

Developing Policy on Sugar-sweetened Beverages for Children and Adolescents in
China

by

Yue Suo

Global Health Program
Duke Kunshan and Duke University

Date: _____

Approved:

Qian Long, Supervisor

Shenglan Tang

Mary Story

Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the
Global Health Program in the Graduate School
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2023

ABSTRACT

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Abstract

Background

China has witnessed a rapid increase in the prevalence of diabetes and childhood obesity over the past decades with an alarming increase in free sugar consumption, especially through sugar-sweetened beverages (SSBs). However, there are no national policies on SSBs in China. Little is known about the acceptability, adaptability, and scalability of policies on SSB consumption in China. Therefore, this study aims to explore stakeholder perceptions on the introduction of SSB policies and implementation challenges in China, and draw policy implications from the information gained.

Methods

This study design is adapted from a theoretical framework “Analyzing and addressing governance in sector operations”, with context analysis, qualitative interviews and stakeholder analysis. Semi-structured interviews were conducted with 37 stakeholders in Shanghai and Chongqing, China, including health commission officers, CDC officers, market regulation officers, academia, nutrition association, industries, and consumers (parents of children and adolescents).

Results

Currently, there is a rising trend of SSB consumption among children and adolescents in China, and the interviewed stakeholders were aware of the change in behaviors. Different stakeholders shared different understandings of the rising SSB consumption trends and conflicting prospects on whether SSB policies should be introduced in China. Besides, they also expressed different views on the choice of SSB policies, effectiveness, acceptability, and scalability. Most policy makers and nutrition experts agreed that health education is the most important and appropriate strategy to control SSB consumption by Chinese children and adolescents, and market regulation officers believe stricter policies such as taxes and mandatory front-of-pack labelling would be effective. On the other hand, industry stakeholders would prefer step-by-step policies including policies with multiple stages and voluntary labelling, wishing to create a better transition period for the market to respond. Furthermore, the interviewed consumers also observed the increasing trend of SSB consumption from their children. Some parents were aware of the health risk of excess SSB intake and believed in the positive impact of public health policy guidance, others would prefer the freedom to make their own choice as consumers and enjoy the sweet tastes of SSBs. In addition, perceived facilitators to the introduction of SSB policies include standard establishment or reform, the multi-sector collaboration of health, marketing, education departments and the industries, and step-by-step adaptation of SSB policies. Besides, potential

challenges include responsibility distribution between different departments, resistance from industries, and consumer opposition.

Conclusion

This study examined the perceptions of SSB policy introduction among different Chinese stakeholders, including policy makers, nutrition experts, the industry and consumers. Although the SSB intake among Chinese children and adolescents is growing, interviewed stakeholders showed inadequate knowledge and awareness of SSB policies. Valid policy action on a national scale would require national standard reforms, as well as improving awareness of policy makers and the nutrition literacy of Chinese consumers. Future studies could conduct formative research and collect implementation evidence to better facilitate the establishment of SSB policies in China.

Dedication

Appreciation to my family and friends who supported my decision to pursue a master's degree. Thank you to my supervisor Dr. Qian Long and the Duke Kunshan Global Health Program for all the support. Thank you to all people that accompanied me through this wonderful adventure.

Contents

Abstract.....	iv
List of Tables.....	xi
List of Figures.....	xii
Acknowledgements.....	xiii
1. Introduction.....	1
2. Methods.....	6
2.1 Logic Framework.....	6
2.2 Context Analysis.....	6
2.2.1 Document Review.....	6
2.2.2 Literature Review.....	7
2.2.3 Identify Stakeholders.....	7
2.3 Qualitative Study.....	7
2.3.1 Setting.....	7
2.3.2 Participants.....	7
2.3.3 Procedures.....	8
2.3.4 Analysis.....	10
2.3.5 Ethical Review and Clearance.....	11
3. Results.....	12
3.1 Current SSB and SSB Related Policies in China.....	12
3.2 Stakeholder Mapping.....	16

3.3 SSB Consumption Trends, Knowledge and Awareness of SSB Policies from Stakeholders	19
3.4 Perceived Importance of SSB Polices from Stakeholders	22
3.4.1 Policy Makers and Nutrition Experts.....	22
3.4.2 Industry.....	23
3.4.3 Consumers.....	27
3.5 SSB Consumption Habits of Chinese Children and Adolescents.....	27
3.6 Perceived Barriers and Facilitators for Adopting SSB Policies in China.....	29
3.6.1 Legislation and Standard	29
3.6.2 Multi-sector Collaboration.....	30
3.6.3 Step-by-step Policy	31
3.6.4 Industry Resistance and Consumer Acceptance.....	32
3.7 Stakeholder Perception of Specific SSB Policies and Strategies.....	33
3.7.1 Taxation	34
3.7.2 Labelling	35
3.7.3 Restricting SSB Supply	36
3.7.4 Restricting Marketing and Advertising	37
3.7.5 Health Education.....	38
3.8 Alternative Measures for SSB Policies.....	38
4. Discussion	40
4.1 Factors Associated with Implementing SSB Policies in China	40
4.1.1 Obesity Disease Burden and Rising Health Expenditure.....	40

4.1.2. Political Will and Policy Development	42
4.1.3 Health Awareness and Nutrition Literacy from the Public	44
4.1.4 Industry Resistance	46
4.1.5 Evidence for Effectiveness in the Chinese Context	47
4.3 Policy Recommendation.....	49
4.4 Strengths and Limitations	52
5. Conclusion.....	55
Appendix A. Stakeholder Views on SSB Policies in China.....	56
Appendix B. Interview Guides	73
Appendix C. Informed Consent.....	79
References.....	83

List of Tables

Table 1: Current SSB and related policies in China.....	13
Table 2: Demographic characteristics of interviewed consumers.....	19
Table 3: Involvement, interest, power and position of interviewed stakeholders	26
Appendix A.1: Emergent themes of stakeholder opinions on SSB policies	56
Appendix A.2: Barriers and facilitators of SSB policies in China from stakeholders	69
Appendix B.1: Interview guide for public health experts, market regulation officers, academia, nutrition association (English version)	73
Appendix B.2: Interview guide for public health experts, market regulation officers, academia, nutrition association (Chinese version).....	74
Appendix B.3: Interview guide for industry stakeholders (English version)	75
Appendix B.4: Interview guide for industry stakeholders (Chinese version)	76
Appendix B.5: Focus Group Discussion Guide for Consumers (English version).....	77
Appendix B.6: Focus Group Discussion Guide for Consumers (Chinese version).....	78

List of Figures

Figure 1: SSB policies feasibility and effectiveness scores from stakeholders (health commission, CDC, market regulation, academia and nutrition association).....	34
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1. Introduction

With the rapid economic growth in China, the food supply is more abundant than in the past, thus the dietary pattern of the population has gradually changed. While fulfilling their basic nutrition need and energy intake, people are willing to try other foods with better taste, higher fats and higher sugar content, including sugar-sweetened beverages (SSBs). Consumption of sugar-sweetened beverages (SSBs) is a major source of free sugars in the diet since its liquid form lacks dietary compensation (Wolf et al., 2008), and its consumption is increasing worldwide, especially amongst children and adolescents. According to the Chinese Dietary Guidelines 2022, SSBs are defined as beverages with artificially added monosaccharides and disaccharides during the production process, and the sugar content is greater than 5% (Chinese Nutrition Society, 2022). SSBs are calorie dense food with almost no nutrition merit. The 2016 national cross-sectional survey in urban China showed that around one-third of children and half of adolescents consumed more than one serving of SSBs every day. Furthermore, SSBs were ranked second in total fluid intake among these surveyed Chinese though the top contributor is plain water (Zhang et al., 2018).

Previous studies have evaluated the direct relationship between excess consumption of SSBs and health risks. For instance, epidemiological studies have shown a positive correlation between SSB intake and the prevalence of obesity (Ding et al., 2015; Harrington, 2008; Hu & Malik, 2010; Rousham et al., 2022; Wolff & Dansinger,

2008). An international meta-analysis proved that consuming 330-350 mL of sugary drinks per day for 1 year could lead to a BMI increase of 0.06 kg/m² in children (Malik et al., 2013). The reason for obesity could be due to increased energy intake through SSB consumption. Since SSB is in liquid form, people do not reduce their dietary intake accordingly by consuming SSB (Colchero et al., 2016; Lesser et al., 2007; Wolff & Dansinger, 2008). Excessive intake of SSB also increases the risk of type 2 diabetes mellitus (T2DM). A European cohort concluded that the risk of T2DM was 1.22 times higher for those who consumed 336g of sugary beverages (including fruit juices, sugary/honey beverages and beverages with artificial sweeteners) per day than for those who did not (Mullee et al., 2019). Besides, research have found that SSB intake could be related to rising risk of oral cavity, especially carbonated SSBs (Hooley et al., 2012). Furthermore, evidence suggested that increasing SSB intake triggers a higher risk of mortality, as one meta-analysis suggested that the risk of all-cause mortality increased by 4% for each 250 ml per day increase in intake of SSBs (Qin et al., 2020).

In China, SSB consumption amount is rising rapidly. From 2003 to 2014, the annual per capita consumption of SSBs by Chinese residents rose from 12kg to 119kg (Mi, 2020). Within the population, children and adolescents are the largest consumers of sugary beverages (SSBs), and their consumption trends are increasing year by year in both rural and urban areas (Zhang & Hu, 2018). On average, school-age kids and adolescents aged 6-17 consume SSBs 3.9 times per week, while this rate rises as age

increases - adolescents aged 15-17 on average drink SSBs 4.8 times weekly (Zhang & Hu, 2018). A meta-analysis in China showed that consuming one serving (approximately 240 mL) of sugary drinks per day increased BMI by 0.03 kg/m² in children over one year (Ding et al., 2015). Such health risks also contributed to higher deaths in China. In 2019, the number of deaths attributed to sugar-sweetened beverages in China reached 46633, with an increase of 95% compared with 1990. The proportion of deaths caused by excessive consumption of carbon-containing beverages increased from 0.34% in 1990 to 0.46% in 2019, an increase of 35% (Jiang et al., 2022). Similar findings were also reported in the literature that in terms of SSB consumption amount, China doesn't rank as high globally (Popkin & Hawkes, 2016; Singh et al., 2015). Nevertheless, China is experiencing notably high growth in sales of SSBs compared to countries like Mexico, where SSB policies were introduced early and a decline in SSB consumption was seen (Popkin & Hawkes, 2016). Thus, there is an urge to prevent more health issues.

Control of SSB intake through policy action is important and feasible, as WHO has promoted and advocated controlling obesity through unhealthy dietary factors. The Global Action Plan 2013-2020 published by WHO listed 9 NCD-related global targets to be attained by 2025, which includes "halt the rise in diabetes and obesity" (World Health Organization, 2013). WHO has called for measures to limit further increasing consumption of SSBs. In its publication "'Best Buys' and other recommended interventions for the prevention and control of noncommunicable diseases", WHO

proposed the following initiatives for controlling dietary risks, including reducing sugar consumption through effective taxation of SSBs, implementing nutrition labelling requirements to reduce total energy and intake of sugar, sodium and fat, as well as conducting mass media campaigns about healthy eating to reduce total fat, saturated fat, sugar, and salt intake. It is hoped that such measures will be able to control and reduce unhealthy dietary patterns and thus achieve the goal of preventing non-communicable diseases (World Health Organization, 2017). Some international communities have published guidelines regulating sugar intake (World Health Organization, 2015), as well as suggestions on implementing policies including taxation, labelling, or marketing restriction as an effective intervention to reduce consumption of SSBs for NCD prevention, especially in LMICs (Acton et al., 2019; Diabetes Canada, 2019; World Health Organization, 2017). Dozens of countries around the world have adopted public health policies to promote their citizens to drink less SSB, and there are low- and middle-income countries (LMICs) that have achieved positive results through such policies. For instance, in Mexico, two years after the introduction of an SSB tax, the purchase of taxed drinks decreased by 7.6% (Colchero et al., 2017).

Currently, China has not proclaimed a national policy on restricting SSB consumption, and unrestricted SSB intake exposes children and adolescents to greater health risks. In December 2020, Shenzhen was the first city in China to release a standard for the production and setting of health warning signs for carbonated beverages,

specifying that sellers of carbonated beverages should place standard health damage warning signs on shelves or counters. However, considering China's geography, demographic structure, the number of people in the country, and economic development level, the feasibility of promoting the SSB policy in multiple regions in China is unclear. Besides, there has been very little research concerning SSB policy implementation in China. Evidence on facilitators and barriers of SSB policies in China is insufficient. Hence, it deserves deeper research on this knowledge gap among multiple stakeholders for better progress in NCD prevention and control, with a focus on children and adolescents.

Therefore, the overall objective of this study is to explore stakeholder perceptions on the introduction of such policies as well as the implementation challenges through the following study questions:

1. What are policies, regulations, or strategies for addressing unhealthy diets with a focus on SSBs internationally and in China?

2. Who are the key stakeholders, and what are their perceptions of facilitators and barriers to restricting SSBs in China?

3. What are some good practices and lessons learned for restricting SSBs internationally?

4. What are some policy implications for restricting SSBs in China to be drawn from the knowledge gained above?

2. Methods

This was a qualitative study conducted in Shanghai and Chongqing, China. Different stakeholders including public health professionals, market regulation officers, academia, nutrition association, industries, and consumers (parents of children and adolescents) were interviewed about their perception of the introduction of SSB policies in China.

2.1 Logic Framework

This study is adapted from a theoretical framework “Analyzing and addressing governance in sector operations”(European Centre for Development Policy Management, 2008), with a preliminary literature review, qualitative interviews (key informant interview, in-depth interview, focus group discussions) and stakeholder analysis will be conducted to study the aims mentioned above.

2.2 Context Analysis

Context analysis was first conducted to collect information and evidence on existing SSB policies and other dietary-related policy documents in China and globally. The collected context would also be reviewed for mapping stakeholders.

2.2.1 Document Review

Mapping policies and regulations regarding unhealthy diet control towards NCD prevention, with a focus on SSB-related policies and implementation experiences internationally and in China. We will search the official websites of international

organizations (e.g. WHO), related associations (e.g. World Cancer Research Fund NOURISH policy database) and government agencies (e.g. National Health Commissions of China).

2.2.2 Literature Review

To gain an understanding of the effectiveness of evidence-based interventions on the restriction of SSBs and their implementation challenges, we will search original research and program reports published in 2005-2021 from online open-access sources. We will also conduct a manual search to identify relevant grey reports according to expert consultation.

2.2.3 Identify Stakeholders

Based on the document and literature review, as well as expert consultation, the study team identified and approach key stakeholders for qualitative interviews.

2.3 Qualitative Study

2.3.1 Setting

This study was conducted in two municipalities in China, Shanghai and Chongqing. Shanghai is located on the east coast of China and Chongqing is in the western central region of China.

2.3.2 Participants

Participants were recruited from April to July 2020. Eligibility criteria included individuals who are professionals in their field. Public health experts were approached

through local collaborators in municipal centres of disease prevention and control (CDCs) while market regulation officers were connected through local CDC collaborators and municipal administration of market regulation. Academia and nutrition association professionals were introduced through local CDC collaborators. Participant selection was performed by convenience sampling.

Industry stakeholders were recruited through networking with local market regulation officers and professional connections. Eligible industry interviewees are managers from the sales and research & development departments of SSB manufacturing companies. Participant selection was performed by convenience sampling.

Consumer participants were recruited through local CDC collaborators. Participants who are the primary caregivers of children aged 6-17 were eligible for the study. Participant selection was performed by convenience sampling.

2.3.3 Procedures

One interviewer who was proficient in both Mandarin Chinese and English wrote the interview guide based on a literature review about stakeholder analysis of SSB policies (Eykelboom et al., 2022; Tan et al., 2021) (for detailed interview topics and prompts, see Appendix B.1, 2, 3; for detailed oral informed consent script, see Appendix B.) and conduct the interviews as the moderator. In total, 37 stakeholders were interested in participating in the study, including policy makers (Health Commission,

Centre for Disease Control and Prevention, Market Regulation), nutrition experts (Academia and Nutrition Association), industry (SSB manufacturers and Artificially-sweetened beverages manufacturers) and consumers. Policy makers and nutrition experts participated in key informant interviews. A total of 11 stakeholders agreed to participate thus 11 key informant interviews were conducted. Industry stakeholders participated in individual in-depth interviews. As 5 industry stakeholders were interested in this study, 5 individual in-depth interviews were performed. All consumers (primary caregivers of children and adolescents aged 6-17) were interviewed through the format of focus group discussion (FGD). Primary caregivers in each city were divided into two groups based on the age of the children they were taking care of, one group held for primary caregivers of children aged 6-11 (n=4-6), and the other group held primary caregivers of adolescents aged 12-17 (n=4-6). A total of 4 FGD interviews were conducted, and 21 primary caregivers participated in the discussion. All interviews were conducted in Mandarin Chinese. The semi-structured interviews were conducted in person according to the stakeholder's convenience and preference for in-person interviews or online interviews. Stakeholders in Chongqing who were not able to be approached by the interviewer due to COVID-19-related travel restrictions were also approached through online interviews.

Interviews usually took 45 minutes to 1 hour. Participants were verbally informed of the informed consent by the interviewer and gave their oral consent to the

interviewer before the interviews began. Stakeholders received their compensation in cash or gifts form after they finished the interview. Compensation varied by different site and was chosen after discussion with local collaborators and reaching a consensus.

The interview guide was developed in Chinese by referencing English literature of previous similar studies. The content of the interview guide was reviewed by the corresponding author, the thesis supervisor and local CDC collaborators in Shanghai and Chongqing. Initial questions about knowledge and information of obesity prevalence, the population's SSB intake habits and SSB policies warranted short responses, and all other questions were designed to be open-ended.

Recordings were transcribed directly into Chinese transcripts. The moderator wrote notes during and after the interview to summarize key points in addition to the verbal transcription. The interviewer would verify the transcripts by listening to the interview recording if the transcription was unclear.

2.3.4 Analysis

All interviews were transcribed verbatim in Chinese. Data were analyzed using a thematic content approach (Green & Thorogood, 2018). One analyst read the transcripts thoroughly to identify key points and codes for developing the coding scheme and familiarize the transcripts. Structural codes were generated based on the interview guides and emergent themes were developed then. After that, the coding scheme was improved through memo writing on uncoded data, preliminary coded data and re-

coded data. No inter-coder verification was conducted. All transcripts were coded in Chinese through NVivo 12 version 12.6.1. Illustrative quotations were identified, translated from Chinese to English and presented in the Results section.

2.3.5 Ethical Review and Clearance

Ethical clearance was granted by the Institutional Review Board at Duke Kunshan University.

3. Results

3.1 Current SSB and SSB Related Policies in China

According to content analysis of literature and government documents, it is found that although China has not issued a national policy to directly address SSB intake, it also has advocated the harm of excessive SSB consumption, and currently has more and comprehensive control over the sale of beverages in the school environment.

Literature on policy reviews demonstrated that regulating SSB supplies on the school campus was early initiated in China. In 2008, Shanghai banned convenience stores from selling food products, including SSBs, on primary school and middle school campuses (Xin et al., 2021). Similarly in November 2013, the Beijing Municipal Education Commission issued the "Notice on Further Regulating the Management of Food and Beverages in Primary and Secondary Schools", which prohibited the sale of carbonated drinks and other unhealthy food and drinks in primary and middle schools. Besides, government documents also reported governmental actions on advocating healthy eating habits and sugar reduction. On February 15, 2019, the General Office of the National Health Commission issued the "Healthy Mouth Action Program (2019-2025)" (National Health Commission of the PRC, 2021), which proposed to carry out the "Sugar Reduction" action, combining with the "Healthy Campus Construction", primary and secondary schools and kindergartens to limit the sale of high-sugar content drinks

Table 1: Current SSB and related policies in China

Title	Issue Department	Year	Content
Notice on standardizing the provision of meals for students in primary and secondary schools and the establishment of supermarkets (grocery stores) in schools in Shanghai	Shanghai Municipal Education Commission	2008	Ban SSB sales in schools
Notice on Further Regulating the Management of Food and Beverages in Primary and Secondary Schools	Beijing Municipal Education Commission	2013	Ban SSB sales in schools
Healthy China 2030 Initiative	State Council of the PRC	2016	Healthy Diet Initiative
National Nutrition Plan (2017-2030)	State Council of the PRC	2017	The “San Jian (3 Reductions)” including sugar reduction
Healthy Mouth Action Program (2019-2025)	National Health Commission of the PRC	2019	Restrict supply of SSB in school canteens
School Food Safety and Nutrition Health Management Regulations (2019)	Ministry of Education of the PRC	2019	Ban food retailing facilities in non-boarding schools, restrict SSB sales in schools
Guidelines for Building Healthy and Nutrition-Aware Schools	Health Commission, Ministry of Education, General Administration of Market Regulation, General Administration of Sports of the PRC	2021	Ban SSB advertising in schools
Dietary Guideline for Chinese Residents (2022)	Chinese Nutrition Society	2022	Recommend less or no intake of SSBs

*Abbreviations: PRC, People’s Republic of China

and snacks, reduce the supply of SSBs and high-sugar content food in school cafeterias (Beijing Municipal Education Commission, 2013). In addition, the Program also encourages companies to innovate products with "low sugar content" or "no sugar" claims and improve consumers' ability to correctly read the nutrition facts table for added sugar. Furthermore, in order to implement the "Health Diet Initiative" of "Healthy China Initiative (2019-2030)"(National Health Commission of the PRC, 2019), the "National Nutrition Plan (2017-2030)"(General Office of the State Council of the PRC, 2017) and the "School Food Safety and Nutrition Health Management Regulations"(Ministry of Education of the PRC, 2019), multiple departments (including the National Health Commission, Ministry of Education, State Administration of Market Regulation and the General Administration of Sport) enacted the "Guidelines for Building Healthy and Nutrition-Aware Schools" on June 7, 2021(Ministry of Education of the PRC, 2021). Article 25 of this guideline explicitly states that "No convenience stores, supermarkets, or other food retailing facilities shall be set up in schools, and no alcoholic beverages or food high in salt, sugar, fat shall be sold. Advertisements of SSBs, seasoned noodles products and other snacks are not allowed," which further promotes the restriction of SSB intake among children and adolescents in China. Moreover, China's national dietary guide "Dietary Guidelines for Chinese Residents" also mentioned the health risks of SSBs such as dental caries and obesity, especially for children and adolescents. It mentioned the importance of drinking water as "SSBs are

not alternatives of water". The Dietary Guideline set limits for the daily intake of added sugar, which is less than 50 g per day but less than 25 g per day is recommended more (Chinese Nutrition Society, 2022).

Meanwhile, Shenzhen became the first city in China to issue a policy on the labelling of SSBs aiming to tackle rising SSB consumption. Shenzhen Municipal Health Commission's official website issued the notice of making standards and setting trial regulations for health warning labels of alcoholic beverages and carbonated beverages on December 31, 2020, which stipulated that it planned to add health warning labels to the shelves placing carbonated beverages in stores, including three core health warning quotes - SSB warning for children and adolescents, daily free sugar intake limits, and health warning of excessive SSB intake in the long term (Shenzhen Municipal Health Commission, 2020). Till this movement, further policy actions of controlling SSB consumption in China have been officially extended beyond the campus.

Additionally, the interviewed CDC officers also provided information on Shanghai and Chongqing's response to health diet promotion and SSB related political movements. Chongqing municipal government initiated the "Healthy China Chongqing Action Plan" in 2019, which included the "Reasonable Diet Initiative" that promotes the improvement of student nutrition in primary and secondary schools that ensuring food safety and nutrition health in schools, and actively carries out health promotion activities of "*San Jian* (Three Reductions)" – reduction in salt, fat and sugar. On top of

this action plan, Chongqing has also issued “Chongqing Child and Adolescent Obesity Prevention and Control Implementation Plan” which emphasizes the provision of nutritious food and avoiding high salt, fat and sugar content foods on campus. In addition, the active promotion of relevant policies has also been conducted in Shanghai. The implementation plan of the Shanghai National Nutrition Program published in 2020 clearly recommended "carrying out health education for primary and secondary school students on reducing SSB intake and strengthen the management of food sales on and around campus, and actively promote the ban of SSB sale in primary and secondary schools". Moreover, two other policy documents, “Shanghai Medium- and Long-Term Plan for the Prevention and Treatment of Chronic Noncommunicable Diseases (2018-2030)” and “Healthy Shanghai Action (2019-2030)” also emphasized the SSB sale ban in primary and secondary schools, while “Healthy Shanghai Action (2019-2030)” also mentioned the goal to reduce regular SSB consumption rate among elementary and middle school students decreased by 20%. In order to reach this goal, Shanghai has been planning for effectiveness trials of SSB warning labels on retailer shelves, thus generating evidence for future policymaking.

3.2 Stakeholder Mapping

From reviewing the literature on SSB policy analysis (Eykelboom et al., 2019), four main groups of stakeholders were identified, which are policymakers, nutrition experts, industry, and consumers. After reviewing the Chinese context and status, the

stakeholders were mapped as follows. Policy makers consist of governmental health institutions such as the health commission, Centres for Disease Control and Prevention (CDC), as well as market regulation. Within these parties, Health Commission and CDCs are responsible for formulating health-related policies, health promotion, and health surveillance. Market Regulation departments are in charge of establishing national and local standards and supervising industries on the implementation of these standards. Ministry of Education is engaged when introducing policies and programs related to school children and adolescents. Nutrition experts are academic professors specializing in nutrition, and health professional associations (such as nutrition associations, eg. China Nutrition Society). These stakeholders are often involved in constituting standards, policies and regulations as they serve as policy advisory members. Industry stakeholders in China include manufacturers, distributors, and retailers, as well as industry associations (eg. China beverage industry association). Stakeholders from the public are consumers.

Based on literature review results and expert consultation, we approach the following parties of key stakeholders as the interviewees, including beverage manufacturers, consumers (caregivers of children and adolescents), health commission officers, CDC officers, market regulation officers, academia and nutrition association. The demographic characteristics of consumers are displayed in Table 2. A summary

table of emergent themes and the corresponding views raised by stakeholders is shown in Appendix A.

Regarding the study setting, the study team chose two Chinese municipalities with different geographical locations, economic development, and SSB policies progress. Shanghai is planning to introduce restriction policies on SSBs through warning labels, as it is currently undergoing effectiveness trials before implementation. It is a mega-city with rapid economic growth, located in eastern China along the coast, and is consisted of mainly urban communities and some minor rural areas. While Chongqing does not issue SSB-related policies. It is in less developed Western China with a 30 million population and a greater portion of rural communities compared to Shanghai.

Table 2: Demographic characteristics of interviewed consumers

Age Group of Children	City	Role	Age, y
Children (Age 6-11 years)	Shanghai	Mother	39
		Mother	52
		Mother	36
		Mother	38
		Mother	41
	Chongqing	Mother	40
		Mother	31
		Mother	37
		Grandmother	64
		Aunt	51
Adolescents (Age 12-17 years)	Shanghai	Mother	50
		Mother	39
		Mother	46
		Father	45
		Mother	47
	Chongqing	Mother	47
		Mother	48
		Mother	49
		Mother	43
		Mother	45
		Mother	44

3.3 SSB Consumption Trends, Knowledge and Awareness of SSB Policies from Stakeholders

All stakeholders thought SSB intake among Chinese children and adolescents is growing, which reflects the same results from literature investigating SSB intake in China (Li et al., 2014; Mi, 2020; Zhang & Hu, 2018). All of them believed that children and adolescents like SSBs because they taste good, so consumption goes up. In addition, all stakeholders believed that the developed economic status in China makes more people affordable to try SSB. The market regulation officer thought that children and

adolescents would develop the habit of drinking SSBs after they found they like it, and “the nature of the human body” led to children’s natural obsession with sweet taste products including SSBs. Furthermore, public health experts, academia nutritionists and nutrition association professionals mentioned that children and adolescents lack the nutrition knowledge to realize that SSB could induce health risks, and their primary caregivers might also lack such awareness to educate their children on making healthy food choices. One academia nutritionist mentioned that “the consumption action is primarily determined by their parents. Nowadays young parents are more open to their children drinking sugary drinks, since they were young, they started to try sugary sodas”. A CDC officer specified in child health emphasized that children and adolescents now are exposed to a variety of information, and they are more accessible to SSB advertisements and SSB products. Additionally, a health commission officer stated the increasing popularity of handmade SSB (eg. bubble tea, fruit tea, slushie) in children and adolescents, which also adds to the SSB intake of Chinese children.

Through the FGD interview with primary caregivers, the results indicated that most of them considered “beverages tasted sweet” as SSBs, and one parent from Chongqing considered “all beverages besides pure water as SSBs”. One young mother from Chongqing also pointed out that some dairy and yogurt products contain added sugar too, which their children enjoy. Only one mother from Shanghai brought up artificially sweetened beverages (ASBs) and claimed ASBs are different from SSBs

because their sweet taste is from artificial sweeteners. In addition, some caregivers believe 100% fruit juices are not SSBs since the sweetness is “naturally from fruits.” Regarding the health risk associated with excessive SSB intake, the caregivers in Shanghai reported SSB intake related to the oral cavity, respiratory system health, bone health, aging, obesity, skin health (acne), cognitive health, changing to a sense of tastes. Moreover, caregivers also brought up that SSB carries social characteristics which influence their children’s choices. For instance, their children would often choose to grab an SSB to-go as it is tasty and convenient to carry around while drinking it when their children meet their friends or go out for leisure activities.

Regarding knowledge on SSB related policies, health commission officers, CDC officers, academia, and nutrition association professionals knew the international SSB policies and the pilot SSB policy in Shenzhen, China. Only half of the market regulation officers (n=1, in Shanghai) interviewed have heard of international and domestic pilot (Shenzhen) SSB policies. Besides, all industry manufacturers interviewed knew both international and domestic pilot SSB policy actions in detail. However, only a small portion of the caregivers interviewed in Shanghai (n=2) knew the SSB policies around the world (eg. SSB tax and sugar tax), and none of them have heard of the Shenzhen pilot SSB control policy.

3.4 Perceived Importance of SSB Policies from Stakeholders

Stakeholders were asked about their perceived importance of SSB policies and whether these policies should be implemented in China now. The details of other interviewed stakeholders' roles, specialization, city, involvement and perceived opinions are presented in Table 2.

3.4.1 Policy Makers and Nutrition Experts

The majority of health commission officers, CDC officers, market regulation officers, academia and nutrition association stakeholders supported introducing SSB policies to China and thought it could be a good way to control SSB intake of children and adolescents, as it can improve health outcomes through consumer education and industry innovation. One health commission officer believed constructing an SSB policy should have enough epidemiological data to prove the harm of SSB on the Chinese population, which is lacking at the moment, while multiple CDC officers and the academia nutritionists thought the scientific data and evidence claiming the health harm of SSBs is sufficient. In addition, one academia nutritionist and nutrition association professional thought the core of SSB policies not only promote healthy diets among consumers but also encourage industries to reformulate their products since the policies would guide consumers to choose less sugar content products, if the industry resisted keeping their high sugar content formula, they would lose consumers' preferences. However, the interviewed market regulation officers believe industries wouldn't be

willing to reformulate as this would increase their innovation costs. Furthermore, the market regulation officers claimed that using artificial sweeteners would be challenging for manufacturers as the taste of sugar can be hardly replaced by sweeteners due to sugar's smooth mouthfeel and structural functions in food formulation.

On the other hand, one health commission officer from Shanghai opposed SSB policies as he thought "Everyone has the right to choose to lose weight, so do they choose to be fat." According to this stakeholder, consumers have the right to eat what they like and choose what type of lifestyle they prefer. Besides, due to the heterogeneous development stages across the country, some regions could be facing rising obesity prevalence while other regions are still solving malnutrition problems from supplement packages. This stakeholder thought regions like Shanghai with great economic development and top prevalence of obesity in the country, SSB policies could be considered. Furthermore, a CDC officer specializing in nutrition and a market regulation officer from Shanghai both agreed that sugar is an essential nutrient that human needs for normal maintenance. Therefore, they thought the control for SSBs should be different from other unhealthy products such as tobacco and alcohol.

3.4.2 Industry

Industry stakeholders hold neutral opinions when being asked about their perceptions on introducing SSB policies. All industry interviewees responded "They are willing to follow the government's policy decisions" when they were asked whether

they would be pro or against the SSB policies. However, all manufacturers who sell both SSBs and ASBs claim they wish the policy works as an advising role to educate consumers to make healthy choices, rather than abolishing consumers' rights to choose what they like, as they believe most consumers would notice the importance of reducing sugar intake while still hoping SSB products are available for them to enjoy occasionally. Furthermore, these manufacturers selling both SSBs and ASBs and those mainly selling SSBs claim their hope to have a "buffer period" that the policy would give the industry time for transition, since they face the challenge of innovating new products, innovating new sugar substitutes which do not have the exact mouthfeel as sugar, replacing sugar with other structural agents to maintain their product features, as well as the fear of losing consumers if their transition is not successful. In addition, some manufacturers claimed that if the government put SSBs under policy control, all other sugar confectionary products should be controlled through similar policies and measures. Otherwise, it would be unfair to the SSB industry since one regulatory manager from an SSB manager said "If you control SSBs, what about candies? Cakes and cookies?".

Moreover, The SSB industry has captured the trend of SSB policies and started to prepare for transformation. One R&D lead from a domestic beverage company brought up that the SSB industry forecasted that the Chinese government was likely to post SSB tax soon during a past meeting of the beverage association, therefore they believed "future development must belong to non-SSBs". When asked about the future trend of

the SSB industry, manufacturers all agreed that sugar-free beverages would be the new rising trend as consumers have a greater need to buy both tasty and healthy beverage products. One stakeholder from an international beverage company mentioned that the COVID-19 pandemic accelerated consumers' need for healthier beverages, while an R&D manager from a Chinese SSB mentioned that "only delicious and healthy products can last long". As the manufacturers from both SSB and ASB companies claim that finding a good sugar substitute with low calories and a good mouthfeel that could alternate sugar, another stakeholder from a tea beverage company stated that "sugar-free" products should be completely no sugar and without artificial sweeteners as well, as they thought "new sugar substitute could bring new health challenges".

Table 3: Involvement, interest, power and position of interviewed stakeholders

Stakeholders	Involvement in the issue	Region	Specialization	Interest	Power	Position
Health Commission	Formulates regional nutrition and health policies and implements national policies	Chongqing	Health standard	High	High	Supportive
		Shanghai	Nutrition standard	High	High	Opposed
Centre for Disease Control & Prevention (CDC)	Implements national and regional nutrition and health policies; conducts health risks analysis and surveillance of obesity, nutrition, child health, health promotion	Chongqing	Food and water surveillance	Medium	Medium	Supportive
		Chongqing	Child health	High	Medium	Supportive
		Chongqing	NCD prevention and control	High	Medium	Supportive
		Chongqing	Food and nutrition	High	Medium	Supportive
		Shanghai	Nutrition and epidemiology	High	Medium	Supportive
Market Regulation	Inspects food product quality and safety; involve in formulating food safety related standards	Chongqing	Standard, inspection of food and medical devices	Medium-high	High	Supportive
		Shanghai	Standard, inspection of food safety	Medium-high	High	Supportive
Academia	Research to generate nutrition health evidence for policy making	Shanghai	Nutrition	Medium	Low	Supportive
Nutrition Association	Conducts popular science work and training in the nutrition science field	Shanghai	Nutrition	Medium	Low	Supportive
Consumer	Consume SSB products			Low-medium	Low	Neutral
Stakeholders	Involvement in the issue	Product type	Specialization	Interest	Power	Position
SSB Industry	Manufactures SSB products; involve in revision of national and industry standards of beverages	ASB, SSB	R&D	High	Medium	Neutral
		ASB, SSB	Marketing	High	Medium	Opposed
		Mainly ASB	Marketing	Medium	Medium	Supportive
		SSB	R&D	High	Medium	Neutral
		ASB, SSB	R&D	High	Medium	Neutral

¹Interest: stakeholder's interest in introducing SSB policies in China; Power: stakeholder's decision making power; Position: whether stakeholder support, oppose SSB policy

²Abbreviations: NCD, non-communicable diseases; ASB, artificially sweetened beverages; SSB, sugar-sweetened beverages; R&D, research and development.

3.4.3 Consumers

Interviewed consumers shared mixed opinions on whether SSB policies should be introduced to their city or the entire country. Some consumers believe political action is a good way to control their children's SSB intake because they think it is challenging for them as caregivers to completely stop their children from consuming SSBs, so they think SSB policies can better assist in controlling and educating their children at the same time. On the other hand, some consumers think SSB policies is just the government interfering with their personal preferences, and some policies like taxation would have no benefit but just cost them more money. These consumers wish to have more autonomy to decide what they would like to consume.

3.5 SSB Consumption Habits of Chinese Children and Adolescents

In terms of SSB choices, caregivers claimed that younger children prefer fruit juice beverages, carbonated SSBs (cola and Sprite), yogurt beverages (e.g. Yakult) and milk beverages, while adolescents also enjoy cola and fruit juice beverages, but they also explore tea beverages (including milk tea and bubble tea), coffee beverages, sports drinks and energy drinks, which literature portrays similar trend that China shows unique larger growth in fruit beverages compared to other countries (Popkin & Hawkes, 2016). Regarding the consumption frequency, younger children's caregiver usually allows their children to try SSBs once a week. In contrast, caregivers do not control their adolescent children much because either the caregivers felt they cannot control their

children, or the caregivers believe that they have adopted good habits from younger ages. In addition, since the interviews were taken place during summer vacations, all caregivers mentioned that their children would have SSBs more frequently during holidays since they would have more time at home and may also have more leisure and travelling activities. Plus, the weather was very warm, and SSBs were more accepted among these caregivers' families.

Primary caregivers of children aged 6-11 claimed that caregivers' purchase is the most common channel through which their children got SSBs. This included offline purchases (from supermarkets and convenience stores) and online purchases (through e-commerce platforms and online stores). On the other hand, primary caregivers of adolescents aged 12-17 mentioned that as their children are old enough to have their pocket money, most of them would purchase SSBs for themselves on their own, and they as caregivers are not able to control as much because as adolescents grow, they would have more time by themselves. Besides, all the caregivers mentioned in situations of travelling, outings, parties and gathering events, their children will consume SSBs, and they usually allow it since they think such situations won't occur often, and it is hard to control in such situations as well.

3.6 Perceived Barriers and Facilitators for Adopting SSB Policies in China

The interviewed stakeholders identified multiple barriers and facilitators that might affect the adoption of SSB policies in China. See the overview of these barriers and facilitators in Appendix A.2.

3.6.1 Legislation and Standard

Stakeholders from all sectors besides consumers address the importance of establishing a clear, detailed national standard or law to facilitate SSB policy adoption in China, no matter which type of policy would be introduced. First, standards would specify the details for the policy requirement, including which type of beverages would be considered SSBs, the details of the labels, etc. One market regulation officer from Chongqing stated, “If a standard is not set, we can’t implement any policy or control with the political procedures.” Second, establishing a standard also assists industries to adopt the change in policies and helps them through the transition. CDC officers, health commission officers and market regulation officers claimed that a detailed and coercive standard could encourage industries to reformulate their products and avoid them using biased information to advertise their products. One industry R&D manager brought up that industries wish policy makers would consider the industry’s transition difficulties and support them with guiding strategies. Besides, the health commission, CDC and market regulation stakeholders suggested current “National Food Safety Standard - Standard for nutrition labelling of prepackaged foods (GB 28050-2011)” could also be

modified to better suit the purpose of SSB restrictive policies as this standard include “no-sugar” or “low-sugar” claims already. SSB policies require national action (such as taxation, front-of-pack labelling) then could be embedded through reform of existing standard to be scaled up nationally.

In contrast, there are also some challenges in legislation administration. One market regulation officer also brought up the challenge of establishing a standard because “multiple departments’ thoughts should be considered”. A CDC officer specialized in nutrition also mentioned establishing the standard should define SSBs clearly, as she said “Whether handmade drinks from bubble tea stores considered SSB in the standard?”. Besides, adopting SSB policies would also add administration load to market regulation departments as they need to ensure the proper implementation of policies at local levels, including quality assurance of products, adapting rural regions, etc. Thus, ensuring effective communication between different levels of sectors and assuring implementation of detailed measures would consider essential to deliver effective controls over SSB through policies.

3.6.2 Multi-sector Collaboration

Stakeholders from the health commission, CDC, academia and nutrition association all agreed that adopting SSB policies in China would require various departments’ collaboration. For instance, health departments initiate the SSB control advocacy through health awareness activities, while market regulation departments

follow up to implement and supervise industries, education departments facilitate school education, etc. Therefore, one CDC officer mentioned that properly distributed responsibilities to each related department would be required in order to achieve effective implementation, as “their responsibilities should be clearly divided, and each department should know what they need to do”. However, effective communication between departments must be achieved for the effective distribution of responsibilities. For example, one market regulation officer brought up that when collaborating with education departments, “other departments must reach out to them first because they usually don’t initiate communication with other departments”.

3.6.3 Step-by-step Policy

All stakeholders besides consumers reached a consensus that SSB policies should be gradually introduced to adapt Chinese context for the following reasons. First, the gradual introduction of SSB policies would allow the public to gain more health knowledge and adapt to SSB policies better. Public health experts from CDC, the health commission, academia and nutritionists from the nutrition association all thought that consumers first need to gain health knowledge and awareness related to SSBs. Second, the industry would benefit from the gradual adoption of SSB policies. Industry stakeholders mentioned their need for a transition stage, which would provide them time to innovate better sweetening agents to replace sugar and create other beverage choices. Third, step-by-step delivery of SSB policies would assist different regions to

slowly adapt SSB policies. One health commission officer and one CDC officer opposed the implementation of the SSB policy at a national scale because China's different regions are facing different nutritional burdens. Therefore, considering inconsistent health challenges and financial backgrounds between regions, a gradual implementation that adapts to local consequences would be helpful.

3.6.4 Industry Resistance and Consumer Acceptance

Stakeholders from the governmental sectors mentioned the collective efforts of industries and industry associations (eg. beverage associations) as a barrier to implementing SSB policies in China. One market regulation officer and one CDC officer specialized in nutrition specified that establishing standards and new laws would require the consensus of the government and the industry, if the industry is strongly against it, no law would be in place. Another CDC officer specializing in child health thought the SSB industry might be opposed that similar standards should be applied to other sugar confectionary products. On the other hand, one academia nutritionist proposed industry manufacturers might oppose SSB policies due to the increasing R&D cost and the fear of not profiting if SSB policies are adopted in China.

During the interview, some consumers showed an indifferent attitude when asked about their perspective toward introducing SSB policies in China. Some of them believed the government shouldn't interfere with their personal preferences through political actions, yet others thought SSBs are not as harmful as cigarettes and alcohol

which are strictly controlled by policies and laws. One health commission officer and one market regulation officer also expressed similar thoughts that individual freedom should not be abolished. Besides, academia stakeholders and industry stakeholders both thought that control over SSBs would let consumers buy other sweet products, which the substitution effect won't improve health outcomes.

3.7 Stakeholder Perception of Specific SSB Policies and Strategies

Stakeholders were also interviewed on their perceptions and opinion of specific types of SSB control policies and strategies. Five main categories of SSB policies were discussed, including taxation, labelling, restricting SSB supply, restricting SSB marketing and advertising, and health education. Each category of SSB policies is defined as follows. 1. SSB taxation is a levy applied to SSB products; 2. labelling includes front-of-pack (FOP) labels, which is a warning label, rating label or color-coded label placed on the front of the SSB product package, and shelf label that is set at the store shelf where SSB products were placed; 3. restricting SSB supplies contain multiple ways including restricting SSB supply at specific locations (eg. schools, governmental institutions, hospitals), increasing non-SSB products at retail stores and placing non-SSBs products at more prominent locations at retailing facilities; 4. restricting SSB marketing and advertising is defined as a ban or restrict the advertisement of SSB products at media channels, 5. health education means health promotion activities that advocate SSB harm and healthy eating, as well as health education classes in schools. Stakeholders from the

health commission, CDC, market regulation, academia and nutrition association were also asked to score these five categories of policies from 1 to 5, of which 5 represent the policy category they thought had the highest feasibility and effectiveness if adopted in China.

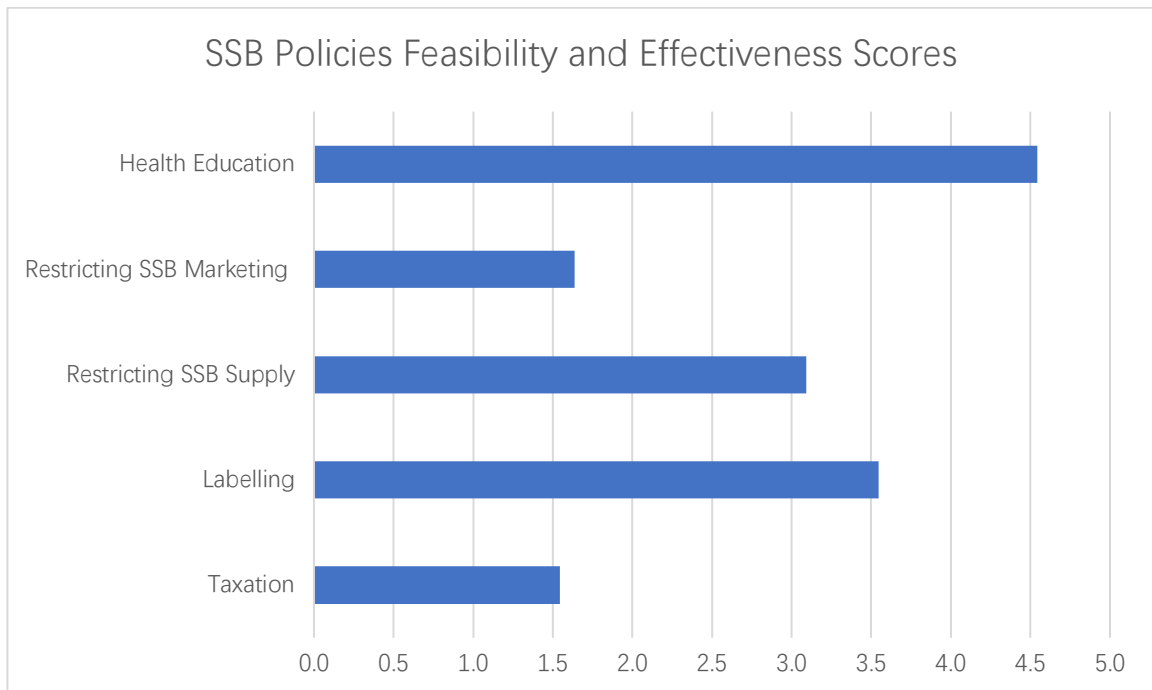


Figure 1: SSB policies feasibility and effectiveness scores from stakeholders (health commission, CDC, market regulation, academia and nutrition association)

3.7.1 Taxation

Most stakeholders except market regulation consider SSB tax not an effective way to control SSB intake among Chinese children and adolescents. The main reason is due to greater economic development leading to more families affordable to SSB products, thus a minor rise in price might not stop them from consuming SSBs. Second, developing a taxation scheme in China requires national actions, which would not be

feasible in the short term according to health sector stakeholders and market regulation stakeholders. One officer from the health commission mentioned that “taxing SSBs itself in Shanghai is doable, but you cannot promote it nationally”. Third, it is concerned by various stakeholders (including policy makers from the health sector, industry and consumers) that SSB taxation would raise financial equity problems since the industry would potentially transfer taxation pressure to consumers through increments in prices, and consumers would then have less money available to purchase other goods they would need. Therefore, the majority of stakeholders believed SSB taxation wouldn’t have good public support in China, but some stakeholders thought it might not just be the time to introduce SSB tax in China yet.

3.7.2 Labelling

Stakeholders express various opinions about using labelling strategies to control SSB intake. Academic nutritionists and nutrition association nutritionists believed labelling would be a good way to inform consumers since labels are both health warnings and health education tools. Market regulation stakeholders also agreed with labelling because “consumers will read package labels already”. Compulsory labelling, voluntary labelling, as well as labelling at different locations were discussed during the interview. Some health commission, CDC and market regulation officers thought voluntary labelling should be introduced to encourage industries to reform, but some other CDC officers hold the opposite opinion that compulsory labelling announced

through national standards is better since voluntary labelling would allow manufacturers to print biased information on their sugar content. Regarding labelling locations, some CDC officers and market regulation officers claimed shelf labels work better because labels on product packages require national standard reform, and label on shelves would assist industries to circulate their products nationally. On the other hand, other CDC and market regulation officer, academia and nutrition association stakeholders had the same opinion that product package labelling would be a better option because it would be more direct for consumers to decide which product would be healthier. If applied color coding corresponded to sugar levels, young children would benefit more from these easy indicators. However, labelling may face some challenges at the same time. Some consumers also brought up that their children would buy SSBs regardless of the health warning labels. One market regulation officer also mentioned that the color coding scheme would be hard to implement in China due to the huge variety of SSB products.

3.7.3 Restricting SSB Supply

Stakeholders also discuss the strategy to restrict SSB supply in certain locations, such as schools, as well as increase the supply of non-SSBs, including providing more non-SSBs and putting non-SSB products at more prominent locations at retailers. First, stakeholders from all sectors except industry agreed that controlling the supply of SSBs in schools is effective and agreed with education departments' support and effort.

Multiple regions in China have started such measures, and some consumers also reported that their children won't be encouraged to consume SSBs in the school environment. However, stakeholders express different opinions on controlling the SSB supply near schools. One market regulation officer opposed such a decision since the scope of the "controlled area" would be hard to define, especially in small-scale urban settings like Chongqing's urban districts, and the entire city might be put on SSB sale restrictions if there were many schools. Stakeholders also commented on the feasibility to provide more non-SSB options in the market. Consumers in Shanghai mentioned that healthy alternatives to SSBs are not available. They mentioned although milk is an option for healthy beverages compared to SSBs, children who are allergic to milk cannot enjoy it. Besides, one other option was prioritizing non-SSBs at more prominent locations, which one CDC officer questioned the definition of "prominent location" and suggested this term should be defined by a national standard. Another potential option is to provide more water fountains in public, which was not strongly supported by stakeholders from market regulation and CDC sectors because they are concerned the quality assurance of water provided and people's habit of not bringing water bottles around could lead to low utilization of water fountains.

3.7.4 Restricting Marketing and Advertising

Stakeholders from the health sectors believed restricting the marketing of SSBs is a good way to raise health awareness while market regulation officers were strongly

against it because no current law in China includes “high sugar content” as a restricted marketing phrase and it would be unfair for the industry which would cause strong opposition. In contrast, market regulation officers suggested increasing the number of public service advertisements (PSAs) to advocate health knowledge and improve the health awareness of consumers.

3.7.5 Health Education

All stakeholders believed in the importance and effectiveness of health education as a strategy to restrict SSB intake in China among children and adolescents. Because health education could help establish healthy habits, strengthen health awareness, and gain health knowledge for children and adolescents. Multiple stakeholders from health sectors and market regulation believed it is the “most cost-effective measure” among all SSB control strategies. According to some stakeholders in CDC and academia, health education for school children and adolescents has been implemented in some regions of China already. Regarding the specific design of school health education, stakeholders from both CDC and the market regulation sector emphasized the importance to let children deliver health education effects to their parents.

3.8 Alternative Measures for SSB Policies

In addition to controlling SSB intakes through policies, stakeholders suggested several alternative strategies to prevent and control overweight and obesity in China, for instance encouraging physical activities, emphasizing sleep quality, and promoting

balanced dietary habits. A CDC officer specializing in child health recommended creating a supportive environment for obesity prevention and control, which can include community support of sports facilities, applying national dietary guidelines and providing necessary treatment and health interventions to obese and overweight children and adolescents. Furthermore, another CDC officer specialized in nutrition claimed the importance of multi-sector involvement in obesity and overweight surveillance which could assist in timely decision-making and health intervention.

4. Discussion

This study aimed to investigate the perceptions of stakeholders on introducing SSB policies in China and the barriers and facilitators to adopting such measures. Various views and opposite opinions on appropriateness, advantages, drawbacks, feasibility, effectiveness, and implementation recommendations were mentioned between and within the parties of stakeholders. In general, the majority of stakeholders are aware of policy measures to control SSB consumption and believe reducing the SSB intake of Chinese children and adolescents through restrictive policies would contribute to better health outcomes. Policy makers questioned the implementation details, responsibility distribution as well as legislative feasibility of SSB policies. Meanwhile, industry stakeholders expressed their attitude to follow policies if in place, and they were concerned more about their profit-making and sustainable development of the entire SSB industry. Caregivers also noticed the increasing consumption of SSB by their children. Although they are aware of the health risk of SSBs, consumers persist to hold their own opinion to choose what they would like to consume and freedom to enjoy the sweetness and better taste products for happiness.

4.1 Factors Associated with Implementing SSB Policies in China

4.1.1 Obesity Disease Burden and Rising Health Expenditure

The result of this study revealed that introducing an SSB policy is correlated to health issues. First, most stakeholders mentioned the increasing obesity prevalence and

its correlation with rising SSB consumption, which is consistent with the literature findings that China has been facing the burden of the increasing prevalence of overweight and obesity (Malik et al., 2013; Rousham et al., 2022). During the interview, some stakeholders expressed their concerns about rising SSB consumption, and without control, they suspect a further increase in consumption could be observed with greater health hazards. Meanwhile, related to the rising prevalence of obesity and increasing disease burden due to such health issues, China's healthcare spending is also rising gradually over time. The total health expenditure of China in 2021 rose by 30% compared to 2018, and so did governmental health expenditure and out-of-pocket expenditure (National Bureau of Statistics, 2021). Notably, out-of-pocket health expenditure reached 2120.57 billion RMB in 2021, which was higher than the government health expenditure of 2067.61 billion RMB in that year (National Bureau of Statistics, 2021). It is predictable that the growing NCD burden will lead to higher demand for health spending, and the COVID-19 pandemic may accelerate this problem. Moreover, some LMICs including Mexico, Samoa, Nauru and French Polynesia have successfully implemented SSB taxation to generate revenue earmarking for health expenditure while coping with the fund-raising needs (Pan American Health Organization, 2015; Thow et al., 2011). Evidence from the US also proved that implementing SSB tax nationally could reduce SSB consumption by 20% and mean BMI by 0.16, as well as prolonging health expectancy through attaining 871,000 quality-

adjusted life-years (QALYs), saving health expenditure of \$23.6 billion and generating tax revenue of \$12.5 billion aside from the initiating cost of \$51 million to run the SSB tax⁴². Besides, restricting sales of SSBs at certain places could also be cost-effective to avoid health loss and decrease health spending (Basu et al., 2020; Long et al., 2015). Therefore, it would be worth thinking to introduce SSB policies as one way to save health expenditure.

4.1.2. Political Will and Policy Development

Strong political will and governance from a collaborative government are powerful factors assisting LMICs' implementation of SSB policies (Bridge et al., 2020; Eykelenboom et al., 2022). According to the stakeholder interviews, there is a positive political will from the government. Also, based on context analysis results, the Chinese government has expressed willingness to advocate and promote healthy eating habits as there have been published documents and policy reports on these actions, including "Healthy China Initiative (2019-2030)" and the "Healthy Diet Initiative" within the "Healthy China Initiative (2019-2030)" Plan that aims to reduce premature death of NCDs (National Health Commission of the PRC, 2019), "Oral Health Action Plan (2019-2025)" that addressed oral health and cavity prevention through reducing sugar intake (National Health Commission of the PRC, 2021). International evidence also suggested that the pro-argument for SSB policy could also expand their scope to cover oral health (Bridge et al., 2020), as oral health is another proven health risk associated with excess

SSB intake (Jamieson et al., 2010; Park et al., 2015), which would allow more supporting arguments and more stakeholders involved too. According to the interview results, the industry presenting a neutral opinion towards SSB policies could be attributable to the existing policy trend and the government's strong will.

Furthermore, there are existing resources that could be utilized for introducing SSB policies. The current national standard for nutrition labelling of prepackaged foods (GB 28050-2011) clearly stated the requirements for no sugar and low sugar content claims that some manufacturers have been utilizing, which created a foundation for future legislation basis if FOP labels were introduced. Regarding SSB supply control, the sales ban of SSB in primary and secondary schools started in China about a decade ago, receiving support and positive effects. Moreover, in terms of health education for school children, China has already initiated health education in primary and secondary school curriculums, although with less focus on nutrition (Zhang et al., 2016). Ministry of Education planned to require primary and secondary schools to offer mandatory and elective health education courses (China Daily, 2021). With these fundamentals, it would be more efficient for China to initiate SSB policies as international evidence also suggested that utilizing existing measures for SSB policy introduction is helpful in resource-limited LMICs (Thow et al., 2011).

Meanwhile, policy makers interviewed in this study were mostly aware of how the SSB rising consumption could directly translate to an increasing prevalence of

obesity and had heard of international experiences of SSB policies and believed China could adopt some of the international lessons. But different levels of awareness among policy makers were observed in the study. Policy makers in Shanghai showed more knowledge and understanding of SSB restrictive actions than policy makers in Chongqing. The potential reason could be due to Shanghai's higher prevalence of obesity and overweight, as well as Shanghai's city context as one of the most internationally developed regions in China. Policy action wise, Shanghai has also taken more actions. For instance, Shanghai published the "Shanghai Nutrition Act" and "Healthy Shanghai Plan" which specify the aim to control SSB intake of children and adolescents, and has started to conduct effectiveness trials of shelf labels, preparing for the implementation of SSB policies. On the other hand, Chongqing's policy actions are still at more advocacy level where the interviewed CDC officer claimed "We have already started health education already and Chongqing has published advocacy documents". The priority to set SSB policies in order for controlling obesity and overweight is still not relatively high according to the interviewed policy makers in Chongqing. This finding suggests further awareness-raising is necessary among policy makers, especially in regions that are less developed.

4.1.3 Health Awareness and Nutrition Literacy from the Public

On the public side, low health awareness and nutrition literacy is a major hindrance in introducing SSB policies in China. Policy makers from both municipalities

worried about the public acceptability of SSB policies since low nutrition literacy of the public could lead to misunderstanding from the public to the government on making SSB policy decisions that may challenge the implementation of SSB policies to a great extent. In this study, although the interviewed consumers knew SSB consumption is harmful, they usually still allow their children to drink SSBs and they are unaware of the suggested amount from the dietary guide. Given all consumers interviewed in this study is from urban municipalities in China, the rural population's nutrition awareness of SSB consumption seemed to be worse. Various studies examined the nutrition literacy and nutrition condition of Chinese children report such findings. According to a Chinese study investigating healthy literacy across 25 provinces and municipalities in China, urban residents have a much higher proportion of adequate health literacy population compared to rural residents (Li et al., 2021). Furthermore, data from National Health Literacy Surveillance shows that the proportion of people with basic health literacy was 19.17% among Chinese residents aged 15–69 years old in 2019 (Yang et al., 2020), which is considered low compared to developed countries, for instance, 64% in the US, 88.6% in the UK and 72.3% in Japan (Li et al., 2021). Research suggested that low nutrition literacy among Chinese children and adolescents could be ascribed to insufficient nutrition education, as the current nutrition education was integrated into a physical education curriculum that lack of focus on nutrition and a shortage of professional teachers and textbooks (Zhang et al., 2016). Hence, if SSB restrictive measures are

implemented in China, these measures should also serve educative purposes aiming to improve health and nutrition literacy at the same time. Other countries over the world used the following strategies to enhance public understanding and acceptability, including the involvement of civil society groups throughout the policy making process. Experience from Mexico recognized the contribution from civil society organizations (eg. “The Nutrition Health Alliance”) as a key step to the successful implementation of the SSB tax due to their help in raising public support (World Health Organization. Regional Office for the Western, 2016). Besides, research also suggested that designing an incremental policy with different grades which provides time for the public to adapt (Bridge et al., 2020). For example, Thailand imposed a graded SSB tax that defined the amount of tax based on the sugar levels of SSBs, and encouraged declining consumption of high sugar level SSBs (Phulkerd et al., 2020).

4.1.4 Industry Resistance

Industry resistance is identified as a major challenge to adopting SSB policies in China based on the qualitative interview results. According to the study results, industry resistance to SSB policy could be from several prospective, such as profit declining, challenging and rising costs in reformulation, and fear to lose consumers. Indeed, opposing industries are a common obstacle for many other LMICs to introduce SSB policies, and industries also influence SSB policy making. For instance, one study argued that international beverage companies interfered with the obesity prevention

policy making in China by advocating physical activities and establishing international research institutes, avoiding addressing the importance of nutrition and dietary health (Lancet Oncology, 2019). Another example is from South Africa where industry lobby groups tried for years and successfully delayed the implementation of SSB tax, claiming “individuals should be responsible for their own SSB consumption rather than governments” (Bridge et al., 2020; Stacey et al., 2021). Similarly, the interviewed industry stakeholders have also expressed the attitude that they would like “consumers to have their own choice for what they want to consume”. In response, studies have suggested cautiously limiting the industry’s involvement in policy making since the industry can work as collaborative efforts and engage with relevant policy makers and stakeholders, and their involvement could lead to the greater power of them to interfere with policy development (Bridge et al., 2020). Moreover, it is also important to keep collecting effective evidence because according to some studies, arguments from the industry might not be evidence-based (Bridge et al., 2020). Furthermore, as mentioned previously, an incremental, graded SSB policy would also encourage industry innovation and reformulation, guiding the manufacturers to transform (Bridge et al., 2020). Introducing the policies step by step can also provide transition time for the industry to adapt.

4.1.5 Evidence for Effectiveness in the Chinese Context

If implementing SSB policies, more evidence should be determined under the Chinese context. For instance, studies on consumer responses need to be conducted as

SSBs are considered inexpensive and abundant in China as other LMICs, plus it is not a detrimental product if consumed properly, different from tobacco and alcohol (Bridge et al., 2020; Chinese Nutrition Society, 2022). Currently, there is some Chinese evidence on the potential feasibility of SSB tax and restricting SSB supplies. A modelling study of SSB tax in urban China suggested SSB tax be feasible in China because the demand for SSB was found sensitive to price changes, and the effect was greater among low income households (Zhai et al., 2022), which is contradicted to the qualitative interview results that urban consumers thought price change will not stop children from consuming SSBs. Therefore, there still lacks comprehensive evidence on the effectiveness of SSB policies in the Chinese context, especially among rural populations (Wang, 2022; Xian et al., 2021; Zhai et al., 2022). Further research on and substitution effects (whether consumers would purchase other products with health risks to compensate for the control of SSB purchase) would also be crucial to understand public response thus prepare more evidence for policy adoption in China. In addition, Chinese scholars have started to investigate the association between near-campus SSB stores with obesity of school children which showed that off-campus availability of SSBs could demonstrate higher obesity risk (Zhou et al., 2020), thus illustrating the potential feasibility of controlling supplies of SSB. Nevertheless, less evidence on the feasibility of other SSB policies, eg. labels, marketing restrictions as well as public acceptability of SSB policies in China was found, which deserves more investigation. Besides, research, evidence can also be

collected throughout evaluation of policy implementation. Literature recommended the evaluation process should be initiating since policy introduction and aim for policy activities and outputs and perspectives from stakeholders (Bridge et al., 2020). Domestic academia is also suggested to be involved during the evaluation which provides scientific and accurate assessments and costs less in resource-limited LMICs (Bridge et al., 2020). A clear evaluation plan with short, medium and long-term impact measurements would also provide real-world experience and lessons throughout the policy delivery.

4.3 Policy Recommendation

This study identified the current stakeholder perceptions on the importance, timing, and policy type for administrating SSB policies in China. Policy suggestions from multiple perspectives were brought up through content analysis and qualitative interviews with Chinese stakeholders.

China could plan a series of steps for initiating SSB policies. First, strategies that help improve health literacy and nutrition awareness among policy makers and consumers can be initiated. Results indicated awareness among policy makers is uneven across China, which suggested further awareness promotion would be helpful for implementing SSB policies. Policy makers could be reached through professional conferences, academia and health professional associations (eg. the Nutrition Society in

China) to promote awareness of obesity prevention through restricting free sugar and SSB intakes.

Meanwhile, the interview results also suggested that improving nutrition literacy and health awareness among consumers could be carried out in the form of health education. For caregivers and preschool children, health education could utilize the existing National Basic Health Care and Medical Service System's health education portion, eg. information pamphlets, community information sessions, routine well-child visits, to administrate more nutrition-focused materials. For school-age children and adolescents, health education and nutrition promotion can be embedded in existing school curriculums. Education departments could collaborate with local CDC and health commission professionals to deliver proper and scientific educational content to students and deliver assignments that help spoil-over the educational content to their family members. Furthermore, public education could be delivered in the form of public service announcements and advertisements displayed in both online and offline media channels to spread out nutrition health knowledge and increase public awareness. Moreover, public education could also be conducted through SSB policies that restrict SSB supply and provide health warning information on labels.

Campus restriction of SSB could be continued as it has achieved good results and public support, then labelling with health warnings on shelves could also be promoted to further emphasize the health risk of SSB at retailing facilities. Since other strategies

such as taxation, product FOP labels, and marketing restrictions would require national legislation reforms, more studies and pilot trials of these measures on smaller scales could be initiated to further analyze the adaptability and scalability of SSB restriction policies in China. With the step-by-step development of SSB policy initiation, it would provide more time for industries to innovate and transform as well as give the public more time to accept the policy change.

Furthermore, the study also showed that more evidence is needed to implement SSB policies on a national scale in China. Before conducting further research on implementation evidence, formative research can be performed to study the community of interest more comprehensively, including the attributes regarding the SSB health issues from the community. When more evidence is available for supporting SSB policy introduction in China, multiple policies that target different aspects, such as health education, restricting SSB supply, SSB health warnings and restricting marketing, should be combined to establish a supportive niche for consumers to adopt healthier SSB consumption habits.

Finally, a policy evaluation plan designed with short, medium and long-term goals and outcomes should be formulated before the implementation of any SSB policy and the plan should be followed through policy implementation. Either utilizing existing indicators for outcomes or developing new indicators to monitor policy

implementation is applicable. It is also suggested that academia and third-party evaluation teams could be involved in policy monitoring and effectiveness evaluation.

4.4 Strengths and Limitations

This study is one of the first that investigate Chinese stakeholder perceptions of introducing SSB policies to China for children and adolescents. Stakeholders from diverse backgrounds, including policy makers, nutritionists, industry, and consumers were included to ensure a comprehensive collection of information. The qualitative design allowed stakeholders to share in-depth opinions from various perspectives on the newly developed SSB policies in China.

However, this study still has several limitations. First, the study failed to approach to all relevant stakeholders. The consumers interviewed in the study are primary caregivers (eg. parents, grandparents) of children and adolescents aged 6-17 in Shanghai and Chongqing. The study team chose to interview primary caregivers but not children and adolescents themselves because during the preliminary trials of interviews, it was found that the SSB consumption of children and adolescents was mainly decided by their primary caregivers, especially for younger children who were not given pocket money yet. Further studies could interview the children and adolescents themselves about their SSB consumption habits and the factors related to their SSB choices, because the children and adolescents might report different results to their primary caregivers compared to their real behaviours. In addition, this study did not include stakeholders

from the education sector, such as school teachers, principals, and officers from the Ministry of Education in the government. Education stakeholders were approached but not included due to no response from the approached interviewees. Future investigations are needed to understand perspectives from the education party to better implement SSB policies from school children and adolescents. Second, in this study, most of the evidence was collected from urban areas, with less focus on rural areas in China. As the great difference in economic development between urban and rural areas, as well as between regions, further analysis could focus more on such comparison and collect more data in rural settings. Third, this study only considered packaged SSBs, which include ingredient lists and nutrition facts label on their packages that provides rich information for consumers. These ingredient lists and nutrition facts labels were put up on packages according to national laws and standards. Besides packaged SSBs, handmade SSBs should not be ignored in SSB policies. These drinks are usually handmade in stores and packaged in plastic cups without a detailed ingredient list or nutrition facts table. Currently, there is no standard in China that require these beverages to label ingredient lists and nutrition facts. Due to their delicious taste, huge variety of choices and creative marketing, handmade drinks are gaining rising popularity in China, also among children. Thus, further studies could also investigate prevention strategies that help target these handmade beverages. Furthermore, the study was conducted during the pandemic period with travel restrictions, thus the data

collection process from two study sites was not the same. For circumstances with travel restrictions, online interviews were conducted instead of in-person interviews. Hence, the different data collection methods might reveal differences and biases in the collected information. Finally, due to time and resource constraints, this study only had one interviewer and one analyst. During the interview process, especially the FGD discussion, without help from an extra moderator, some information might be missed by the interviewer. In the analysis part, there is no cross-validation and discussion for coding, identifying themes and drawing conclusions. Without input from another analyst, the study result could possibly contain biased interpretations.

5. Conclusion

The intake of SSBs is rising among Chinese children and adolescents. During the interviews, policy makers, nutrition experts and industry stakeholders showed insufficient awareness and knowledge of SSB related policies internationally and domestically, while the knowledge and awareness of consumers is even lower. However, these stakeholders expressed conflicting opinions on the choices, effectiveness, feasibility and appropriateness of adopting SSB policies in China. Policy makers and nutrition experts believed that using health education to control SSB intake of children and adolescents in China has the highest feasibility and effectiveness.

There is an urge to advocate appropriate intake of SSBs among Chinese children and adolescents and compulsory measures could be introduced when necessary, however raising awareness through advocacy and education is the most crucial step before any other stricter measures when SSB policies are introduced to the Chinese current condition. In order to create a supportive environment that assists consumers' habit change, multiple political actions that combine health education, health warning and market restriction should be considered. This study provided preliminary stakeholder analysis to adopt SSB policies for future studies to examine the effectiveness of these proposed political strategies in China.

Appendix A. Stakeholder Views on SSB Policies in China

Appendix A.1: Emergent themes of stakeholder opinions on SSB policies

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>	
Current state of SSB consumption	Rising SSB consumption	Due to higher economic growth	X	X	X	X	X	X	X	
		SSB tastes good so children and adolescents like them	X	X	X	X	X		X	
		Children and adolescents have the habit of drinking SSBs								
		SSB packages and advertisements are attractive to children and adolescents		X		X	X		X	
		Human nature determines humans' love to sweetness	X	X	X					
		Children from rural areas have higher intake of SSBs than urban children			X					
		Changing of dietary structure leads to higher intake of sugar and the need of sugar intake			X	X	X	X	X	
	Artificially sweetened beverages (ASB) and non-sweetened beverages	There is a rising need of non-sugar beverages after the COVID-19 pandemic							X	
		Artificial sweeteners are generally considered safe	X		X				X	
		Caregiver and their children	Caregivers determine their children's SSB consumption behaviors		X	X	X	X		X

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>
Current state of SSB consumption	Caregiver and their children	Caregivers are acceptable to children drinking SSB		X		X	X		X
	Health awareness	Children and adolescents are not aware of the health harm of SSBs	X	X	X	X	X		X
		Caregivers don't know the health harm of SSBs	X	X	X	X	X		
		Caregivers should know the health risk of SSBs	X	X	X	X	X		
		Insufficient nutrition education and promotion	X	X		X	X		
Effectiveness	Purchase & Consumption	SSB policies would encourage the public to drink less SSB	X	X	X	X	X		X
	Health outcomes	SSB policies would lead to better health outcomes	X	X	X	X	X		
	Scientific evidence	SSB policies should be supported by more scientific evidence of effectiveness	X		X				
		There is no need for more scientific evidence of the effectiveness of SSB policies			X		X	X	
	Reformulation	SSB policies would force industries to reformulate SSBs			X		X	X	
		Industries refuse to reformulate				X			

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>	
Appropriateness of SSB as a target for interventions	SSB as a target for interventions	SSB are an appropriate target in the reduction of overweight and obesity	X	X	X	X	X			
		SSB as target for intervention need more epidemiological data and evidence support	X		X					
		SSB as target for intervention have enough epidemiological data and evidence support on its health risk		X		X	X			
Appropriateness of SSB as a target for interventions	Excessive focus on SSB	SSB is not the primary source of free sugars among Chinese						X		
	Unfair for the SSB industry	Targeting SSB would be unfair for the SSB industry			X			X		
Appropriateness of SSB policies	Governmental intervention	Governmental intervention would be appropriate in the reduction of overweight and obesity								
		Preference for voluntary solutions in the reduction of overweight and obesity		X	X	X	X	X		
		Government should not hinder industrial development and engagements through political actions				X			X	
	Scale	SSB should be controlled at a national scale				X				
		Local SSB policies would create exclusivity burdens for industries				X				
		SSB policies should start with implementing in more developed regions because in regions suffering from poverty are still challenged from basic nutrition needs	X	X						

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>	
Appropriateness of SSB policies	Individual freedom	Consumers should have the freedom to choose what they want to consume	X		X			X	X	
	Health awareness	SSB policies would improve health awareness among consumers	X	X	X	X	X		X	
		SSB policies should be introduced after consumers have enough health knowledge and health awareness			X	X	X	X		
	Other sweet confectionaries	Consumers might consume other sweet confectionaries if SSB control is in place	X					X		
Appropriateness of SSB policies	Other sweet confectionaries	Other sweet confectionaries should also be regulated		X				X		
Technical issues	Industry innovation	Innovation of beverages without sugar is challenging			X			X		
		Industries are afraid to lose consumers due to innovation						X		
		Industries' transition takes time		X			X		X	
		SSB policies can encourage industries to innovate	X	X	X	X	X	X	X	
		Industries refuse to innovate				X				
		Industry transition requires support from various sectors				X				

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>
Legislation	Standard	SSB policies should be promoted based on standards	X	X	X	X	X		
		Forming a standard is challenging	X		X				
TAXATION									
Effectiveness		SSB tax is not very effective	X	X		X	X		
Economic consequences	Industry resistance	Industry cannot bear high SSB tax			X			X	
	Financial equity	Tax payment would be transferred to consumers as industries increase SSB price for compensation	X	X		X		X	X
		SSB tax may lead to consumers having less money available to purchase other goods		X		X			
Design	Tax rate	Developing SSB tax rate needs to consult the community			X				
	Tax revenue	Utilization of the tax revenue should be clearly determined	X			X			
	Target product	Taxing SSBs itself is feasible, but the effect is small	X	X		X			
		Taxing sugar could lead to greater price increase	X						
Feasibility	Scale-up	It is challenging to promote SSB tax nationally, but doable in more developed cities	X			X			

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>
Feasibility	Scale-up	It's not time to introduce SSB tax yet		X		X			
		National government can hardly get the tax revenue because industries might ask for subsidies for R&D cost				X		X	
		SSB consumption won't be influenced by economic levels and pricing		X			X		
		SSB tax won't have good public support		X	X				
LABELLING									
Policy design	Voluntary labelling	Voluntary labelling should be introduced	X	X	X				
		Voluntary labels will present biased information on sugar content		X					
	Compulsory labelling	Compulsory labelling should be introduced		X					
		Compulsory label should be introduced through national standards	X	X	X				
	Existing standard	Current national standard on nutrition labels includes "no sugar" and "low sugar" claim	X	X	X	X			
Location of label	Shelf label	SSB labels on the shelves are better		X	X				
		SSB shelf labels would cost consumer longer time to choose products					X		

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>
Location of label	Package label	SSB labels on the front package of SSBs are better			X	X	X		
		Consumers have the habit to read information on product packages			X		X		
		Young children cannot understand all information on SSB packages		X		X			X
Content of label	Color coding labels	SSB labels should combine color coding and health warning texts					X		
		Color coding/traffic light labels are challenging to implement in China		X	X				
		Color coding scheme is challenging to define				X			
		Color coding labels would be easier for children to understand							X
	Industry resistance	Retailers are unwilling to put up labels on shelves				X			
		Manufacturers resist to put negative information of their products on the label		X	X				
Effectiveness	Health awareness	Consumers can learn about SSB health risks through labels	X	X	X	X	X		X
		Consumers who don't read nutrition tables won't pay attention to extra SSB labels	X						

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>
Effectiveness	Consumer choices	Children will buy SSBs regardless of the SSB labels							X
Acceptance	Industry resistance	Retailers are unwilling to put up labels on shelves		X	X				
	Consumer acceptance	Labels give consumers the right to be informed and the freedom to choose products	X		X	X	X		X
Feasibility	Cost	The cost of creating labels is high	X						
RESTRICT SUPPLY									
Effectiveness	Restrict SSBs in schools	Controlling supply of SSBs in schools is effective	X	X	X	X	X		X
		Education departments support restricting SSB supply in schools	X	X		X			
		Multiple regions in China have started to restrict SSB supply in schools		X		X	X		
	Restrict SSBs near schools	Controlling supply of SSBs near schools is not effective nor feasible		X	X				
		The controlled area is hard to define especially in small cities				X			
	Health awareness	Restricting supplies of SSB can help raise health awareness of consumers				X	X		
	Adding water fountains	Adding more water fountains is not effective			X				

Themes	Subthemes	Views raised by stakeholders	Health commission	CDC	Market regulation	Academia	Nutrition association	Industry	Consumer
Effectiveness	Consumer choices	Children will buy SSBs regardless of the SSB labels							X
Feasibility	Adding water fountains	Setting water fountains require extra quality assurance for water safety	X	X					
	Placing the low or no sugar beverages prominently for customers to see	It will be challenging to implement such measures in rural areas "Prominently" requires clear definition by the national laws and standard		X					
Implementation	Emphasis on water intake	Health education on water intake should be conducted at the same time of restricting SSBs supply	X	X		X			
Consumer acceptance	Healthy alternatives of SSBs	The market should provide more healthy beverage choices	X	X		X	X		X
RESTRICT MARKETING									
Effectiveness	Health awareness	Consumers can be more aware of SSB health risks	X	X		X	X		
Implementation	Emphasis on water intake	Health education on water intake should be conducted at the same time of restricting SSBs supply	X	X		X			
Feasibility	Government intervention	"High sugar content" is not included in the national advertisement laws				X			

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>	
Effectiveness	School education	Health education is effective	X	X		X	X			
		The warning effect and focus on nutrition (SSB) education is low		X			X			
	Consumer SSB intake	Health education can help consumer control their SSB intake	X	X	X	X	X			
	Health outcomes	Health education can help establish healthy habits			X					
		Health education can strengthen health awareness of consumers			X					
		Health education can bring health knowledge for child growth	X	X	X	X	X			X
		Health education is the most cost-effective SSB control strategy	X	X	X					
School education	Age	Starting from 10 years-old of age since younger children cannot understand the information	X							
		Health education should be covered in all curriculums from kindergarten to high school, even college		X	X				X	
	Content	Health education should cover both health knowledge advocacy and health risks warning	X							
		Health education should be taught in an interactive way to engage students				X				

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>
School education	Content	Health education content should be designed based on different age groups of students		X			X		
Feasibility	Government intervention	Limiting marketing and advertisements of SSBs is feasible		X		X	X		X
		Limiting marketing and advertisements of SSBs is not feasible			X				
		Leading advertisement campaigns, combined with consumer education		X	X				
Design	Advertisement control	Banning all SSB advertisements		X					
		Restricting advertising hours, locations, and amounts		X					X
		Limiting advertising in children's programs		X					X
		Reducing "soft advertising" in literature, film and television works				X			
		Providing advertisement guidance for self-media and social media platforms	X			X			
	Advertisement content	Encouraging increase the amount of public service advertisements (PSA)				X			
		PSAs can involve celebrities			X				
HEALTH EDUCATION									
Current state	School education	Health education of children and adolescents have been implemented already		X		X			

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>
School education	Content	Health education contents should be standardized and proven to be scientific		X					
	Teaching	Health professionals should be involved in teaching health courses in schools	X	X					
		Homeroom teachers and school nurse can be involved in teaching health courses in schools while health professionals train them					X		
	Caregiver involvement	Caregivers' education can be involved through their children's health education in school	X	X	X				
	Government involvement	Health department should initiate the health education program by contacting and facilitating education department			X				
Recommendations of SSB policies	Policy design	Adapting to local conditions	X	X					
		Policy should encourage proper intake of SSBs instead of zero intake of SSBs		X	X				
		The aim of SSB policies should focus on health reminders	X	X					
		Policies should not be too extreme to avoid backfires which could cause other new problems	X			X		X	
	Scale-up	Starting with pilot trials in smaller regions, if successful then scale-up		X					

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>	
Recommendations of SSB policies	Combination	Combination with multiple strategies		X		X	X			
		Health education content should be designed based on different age groups of students		X			X			
	Policy maker's awareness	Policy makers should be aware of the health risks of SSBs		X						
	Legislation and Monitoring	Setting strict rules to discipline industries' behaviours			X					
		Both manufacturers and retailers should be monitored	X	X			X	X		
		Forming standards should consider opinions from various sectors				X				
		SSB policies need to have corresponding regulatory policies and allocation of responsibilities, and develop corresponding punitive measures			X	X				
	Definition of SSB	Definition of SSBs should be clear, also whether to include handmade SSBs	X				X			
SSB tax rate	SSB tax rate should not be too high			X	X					

Appendix A.2: Barriers and facilitators of SSB policies in China from stakeholders

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>
Recommendations of SSB policies	SSB label	The SSB label should be clear and obvious according to the standard	X	X	X				
		Existing "no sugar" and "low sugar" products should be encouraged to put on such claims voluntarily		X	X	X	X		
	Health education	Health education should include explanation of SSB policies	X						X
	Restrict supply	Starting with restricting SSB supplies to improve health awareness of consumers, then introduce further measures Health education content should be designed based on different age groups of students		X				X	
Other measures on obesity prevention and control	Diet	Promoting a balanced dietary structure		X		X	X		
		Applying the national dietary guideline		X		X			
		Strengthening the "school nutritious lunch" program				X	X		
	Sleep	Emphasizing healthy sleep habits in children and adolescents		X					
	Physical activity	Encouraging physical activities of children and adolescents	X	X	X	X	X		

Themes	Subthemes	Views raised by stakeholders	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>	
Other measures on obesity prevention and control	Physical activity	Establishing exercise facilities in communities		X						
		Setting more physical education classes in schools to help establish exercising habits			X					
		Include physical education tests scores into school entrance examination tests and increase its score portion	X		X					
	Treatment	Provide necessary treatment and health interventions for obesity children and adolescents		X						
	Social environments	Establishing a supportive environment for obesity prevention and control			X					
		Attention should be drawn to peer pressure and social needs among children and adolescents	X		X					X
Surveillance	Multiple sectors should be involved in obesity and overweight surveillance				X	X				

Themes	Barriers raised during interviews	Facilitators raised during interviews	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>
Legislation	Difficulties in defining SSB		X			X			
		Establishing a national standard	X	X	X	X	X	X	
		Gradual introduction of SSB policies		X	X	X	X	X	
Administration	Administrative load on monitoring and market regulation			X	X				
	Responsibility distribution between different departments		X	X	X				
SSB Industry		Cross- governmental sector collaboration	X	X	X	X	X		
	Resistance from industry and SSB associations (industry associations)								
	Increase in sales of non-packaged SSBs		X		X				X
Public acceptability		Technology innovations in sweeteners and sweetening agents	X		X			X	
	Perceived public opposition								X
	Consumers choose other sweet products					X		X	
Themes	Barriers raised during interviews	Facilitators raised during interviews	<i>Health commission</i>	<i>CDC</i>	<i>Market regulation</i>	<i>Academia</i>	<i>Nutrition association</i>	<i>Industry</i>	<i>Consumer</i>

Public acceptability		Increase in consumer health awareness and nutrition literacy	X	X	X	X	
Implementation	It is challenging to restrict supplies of SSBs and increase supplies of non-SSBs in rural areas			X			
		Increase the supply of water and non-SSB beverages in the market	X	X	X	X	X
		Ensure the quality of non-SSB beverages		X			
	Water fountains should be monitored and ensured safety		X	X			

Appendix B. Interview Guides

Appendix B.1: Interview guide for public health experts, market regulation officers, academia, nutrition association (English version)

Topics	Prompts
Opinion on introducing an SSB restriction policy in China	Support or against, type of policy
Advantages and disadvantages of an SSB restriction policy (tax, front-of-pack label, warning label on shelves, restriction in school, education)	Purchases and consumption of SSB, health-related outcomes, product reformulation, government intervention, socioeconomic equality, economic consequences
Support and opposition of stakeholders	The public, health and consumer organizations, health professional associations, the food and beverage industry, academics, policymakers, government, international stakeholders
The feasibility of the decision to implement an SSB restriction policy in China	Choice of policy, support of stakeholders, communication between stakeholders, scientific evidence, successes in other countries, use of revenues (tax), administration, legal framework, type of product restricted
Facilitators and barriers of the potential future implementation of an SSB policy in China (at city, province and country level)	Stakeholder perspectives, vertical and horizontal communication, public acceptability, scalability
Recommendations for the design of an SSB restriction policy if introduced in the Chinese context	Definition of SSB in China, tax rate, use of tax revenues, type of label (recommended or compulsory), school restriction
Recommendations for alternative measures to reduce overweight and obesity in China	

Appendix B.2: Interview guide for public health experts, market regulation officers, academia, nutrition association (Chinese version)

话题	提词
关于在我国实行含糖饮料限制政策的意见	支持或反对，具体政策类型
含糖饮料限制政策的优缺点（税收、包装正面标签、货架上的警告标签、学校限制、教育）	含糖饮料的购买和饮用，健康相关结果、，产品配方更改，政府干预，社会经济平等，经济后果
利益相关者的支持和反对意见	公众，健康和消费者组织，健康专业协会，食品和饮料行业，学术界，政策制定者，政府，国际上的利益相关者
在中国实施含糖饮料限制政策的可行性	政策选择，利益相关者的支持，利益相关者之间的沟通，科学证据，在其他国家的成功案例，（税收）收入的使用，管理、法律框架，受限制的含糖饮料产品类型
中国未来实施含糖饮料政策的促进因素和障碍（国家、省、市级层面）	利益相关者前景，纵向和横向沟通，公众接受程度、政策可扩展性
符合中国国情的含糖饮料限制政策：设计建议	中国含糖饮料的定义，税率，税收收入的使用，标签类型（自愿或强制），学校层面限制
建议解决我国超重和肥胖问题的其他替代措施	

Appendix B.3: Interview guide for industry stakeholders (English version)

Topics	Prompts
China's SSB market development	Future trend, popular products, consumer choices
Opinion on introducing an SSB restriction policy in China	Support or against, type of policy
Advantages and disadvantages of an SSB restriction policy (tax, front-of-pack label, warning label on shelves, restriction in school, education)	Purchases and consumption of SSB, health-related outcomes, product reformulation, government intervention, socioeconomic equality, economic consequences
Support and opposition of stakeholders	The public, health and consumer organizations, health professional associations, the food and beverage industry, academics, policymakers, government, international stakeholders
The feasibility of the decision to implement an SSB restriction policy in China	Choice of policy, support of stakeholders, communication between stakeholders, scientific evidence, successes in other countries, use of revenues (tax), administration, legal framework, type of product restricted
Response strategies if SSB policy is in place in China	Innovation directions, previous work and current actions, communication between stakeholders, international experience
Recommendations for the design of an SSB restriction policy if introduced in the Chinese context	Definition of SSB in China, tax rate, use of tax revenues, type of label (recommended or compulsory), school restriction
Industry engagement in public health programs and policies	Missions and goals, previous work, future actions, channel of communication, multistakeholder collaboration

Appendix B.4: Interview guide for industry stakeholders (Chinese version)

话题	提词
我国含糖饮料市场的发展	未来趋势，流行产品，消费者的选择
关于在我国实行含糖饮料限制政策的意见	支持或反对，具体政策类型
含糖饮料限制政策的优缺点（税收、包装正面标签、货架上的警告标签、学校限制、教育）	含糖饮料的购买和饮用，健康相关结果、，产品配方更改，政府干预，社会经济平等，经济后果
利益相关者的支持和反对意见	公众，健康和消费者组织，健康专业协会，食品和饮料行业，学术界，政策制定者，政府，国际上的利益相关者
在中国实施含糖饮料限制政策的可行性	政策选择，利益相关者的支持，利益相关者之间的沟通，科学证据，在其他国家的成功案例，（税收）收入的使用，管理、法律框架，受限制的含糖饮料产品类型
我国实施含糖饮料政策后的应对策略	研发方向，前期工作和现阶段工作，利益相关者之间的沟通，国际经验
符合中国国情的含糖饮料限制政策：设计建议	中国含糖饮料的定义，税率，税收收入的使用，标签类型（自愿或强制），学校层面限制
健康卫生项目中企业的参与	公司目标，前期工作，未来方向，沟通宣传渠道，多部门合作

Appendix B.5: Focus Group Discussion Guide for Consumers (English version)

Topics	Prompts
Current SSB consumption habit (without SSB policy)	Consumption amount and frequency now, change in habit if introducing an SSB policy, purchase of SSB, knowledge of SSB health risks
Opinion on introducing an SSB restriction policy in China	Support or against, type of policy, acceptability
Whether SSB consumption habits would change with SSB policy	Change in consumption amount and frequency, change choice of beverages
Advantages and disadvantages of an SSB restriction policy (tax, front-of-pack label, warning label on shelves, restriction in school, education)	Purchases and consumption of SSB, health-related outcomes, product reformulation, government intervention, socioeconomic equality, economic consequences
Recommendations for the design of an SSB restriction policy if introduced in the Chinese context	Acceptable tax rate, type of label (recommended or compulsory), school restriction
Recommendations for alternative measures to reduce overweight and obesity in China	

Appendix B.6: Focus Group Discussion Guide for Consumers (Chinese version)

话题	提词
目前的含糖饮料消费习惯（无限制政策）	现在的消费量和频率，如果引入新政策会改变习惯，含糖饮料的购买习惯，是否了解含糖饮料带来的健康风险
关于在我国实行含糖饮料限制政策的意见	支持或反对，具体的政策类型，可接受度
含糖饮料消费习惯是否会随着相关政策而改变	改变消费量和频率，改变饮料的选择
含糖饮料限制政策的优缺点（税收、包装正面标签、货架上的警告标签、学校限制、教育）	含糖饮料的购买和饮用，健康相关结果，产品配方更改，政府干预，社会经济平等，经济后果
符合中国国情的含糖饮料限制政策：设计建议	可接受的税率，可接受的标签类型（自愿或强制），学校限制
建议解决我国超重和肥胖问题的其他替代措施	

Appendix C. Informed Consent

English Version

Oral Informed Consent Script

Thank you for your interest and time in talking with me. My name is Yue Suo. I'm currently a master's student in Global Health at Duke Kunshan University.

In my study, I want to investigate the adaptability and scalability of restriction policies on sugar sweetened beverages in China. This research project has been reviewed and approved by DKU's Institutional Review Board. If you choose to be a part of this project, I will have an interview with you, where I will ask a range of questions about your opinions on the introduction of this policy in China, and what type of policy would better adapt and scale up in China. We can talk for as long as you like, but I expect our conversation will take about an hour. I would also like your permission to let me audio-record our conversation so that I can focus on our conversation rather than taking notes.

With your permission, I would like to make an audio recording of our discussion to make sure I'm getting an accurate record of the interview. Do you give your permission for me to interview and audio record you?

Although I will include your identity in my research notes, your identity or personal information will not be disclosed in any publication of the study. Instead, I will use a fake name or report my results in groups and averages so no one can be recognized. Although collected data may be made public or used for future research purposes, your identity will always remain confidential. I will store the research data safely and confidentially in encrypted storage provided by DKU. Only people in my research team could have access to the data.

You can ask me any questions at any stage of our interview, and you can skip any question that you do not want to answer. You can also stop our interview at any time, for any reason. If you do not want to be recorded, that is okay. Whatever you decide to do is fine, I fully respect your decision.

Please let me know if you have any questions for me at this time. If you have any other complaints or concerns later, you can also contact me through my email: yue.suo@duke.edu.

I fully respect your opinion of whether you will participate. Do you have any questions? Are you happy to take part?

Ok, thank you, let's start the interview.

Chinese Version

知情同意口述稿

感谢您在百忙之中抽空与我谈话。我叫锁悦，目前是昆山杜克大学全球健康专业的研究生。

我的研究方向是含糖饮料政策在中国的推广。这个研究项目是我的硕士课题，目前项目已通过我们昆山杜克大学伦理委员会的审查和批准。如果您选择参与我们项目，我将对您进行采访，了解您的想法。只要您方便，我们访谈时间没有绝对的固定长度，我大概预计我们的谈话会在 45 分钟到 1 小时左右。

我的研究笔记中可能会包含您的身份信息，但我承诺这些信息不会出现在该研究相关的任何出版物中。我会使用“疾控专家”“市场局专家”“行业资深人士”等代称，或群组数据来撰写文章或报告，这样您的个人信息不会被泄漏。尽管收集的数据可能会公开，或用于未来的研究，但您的身份将始终保密。关于数据存储，研究录音会在项目结束后保存五年，然后销毁。我会将您提供的数据和录音安全保密地存储在昆山杜克大学提供的加密平台中，且只有我的研究团队中的成员才能访问这些文件和数据。

我想对我们的对话进行录音，用于转成会议纪要用作研究分析，以便我获取最准确的信息，这样我也可以更好地专注于我们的对话了，希望得到您的允许。请问您是否介意我录音？如果您不想被录音，那也没关系，我会用纸笔来做笔记。

您可以在我们采访中任何时间问我任何问题，您也可以跳过任何您不方便回答，或者不想回答的问题。我完全尊重您的决定。

如果您有任何疑问，请随时告知我。如果您以后有任何其他投诉或疑虑，也可以通过邮件与我联系。我的邮箱是 yue.suo@duke.edu。

我完全尊重您是否愿意参与的意见。您还有什么疑问的地方吗？您愿意参与本研究吗？

好的，谢谢您，那我们开始采访吧。

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