policy, Social determinants of health, France, Chile

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List of abbreviations

BMI	Body Mass Index
NCD	Non-Communicable Diseases
SSB	Sugar-sweetened Beverages
OECD	The Organisation for Economic Co-operation and Development
SDH	Social Determinants of Health
JBI	Joanna Briggs Institute Checklist
SES	Socioeconomic Status
SEP	Socioeconomic Position
High-SSB	High Sugar Sweetened Beverages
Low-SSB	Low Sugar Sweetened Beverages

Chapter 1: Introduction

1.1 Introduction

Obesity is defined as a medical condition which is characterized by a Body Mass Index (BMI) of 30 or higher (WHO, n.d.). As of 2023, this has been considered as a global epidemic due to the widespread and sudden rise of the disease (Koliaki, Dalamaga and Liatis, 2023). Several factors have been identified to be contributing elements to obesity which is genetics, lifestyle and diet and environmental factors (NICE, 2025). Diet has been found as one of the major modifiable risk factors for obesity (NHS, 2023). As of 2022, over 1 billion people were found to be living with obesity (WHO, 2024), 43 per cent were overweight and 16 per cent were diagnosed with obesity (WHO, 2025). This urges nations to begin curbing the spread to protect the population (Department of Health & Social Care, 2020). Obesity is a disease which serves as a bridge to non-communicable diseases (NCD), such as type 2 diabetes, cardiovascular disease, liver disease, kidney diseases and even certain cancers (NHS, 2023). Hence, obesity alone does pose a relative threat, however, the ability of it to act as a driver to other diseases is a rather serious problem.

1.2 Impact of Obesity

The impact of obesity on type 2 diabetes mellitus is that it impairs insulin sensitivity and around 80 to 90 per cent of type 2 diabetics are classified as obese (Grant *et al.*, 2021). Obesity is also often linked to increase in blood pressure, low-density lipoprotein cholesterol and triglycerides which leads to cardiovascular diseases (CDC, 2024). The fat tissues related to obesity often increases estrogen and inflammatory cytokines which increases risk for cancers such as breast and colon (National Cancer Institute, 2025). The fat accumulated around the abdomen also restricts lung expansion leading to sleep apnea and asthma which causes respiratory diseases as well (Palma *et al.*, 2022).

Obesity trends have also nearly tripled in women and quadrupled in men between 1975 and 2022 (World Obesity Federation, n.d.) and according to this trend, in 2035, 1 in 4 people globally may be obese (World Obesity Federation, n.d.). As obesity and NCDs are closely linked, the mortality rate for NCDs yearly is estimated to be 41 million which accounts for

74% of global deaths (Hildebrand and Pfeifer, 2025). Obesity increases the mortality rate by 20 to 40 per cent (Wang *et al.*, 2016) and high BMIs have been found to the 4th leading risk factor for death worldwide (WHO, 2022). To achieve the SDG 3.4 goal, obesity prevention is essential as it is a major factor to the mortality rates caused by NCDs and countries have been encouraged to implement regulatory and health promotion policies to curb this issue (Ejigu and Tiruneh, 2023). The World Health Organization (WHO) has also classified obesity as a major global health challenge and as part of their Global Action plan for NCDs (2013-2030), the goals set included to halt the rise in obesity and diabetes by 2025 (WHO, 2016) and reducing NCD-related deaths by one-third by 2030 (Thakur, Nangia and Singh, 2021). Some initiatives which were introduced were promoting taxation on sugary beverages, food reformulation for manufacturers (Office for Health Improvement and Disparities, 2024) and tracking obesity trends via tools such as STEPwise and NCD surveillance (STEPS) (Riley *et al.*, 2016).

1.3 Sugar Tax

Excessive sugar intake has been associated with higher risk of developing conditions such as diabetes, obesity and dental caries (WHO, 2017). In the current era of the food landscape, it is increasingly easier to overconsume sugar through sugary beverages. These beverages have been found to be a major source of dietary sugar and there has been a relative rise in consumption especially in children and adolescents (WHO, 2017). An example would be a typical can of sugar-sweetened beverage contains approximately 40 grams of free sugars which is equivalent to 10 teaspoons of table sugar and this contributes significantly to daily sugar intake (WHO, 2017). In attempts to reduce the risk of obesity and tooth decay, the World Health Organization (2015) advises adults and children to limit the intake of free sugar to less than 10 per cent of the individuals' daily energy intake; for adults, this is equivalent to 12 teaspoons of table sugar. WHO also recommends lowering this amount to below 5 per cent of daily energy intake (approximately 6 teaspoons).

There is evidence that suggests that the implementation of taxes on sugary drinks have led to reduction in consumption (Andreyeva et al., 2022; Teng et al., 2019) and consequently reducing the prevalence of obesity and diabetes (Pfinder et al., 2020). The Sugar Tax (also known as sugar-sweetened beverage tax) is defined as a tax that is imposed on sugary drinks and the implementation levels differs based on countries (WHO Regional Office for

Europe, 2022). This is a form of a public health measure formed to discourage the consumption of sugar-sweetened beverages which are linked to many preventable diseases (Itria *et al.*, 2021). The aim for this tax is to ensure sugary beverages are made to be more expensive; hence, manufacturers will use this as an opportunity to reformulate products with lower sugar content and encourage consumers to choose healthier options (Hashem *et al.*, 2024). This ensures the overall health of the public is improved and in an economic perspective, the revenue generated can be used to fund public health initiatives such as to promote healthy eating and physical activity (WHO, 2023). The behavioural change of consumers to opt for healthier options was the main driver to ensure the tax is effective (WHO, 2022).

1.4 Literature Review

1.4.1 France

In France, which is a developed country, nearly 1 in 2 adults are either overweight or obese (Statista, 2025). An estimate of 50 per cent of the French adult population are either overweight or obese and around 17 per cent of the population has a BMI of more than 30 indicating obesity (Fontbonne *et al.*, 2023). The obesity rates also vary as the northern regions of France has a higher obesity rate compared to the southern region (Fontbonne *et al.*, 2023). In comparison to other European countries and UK, France has a relatively lower obesity rate, however, public health officials remain concerned (Clément *et al.*, 2020). In 2012, France implemented the sugar-sweetened beverage (SSB) tax primarily as a revenue-generating measure and later further modified it in 2018 with the aim to encourage product reformulation with lowered sugar content (Bodo *et al.*, 2022). The sugar tax focuses on non-alcoholic beverages with added sugar and artificial sweeteners and the tax implemented in 2012 was a flat rate of €0.0716 per liter with an initial focus on the public health measure which eventually shifted to serve as a role in balancing the national budget (Sarda *et al.*, 2022). The 2018 revision, however, followed a progressive tax format with a tiered-system based on the sugar content; this ranged from €0·03 to €0·24 per litre and for a typical sugar-sweetened soda, the modification was substantial and for drinks with 12g of added sugars per litre resulted in tax being doubled (Sarda *et al.*, 2022). This tax targeted on manufacturers, processors and importers of sweetened beverages (Capacci *et al.*, 2019). The focus of the 2018 sugar tax as compared to the 2012 sugar tax was to incentivize companies to reduce the sugar levels in their products.

The manufacturers and importers were responsible for paying the sugar tax (Capacci *et al.*, 2019) and studies found the tax to be generally well-received by the public as many were aware of its existence and supported the measure (Sarda *et al.*, 2022). The public health improvements found in other countries as an effect of the sugar tax were suggesting improved dental carries (National Institute for Health and Care Research, 2023) and obesity prevalence especially in the lower-socioeconomic status communities (Rogers *et al.*, 2025). The food and beverage industry have also attempted to reformulate their products with reduced sugar content and have obtained mixed success (Wang, Zheng and Kaiser, 2023). Concerns on the substitution of sugary drinks with other sugary products remain as it diminishes the purpose of the tax (Smith-Drelich, 2024) and those of lower socioeconomic status may be disproportionately affected by the tax as a larger sum of their income are spent on food and beverages as opposed to others in varied social hierarchy status (Etilé, Lecocq and Boizot-Szantai, 2020). In conclusion, the French sugar tax has had substantial success and challenges as well, hence ongoing monitoring and adjustments are required to maximize the potential and quality of the sugar tax to meet its goals.

1.4.2 Chile

The obesity rate of adults in Chile is 34.4 per cent which is higher than the OECD average (OECD, 2019) as 33.7 per cent of women and 27.6 per cent of men are living with obesity which is also higher than the regional average (Global Nutrition Report, n.d.). The 2024 World Obesity Organization data ranks Chile at 20th amongst countries with the highest obesity rates (World Obesity Organization, 2024) and despite implemented measures to curb obesity, no significant progress has been observed and some experts argue that it may take decades to see any significant impact as evidence of these measures (White *et al.*, 2023). Further, Chile had implemented the tax called Additional Tax on Non-Alcoholic Beverages in 1979 which was a flat rate of 13 per cent on all non-alcoholic beverages; regardless of the sugar content, this tax was fiscal in nature and mainly aimed at raising revenue without regards to public health concerns (Nakamura *et al.*, 2018). This initial tax did not focus on the sugar content, however, it acted as the first step to sugar taxation in Chile. In June 2014, the policy was reformed to revise the existing 13 per cent flat tax and introduced tiered system based on the sugar content which was effective from October 2014 (Caro *et al.*, 2018). The sugar tax was divided into 2; beverages with 6.25 grams or more of sugar per 100ml had an increased tax from 13 per cent to 18 per cent and beverages with lesser than 6.25 grams per 100ml had a reduction in tax from 13 per cent to 10 per cent

(Nakamura *et al.*, 2018). The difference between the tax of both categories were 8 per cent. The goals of the reformed policy included promoting healthier consumption habits and combating diseases such as obesity and diabetes rates (Nakamura *et al.*, 2020) which was one of the main differences compared to the previous policy of 1979. The impact of this reformed policy on the prices of beverages was increases and decreases based on the sugar content of the drinks (Carriedo *et al.*, 2021). There is also evidence that the tax led to a reduction in volume of higher-taxed drinks with consumers turning to lower-sugar content options (Nakamura *et al.*, 2018).

The effects of the sugar tax in consumption were found in studies whereby significant reduction in purchases of sugary drinks with almost a decrease of 22 per cent in monthly volume (Nakamura *et al.*, 2018). Research has also found that those of higher socioeconomic group have shown a higher decrease in consumption of sugary drinks compared to those of a lower socioeconomic group (Nakamura *et al*., 2020). Although the tax has positively influenced consumers and increased purchases of low-sugar products, the direct impact of producers in reformulating their products remain unclear (Caro *et al.*, 2018). For the long-term effects, although some studies show a positive impact of the tax in reduced sugar consumption and potential positive impacts on obesity rates, more research is required to understand the long-term impact of the tax on the public (Semerád *et al.*, 2024). Overall, the sugar tax in Chile has proven successful with a significant decline of 22 per cent in sales for sugary beverages and this reduction in consumption led to a 15 per cent decrease in overall added sugar intake (Nakamura *et al.*, 2018).

1.4.3 Childhood Obesity

Childhood obesity has been defined as having a BMI at or above the 95th percentile for age and sex with reference to the standardized growth charts (Jebeile *et al.*, 2022). This indicates an excessive amount of body fat in a child based on their age and height (Kansra, Lakkunarajah and Jay, 2021) which increases the risk of health and psychological problems during childhood and adulthood (Balasundaram and Krishna, 2023). These health risks include type 2 diabetes, high blood pressure and cardiovascular diseases (Bhadoria *et al.*, 2015). Childhood obesity has been viewed as a growing concern worldwide with significant rise in prevalence especially in low- and middle-income countries (WHO, 2025). Socioeconomic factors have also been found to play a crucial role with lower-income

children at higher risks due to factors such as insufficient access to healthy food and reduced opportunities for physical activity (Williams *et al.*, 2018). Studies have also found early intervention to play a notable role in identifying and addressing childhood obesity to prevent long-term health problems (Johnson *et al.*, 2024).

In the context of France, the prevalence rates of childhood obesity has significantly increased over the past few decades; tripled since 1980 (Carriere *et al.*, 2014). The current shifting of dietary habits from traditional French cuisine which is often rich in fat and sugar to increased ingestion of fast food and processed foods coupled with sedentary lifestyles (Bellisle and Rolland-Cachera, 2007) are contributing factors to childhood obesity. Some socioeconomic factors which are linked to childhood obesity are children from poorer socioeconomic background have lesser access to healthy food options and safe spaces for physical activity (Darmon and Carlin, 2013); this has also been proven as studies found these children to be twice as likely to be overweight and four times more likely to be obese (Singh, Siahpush and Kogan, 2010).

The childhood obesity phenomenon in Chile has been found to be a concern as well; nationally, up to 33.5 per cent of children and adolescents aged 5 to 19 have been classified as either overweight or obese (UNICEF, n.d.). This poses as a problem particularly in the metropolitan region of Santiago with childhood obesity rates of 31.7 per cent of children under age 6 and up to 52 per cent of school-aged children (UNICEF, n.d.). Over the past three decades, Chile's economic growth and lifestyle changes has been simultaneously growing with the obesity rates coincidentally (Mujica-Coopman *et al.*, 2020); specifically, the childhood obesity rates grew from 16 per cent in 2008 to 27 per cent in 2022 (NHS England, 2024). Some contributing factors which have been identified includes the obesogenic food environment surrounding Chilean children who grow up with access to contemporary food systems designed without regards to their nutritional needs and increased consumption of processed foods; fast food and ultra-processed products (UNICEF, n.d.). The decrease in physical activity as a result of lifestyle changes associated with economic growth have impacted children and adolescents (Charnes *et al.*, no date). Socioeconomic factors also play a vital role as studies found children from lower socioeconomic status are more likely to be overweight or obese (Williams *et al*., 2018). Studies have additionally found Chilean children to have high percentages of obesity, overweight and vitamin D deficiency (Pérez-Bravo *et al.*, 2021).

1.4.4 Social Determinants Influencing Sugar Tax Effectiveness

The effectiveness of sugar tax influence on consumer behaviour is significantly shaped by various social determinants which includes income, price sensitivity (Nakhimovsky *et al.*, 2016) and cultural factors (Alzaben *et al.*, 2024). These factors also affect the community response to price increases for sugary drinks and the impact of the overall success of the effectiveness of the tax in reducing consumption (Nakhimovsky *et al.*, 2016). Studies have found low-income individuals to be more sensitive to price changes and would reduce their consumption of sugary drinks in response to the tax (Knox and Jones-Smith, 2024), however, research has also suggested that the tax could disproportionately affect lower-income households due to a larger portion of income delegated to food consumption purchases in comparison to higher- or middle-income earners (Ells *et al.*, 2015). The price sensitivity and elasticity also vary according to the price hike, availability of alternatives (Escobar *et al.*, 2013) and individual preferences which may affect the response to the tax (Bascuñán and Cuadrado, 2017).

Some cultures have a higher acceptance of sugary drinks as part of traditions which may hinder acts of changes in consumption patterns (Alzaben *et al.*, 2024) and individuals with unhealthy lifestyles or are unaware of the recommended sugar intake are also less likely to reduce their consumption (Reyes-García *et al.*, 2023). Factors such as public perception and support are influenced by the perceived fairness and health benefits of the tax (Case *et al.*, 2022); if the public are unaware or do not understand the gravity of the tax, they are less likely to support it. The industry response can also influence the effectiveness of the tax as some may choose to reformulate their products with lower sugar content (Moynihan and Miller, 2020), some may absorb this tax or even choose to pass it onto consumers (Veerman, 2016). The industrial response is crucial to either amplify or diminish the impact of the tax on consumer behaviour (Taber *et al.*, 2018). The sugar tax policy implementation coupled with public health campaigns, subsidies for healthier food alternatives or restrictions on advertisement of unhealthy products can also enhance the impact of the policy instead of being a standalone initiative ('Taxation and Sugar-Sweetened Beverages: Position of Dietitians of Canada,' 2016).

Sugar taxes have been found effective particularly in developed nations but its effectiveness varied between developing and developed nations (World Bank Group, 2020) due to diverse

social determinants. Understanding the fundamentals of these social determinants is crucial in designing effective sugar tax policies in varying country development status to achieve public health goals (Tamir *et al.*, 2018). In the context of socioeconomic factors in high-income countries such as France, the sugar tax has led to a decrease in SSB purchases (Sarda *et al.*, 2022) additionally, the effect has been found to be more pronounced among higher-income groups compared to lower socioeconomic groups (Sarda *et al.*, 2022). On the contrary, in Chile, the tax has resulted in reduction in sugary drink purchases across all socioeconomic groups with the reduction less prominent for lower-income groups which potentially exacerbates existing health disparities (Nakamura *et al.*, 2018).

In France, the public awareness and education is viewed as a crucial factor as a more informed public with great awareness of the health impacts of sugary drinks are able to utilize the maximum potential of the sugar tax and capitalize its benefits (Bodo *et al.*, 2022). Developing countries such as Chile have lower levels of public awareness about the health risks surrounding sugary drinks which may hinder the effectiveness of the tax for the population (Saurombe, 2024). A degree of the success in the sugar tax implementation in France is affiliated with its integration in the National Nutrition and Health Program (Bonnet and Requillart, 2014; Sarda *et al.*, 2022), however, the French food industry initially opposed the tax due to concerns about the impact of the industrial response and potential price adjustments in response to the tax (Bodo *et al.*, 2021; Berardi *et al.*, 2016).

The tax design and implementation in Chile initially aimed at reducing sugary drink ingestion which successfully reduced SSB purchases, even so, the overall impact on SSB consumption and health outcomes remain unclear (Nakamura *et al.*, 2018). The Chilean sugar tax policy should also be integrated with other public health measures to address factors which promote SSB consumption consequently yielding better success through the tax (Valenzuela, 2021). In conclusion, the effectiveness of sugar taxes are heavily dependent on the interplay of complex factors such as social, economic and political components which varies for each country based on their development status (Varghese *et al.*, 2024; Nakamura *et al.*, 2020). The comprehension of these factors is crucial to effectively design and implement successful and functional sugar tax policies which achieves public health goals (Liu *et al.*, 2021) and minimize potential health disparities.

1.5 Theoretical Framework

https://www.futurelearn.com/info/courses/tackling-public-health-issues-concepts-and-evidence/0/steps/305607

(Future Learn, n.d.)

The social determinants of health (SDH) framework will be used to explain the conceptual framework of this study. Sugar taxation does not merely act as a fiscal tool but is designed to address diet-related risk factors at a larger scale (Nakhimovsky *et al.*, 2016). Its effectiveness not only depends on the tax design but its operating mechanism, particularly in how social determinants affect consumer behaviours, health inequalities (Djojosoeparto *et al.*, 2020) and political context (Serban and Conway, 2025). SDH refers to the conditions in which people are born, grown, live and age with the influence of wider forces which shapes their daily life including policies and social norms (WHO, 2025). As shown in the diagram above, the interaction between all the factors; social, economic and political factors influences individual and population health and does not solely rely on biological factors.

At the macro level, in the economic and political context, this model considers the influence of lobbying, political will and industry resistance (Donkin *et al.*, 2017) which affects the implementation and the success of the sugar tax in varying development status countries' (Eykelenboom *et al.*, 2019). As France is a developed nation, it has greater institutional capacity to implement and monitor public health policies with a population of higher average health literacy (Sarda *et al.*, 2022), in contrast to Chile which is a developing nation and faces greater income inequality and socio-political challenges which affects the equity in health access (Salas, 2022). In the context of health inequalities, the framework highlights the influence of health disparities evident between varying socioeconomic groups which ensures to understand the impact of the sugar taxes which may disproportionately affect these groups (Pfinder *et al.*, 2020) depending on the development status of the respective country as well. In the policy context, this model gives rise to examine the impact of the policy on varied income and education level populations with or without adequate access to healthier options as an alternative to the policy (Peñalvo *et al.*, 2017).

Another context is the cultural norms which is subjective to each country as this model also highlights the influence of the social norms on the populations' diet with regards to the sugar tax (Bélanger-Gravel *et al.*, 2022). By applying the SDH model, this study aims to use this as a comparative and objective lens to understand the sugar tax policy which acts as a product of the socioeconomic and political environment designed with respect to the countries' varying differences. This also highlights how the same policy mechanism may yield varying outcomes in different development status of countries and this approach supports a nuanced understanding of policy effectiveness.

1.6 Rationale

As the global burden of the diseases of obesity and related NCDs increase, the urgency to curb the spread also simultaneously increases (Hildebrand and Pfeifer, 2025). Hence, in response to this, many countries as per urged by WHO has began to implement sugar taxation policies as a first step to their efforts to manage this issue (WHO, 2022). The policies are aimed to reduce the consumption of sugar-sweetened beverages and improve overall public health (Emmert-Fees *et al.*, 2023). Although the evidence of these policies' effectiveness have begun emerging (Madsen, Krieger and Morales, 2019), there has been a lack of comparative studies to understand the success and failures between the same policy domains in varying country development status (Hattersley and Mandeville, 2023). Hence, this study aims to be a systematic review which compares this information between two countries; France which is a developed nation and Chile which is a developing nation. As both countries have previously implemented sugar tax prior to the WHO manual and reformed their sugar tax, the similarities between both countries' implementation are unparalleled. However, their successes and challenges varied and this study aims to understand the contextual factors which shaped the policies' effectiveness in these respective countries. The systematic review methodology chosen for this study enables a rigorous and transparent synthesis of existing evidence (Booth *et al.*, 2020) which helps policymakers and researchers to assess the effectiveness of the sugar tax policies enacted. In a broader scope, this research is timely and aligns with the Sustainable Development Goal 3.4 which is to reduce premature mortality from NCDs and understanding the differential impact of sugar tax policies helps to develop global policy learning and health equity (WHO, 2022).

1.7 Research Aim and Research Objective

Research Aim:

To compare the effectiveness of sugar tax policies implemented in France and Chile in achieving public health goals, focusing in reducing sugar consumption and obesity rates, and to examine the socio-economic, cultural, and policy factors that contribute to the success or limitations of such interventions in a developed and a developing nation.

Research Objective:

- To examine the impact of sugar tax policies on the obesity prevalence in France and Chile.
- To evaluate the influence of the social determinants of health on the effectiveness of sugar tax policy.
- To compare the effectiveness of the sugar taxation in altering consumer behaviour with regards to sugar-sweetened beverages in France and Chile.
- To assess the differences in the barriers and enablers to effective implementation strategies in France and Chile.

1.8 Overview

Chapter 1 of this dissertation discusses the background of obesity and the sugar tax implemented to contain the spread of the obesity pandemic. The chapter also delves into understanding the importance of sugar tax and methods used by France and Chile to combat obesity and other related NCDs. The theory which helps understand the fundamentals of the research and the importance of the research is also further discussed. Chapter 2 delves into the methodology used to conduct the systematic review with clear explanations on each relevant criteria carried out. It also describes the search strategy and accordance to PRISMA guidelines in detail. The chapter concludes with the data analytical steps followed and the ethical considerations focused on in the study. Chapter 3 states the findings of the research conducted as according to the methodology discussed in the previous chapter. This chapter explains the themes and subthemes derived from the findings

of this systematic review. Chapter 4 discusses these findings in relation to existing literature and the relationship between these factors with a focus on the social determinants of health. The chapter also focuses on the policy implications derived from the findings of this study and some limitations evident in the literature gathered and this study as well. Chapter 5 presents the conclusion of the study and includes recommendations for future researchers and contributions of this study.

Chapter 2: Research Methodology

2.1 Introduction

This chapter will focus on the methodological approach used to conduct the systematic review of comparing the effectiveness of the sugar tax policy in France and Chile. The chapter will outline the study design, search strategy, selection criteria, critical appraisal process and data analysis method. The systematic review process will also ensure transparency, honesty and reproducibility with relevance to the research objectives.

2.2 Study Design

A systematic literature review is defined as a type of research synthesis which uses a rigorous and transparent approach to identify and synthesize all relevant and available evidence related (Paré and Kitsiou, 2017) to a research question. The key aspects involved in a systematic literature review includes a clearly defined research question using the PICO (Population, Intervention, Comparison, Outcome) format (Amir-Behghadami and Janati, 2020), a systematic search of relevant literature through predetermined keywords and databases, specific inclusion and exclusion criteria, critically appraised studies to ensure quality and accurate synthesis of the findings (Mengist, Soromessa and Legese, 2019). The strength of this approach includes comprehensive evidence synthesis, reduced biasness, improved generalizability and identification of knowledge gaps (Shaheen *et al.*, 2023). On the other hand, the weaknesses are time and resource intensive, protentional researcher biasness as the analyses is heavily reliant on the researchers' understanding of the evidence and high dependance on primary study results and quality (Jackson and Kuriyama, 2017).

The rationale for this chosen approach is due to the obtainability of a rigorous comparison of existing evidence between both countries with distinct socioeconomic status contexts. This also aligns with the objectives of this study to synthesize data on sugar tax effectiveness, consumer behaviour, policy impact and enabling policymakers to make informed decisions based on cumulative findings. As the research question for this study is multi-faceted, the structured nature of a systematic review is ideal as it supports cross-country comparison and thematic synthesis of public health and policy literature.

2.3 Search Strategy

This section has outlined the strategy utilized to identify, retrieve and screen relevant studies to be included in this paper. A structured and replicable approach was used to ensure the review aligns with the research objectives of this research.

2.3.1 Development of Search Terms

The formulation of the search terms was guided using the PICO framework (Table 2.0) and these terms reflect the intervention (sugar taxation) and outcomes (obesity) as they relate to the general population in France and Chile with reference to the research question and research objectives of this study. The PICO framework was chosen due to the ability of the framework to capture each key element of the research question and ensures the focus is on the main issue which is the heart of the study (Eriksen and Frandsen, 2018). Based on this structure below, the primary keywords and controlled vocabulary terms were identified and synonyms were also added to ensure a wide range of relevant studies are recognized.

Table 2.0 Population, Intervention, Comparison and Outcome Table

Research Question: How effective are sugar tax policies in reducing sugar consumption and improving public health outcomes in France and Chile?	
Population	Population of France and Chile
Intervention	The sugar taxation policy
Comparison	Varying development status of the countries (France and Chile)
Outcome	Reduced obesity rate, reduced purchase of sugar-sweetened beverages, reduced non communicable diseases (obesity)-related morbidity and mortality rates

2.3.2 Use of Boolean

Boolean operators were used to connect and expand the search terms for this study to ensure sensitivity and specificity. The Boolean operator 'AND' was used to combine concepts while the Boolean operator 'OR' was used to expand synonyms.

Table 2.1 Boolean Operator Table

Concept	Keywords and Synonyms
1. Policy Intervention	"sugar tax" OR "sugary drink tax" OR "beverage tax" OR "sugar-sweetened beverage tax"
2. Health Focus	"public health" OR "health outcomes" OR "obesity" OR "diabetes" OR "diet-related diseases"
3. Evaluation	"effectiveness" OR "impact" OR "evaluation" OR "outcome" OR "policy assessment"
4. Country	"France" OR "French" OR "Chile" OR "Chilean"

2.3.3 Database Search

A range of electronic databases were utilized during the database search to ensure comprehensive coverage. The databases chosen are widely used in public health and policy research with sufficient access to peer-reviewed and grey literature such as policy briefs and evaluations. These academic databases included PubMed, Google Scholar, Cochrane Library, EBSCOhost, JSTOR and UWTSD online library.

2.3.4 Limiters

Some of the search parameters and limiters included were data range, language restrictions, type of document and filters such as full text only. To ensure relevance and timeliness, the search was limited to studies published between 2015 and 2025 which also aligns with the policy implementation dates in France and Chile. The studies which were chosen must have been available in English and the filters included ensuring the full text article was available. Articles whereby the abstract-only or was inaccessible was excluded.

2.3.5 Inclusion and Exclusion Criteria

Several inclusion and exclusion criteria were implemented to ensure the articles were accurately chosen and represented the needs of the research objectives of this paper. These criteria are as below.

Table 2.2 Table of Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria	Justification for Exclusion
Studies conducted in France and/or Chile.	Studies not focusing on France or Chile.	This review focuses on specific countries.
Evaluates a sugar tax policy or fiscal measure targeting sugary drinks.	Studies focusing on non-tax interventions.	The focus is sugar taxation.
General population, children, or subgroups within France and/or Chile.	Studies on populations outside France or Chile.	Research must focus on the specific country population.
Studies reporting on obesity, NCD prevalence, consumer behaviour, SSB consumption, or policy implementation outcomes.	Studies not reporting relevant health, behavioural, or policy outcomes.	Research focuses on the effectiveness, social determinants of health influence, and policy impact.
Empirical studies, systematic reviews, evaluations, or grey literature.	Editorials, news articles, blogs, or purely theoretical research papers without data.	Only evidence-based sources are found credible for this review.
Studies that consider social, economic, environmental or cultural factors in evaluating tax impact.	Studies that focus only on economic or sales data without health or social outcome interpretation.	Excludes work that focuses on other factors other than the social determinants of health.

Studies assessing changes in purchasing and/or consumption of SSBs.	Studies that do not discuss consumer behaviour.	The research assesses impact on consumer decisions and behaviour change.
Studies that assess tax design, political feasibility, enforcement, and/or barriers and enablers.	Studies that only mention the tax without further analyses.	The research analyses barriers and enablers to implementation in both countries.
Studies must be published between 2015 and 2025.	Studies published before 2015.	The research analysis ensures focus on recent and post-implementation evidence.
Studies must be accessible in English.	Studies published in other languages without accessible translation.	The research ensures accurate comprehension and synthesis of findings.

2.4 Screening

The screening process for this systematic review was conducted through a multi-step screening process in accordance with the PRISMA 2020 guidelines. These steps included beginning the screening through analyzing the titles of the articles against the inclusion criteria to discuss relevance and the irrelevant studies were disregarded. The initial overall searches conducted through the multiple databases provided 3,444 articles and with use of the limiters before, this was narrowed to approximately 60 articles. Articles which were thought to be relevant to this study were downloaded into a specific folder created for this dissertation. The reference list of chosen studies was also examined and searched to identify further studies. This was done precisely on systematic reviews with meta-analysis.

2.5 Selection

During the selection process, the screening identified 57 articles which was later reduced due to the presence of duplicates to 50 articles. The titles and abstracts of the articles were also screened with reference to the inclusion criteria, and this narrowed the search to 28

articles. The full-text review allowed a shortlist of 15 articles to be identified, and the final selection was made based on the thematic relevance and data saturation of 15 articles. This process has also been reflected in the PRISMA diagram below.

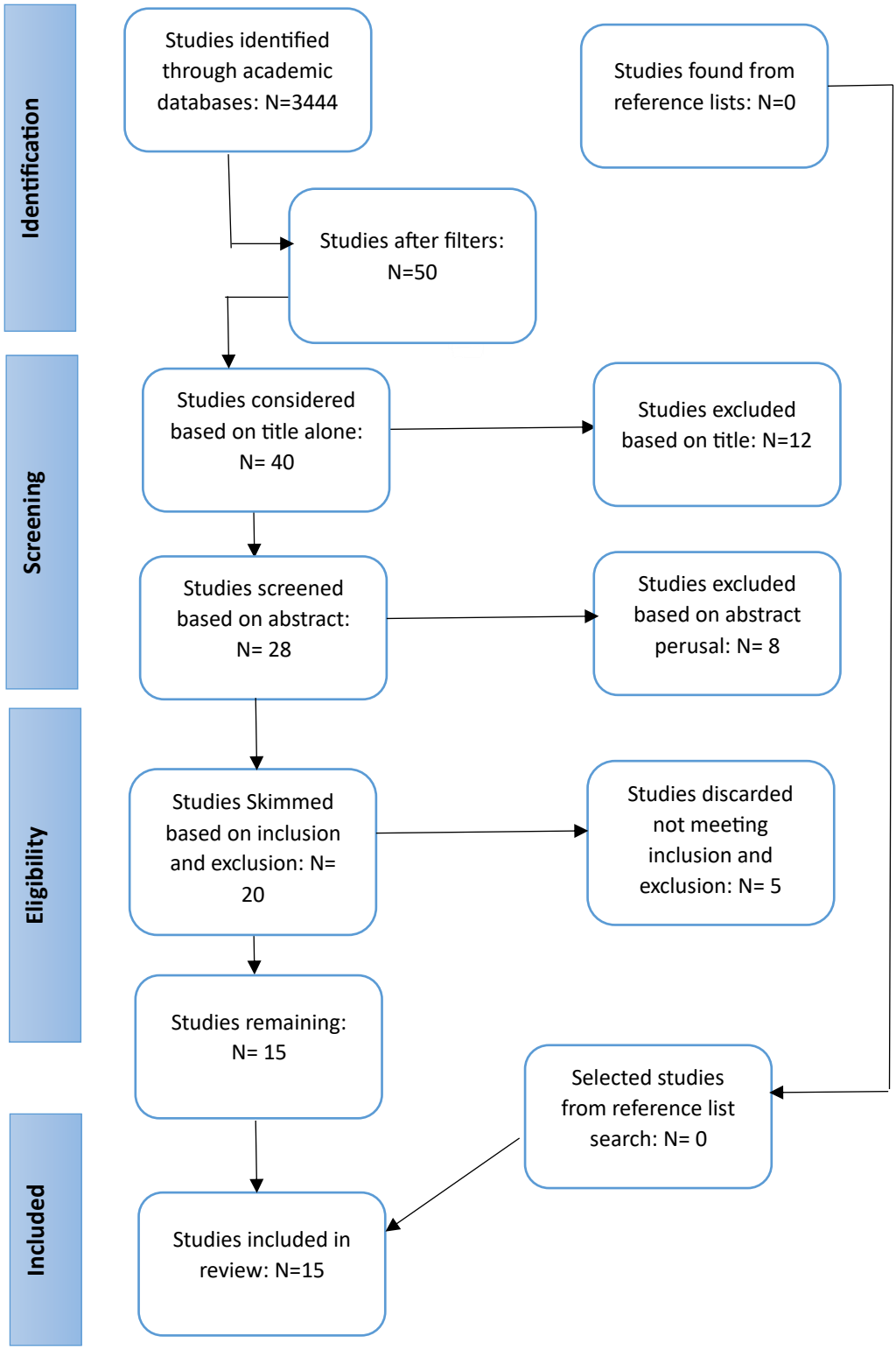

Figure 2.0 PRISMA Diagram

2.6 Data Extraction

The data extraction process was conducted systematically to ensure accurate findings was reported for this study. The data extraction table was made in a separate Microsoft Word document with fields such as the citation containing author(s) of the articles, the year of publish and location of creation of the published article; other fields also included the study design, the sample size, aims and objectives of the respective studies, the methodology utilized, the key findings of the studies and strengths and limitations of the studies as well (see Appendix 1).

2.7 Critical Appraisal of Studies

Each study selected was assessed to ensure methodological quality and relevance to the research objectives were complied with (Shaheen *et al.*, 2023). The tool utilized for this process was the Joanna Briggs Institute Critical Appraisal (JBI) tool which is defined as a set of checklists to assess studies of varied types particularly in the context of a systematic review (Hilton, 2024). This checklist aided the reviewer to evaluate the potential for bias in study design, study analysis and relevance (Munn *et al.*, 2019). The number of questions in each checklist varied depending on the specific study design evaluated, for example, systematic review article checklists contained 11 questions (Aromataris *et al*., 2015), case series checklists contained 10 questions (Munn *et al.*, 2019) and randomized controlled trials checklists contained 13 questions (Tufanaru *et al*., 2020). The advantages of the JBI checklist includes versatility to be adapted to the context of use, standardized and comprehensive and evidence-based which ensures its validity and reliability (Munn *et al.*, 2019). The weaknesses included complexity due to the detailed nature of the JBI tool, time-consuming and potential for subjectivity subjective to the nature of the reviewer (Hilton, 2024). Based on the critical appraisal to ensure quality studies were chosen for the systematic review, these studies were further assessed and were subject to exclusion after extensive and rigorous synthesis process. A summary table is attached containing the JBI checklist for the chosen 15 articles in Appendix 2.

2.8 Data Analysis

To analyze and synthesize the findings from the included studies, this review has adopted the Braun and Clarke thematic analysis. This method is used to synthesize findings across multiple studies and delve beyond simple aggregation to gage new interpretations and explanations (Naeem *et al.*, 2023). The framework is flexible yet has a rigorous qualitative method which identifies patterns, meanings and themes across the data set (Ahmed *et al.*, 2025). Thematic analysis allows comparative exploration of both content and context which aligns with the research objectives of this paper and the ability to accommodate mixed-method evidence (Fàbregues and Paré, 2018) makes this data analysis type ideal for the type of literature included in this review.

- The data analysis began with the familiarization stage whereby all the included full-text articles were read multiple times to gain deep familiarity with the content while taking notes and actively engaging with the content to recognize ideas and patterns (Ahmed *et al.*, 2025).
- The second stage involved generating initial codes which involved labeling interesting points in the data and codes with concise labels which captured the essence of the data (Naeem *et al.*, 2023). Some examples from the data analysis codes of this systematic review were 'Evidence of reduced calorie/sugar consumption', 'Health literacy and education level' and 'Reduced purchase or consumption of sugary drinks'.
- The third stage was searching for themes which is defined as a broader pattern of meaning for a collection of multiple codes (Maguire and Delahunt, 2017). This step also involved organizing codes into themes and identifying the connection between codes across countries and objectives. An example of this from the data is the combination of codes; 'Health literacy and education level' and 'Income and affordability of alternatives' into the theme 'Influence of social determinants of health affecting policy effectiveness'. Another example is the combination of codes; 'Shifts toward non-taxed or reformulated products' and 'Public awareness and acceptance of the tax' into the theme 'Consumer behaviour, public perception of SSB taxation and substitution alternatives (reformulated and non-taxed products)'.
- The fourth stage involved critically evaluating the themes to ensure accurate representation of the data and during this stage, the themes were further refined while either combining them or discarding those which were less supported (Pearson *et al.*, 2025). An example of this from the data is the combination of the subthemes 'shifts toward non-taxed or reformulated products' with 'price increase post-tax' and 'no significant increase in untaxed beverages'.
- The next stage involved defining and naming themes to further refine and develop concise definitions for each theme with a link to the specific objectives (Byrne, 2021).
- The last stage was writing and presenting the themes through a detailed report which included describing, supporting and discussing the implications of the themes (Byrne, 2021). These themes were used to structure the findings in Chapter 4.

The analytical approach used was a hybrid approach which combined the deductive (theory-driven) and inductive (data-driven) coding to form the themes (Swain, 2018). The deductive themes were informed through the research objectives while inductive coding was derived from unexpected patterns which emerged from the data (Swain, 2018). Each included study

was coded against the framework and themes were compared across two national contexts (France and Chile) to support comparative analysis. It was also vital to reflect on the potential biases present in the perspective of the researcher and its possible influence on the analysis (Peel, 2020). To ensure the credibility and dependability of the analysis, memo-writing was used to track decisions during the theme development process, and all the data was managed using Nvivo to support transparency and auditability. The thematic analysis approach was chosen for this study as the fundamentals for a systematic review includes recognizing themes with a structured approach which is available through this method.

Table 2.3 Data Analytical Table

Objective	Themes	Subthemes	Sources
• To examine the impact of sugar tax policies on the obesity prevalence in France and Chile.	Theme 1: Public health outcomes from sugar taxation	1. Trends in obesity and overweight rates post-tax implementation 2. Evidence of reduced calorie/sugar consumption 3. Health disparities across income and age groups	(Sassano *et al.*, 2024) (Itria *et al.*, 2021) (Backholer *et al.*, 2016) (Caro *et al.*, 2018) (Caro *et al.*, 2017) (Cuadrado *et al.*, 2019) (Capacci *et al.*, 2019) (Nakamura *et al.*, 2018) (Valenzuela, 2021)
• To evaluate the influence of the social determinants of health on the effectiveness of sugar tax policy.	Theme 2: Influence of social determinants of health affecting policy effectiveness	1. Health literacy and education level 2. Income and affordability of alternatives 3. Equity of health outcomes	(Sassano *et al.*, 2024) (Nakamura *et al.*, 2018) (Teng *et al.*, 2019) (Bodo *et al.*, 2022) (Caro *et al.*, 2018) (Guerrero-López, Unar-Munguía and Colchero, 2017) (Valenzuela, 2021)

		across social groups 4. Socio-economic and consumption behavioural responses to SSB taxes	
• To compare the effectiveness of the sugar taxation in altering consumer behaviour with regards to sugar-sweetened beverages in France and Chile.	Theme 3: Consumer behaviour, public perception of SSB taxation and substitution alternatives (reformulated and non-taxed products)	1. Shifts toward non-taxed or reformulated products 2. Public awareness and acceptance of the tax	(Allais *et al.*, 2023) (Guerrero-López, Unar-Munguía and Colchero, 2017) (Nakamura *et al*., 2018) (Teng *et al*., 2019) (Cuadrado *et al*., 2019) (Caro *et al*., 2018) (Bonnet *et al.*, 2024) (Thow *et al.*, 2022) (Bodo *et al*., 2022)
• To assess the differences in the barriers and enablers to effective implementation strategies in France and Chile.	Theme 4: Barriers and enablers to effective policy design and implementation strategies	1. Industry response and lobbying 2. Enforcement and compliance challenges 3. Revenue use and reinvestment	(Thow *et al.*, 2022) (Cuadrado *et al*., 2019) (Nakamura *et al*., 2018) (Bodo *et al*., 2022) (Thow *et al*., 2022) (Caro *et al*., 2017) (Valenzuela, 2021)

2.9 Ethical Consideration

This research is a systematic review which utilized secondary data only and did not involve any direct contact with human participants or identifiable personal data. In accordance with the University of Wales Trinity Saint David's Research Ethics Guidelines, only peer-reviewed journal articles and publicly available sources were obtained. No primary data collection was

conducted, and no human participants were involved. This study followed the PRISMA 2020 guidelines to ensure the data collection, screening and data analysis process were conducted responsibly with reproducibility by other researchers (Page *et al.*, 2021). The review process also adhered to ethical research standards which included transparency in methodology and avoidance of plagiarism. All sources of information were appropriately referenced using the Harvard citation style to avoid plagiarism and ensure academic integrity. The originality of this paper was maintained through paraphrasing and citations. To reduce bias, a systematic and objective screening and appraisal process was followed, and studies were selected based on relevance and quality. These studies were also critically appraised through the Joanna Briggs Institute Critical Appraisal Checklist. Through this process, both positive and negative findings were considered to ensure research neutrality. No conflicts of interest were declared and the researcher remained reflexive throughout the process to minimize subjective biases.

Chapter 3: Results

3.1 Introduction

This chapter presents the results for the systematic review on a comparative study on the effectiveness of sugar tax policy in France (developed nation) and Chile (developing nation). The findings are reported based on objectives which encompasses themes and subthemes with codes obtained from the reviewed articles. These articles are also further critically appraised to ensure quality of the review. This chapter also includes criticisms and strengths of the articles reviewed.

3.2 Public Health Outcomes from SSB Taxation

Several studies found evidence of the public health impact of the sugar tax policy on obesity prevalence in both countries studied. From the synthesis of these studies (n=9), three subthemes were developed, which includes (i) trends in obesity rates post-tax implementation, (ii) evidence of reduced calorie/sugar consumption and (iii) health disparities across income groups.

3.2.1 Trends in Obesity Rates Post-Tax Implementation

Research found the SSB taxation to benefit the health of the population in long-term (Sassano *et al.*, 2024) and a study by Itria et al. (2021) has also found 8 out of 13 studies reported decrease in obesity prevalence post- sugar tax implementation in higher-income countries with tax rates exceeding 20 per cent while countries with smaller levies (≤10 per cent) showed limited effects. Valenzuela (2021) validates the importance of higher tax in ensuring effectiveness as the lack of meaningful reduction prompts for higher taxes as also suggested by Itria et al. (2021). Conversely, Caro et al. (2018) analysed the household panel data one-year post-tax in Chile and reported no significant reduction in obesity prevalence which is consistent with Itria et al.'s (2021) results. However, Caro et al.'s (2018) study had limitations which included a short-term evaluation of 1 year and the exclusion of rural populations which may have introduced an urban biasness. Similarly, Valenzuala (2021) stressed that the effect of the tax was statistically non-significant in the short-term although

modest reductions were observed in urban areas with higher baseline consumptions. The modelling study by Teng et al. (2019) suggested that a 20 per cent tax may reduce obesity prevalence by 1.6 per cent within 10 years, however, this was not achievable due to Chile's existing low tax rates. In France, Capacci et al. (2019) found no significant reduction in obesity prevalence despite national surveillance data reporting that the tax slowed the rate of increase. The estimates reported the impact of the tax to equate to less than 0.2 BMI units per capita annually which is small but meaningful at a population level (Capacci *et al*., 2019).

3.2.2 Evidence of Reduced Calorie/Sugar Consumption

In Chile, Caro et al. (2018) found 3 per cent reduction in household purchases of beverages with high-sugar content and an increase of 10 per cent in purchases of beverages with low- or no-sugar content. Caro et al. (2018) also suggested that Chilean consumers are sensitive to price changes. This is consistent with the evidence provided by Cuadrado et al. (2020), who conducted a study examining the impact of SSB taxes on retail prices and affordability through national-level data analysis. This study estimated a full pass-through of the prices as the prices raised by 5.6 per cent which decreases affordability for consumers, suggesting a decrease in consumption. A setback in the study was that the analysis was limited to price index data and did not observe the health outcomes, and the findings are specific only to Chile. This implicates the lack of generalisability of the findings for other countries with varied tax structures and purchasing habits and the lack of health outcomes measurement provides an incomplete picture of the effectiveness of the tax. Guerrero-López et al. (2017) also found the total household calories from beverages in Chile reduced by about 6 per cent and Nakamura et al. (2018) showed high-income households had reduced caloric intake from SSBs by 11 kcal/day, compared to just 3 kcal/day among low-income groups. Hence, the overall calorie reduction is modest and there is a risk of widening the health disparities between the counterparts.

In France, Capacci et al. (2019) found that there is no clear evidence of reduced purchases of SSB and the tax rate appears too small to generate any significant changes (0.5 litre per capita annual reduction in SSB purchases; around 1 per cent decline in national consumption). This finding may be underestimated as Capacci et al. (2019) did not include out-of-home purchases which accounts to up to 25 to 30 per cent of consumption in their study, hence, the behavioural changes in ingestion of the French population may have been

underestimated. Heavy consumers were found to respond to the SSB tax more strongly and this can be explained through the rational addiction theory which expresses that individuals who regularly consume something (sugary beverages) are more sensitive to price changes as even small reductions in their consumption can lead to substantial savings; as sugary beverages consume a big portion of their budget, they are more likely to reduce their purchases (Capacci *et al.*, 2019). Heavy consumers view the tax as a form of health warning signal and are more likely to react strongly due to their higher-than-average consumption (Capacci *et al.*, 2019). Similarly, Allais et al. (2023) recorded industry reformulation to reduce their sugar content of taxed beverages by 6 to 7 per cent between 2015 to 2018 which is equivalent to 1.2g sugar/100ml on average. This shows that the taxation not only affected consumer behaviour but also manufacturer behaviour which improves the overall health profile of the products.

3.2.3 Health Disparities Across Income Groups

The effect of the SSB taxes is not the same for everyone as the study by Backholer et al. (2016) found that the low socio-economic groups experienced greater improvements compared to high socio-economic individuals. The study found that the monetary burdens of households was minimal across all income levels, suggesting that concerns of financial regressivity are overstated, as individuals in low-income household experienced great health outcomes despite low financial costs (Backholer *et al.*, 2016). The concerns on the unequal income expenditure remains as low income-level individuals are subjected to spend more on food and beverage necessities compared to high-income individuals. Further, the limitations viewed in Backholer et al.'s (2016) study such as the lack of inclusion of lower- and middle-income countries in the sample data, limited number of three real-world evaluations and the small number of studies (n=11) included in this review can cause these results to be limited in applicability.

Studies have suggested that low-income households have a higher consumption of sugary beverages compared to their higher-income counterparts, and one major concern propelled for SSB taxes is the unequal proportion of income spent on the tax between the varied income earners (Backholer *et al.*, 2016). In Chile, Caro et al. (2017) and Nakamura et al. (2018) found high socioeconomic status (high-SES) groups to have reduced their consumption of SSB by up to 11 per cent in accordance to the SSB tax, however, low

socioeconomic status (low-SES) households reduced their SSB consumption minimally by up to 5 per cent which maintained the diet-related socioeconomic inequalities between these counterparts. The price elasticity for ready-to-drink sodas was also lower among low-income households (0.8) compared to middle-income households (1.3) which suggested that carbonated drinks were found less suitable among poorer groups. In contrast, Valenzuela (2021) reported that the SSB consumption remained unchanged across all the socioeconomic groups and the tax did not narrow disparities between the households. In France, Capacci et al. (2019) found low-SEP's heavy consumers reduced their SSB purchases by 5 to 7 per cent while high-SEPs consumers reduced only by 2 to 3 per cent. This shows that there are greater health gains for the disadvantaged groups, and the tax may potentially narrow the inequalities between the counterparts.

Nakamura et al. (2018) argues that the tax may impose financial burden on the low-income earners and would require policy makers to reconsider if the diet-related benefits obtained by high-SES group amounts to the increased health-related inequalities faced by their counterparts. According to Backholer et al. (2016), supporters of the tax argue that the higher obesity prevalence and greater consumption of SSB can justify the needs for the heavier burden of the tax on low-SES households. However, a limitation in this systematic review by Backholer et al. (2016) was that the articles which were included did not test for statistical significance between the socio-economic positions and only focused on high-income countries which limits the generalisability of these findings.

3.3 Influence of Social Determinants of Health on Policy Effectiveness

This theme focuses on the influence of social factors such as income, education and health literacy on the effectiveness of the SSB taxation. Multiple studies proved evidence on the social determinants which shapes the ability of an individual to respond to price changes, access to health alternatives and understanding the health risks involved in prolonged SSB consumption. From these studies (n=7), several subthemes were derived and these included, (i) health literacy and education level, (ii) income and affordability of alternatives, (iii) equity of health outcomes across social groups and (iv) socio-economic and consumption behavioural responses to SSB taxes.

3.3.1 Health Literacy and Education Level

The study by Sassano et al. (2024) found combining initiatives relating to raising awareness on SSBs and the taxation policy yields good results. In Chile, Nakamura et al., (2018) found high-SES groups had better access to information regarding the tax and were able to respond better by reducing their purchases of SSB post-tax. The study by Cuadrado et al. (2020) also found the front-of-pack black warning labels to coincide with the SSB tax which raised consumer awareness. Further, this was proven through the increase in related keyword searches post-tax implementation which reflects the greater access to media and information sources by high-SES groups; this may also explain the relationship between the purchasing trend across the various SES groups (Nakamura *et al.*, 2018). A limitation in Nakamura et al.'s (2018) study was the lack of representation of rural households which could be improved in future studies. Overall, this implicates that pairing the taxes with education strategies can amplify the effectiveness, but these efforts must reach rural and low-SES groups to reduce the risk of enhancing health inequalities.

Teng et al. (2019) found public health messaging discouraged SSB consumption were more effective for high-SES groups compared to low-SES groups; however, a limitation in this study was that it measured the affordability across groups rather than the actual consumption, which was the main aim. Similarly, in France, Bodo et al. (2022) found the population with lower education levels were less supportive of the taxation and focused on the injustice (disproportionate income amounts spent on the tax) of the tax towards the lower-income earners; however, a limitation of this study was that it included no new data collection which can reduce the relevance of these results for the current population of France. Further, Thow et al. (2022) found only 38 per cent of French consumers were aware of the tax as a health measure, most viewed it as a form of a revenue tool; thus, this lack of awareness may have weakened the motivational effect of the tax.

3.3.2 Income and Affordability of Alternatives

In Chile, Caro et al. (2018) found the prices of untaxed beverages such as milk and 100 per cent fruit and vegetable juices increased by 1.8 per cent post-tax implementation. This spillover effect from the taxed market was precisely evident in the low-SES markets, where prices increased by up to 3.2 per cent (Caro *et al.*, 2018). As a result, the purchases of

untaxed beverages reduced, marking the largest reduction compared to other taxed SSB; thus, the affordability of untaxed beverages declined and steered consumers to low-SSBs, as their lower tax encouraged higher consumption (Caro *et al.*, 2018). Nakamura et al. (2018) found all income-earners in Chile had similar purchasing patterns of high-taxed beverages pre-tax implementation, however this changed as high-income earners reduced their high-taxed purchases considerably compared to middle-income and low-income earners; interestingly, low-income earners had no significant reduction in high-taxed SSB purchases post-tax. This shows that unintentional spillover effects may limit the health benefits of the SSB tax especially for low-income groups.

In substitution attempts, according to Guerrero-López, Unar-Munguía and Colchero (2017), bottled water purchases in Chile rose by 12 per cent post-tax and substitution was most evident among low-income households, who viewed SSBs as 'luxury goods' (Caro *et al*., 2017). However, their inelasticity to replace colas suggests a strong cultural attachment (Caro *et al*., 2017). The higher price responsiveness among low-income groups reflects the trend in low-income countries, where food expenditures account for a large portion of their income, making taxes alone as an initiative to be sufficient to influence behaviours (Guerrero-López, Unar-Munguía and Colchero, 2017; Backholer *et al*., 2016). To support healthier alternatives, Guerrero-López, Unar-Munguía and Colchero (2017) believe it is vital to return the fiscal revenue from the tax to consumers through initiatives such as public drinking fountains and education programs to ensure a well-informed public. In France, the substitution was less evident as bottled water was already very affordable (≈ €0.25/litre) hence, the tax did not strongly shift consumption towards it (Capacci *et al*., 2019).

3.3.3 Equity of Health Outcomes Across Social Groups

According to Caro et al. (2018), in Chile, price changes for untaxed beverages varied based on the market-level SES but it remains unclear whether this was due to manufacturer pricing strategies or differences in consumer behaviour. Studies (n=2) have found high-SES households reduced their purchases of high-sugar content beverages more than low-SES households, raising concerns since SSB taxes were devised to ensure all consumers especially, low-income consumers to reduce their SSB consumption the most (Valenzuela, 2021; Caro *et al*., 2018). Further, these results probe for more research to understand the limited response from low-income earners as high-SES households are benefiting from the

tax more at this stage which also widens the gap in health inequalities (Caro *et al*., 2018). Information regarding the equity of health outcomes across social groups in France was sparse.

3.3.4 Socio-Economic and Consumption Behavioural Responses to SSB taxes

In the context of untaxed beverages, the study by Caro et al. (2018) found low-SES households reduced their purchases more by volume and high-SES households reduced their purchases more by calories; this requires further research as the categorical grouping in this study included beverages with and without calories into one category which serves as a limitation for this study (Caro *et al*., 2018). High-SES households also had larger reduction in SSB purchases compared to low-SES households (Caro *et al*., 2018). These findings show that the effects of the SSB tax vary by socioeconomic status and further research is required to assess equity impacts.

3.4 Consumer Behaviour, Public Perception of SSB Taxation and Substitution Alternatives (Reformulated and Non-Taxed Products)

This theme explores the response of consumers to SSB taxes while focusing on the changes in their purchasing habits and shifts towards alternative goods. Several studies (n=9) examines the reduction in consumption of taxed beverages, increases in the purchases of untaxed and reformulated products and the influence of public awareness of the tax. Multiple themes emerged through the synthesis of these studies and these included; (i) shifts toward non-taxed or reformulated products and (ii) public awareness and acceptance of the tax.

3.4.1 Shifts Toward Non-Taxed or Reformulated Products

Research suggests SSB taxes to be more effective in changing manufacturer behaviour than consumer behaviour (Allais *et al.*, 2023). As a result of increased prices for soft drinks, Guerrero-López, Unar-Munguía and Colchero (2017) estimated the increase in demand for other products such as bottled water, milk, coffee and teas, however, this assumption was

based on models that was created for the study which lacked the real-world experience to strengthen this assumption.

Similarly, Nakamura et al. (2018) conducted a study in Chile which found no significant increase in the volume of flow-tax items purchased, supporting Kahneman and Tversky's prospect theory that consumers responded more strongly to price hikes than price reductions. Nakamura et al. (2018) also found all SES groups to have bought similar volumes of high-tax soft drinks pre-tax implementation, however, after the implementation, high-volume buyers reduced their consumption. Interestingly, these purchases also declined without substantial increase in the price, though a key limitation of this study was the inability to measure in-store price increments (Nakamura *et al*., 2018). This implicates that consumer sensitivity is more aligned with price increases than reductions as also displayed by the behaviour of high-volume buyers.

As a result of the tax reduction for low-SSBs in Chile, Teng et al. (2019) expected lower prices of items such as bottled water and concentrates and higher consumption, instead, the untaxed and low-SSBs prices increased after the tax was introduced (Cuadrado *et al*., 2020). Cuadrado et al. (2020) reported that this was due to industrial strategies and increased demand from consumers who switched to untaxed beverages, a trend also noted in other studies (Nakamura *et al*., 2018; Caro *et al*., 2018) (n=2). This was supported through the evidence from Caro et al.'s (2018) study as purchases of diet sodas rose 10 to 12 per cent and bottled water by 12 per cent. Hence, policy makers should be cautious to consider the differences between the beverage categories and its impact on consumer responses and their health (Cuadrado *et al*., 2020).

Bonnet et al. (2024) found consumers in France tend to shift away from reformulated products towards non-reformulated products with high sugar when faced with tax. Reformulation as a standalone initiative caused only minor changes in consumer behaviour, however, tax scenarios coupled with reformulation produced much greater reductions of up to 20 per cent (Bonnet *et al.*, 2024). In the tax and reformulation scenario, Bonnet et al. (2024) found taxes to cause a price hike which pushes consumers to healthier options (reformulated products) in France. However, a limitation in this study is that it relied on simulations which assumed a full tax pass-through to consumers, this may not reflect real-world manufacturer decisions.

3.4.2 Public Awareness and Acceptance of the Tax

In Chile, according to Nakamura et al. (2018), the SSB tax was introduced as a part of a broader health reform, meaning, the efforts to increase public awareness on this tax was limited. Those with better access to information such as individuals in high-SES groups were more likely to be aware of the tax and initiate efforts to reduce their purchases of SSBs. Nakamura et al. (2018) found evidence as data showed higher number of internet searches on keywords relating to the tax from high-SES groups post-tax implementation. Similarly, Teng et al., (2019) found the SSB tax to cause a difference in consumption, for example, lowered tax rates for healthier SSBs and increased tax rates for high-sugar content beverages signalled the seriousness of a health concern associated with consuming the product. Chilean surveys showed around 62 per cent public acceptance of the SSB tax when framed as a health policy, especially among parents (Valenzuela, 2021).

In France, Thow et al. (2022) reported the SSB tax to have initially received strong opposition through the media while farmers supported the tax due to its revenue allocation benefitting them. To improve the public awareness and health literacy, the French government ensured effective communication with the general public and important groups such as parents through social media and coalitions (Thow *et al.*, 2022); however, Thow et al. (2022)'s study conducted the media analysis mostly in English which could have caused the authors to miss the local narratives and the involvement of the World Health Organization (WHO) could have caused biasness in the interviewee response. Further, Thow et al. (2022) found the academics in France were supportive upon dissemination of the health burden and the possible benefits obtained through the SSB taxation. Correspondingly, Bodo et al. (2022) also found the acceptance rate of the SSB tax in France to be close to 50 per cent with additional support connected with reduction in price for healthier food options and revenue allocation for the healthcare system. Bodo et al. (2022) concluded the acceptance of the soda tax may have improved due to continuous discussion on food taxation over time.

3.5 Barriers and Enablers to Effective Policy Design and Implementation Strategies

This theme examines the structural aspect of the SSB tax including its design, implementation and enforcement. Several studies (n= 7) observe the key factors such as political support, industry responses, enforcement challenges and the revenue use and reinvestment. The effectiveness of the SSB tax is heavily dependent on the way it is framed, executed and integrated into the health frameworks of specific countries'. Several themes which emerged from these studies are (i) industry response and lobbying, (ii) enforcement and compliance challenges and (iii) revenue use and reinvestment.

3.5.1 Industry Response and Lobbying

In response to the tax, Thow et al. (2022) found companies supported the tax when they could promote beverages which contained non-sugar sweeteners and they used the SSB taxation as an opportunity to launch product innovations. However, Valenzuela (2021) also reported that these companies strongly opposed stronger tax design and successfully lobbied to limit the reduced tax rate at 10 per cent for low-sugar beverages which may have diluted the health impact of the SSB tax in Chile. Cuadrado et al. (2020) noted that the efforts of reformulation in Chile could not be measured, as there was no direct evidence available to measure the amount of reformulation driven by the tax. The authors deduced that if significant reformulation occurred, this would have reduced product prices by shifting them into the lowered tax bracket for low sugar sweetened beverages (low-SSB). Nakamura et al. (2018) found that some manufacturers in Chile absorbed some or all the tax cost themselves, they balanced out their prices by keeping high sugar sweetened beverages (high-SSB) prices the same or slightly higher and increased the prices on low-SSBs to narrow the price gap. This allows consumers to assume sugary drinks were not much more expensive, hence, weakening the impact of the tax (Nakamura *et al*., 2018).

In France, Bodo et al. (2022) noted that the manufacturers response were not fully measured as reformulation efforts vary across companies based on production cost and consumer preferences. This supports Capacci et al.'s (2019) findings that the lobbying in France also focused less on blocking the taxation and rather more on negotiating the thresholds of reformulation. Bodo et al. (2022) noted the ongoing debate on replacing sugar with artificial sugars as the long-term health effects of artificial sweeteners were unclear. However, a limitation of Bodo et al.'s (2022) study was the lack of empirical data as it solely

relied on previous literature and the effectiveness of the reformed 2018 tax was not fully evaluated and only discussed hypothetically.

3.5.2 Enforcement and Compliance Challenges

Cuadrado et al. (2020) suggested fiscal policies to be adjusted over time to reflect average income growth, if the tax amount remains the same, sugary drinks may become affordable again and this nullifies the expected benefits of the SSB tax. Research suggests policymakers to evaluate each drink separately as different beverages respond differently to tax fluctuations due to under-shifting (Cuadrado *et al*., 2020). In Chile, manufacturers had to report the sales and values above and below the sugar threshold, Cuadrado et al. (2020) noted the absence of a formal audit mechanism which may reduce accountability; this soft-regulation approach raises concerns as it may allow the industry to undermine the effectiveness of the policy. As evidence of compliance challenges in Chile, Caro et al. (2018) found that small retailers had misclassified up to 15 per cent of taxed products. Reformulated products can also shift from high-SSB to low-SSB tax bracket, potentially masking the changes in the purchasing behaviour, however, this remains an assumption as no direct reformulation effects were measured by Cuadrado et al. (2020). In France, the existing tax infrastructure had achieved up to 95 per cent compliance within the first year of tax implementation (Capacci *et al*., 2020).

3.5.3 Revenue Use and Reinvestment

In Chile, Thow et al. (2022) describes the SSB tax as a cost-effective intervention to address health problems and to raise revenue. Caro et al. (2017) reported the revenue generated in Chile was around $40 million in the first year and suggested reinvesting in education programs and subsidies for healthier food alternatives. Caro et al. (2017) also proposed to extend the tax beyond SSBs to reduce the consumption of unhealthy foods; however, the researchers caution this suggestion to be considered with reservation as this study simplified the tax pass-through and assumed full price transfer to consumers. In France, Bodo et al. (2022) highlighted similar opportunities to utilize the tax revenue of around €400m annually for health and prevention programs but found that funds were designated for the Farmers' Social Security Scheme, which limits the potential health benefits gained through the revenue. The authors also identified the tax collection system in France to be rather complex

as it involves multiple beverage taxes which requires a legal analysis to address (Bodo *et al*., 2022). This shows that the effectiveness of the health promotions derived from the revenue is dependent on the transparency of the reinvestment and simplified tax structures.

Chapter 4: Discussion

4.1 Introduction

This systematic review investigated the effectiveness of the SSB tax in France and Chile; mainly focusing on the outcomes in the consumption behaviour, health impact and equity implications. This chapter discusses the main findings obtained through the systematic review of the effectiveness of SSB taxation in France and Chile through the lens of the social determinants of health theory. Majority of the studies included found reductions in purchased SSB which differentiated according to tax design and national context. In Chile, seven studies reported consistent declines in SSB purchases ranging from 3 per cent to 21.6 per cent however, three studies found no significant reduction in obesity prevalence in the short-term evaluation. In France, five studies reported reduction in household SSB purchases (around 1 per cent annually) (Capacci *et al*., 2019) with stronger reductions among heavy consumers who opted for reformulated products as well; this caused the average sugar content consumption to reduce by 6 to 7 per cent.

As both countries demonstrated modest reductions of sugar consumption and limited signs of behavioural change, the impact on obesity prevalence was sparse. The review found that the effectiveness of SSB tax was not uniform across the population and was heavily dependent on factors such as income levels, education, health literacy, affordability of alternatives and cultural attachment to certain SSBs. Through the lens of the SDH framework while reviewing the findings, this chapter will examine the social, economic and structural factors which mediates the outcome of the SSB tax in France and Chile. The discussion will entail comparing countries' contexts, critiquing the implications of their policy and understanding broader policy lessons to design taxation strategies which are effective and compatible.

The review found SSB taxation in France and Chile produced uneven health outcomes as these responses were shaped by the social determinants of health. In Chile, high-SES households were more receptive of the tax by reducing their SSB caloric intake compared to low-SES households, who only showed minor reductions despite a higher baseline consumption level (Nakamura *et al*., 2018; Caro *et al*., 2018). This indicates that sufficient access to healthier alternatives and greater health literacy allowed high-SES households to benefit disproportionately from the tax. Conversely, low-SES households faced limited

alternatives as untaxed beverages such as milk and juice faced price increments (Caro *et al*., 2018).

In France, the low tax rate caused only minor reductions of less than 1 per cent in SSB purchases at a national level (Capacci *et al*., 2019). Further, heavy consumer in the low-SES groups reduced their SSB purchases more strongly compared to high-SES consumers which indicates that the price sensitivity among these individuals who spent a larger portion of their income on SSBs were greater (Capacci *et al*., 2019). Both countries reported the lack of an immediate impact on the obesity prevalence from the SSB taxation, though modelling studies have suggested that a higher tax rate (20 percent and more) could deliver more meaningful impacts in the long-term (Itria *et al*., 2021; Teng *et al*., 2019). These findings have highlighted that the impact of SSB taxation is dependent on social determinants of health which shapes the willingness of different groups to change their behaviours.

4.2 Interpreting Findings

The differential outcomes obtained from Chile and France is caused by the interaction between the varied tax designs with the influence of the social determinants of health. In Chile, the limited impact among the low-SES households were due to the structural barriers of the tax such as lack of affordability and cultural attachment to specific sodas hence, the demand was inelastic despite price increment (Caro *et al*., 2017; Valenzuela, 2021). These findings also resonate with literature from Mexico and South Africa, whereby low-income groups experience limited benefits from SSB taxes due to affordability barriers (Colchero *et al*., 2017; Stacey *et al*., 2021). The cultural attachment aspect aligns with the findings by Cawley et al. (2019) as they describe the ‘cultural stickiness’ of dietary habits to remain unaffected when faced with fiscal measures alone. However, high-SES households who had better access to information were able to adapt to the tax changes and substitute to the alternatives more readily. Hence, this pattern can be explained by previous research where education and health literacy influences the behavioural changes from tax measures and health-literate individuals are more prone to view the tax as a health signal and began changing their consumptions appropriately (Cuadrado *et al*., 2020).

In France, the limited reduction in the overall national consumption is due to the low tax rate but the strong response from heavy consumers is attributed to the rational addiction theory

which states that individuals who consume large volumes are more price sensitive as even minor reductions can equate to an amount of financial savings (Capacci *et al*., 2019). Similarly, a study from Spain found evidence as the decline in SSB purchases was larger in higher baseline obesity areas (such as low-income neighbourhoods), hence, indicating heavier consumers responded more strongly to the SSB tax (Castelló and Casasnovas, 2019). Evidence in both France and Chile support the prospect theory whereby the population reacted more strongly to price increment on unhealthy beverages than price reductions on healthy beverages (Nakamura *et al*., 2018). These results reflect the importance of observing the tax in a whole context with interactions between income distribution, educational background, consumer psychology and cultural norms rather than in isolation.

4.3 Policy Implications

The findings of this systematic review clearly states that SSB taxes can only achieve their purpose when designed and implemented appropriately, focusing on the social determinants of the population's health. In both France and Chile, modest reductions of SSB were observed however, there were unequal health benefits between high-SES and low-SES groups. High-SES groups were positioned better to respond to the tax however, low-SES groups faced constraints such as affordability barriers and cultural norms (Caro *et al*., 2018; Nakamura *et al*., 2018; Capacci *et al*., 2019). This trend shows that the SSB tax alone without complementary measures may widen the health disparities between these groups. Another policy implication is that tax levels should be set at moderately high thresholds to ensure meaningful change is produced. Evidence from modelling studies highlight that the taxes should be set at 20 per cent or higher to generate significant change in the obesity prevalence (Itria *et al*., 2021; Teng *et al*., 2019). In the case of France, the low tax rate did not produce any meaningful difference and Chile's 10 per cent tiered tax structure was diluted through lobbying. Lessons learnt through strong tax designs such as United Kingdom's Soft Drinks Industry Levy showed the impact of an effective tax design and implementation which can guide reformulation and change consumer and manufacturer behaviour (Briggs *et al*., 2016; Scarborough *et al*., 2020).

The policy effectiveness is heavily reliant on affordability and accessibility of healthier substitutions, particularly for low-income groups. In Chile, the increased prices of untaxed

beverages reduced the affordability of alternatives for poorer households (Caro *et al*., 2018). Similar evidence from Mexico and South Africa found SSB taxes combined with subsidies for healthier options enhances the consumptions amounts and equity outcomes (Colchero *et al*., 2017; Stacey *et al*., 2021). In France, bottled water was already very affordable, thus, this shows that price differences alone may be insufficient to fuel behaviour change and would require additional complementary measures such as health literacy and awareness measures.

The use of the tax revenue should also be utilized to maximize public trust. In Chile, the estimated annual revenue is USD 40 million which has been suggested to reinvest into nutrition education and subsidies for healthier alternatives (Caro *et al*., 2017) and in France, the revenues have been allocated for the Farmers' Social Security Scheme which limits the potential health benefits from reinvestment of funds (Bodo *et al*., 2022). Global evidence has found that transparent fund allocations for health-promoting programmes can increase public support and ensure tax interventions are efficient and equitable (Wright, Smith, and Hellowell, 2017). These findings have summarized the importance to enact tax reforms as part of broader strategies while addressing social determinants of health.

4.4 Limitations

Several limitations observed in this review were the included studies' analyses which was conducted over short evaluation periods, especially in Chile, an example is the analysis by Caro et al.'s (2018) which was limited to 1-year post-tax implementation. These short-term evaluations often fail to capture the overall long-term behavioural changes and its impact on obesity prevalence which restricts the applicability of findings for the future. There is also a risk of urban and high-income bias within the studies selected, as the Chilean studies by Caro et al. (2018) and Nakamura et al. (2018) relied heavily on household panel and urban survey data which excluded information from rural populations who may have varied consumption patterns, limited health literacy and scarce healthy alternatives. In France, evaluations by Capacci et al. (2019) and Bodo et al. (2022) relied on in-home purchase data which limited data from out-of-home consumption which represent up to 30 per cent of SSB intake. Another limitation evident in the studies was the lack of determination of causality at individual level as the study by Allais et al. (2023) used an observational design which does not permit a causal inference at individual level and the study by Sassano et al. (2024)

operated at a country level which also does not allow causal inference at individual level. The quality of sample data may cause issues in understanding the impact of the SSB tax on more socially disadvantaged groups.

There were also gaps between the industry response to the tax and its interaction with the social determinants of health. In Chile, the reformulation and price absorption methods were evident, however, the direct impact on how these methods affected consumer response is still unclear (Cuadrado *et al*., 2020). In France, the reformulation strategies were tested at a population level however, there was no connection of its impact of the different SES groups which raises query on whether the disadvantaged groups benefitted equally. Another limitation is the limited availability of primary studies. Most of the evidence stemmed from high-income groups and fewer studies on low-income contexts. This restricts the generalizability of the findings in this review especially among countries with prominent affordability barriers and health literacy gaps. These limitations urge for the need of more long-term and equity-focused evaluations which integrates rural and culturally diverse perspectives. This evidence is crucial to highlight the important mediating factor played by social determinants in the impact of a taxation strategy.

This study has several limitations as well. The scope of the review was restricted to utilize published articles which relied on household purchase data and urban responses which could have underestimated the out-of-home consumption and rural data. The evidence analyzed through the systematic review of the 15 chosen articles were limited for the factors such as socioeconomic factors, health literacy and cultural background. Another limitation in this study is the possibility of reviewer bias. This is due to subjective judgements which is present when analyzing the studies and the interpretation of the findings, hence, to ensure this is controlled, the researcher ensured to read the chosen articles multiple times with strict adherence to PRISMA guidelines. Time constraint was an apparent limitation as this systematic review is a dissertation thesis with a 16 weeks' time period.

4.5 Future Research Through the SDH Lens

The future research on SSB taxation should address the limitations identified through this systematic review and enhance the understanding of the influence of social determinants of health. Longitudinal study which extends beyond a simple short-term evaluation are

encouraged. Research which observes a population over a period can determine if minor reductions in SSB purchases eventually leads to meaningful health gains. The future evaluations must also include diverse population groups with inclusion of rural and low-SES households which have been underrepresented in the existing studies. This neglect often risks underestimating the impact of SSB taxation on disadvantaged groups who may have different SSB consumption patterns and social determinants of health. By incorporating these factors, the SSB taxation can be designed with inclusivity as a vital element.

Future research should also focus on acquiring real-world effects of industrial responses. Studies in France reported measurable reformulation (Allais *et al*., 2023) however, Chilean studies relied on assumptions and secondary data with no measures of reformulation (Cuadrado *et al*., 2020). It is vital to evaluate the impact of industrial strategies on the SES groups. Research should also be conducted on the combination of fiscal policies and complementary measures such as subsidies for healthier alternatives and public education campaigns. Comparative studies around the globe have found the importance of contextual social determinants of health factors in empowering the effectiveness of reforms. Future research should examine the interaction between taxation and social determinants of health. Through long-term and equity-focused approaches, future evidence will be able to guide policy designs to reduce SSB consumptions and reduce the health disparities between diverse populations.

In a structural perspective, the differences in policy design and implementation also influenced the outcomes. The French population demonstrated strong compliance and beverage reformulation while, Chilean population were faced with weak enforcement and lobbying methods which diluted the impact of their tax. This shows that the SSB tax should not be enforced in isolation but rather with consideration to its social and political context. The message from this review for policymakers is that SSB taxes are most effective when combined with complementary health strategies. The measures include higher tax brackets, reinvestment of revenues into education and healthy alternative subsidies and effective communication campaigns. To conclude, the evidence suggests that SSB taxes are promising when it is a part of a broader health reform to reduce sugar consumption and preventing obesity. However, taxes enforced without appropriate attention to social determinants of health in the community may risk uneven benefits and widening health disparities between social class. A strategy with the combination of a fiscal policy, accurate

health education and equity-oriented initiatives will lead to sustainable achievements in population health.

Chapter 5: Conclusion

5.1 Answering the Research Question

This dissertation aimed to evaluate the effectiveness of the SSB tax in a developed nation, France and a developing nation, Chile. The findings from this study suggests that the SSB taxes can modestly reduce the purchase rate of sugary beverages and encourage reformulation, however, the overall impact remains limited particularly in the short-term basis. A vital factor found was the importance of social determinants of health in shaping the effectiveness of the policies; these include income levels, education levels, health literacy and affordability of substitutions. High-SES groups benefited from the policies better while low-SES households faced affordability and cultural norm barriers. The differences in the changes needed to improve the SSB taxation in a developing country and a developed nation varied, in Chile, the developing nation needed to improve their affordability of alternatives and improve education to enhance the impact of the tax whereas, in France, the developed nation needed to encourage reformulation. Hence, this demonstrates the different needs and changes required by the varying nations although similar SSB taxation was implemented.

5.2 Reflection on the Research

The method chosen for this systematic review to be conducted while critically appraising the chosen studies worked very well. This allowed for a clear and structured comparative analysis to be conducted between France and Chile. The PRISMA approach allowed the studies to be identified appropriately and the JBI checklist allowed quality studies to be chosen for this research. The strengths of this study were the ability to objectively assess the social, political and varied industry dimensions and not be restricted to the health outcomes only. Several gaps were evident in the literature amassed for this systematic review and this includes many studies with a short-term evaluation of 1 to 2 years and an urban bias as rural populations were often excluded from the dataset. There were also limited studies which focused on equity analysis. Another limitation was that many studies excluded out-of-home SSB purchases which caused an inaccurate overall representation of the SSB consumption for the population. Several new insights were found through this research which were the strong influence of the food and beverage industry on the influence of the tax; in Chile, the

strong lobbying by the industry maintained the low tax rate and in France, the reformulation efforts were led by the tax designs. The SSB tax alone is also insufficient to produce significant changes and is required to be a part of a broader reform. Hence, this demonstrates the importance to ensure equity-focused policies are devised and accompanied with other health strategies.

5.3 Recommendations

Several recommendations which stemmed from this research for the policy aspect is to set the SSB tax to be 20 per cent and more to ensure meaningful impact. It is also vital to ensure transparent reinvestment of the revenues; these efforts include education programmes, public health campaigns and healthy food alternative subsidies. Another important suggestion is to improve communication strategies with the public to frame the policy as a health measure rather than a revenue tool which allows the public acceptance and compliance rate to subsequently rise as well. The policies should be structured with equity as a goal by pairing the taxes with healthy food alternative subsidies and to protect low-income households from disproportionate burdens. Many low- and middle- income countries such as South Africa found that directing the revenue towards health promotion made political acceptability and behaviour change better among the population (Amukugo *et al.*, 2021).

The study by Thow et al. (2022) has also suggested including a wider scope of products to be reformulated and by setting thresholds to sugar content, this forces manufacturers to lower the sugar content in their products. The incorporation of local data and evidence on the SSB consumption rate, obesity rates and projected health benefits allows countries to perform good evaluations and are able to implement and design the tax better (Mulcahy *et al.*, 2022). The recommendation for future research is to conduct more longitudinal research to understand the effects of the policy on long-term health outcomes. Studies should consider the inclusion of rural and low-income groups as part of their dataset to assess the equity impact of the policies. Research should also consider examining industry responses to reformulation, pricing strategies and marketing shifts. The focus on comparing the policies from different countries allows the identification of the best practices which yields beneficial results.

5.4 Contribution of the Research

This study has provided robust research on the comparative analysis of SSB taxes in countries of two different socioeconomic status; France and Chile. The study used the lens of social determinants of health which highlights how context shapes the outcomes. The study also demonstrates that effectiveness is not solely determined on the tax rate or design, rather it is focused on the population who benefits. The systematic review confirmed that SSB taxes were useful but could not be a standalone initiative as it produced better results when embedded into broader health strategies. Some contributions derived from the policy aspect were to implement higher or tiered taxes which can achieve better results. This study strengthens the evidence base between fiscal policies and developed and developing nations and contributes knowledge to encourage a multifaceted strategy when applying policies. It also highlights the gaps in existing knowledge and sets a clear agenda for future research. The study provided advocacy contribution to serve as an evidence base for governments to design higher and better taxes. The lessons amassed from this research applies beyond France and Chile as it provides strong evidence for the recommendations of the SSB taxes provided by WHO. The conclusion of this study was that fiscal policies could reduce unhealthy consumption but must also be supplemented by other strategies. The application of similar tax policies is very different in countries of varied development status and must be tailored according to the social determinants of health of the population.

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Appendix 1: Data Extraction Table

This appendix acts as a summary table of all the included studies in this systematic review.

Citation (Author, Year, Country)	Study Design	Sample and Setting	Aims and Objectives	Methods	Key Findings	Strengths	Limitations
Guerrero-López, Unar-Munguía and Colchero, 2017, Latin America	Quantitative Study	10,527 households	The study aims to measure the sensitivity of Chilean urban households to price changes in soft drinks, sugary beverages and high-energy foods by estimating the price elasticity of their demand.	The study analysed Chilean household expenditure data between 2012 to 2013 using system models to estimate own and cross-price elasticities for beverages and foods.	The study found soft drinks to be highly price sensitive as a 10 per cent price hike reduced consumption by 13.7 per cent. Other foods and beverages acts as a substitution with water consumption increasing by 6.3 per cent when soft	The strengths include large representative sample with detailed subgroup analyses and highly relevant findings for fiscal health policy.	The limitations include heavy reliance on cross-sectional data, lack of out-of-home consumption and limited geographical coverage which limits the comprehensive assessment of SSB consumption.

					drink price increased.		
Capacci, Sara; Allais, Olivier; Bonnet, Celine; Mazzocchi, Mario, 2019, France and Italy	Quasi-experimental quantitative study	2,928 French households 400 Italian households Italian Expenditure Survey: 6,379 (2011) and 6,510 (2012) households	This study assessed the impact of the French SSB tax on retail prices and purchases, it also examined if heavy consumers were affected differently.	The study compared the French and Italian price and purchase data between 2011 and 2012 using differences-in-differences model, the researchers used Italian regions and water consumptions as controls to test the reliability of the results.	The tax was fully passed on for soft drinks and partially for fruit juices, however, its effects on the purchases were limited with stronger reductions evident for heavy consumers. Fuit juices and water purchases remain unaffected.	The study utilized real world observational data across countries, included robust checks and used a strong quasi-experimental design.	The limitations included a short-time window of 1-year post-tax, lack of out-of-home consumption report and a small Italian panel sample and lack of income data for socioeconomic relationships.
Juan Carlos Caro, Camila Corvalán, Marcela Reyes, Andres Silva,	Observational longitudinal study	2,000 households	The study aimed to assess the changes in beverage prices, purchase volumes and calorie intake	The study utilized data from Chilean households between 2013 to 2015 to compare	The tax yielded results such as small price increment which led to purchase	The strengths include rich longitudinal dataset across 3 years, strong	The limitation includes no control group, short term evaluation of only 1-year post-tax and

Barry Popkin, Lindsey Smith Taillie, 2018, Chile and America			post-tax implementation with attention to socioeconomic status and household factors.	the beverage prices, volumes and calories pre- and post- 2014 tax. The beverages were categorised based on tax level and type.	reductions for high-sugar beverages and increased purchases of low-sugar beverages' however, untaxed drinks also experienced reduction in purchases. High-SES households reduced their purchases more drastically than low-SES households.	methodological transparency and barcode-level sugar categorization.	an urban bias as rural responses were not collected.
Anne Marie Thow, Holly L Rippin, Georgina Mulcahy, Keeva Duffey, Kremlin Wickramasinghe, 2022, Denmark	Qualitative Research	20 interview participants	The study aimed to shape public health advocacy in policies by understanding political, economic and stakeholder factors in guiding the	The study utilized a policy analysis approach and combined documents, media and interviews to analyse the adoption factors of	The study found all countries to prioritize NCD prevention and revenue generation. The SSB taxes varied in types and rates but their	The strengths include a multi-method approach, cross-country comparison and integration of political,	The limitations include a small number of interviewees from each country which risks limited perspectives, media analysis which were

			adoption of SSB taxes.	SSB taxes in 10 European countries.	adoption was heavily reliant on the collaboration between health and finance ministries and stakeholders.	economic and institutional perspectives.	conducted mostly in English and may have missed local narratives and WHO's involvement which could have biased interviewee's responses.
Andrea M. Teng, Amanda C. Jones, Anja Mizdrak, Louise Signal, Murat Genç, Nick Wilson, 2019, New Zealand	Systematic Review	17 Studies	The study utilized real-world SSB tax evaluations to assess the effects on dietary intake and beverage purchases.	This study conducted a systematic review with 17 articles focusing on real-world SSB tax evaluations to assess the impacts of 10 per cent tax on beverage purchases and untaxed substitutes.	A 10 per cent SSB tax resulted in around 10 per cent reduction in purchases and slight increment in untaxed beverage consumption.	The strengths include focusing on real-world SSB tax implementation, PRISMA-compliant and inclusion of both sales, purchase and dietary intake data.	The limitations included limited evidence from middle/low-income countries, many included studies had a small sample and some classification between taxed and untaxed beverages were unclear.

Cristóbal Cuadrado, Jocelyn Dunstan, Nicolas Silva-Illanes, Andrew J. Mirelman, Ryota Nakamura, Marc Suhrcke, 2020, Chile	Quasi-Experimental Study	9629 stores	The study aimed to understand how SSB tax modifications affected beverage prices and the affordability of these beverages.	The standard regression method was unsuitable for this study, hence, the study utilised the ARIMAX model, which accounts for patterns over time to compare before and after-tax implementation.	The prices of carbonated beverages raised more than the tax percentage (over-shifting) and other drinks that were supposed to become cheaper became more expensive. The mixed results emphasised the importance of anticipating the industry pricing strategies as consumer behaviour is heavily influenced by the industry pricing.	The strengths include a national representative sample, inclusion of affordability as an important public health factor and robust ARIMAX modelling.	The limitations include no direct analysis of the reformulation of products; the results may underestimate true effects as an example is that diet sodas and sugary sodas were not separated and affordability is an intermediate outcome which does not translate to consumption.
Yann Le Bodo, Fabrice Etilé,	Case Study	1 country	The article aims to understand the	The research used a multidimensional	The 2012 French soda tax focused on	The strengths include an	The limitations include no new data

Chantal Julia, Marine Friant-Perrot, Eric Breton, Sébastien Lecocq, Christine Boizot-Szantai, Céline Bergeran, Françoise Jabot, 2022, France			lessons from France's first SSB tax and outlines the benefits of the tax while highlighting any remaining questions.	approach to combine past research and a review of French literature to assess the public health impacts of the SSB tax.	revenue generation with a low tax rate and led to modest consumption reductions. The 2018 reform focused on public benefit and incited reformulation and evolving public acceptance of the tax.	interdisciplinary approach, contextual understand of the 2012 and 2018 SSB tax and the reviews on both implementation and outcomes.	collection, limited discussions on consumer substitutions and the effectiveness of the 2018 tax reform was not fully evaluated and was discussed hypothetically.
Juan Carlos Caro, Shu Wen Ng, Lindsey Smith Taillie, Barry M. Popkin, 2017, Chile	Quantitative cross-sectional study	10,527 households	This study compares how SSB taxes affect nutrient availability in Chile through price elasticities estimated from household data.	The study simulated how household would change their purchases based on different prices and tax scenarios through the QUAIDS model.	The taxes on foods and drinks high in salt, sugar and fat displayed the greatest reductions in calories and purchases with similar results from all socioeconomic groups.	The strengths include the stratification conducted by income groups, policy-relevant simulations based on realistic frameworks in Chile and the	The limitations include the data only provided simulations and no causal inferences, this cannot model actual real-life behaviour and it also simplifies a full tax pass-through.

						use of a robust econometric model.	
Bonnet, Céline and Allais, Olivier and Marine, Spiteri and Réquillart, Vincent and Tranchard, Maxime, 2024, France	Quantitative cross-sectional study	6638 households	This paper aims to understand how companies are affected by the tax to understand if the high-risk groups are targeted, reformulation through reducing sugars and increasing other nutrients are followed through.	The study utilised French household purchase data and a supply-demand model to understand the effects of the SSB tax on the French dessert market.	The study found low tax rates yielded reduced sugar intake however, consumer profits faced a reduction as well. The tax and reformulation scenarios better targeted high-consuming and obese households.	The strengths include real household purchase data, scenario simulations and a clear focus on the distributional effects of the taxes on the public.	The limitations include one-year post-tax observation which is insufficient to understand seasonal trends, assumes a full tax pass-through to consumers and is based on simulations which lacks the real-world application of the policy.
Maria Josefina Valenzuela, 2021, United Kingdom	Mixed-method Study	Quantitative sample: 10,528 and	To assess the effects of the SSB tax in Chile on consumption	The study utilized a mixed method design to understand the	The SSB tax produced modest reductions in SSB purchases	The strengths include a nationally representative	The limitations include a lack of representation of rural households

		15,239 households Qualitative sample: 23 stakeholders.	patterns and oral health. To understand the policymaking process and its effects using a mixed method design.	impact and effects of the 2014 SSB tax through Chile's Household Budget Surveys in 2011/2012, 2016/2017 and interviews.	especially among high-SES households. Affordability was a key issue among low-income households, and no changes were observed in the obesity prevalence and oral health.	household data, equity focused as it highlighted the discrepancy in the effects of the tax on different socioeconomic status households and importance on the policy relevance by engaging in interviews with stakeholders.	which may have led to urban bias, self-reported limitations as it may underestimate the actual consumption and a short follow-up period post-tax implementation.
Alexander Itria, Stéfani S Borges, Ana Elisa M Rinaldi, Luciana Bertoldi Nucci, Carla	Systematic Review	16 articles	The study assessed the effects of the SSB taxes on obesity prevalence in different countries	This study was registered under PROSPERO and followed the PRISMA guidelines. It searched 5 databases between	Most of the studies found SSB tax resulted in reduced purchases and consumption. 8 studies found a reduction in obesity	The strengths include modelling and real-world evaluations, a transparent PRISMA	The limitations include a lack of data from low-income countries and very few real-world policy studies

Cristina Enes, 2020, Brazil			with varied income levels.	2009 to 2019 for studies reporting the effects of SSB taxes on obesity-related outcomes.	prevalence. A 20 per cent tax was found to be more effective than 10 per cent and significant impacts were observed more prominently in middle- and upper-income countries compared to high-income countries.	methodology and a wide geographical and income inclusivity.	as most were simulations.
Kathryn Backholer, Danja Sarink, Alison Beauchamp, Catherine Keating, Venurs Loh, Kylie Ball, Jane Martin, Anna Peeters, 2016, Australia	Systematic Review	11 articles	The study aimed to understand how SSB taxes affect beverage purchases and consumption, obesity outcomes and the differential tax burdens on individuals of varied	A systematic search was conducted on OVID, EMBASE and grey literature (2015) to identify studies on the effects of the SSB tax on beverage consumption, obesity outcomes and tax burden from	Most studies found either similar or greater weight reductions among low-SES groups and five studies found the tax to be regressive.	The strength of the study includes a comprehensive review which follows the PRISMA guidelines, includes both real-world and simulation	The limitations include limited real-world evaluations, assumptions in the models were not tested and this review mainly focused on including studies

			socioeconomic status.	varied socioeconomic positions in high income countries.		studies and multiple reviewers improves the reliability of the study.	from high-income countries only.
Ryota Nakamura, Andrew J. Mirelman, Cristóbal Cuadrado, Nicolas Silva-Illanes, Jocelyn Dunstan, Marc Suhrcke, 2018, United State of America	Quasi-experimental observational study	2,836 households	To assess whether the 2014 SSB tax was passed onto the consumers and the effect of the tax on the beverage purchases.	The secondary data analysis of the household purchase data between 2013 to 2015 was conducted through a differences-in-differences model to compare taxed and untaxed beverages pre- and post-tax.	The 2014 Chile SSB tax led to 3 per cent reduction in high-sugar beverage purchases and 10 per cent increase in low-or no-sugar substitutions. The tax showed a full pass-through as high-sugar beverage price increased by 5.6 per cent.	The strengths include a large nationally representative dataset and real-world policy evaluation.	The limitations include an urban bias as the data was limited to the consumption of urban household only, a short follow-up period of 1-year and only accounting purchasing data which does not translate to consumption patterns.

Michele Sassano, Carolina Castagna, Leonardo Villani, Gianluigi Quaranta, Roberta Pastorino, Walter Ricciardi, Stefania Boccia, 2024, Italy	Systematic Review	76 tax laws issued between 1940 and 2020 by 43 countries	The study aimed to assess the effects of SSB tax and their influence on obesity and diabetes.	The study conducted a systematic review of SSB taxes between 2009 to 2022 and identified 76 tax laws in 43 countries. The aim was to test the influence of tax design and income level on the health outcomes.	The results were mixed as some countries reported reduced obesity trends among children and adolescents but was found to be weaker for adults. Diabetes prevalence was also gradually reducing.	The strengths include a large sample size and a robust pool of datasets.	The limitations include a cross-sectional analysis which does not allow causal interpretation and other unmeasured variables (health campaigns) could have an influence on the health outcomes.
Olivier Allais, Géraldine Enderli, Franco Sassi, Louis-Georges Soler, 2023, France	Quasi-experimental observational study	10695 new sugar-sweetened beverages (SSB) launched between 2010 and 2019	The study aimed to assess the long-term effects of the SSB tax and the reformulation efforts in UK, France and Netherlands.	The study researched the new SSBs between 2010 and 2019 and a differences-in-differences design was used to compare the average sugar content in new	Sugar reductions were more prominent in countries with specific SSB policies. The country with the most sugar reductions was UK, followed by France	The strengths include longitudinal data which clearly observed pre- and post-tax trends, cross-country comparisons which allows	The limitations included an observational design which does not allow causal inferences, the study focused on new product launches only which excluded the

				beverages in countries with SSB policies against countries which do not have.	and then Netherlands. The control countries displayed no sugar reductions.	comparison of regional trends and the dataset consisted real-world evidence.	reformulations of existing products and no factor in the study accounts for substitution behaviour.

Appendix 2: Systematic Review Studies Critical Appraisal

Type of JBI Checklist Used	Article ID	Outcome Question 1	Outcome Question 2	Outcome Question 3	Outcome Question 4	Outcome Question 5	Outcome Question 6	Outcome Question 7	Outcome Question 8	Outcome Question 9	Outcome Question 10	Outcome Question 11
JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies	(Guerrero-López, Unar-Munguía and Colchero, 2017)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Null	Null	Null
JBI Critical Appraisal Quasi-Experimental Study	(Capacci et al., 2019)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Null	Null
JBI Critical Appraisal Cohort Study	(Caro et al., 2018)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes
JBI Critical Appraisal Checklist for	(Thow et al., 2022)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Null

Qualitative Research												
JBI Critical Appraisal Checklist for Systematic Reviews	(Teng et al., 2019)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
JBI Critical Appraisal Checklist for Quasi-Experimental Studies	(Cuadrado et al., 2020)	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Null	Null
JBI Critical Appraisal Checklist for Text and Opinion Papers	(Bodo et al., 2022)	Yes	Yes	Yes	Yes	Yes	Yes	Null	Null	Null	Null	Null
JBI Checklist for Analytical Cross Sectional Studies	(Caro et al., 2017)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Null	Null	Null

JBI Checklist for Analytical Cross Sectional Studies	(Bonnet et al., 2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Null	Null	Null
JBI Critical Appraisal Checklist for Qualitative Research	(Valenzuela, 2021)	Yes	Yes	Yes	Yes	Yes	No	Unclear	Yes	Yes	Yes	Null
JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies	(Valenzuela, 2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Null	Null	Null
JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses	(Itria et al., 2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses	(Backholer et al., 2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
JBI Critical Appraisal Checklist for Quasi-Experimental Studies	(Nakamura et al., 2018)	Yes	No	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Null	Null
JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies	(Sassano et al., 2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Null	Null	Null
JBI Critical Appraisal Checklist for Quasi-Experimental Studies	(Allais et al., 2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Null	Null