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Assessing the Feasibility of a SIB to Target
Overweight and Obese Children in Portugal – Identifying a Strong Intervention Model

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Abstract (100 words maximum)

Like many other countries, Portugal is witnessing the social issue of childhood obesity leading to an increased cost burden. This thesis aims to assess the feasibility of a SIB in tackling this social issue in Portugal. After conducting a thorough analysis of the issue, potential intervention options, and a suitable outcome metric, a SIB was developed through an Excel model. This study suggests that replicating a combination of MUN-SI and JOGG on the Azores for elementary school-aged children can be viable and likely to create social and financial value for all stakeholders.

Keywords: Impact Investment, SIBs, Childhood Obesity, Portugal

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1. Introduction

Since 2010, Social Impact Bonds (SIBs) have emerged as a novel financing mechanism, aiming to address public social issues, such as homelessness or unemployment, through innovative partnerships between public, private, non-profit, and voluntary sectors. As a departure from conventional funding models, SIBs are designed to align financial investments of private investors with public social outcomes. The basic premise of a SIB is to attract private investors who fund social interventions targeting specific social issues. The success of these interventions is measured based on predetermined outcomes, and if the desired outcomes are achieved, the government repays the investors' initial investment with a return on investment. In this way, SIBs are designed to shift the financial risk from the public sector to private investors, providing an incentive for innovative, evidence-based interventions that effectively address social challenges (OECD 2016; The Government Outcomes Lab. n.d.; Social Finance n.d.; GoodFinance n.d.).

Despite the growing interest in SIBs as a funding mechanism for social programs, there is a notable research gap regarding their feasibility in addressing childhood obesity, particularly in the context of Portugal. Childhood obesity is a pressing public health concern worldwide, posing significant risks to the physical and mental well-being of children and adolescent and significant healthcare costs for the government in Portugal. The prevalence of childhood obesity has been steadily increasing in recent years. Addressing this issue requires innovative approaches that involve various stakeholders and explore new funding mechanisms. However, existing literature primarily focuses on SIBs in various social policy domains, but few studies specifically examine their potential application to combat childhood obesity. Thus, this thesis aims to fill this gap by assessing the feasibility of implementing a SIB to target overweight and obese children in Portugal.

In *chapter 3*, five existing intervention models targeted at addressing childhood obesity within the context of a potential SIB will be delineated and evaluated based on their effectiveness. Building upon the insights garnered from *chapter 3*, the subsequent chapters *4 to 6* will meticulously expound upon a potential SIB tailored to address childhood obesity in Portugal. *Chapter 4* will ascertain the feasibility of this SIB by examining its prospective framework and subjecting it to feasibility criteria. In *chapter 5*, the SIB will be modeled by elaborating on its intervention scope, intervention costs, outcome metrics, payment mechanism, public sector value, and investment structure. Continuing the analysis, *chapter 6* will assess the potential SIB as a business case, utilizing sensitivity analysis to evaluate its payout rate, success rate, cost of intervention, and scenario analysis. Finally, *chapter 7* will elaborate on the limitations inherent in this thesis, thereby presenting potential avenues for further research and exploration. Finally, this thesis will conclude with a conclusion of its findings in *chapter 8*.

By assessing the feasibility of implementing a SIB to address childhood obesity in Portugal, this research contributes significantly to the scholarly discourse on innovative financing models for public health by filling a critical gap in knowledge. The research work lays an essential foundation for exploring the theoretical application of SIBs in the context of childhood obesity and overweight problems in Portugal that was never addressed before. Although the thesis examines the feasibility of implementing a SIB in theory, the thesis's findings pave the way for pilot projects that could test the implementation of such a SIB in a real-world scenario. Therefore, this thesis can guide future research towards assessing the practical feasibility and effectiveness of SIBs in addressing childhood obesity in Portugal.

2. Methodology

This thesis employs a mixed research approach, combining quantitative data analysis and qualitative research methods. The methodology involves a literature review for *chapter 3*, where existing intervention models are examined. This chapter relies on an extensive review of

academic papers, reports, and case studies. The information derived from the literature review forms the basis for the subsequent *chapters 4 to 6*. These chapters utilize a combination of information from the literature review and the construction of a business case and financial model in Excel. These chapters assess the feasibility of the potential SIB, model its intervention scope, costs, outcome metrics, payment mechanism, public sector value, investment structure and business case. Data used derived from various sources, besides others information about the two programs JOGG/MUN-SI, discussions with professionals and assumptions. The methodology regarding the developing of a SIB follows the guidelines proposed by Social Finance UK (2013).

3. Identifying a Strong Intervention Model

In this chapter, the importance of interventions for a SIB is explained, followed by an introduction of five existing intervention programs tackling childhood obesity, with the aim of determining the best model for a possible SIB in Portugal. Appendix 8 gives a comprehensive overview of the subsequent interventions. The selection of these programs is based on allowing for a broad and differentiated overview of possible interventions to identify the most suitable and effective one. Hence, the programs vary greatly in size, methodology, country, and target population.

3.1. Importance of Interventions for a SIB

Identifying a strong intervention model is vital for creating a successful SIB for various reasons. First, the main features of a SIB are built around its interventions, making the latter a key element of a SIB (La Torre et al. 2019). Moreover, the success of a SIB relies heavily on the effectiveness of its intervention. Thereby, implementing inefficient interventions would minimize the social impact as well as the financial return and thus lead to a failure of the SIB. To develop a strong intervention model, various frameworks and theories have been introduced, focusing mainly on behavioral, sociological and psychological changes of an individual, whilst

highlighting the importance of evidence, evaluation and a multi-level approach, the latter being especially important in the context of childhood obesity (Wight et al. 2016; World Health Organization 2016; Huang et al. 2015; Waters et al. 2011; Campbell 2000). In order to assess the suitability of the intervention programs introduced later in this chapter, the following criteria have been established, based on common factors in the existing frameworks:

- (i) *Social Issue*. The intervention clearly addresses the social issue, which aligns with the public interest and is tailored to the needs and the context of the target population (Iovan, Samantha and Lantz, Paula 2017; Wight et al. 2016; de Zoysa et al. 1998; Barclay and Symons 2013).
- (ii) *Outcome*. The intervention's goals have to be well-defined, measurable and aligned with the desired outcomes, thereby implying the need for well-defined and achievable outcome metrics (de Zoysa et al. 1998; Iovan, Samantha and Lantz, Paula 2017; Milner et al. 2016).
- (iii) *Evidence*. The intervention must be based on theories and evidence, especially regarding the selection and effectiveness of the interventions (Craig et al. 2008; Campbell 2000; Milner et al. 2016).
- (iv) *Theory of Change*. The intervention clearly states how it will achieve the desired social outcome (Wight et al. 2016; Milner et al. 2016).
- (v) *Evaluation*. The defined objectives of the intervention need to be monitored and evaluated to understand the effectiveness and possible gaps in the model (Milner et al. 2016; CORE Group 2008).
- (vi) *Multi-level*. The intervention should be comprehensive and target determinants across multiple levels, such as individual, interpersonal, community and policy (Green and Kreuter 2005).

Further, the intervention models are assessed against the *cultural fit* in Portugal as another criterion. Following, the five programs concerned with childhood obesity will be introduced.

3.2. Komm mit in das Gesunde Boot

Introduced in 2009, *Komm mit in das Gesunde Boot* or *Join the Healthy Boat* (JHB) is a multi-component school-based health promotion program targeting children from infancy until the age of 10 in Baden-Württemberg, Germany. Initially implementing the program in schools only, it was later introduced in kindergartens. JHB was developed by the Ulm University and aims to improve children's overall health, including increased physical activity and healthy food consumption, less screen time as well as building mindfulness. The main objective is to prevent children from suffering from obesity (Das Gesunde Boot 2023; Sonnenmoser 2009).

3.2.1. Program Methodology

According to Wartha et al. (2016), JHB is based on four main theories and was developed according to Bartholomew's *Intervention Mapping Approach*, a systematic, evidence-based approach. It involves six steps: (i) needs assessment, (ii) development of intervention goals and objectives, (iii) identification of theoretical methods and strategies to achieve the objectives, (iv) development of a detailed intervention plan, (v) implementation of the intervention, and (vi) evaluation of its effectiveness (Kok et al. 2004; Bartholomew Eldredge et al. 2016).

Moreover, JHB bases on the *Social cognitive theory* by Bandura (2001), which explains how people obtain and maintain behavioral patterns, as well as how they learn new behaviors. According to this theory, human behavior results from the interaction between personal and environmental factors (Bandura 2001; Schunk and Pajares 2010). Bronfenbrenner's *ecological framework for human development* (1979) is a theory that emphasizes the multiple levels of influence on individual development. It suggests that development is influenced by individual behavior as well as environmental and contextual factors (Bronfenbrenner 1974; 1979; N. Hayes, O'Toole, and Halpenny 2017). Finally, *RE-AIM* is a framework for evaluating the reach, effectiveness, adoption, implementation, and maintenance of health interventions (Gaglio, Shoup, and Glasgow 2013; Glasgow, Vogt, and Boles 1999). Appendix 9 illustrates the

framework of the intervention specifically for kindergartens and highlights the importance of teacher's role in this program.

3.2.2. Outcomes and Social Impact

JHB's number of participating teachers has almost reached 10,000, whilst facilities, such as schools, amount to roughly 3,000, meaning that around 200,000 students have engaged each year (Das Gesunde Boot 2023). The intervention has been evaluated by the Health Survey and Baden-Württemberg Study, the latter analyzing the impact of implementing the program for one year in 91 schools (Kobel et al. 2017; 2022; Dreyhaupt et al. 2012). The study showed that the program positively impacted the students' BMI reduction and physical activity levels. Moreover, according to Kobel et al. (2022), a significant difference in sweet beverage consumption and fruit and vegetable intake could be found after implementing the intervention.

3.2.3. Operations and Financials

The program is currently funded by the Baden-Württemberg Stiftung and gaining funds through various awards it has received. The average cost for two seminars consulting teachers is approximately 2,160 EUR, whereas three vocational trainings cost 5,872 EUR. In addition to that, the personnel cost of 28,470 EUR must be considered. Thus, the annual cost for implementing this intervention sums up to 36,500 EUR, or 25 EUR per student participating. The intervention's effectiveness leads to a cost aversion between 1,789 EUR and 1,963 EUR per participating student (Das Gesunde Boot 2023; Kesztyüs et al. 2017)

3.3. Action for Healthy Kids

Action for Healthy Kids (AFHK) is a non-profit organization based in the US with the goal of promoting a healthy lifestyle in children. It focuses on family-school partnerships, targeting children aged 6 to 19. The organization was founded in 2002 after an appeal to the increasing problem of childhood obesity in the US. It is involved in the assembly of the Healthy School

Summits, a conference involving health experts, policymakers, and other vital stakeholders, discussing trends and possible solutions to the childhood obesity epidemic (AFHK 2023e).

3.3.1. Program Methodology

AFHK's interventions can be categorized into three sections, namely (i) Tools and Resources, (ii) Programs and Practices, as well as (iii) Staff, Family, Student and Community Engagement (AFHK 2023e). The program centers around a holistic *family-school partnership model* and is moreover based on the *Whole School, Whole Community, Whole Child model*, following WSCC (AFHK n.d.). WSCC is evidence-based and highlights a collaborative approach between schools, families, and communities. It encompasses ten components that are vital for improving school health, illustrated by Figure 1 (CDC n.d.; Washington University in St.Louis n.d.). Contingent with this, AFHK established three key programs concerned about nutrition, physical activity and emotional well-being. The program *NourishEd* focuses on access to food and nutrition education. To achieve this, school meal programming, experiential learning initiatives and an evidence-based education curriculum are implemented (AFHK 2023c; n.d.). *EnergizEd* is AFHK's program tackling physical activity and aims to increase students' activity during the school day to 60 minutes daily (AFHK 2023b; n.d.). Finally, the *ConnectEd* program concentrates on the students' emotional health and well-being, with the aim of preventing risk behaviors. Aligned with the CASEL program (Collaborative for Academic, Social, and Emotional Learning), it provides stakeholders with an evidence-based curriculum (AFHK 2023a; n.d.). AFHK distinguishes and measures outcomes on four levels: (i) academic success, (ii) change in behavior, (iii) healthy school environments and (iv) knowledge of healthy behaviors (AFHK 2019).

3.3.2. Outcomes and Social Impact

AFHK is active in most states in the US, and from 2013 to 2016, it granted 1.6 m USD to 1,143 schools, thereby impacting approximately 620,000 students through grants solely (AFHK, n.d.). Moreover, daily physical activity was improved to 56 minutes per day. During the school year of 2018 to 2019, additional 437,01 students were impacted by school grants. In that year, 406 minutes of new physical activity were added to the school day, increasing the physical activity of one student by 10 minutes. Regarding nutrition, 5.4 m new meals were served to students, leading to an increase in nutrition awareness in 90 % of the students (AFHK 2020).



Figure 1: WSCC Model (CDC n.d; Washington University in St.Louis n.d.)

3.3.3. Operations and Financials

The organization relies on various funding sources to support its operations, including grants, corporate partnerships, individual donations, and fundraising events. According to Action For Healthy Kids (2023), out of every dollar that goes to the organization, 84 cents are allocated to improving children's health. As a nonprofit organization, AFHK has issued its financial statement, revealing a total revenue of 2.9 m USD in 2021, nearly two million less than in 2020 (AFHK 2022). The biggest income came from contributions and grants, given a vast number of partnerships with corporates. For instance, in 2019, ALDI Inc. and The Walmart Foundation alone contributed with more than 1 m USD (AFHK 2020). Total expenses in 2021 added up to

3.7 m USD, whilst in 2019, operating expenses amounted to 16.2 m USD, of which 62 % were attributable to in-kind school health programs (AFHK 2020). According to the 2021 financial statement, the organization was comprised of 16 board members in 2021 and 22 additional employees, whilst the number of volunteers was estimated to be 100,000. AFHK organizes teams for each state in the US, comprised of “state-based leaders in children's education, health, physical activity, nutrition and government, as well as school administrators, concerned parents, student leaders, and community and business leaders” (Moag-Stahlberg 2004).

3.4. Joint Action on Nutrition and Physical Activity

Joint Action on Nutrition and Physical Activity (JANPA) is a project funded by the European Union (EU), including 25 participating member countries and Norway. Thereby, it differs greatly from the coordination and structure of other programs discussed in this paper. For the sake of a differentiated overview, JANPA is included in this thesis, although it has been inactive since 2017. The project focused on a multi-level approach and targeted decision-makers, educational institutes, parents as well as communities. JANPA evolved from the European Action Plan on Childhood Obesity by the High Level Group in 2014 (Balanda et al. 2017). Its goals included stopping the rise of childhood obesity in member states by 2020, estimating costs associated with obesity in children, promoting healthy environments at home and in their educational facilities (Balanda et al. 2017).

3.4.1. Program Methodology

JANPA was organized in seven Work Packages (WP), while not every participating country implemented all WP. Appendix 10 illustrates the WP and their respective tasks. The first three WP were concerned with overall and more general objectives, such as the management and evaluation of JANPA. The other WP focused on more specific topics, for example nutrition or early interventions, which occasionally involved the implementation of case studies (JANPA 2018).

According to Balanda et al. (2017), the whole project is based on the belief that a *life-course approach* is needed. Thereby, effective prevention of childhood obesity can only be tackled if interventions start during the earliest ages, including pregnancy. Additionally, policies and interventions were subject to a multi-sectoral approach, highlighting the importance of improved government actions. Through analyzing the WP, JANPA's interventions can be summarized into three main categories: (i) *Policy interventions*, which aim to establish new or change existing policies related to healthy environments, such as increasing taxes on unhealthy food and beverages or restricting marketing campaigns for the latter; (ii) *School interventions*, that propose the implementation of nutrition and activity plans in the school environment; (iii) *Community interventions*, for which JANPA shapes health-supportive surroundings for children by interacting with communities to raise awareness about healthy behaviors (JANPA 2018c; 2017; 2016; Balanda et al. 2017).

3.4.2. Outcomes and Social Impact

As JANPA's interventions were highly focused on changes in policies and addressing decision-makers, most of the program's goals were aimed to be achieved in the long-term. Hence, measuring the social impact it has created can only be done limitedly. According to JANPA (2018), the program proved to be successful in meeting most of its objectives and quality. These objectives, however, focused increasingly on creating awareness, sharing relevant information, and analyzing and estimating existing interventions (JANPA 2018c). Consequently, specific outcomes regarding the decrease in childhood obesity could not be found. In terms of economic outcomes, the estimation of costs related to childhood obesity was included in WP4 (JANPA 2018a; 2018b), where the Republic of Ireland was used as an example to calculate and showcase these findings. Nevertheless, JANPA established various guidelines, frameworks, toolkits and recommendations for relevant stakeholders and future research, and moreover identified gaps in tackling childhood obesity (CHAFEA n.d.).

3.4.3. Operations and Financials

JANPA was funded by the European Union's Health Program and managed by the Consumers, Health, Agriculture, and Food Executive Agency (Chafea). The program's total budget was approx. 2 m EUR, of which 1.2 m EUR was funded by the EU, from 2014 to 2020 (CHAFEA n.d.; European Commission 2018). The budget allocated to each country for implementing interventions through JANPA varies depending on the country's needs and the specific interventions being implemented. The program operated with a consortium of 39 partners from 24 different European countries, with a central coordination team located in the Netherlands. Moreover, 13 additional stakeholders collaborated with the program (Balanda et al. 2017).

3.5. MUN-SI: Programa de Promoção de Saúde Infantil em Municípios

The MUN-SI program in Portugal was developed in 2008 and follows a community-based approach, targeting children aged 6 to 10 years. Moreover, the families of targeted children, school environment as well as the local community are involved. The duration of implementing this intervention varies from one to four years. The aim is to establish a dedicated and collective solution to weight-related health issues in children, including childhood obesity (A. I. Rito et al. 2020).

3.5.1. Program Methodology and Structure

The program focuses on prevention at a municipality level using a comprehensive approach. This entails that interventions are aimed at all relevant stakeholders, such as families, schools, and the community. Moreover, the program established that interventions should be adopted as early as possible to be effective (CEIDSS n.d.). MUN-SI's interventions are based on three guidelines, including the improvement of physical activity and healthy food consumption as well as the post-intervention evaluation of participating children. The assessment of the first and second guideline is conducted through parent surveys, whereas the last one is measured

conforming to WHO's criteria of 2007 (A. I. Rito et al. 2020). According to its guidelines, the program identified six key areas that need to be addressed:

- (i) *Healthy School*. The interventions focus on the school environment on a behavioral level. Children engage in awareness-increasing and fun interventions, aiming to improve a sustainable healthy lifestyle, of which one focus lies on promoting a Mediterranean diet.
- (ii) *Training*. As MUN-SI is very prevalent in school settings, teachers are provided with training, especially regarding evaluation and monitoring of children.
- (iii) *Research*. Continuous research is vital to understand and design effective interventions, which MUN-SI supports according to the WHO.
- (iv) *Healthy City*. With the aim to create a healthy community, several initiatives in neighborhood settings have been implemented.
- (v) *Communication*. Interventions aimed to advertise the program on various platforms and thereby increase awareness of the issue are an important part of MUN-SI.
- (vi) *Family*. Interventions targeting families specifically aim to improve healthy lifestyle at home whilst educating family members regarding nutritional food and regular exercise. (CEIDSS n.d.; 2018; A. I. Rito et al. 2020).

The interventions for each of these areas are designed by all relevant stakeholders, such as parents, teachers, children and the community. A. I. Rito et al. (2020) describe the program's structure, which incorporates three key phases. First, participating children will be diagnosed while additionally raising awareness about the issue. Motivational interventions will then be implemented by these experts in fun and engaging school-based sessions and address the above-mentioned areas. During the second phase, training and education will be provided to staff members of selected schools. In the last phase, the progress of schools and students will be tracked and evaluated with the help of parents to provide a thorough analysis (A. I. Rito et al. 2020).

3.5.2. Outcomes and Social Impact

MUN-SI has been implemented by 16 municipalities, including 186 schools and around 9800 students (CEIDSS 2018 n.d.; Youth Health Community n.d.). According to Rito et al. (2020), the interventions showed a positive effect on the behavior of children, their awareness of the Mediterranean diet, the amount of physical activity and an overall decrease in the prevalence of obesity in children in participating municipalities. In the municipality of Oeiras, which has been implementing MUN-SI since its founding, the percentage of obese children went down from 16.7 % in 2008 to 6.4 % in 2019 (CEIDSS n.d.).

3.5.3. Operations and Financials

Information regarding costs and financials was not found. MUN-SI is coordinated by the Centre for Study and Research on Social Dynamics and Health (CEIDSS) and implemented through a coordination team composed of “supervising nutritionists, including the municipal technicians appointed to the program and, after selecting the school, the teachers of the school years covered” (A. I. Rito et al. 2020). Each year, the project is designed according to the needs of the respective municipality. MUN-SI has been part of the EPODE European Network, which will be discussed in more detail in the following subchapter (CEIDSS n.d.).

3.6. Jongeren Op Gezond Gewicht (JOGG)

The project Young People at a Healthy Weight (JOGG) is a Dutch community-based program targeting children from infancy to the age of 19. Founded in 2010, the goal is promoting a healthy lifestyle to reduce childhood obesity ultimately (CHRODIS 2017).

3.6.1. Program Methodology and Structure

JOGG is based on the *EPODE methodology* (CHRODIS 2017), which employs a capacity development strategy targeting communities to implement long-lasting and impactful strategies to combat childhood obesity (J. -M. Borys et al. 2012). The EPODE approach implements a societal process to decrease obesity in children, in which family patterns, childhood and local

environments are all addressed, thus making it a multi-stakeholder approach. According to J. -M. Borys et al. (2012), EPODE describes addressing four integral components to achieve its goals: (i) political commitment, (ii) public and private partnerships, (iii) community-based actions, and (iv) evaluation. The interventions are implemented on four levels: individual, community, local and central organization. Based on these levels, the evaluation of interventions is conducted by monitoring both process and outcome indicators. The EPODE methodology can be modified, for example according to age, culture, socioeconomic group (J. -M. Borys et al. 2012). JOGG is an example of this modification and implemented through public-private institutions. The interventions of the program are based on five principles, including (i) Political and Governmental Support, (ii) Cooperation between Public and Private Sectors, (iii) Social Marketing (iv) Scientific Coaching and Evaluation, and (v) Interlinking preventive care and local health care structures (CHRODIS 2017). Further, the interventions address seven areas on five levels, as illustrated by Figure 2. Each municipality receives a tailored program, as the needs and characteristics of the target population vary. Moreover, interventions are realized through collaboration and participation of local stakeholders and community members (Huiberts et al. 2022).

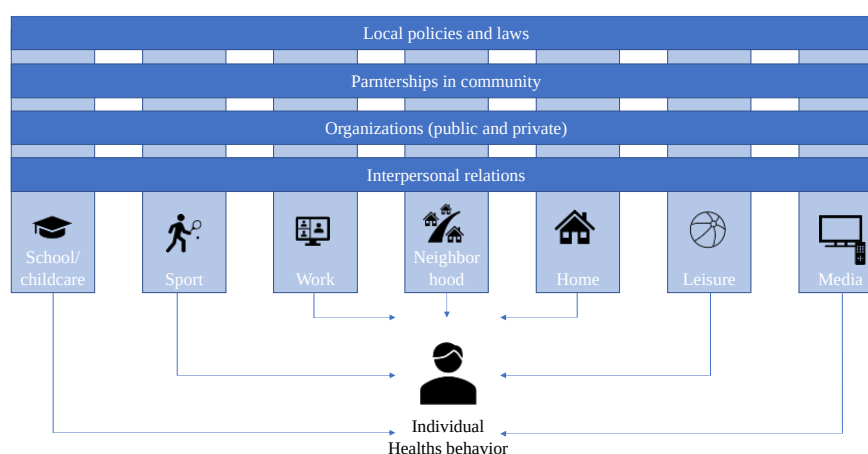


Figure 2: Intervention areas and levels addressed by JOGG (Huiberts et al.)

3.6.2. Outcomes and Social Impact

The pilot EPODE model in France, has been successful in decreasing prevalence in childhood obesity (Romon et al. 2009), suggesting a positive outcome of JOGG. Until late 2022, JOGG has been implemented in 210 municipalities, including 1,069 schools, 2,115 sports clubs, almost 800 coaches, more than 1000 companies and 21 international organizations (JOGG 2022). The assessment of JOGG has been undertaken by the OECD (n.d.), based on five factors, shown in Appendix 11. The assessment is done through calculations and forecasting of JOGG's impacts, both within the Netherlands and outside of it, using a timeframe until 2050. Regarding the *effectiveness* of JOGG, it is evaluated with the expectation of reducing the morbidity rate by 95,000 years of life by 2050. Moreover, the prevention of obesity-related diseases is expected to decrease through implementing JOGG interventions. By implementing the program in the Netherlands, OECD (n.d.) estimates to prevent more than 40,000 musculoskeletal disorders (MSDs), more than 10,000 cardiovascular diseases (CVDs) and more than 5,000 Diabetes. In case of realizing the project in all OECD countries, the number of MSDs avoided by 2050 amounts to almost 3 m cases, roughly 1 m avoided cases of CVDs and half a million fewer cases of Diabetes. The assessment regarding *equity* is strong, as the program aims to target low socio-economic groups, thereby diminishing health and social inequalities. According to OECD (n.d.), there is room for improvement in the quality of *evidence* regarding data collection methods and bias in selection. Moreover, JOGG reaches 30 % of its *target group* in the Netherlands, which should also be enhanced. In terms of *efficiency*, JOGG is cost-effective and will produce cost savings in OECD countries in the future (OECD n.d.).

3.6.3. Operations and Financials

JOGG is primarily funded by the Dutch government, but it also receives funding from private organizations and foundations. Moreover, each municipality pays a fee ranging from 5,000 EUR to 10,000 EUR, dependent on the population size (J.-M. Borys et al. 2015). According to

OECD (n.d.), Zaanstad, a JOGG municipality, had costs associated with JOGG of 432,000 EUR for one year. Out of this number, 140,000 EUR are paid to directors of the program, 65,000 EUR to municipality-located director, 60,000 EUR to interventions, 115,000 EUR to obesity specialists and 52,000 EUR to Central JOGG operations. Given that 33,304 children were targeted in this municipality, the cost per child amounted to 12.97 EUR in 2020 (OECD n.d.).

3.7. Suitability of an Intervention Model for a SIB

Based on the assessment criteria for a strong intervention described in subchapter 3.1, the most suitable intervention model will be selected for a business case analysis, which will be analyzed in chapter 6.

Whilst JHB was developed using evidence-based theories and frameworks, it has only been implemented in schools across one state of Germany, diminishing its reach and impact. This also leads to uncertainty regarding a potential scaling-up of the project. Moreover, as part of JHB's philosophy is the availability of free-of-charge resources and support, which would be difficult and very costly to implement on a larger scale. Outcomes and a strategy on how to achieve them are defined and evaluation is conducted regularly. However, there has been criticism regarding the studies used for evaluation, especially regarding the outcomes and the statistical analysis (Vorland et al. 2020). Further, JHB lacks a multi-level approach, addressing school-based settings only, not complying with the multi-level criterion.

For AFHK, its involvement of parents, educators, and community members in planning and implementing interventions may lead to greater interest and sustainability of interventions. Although AFHK uses the WSCC model as a base for its interventions, the program directly affects only five of WSCC's ten components. Moreover, the model was developed for schools in the US specifically, diminishing its adaptability to other contexts, thus not complying with the cultural fit criterion (Willgerodt, Walsh, and Maloy 2021). Additionally, the program's

impact depends on the level of support and resources available to individual schools. A scientific evaluation by independent evaluators of AFHK's impact could not be found.

JANPA is a collaborative effort across multiple European countries, allowing for sharing of best practices and resources across borders. Additionally, the program's focus on policy change and the involvement of multiple stakeholders may lead to longer-term, systemic changes in addressing childhood obesity. Nevertheless, this requires a coordinated effort from various high-level stakeholders, which can be challenging to achieve. Additionally, the program's success depends on the commitment and collaboration of different organizations, which may be difficult to sustain in the long run. Even though JANPA addresses various stakeholders, the individual itself is not as involved as in other projects. Furthermore, JANPA's outcomes were not as clearly defined compared to other programs, and focused predominantly on analyzing existing frameworks and interventions, sharing relevant information, and increasing overall awareness, especially on a policy level, making it difficult to evaluate and measure these. The outcomes regarding raising awareness on a national level and policy changes are relevant in the context of this issue and should not be neglected. However, these objectives go beyond the scope of this thesis.

MUN-SI's training of individuals embedded in local communities may allow for more tailored and culturally appropriate interventions in Portugal. As this thesis focuses on Portugal in its assessment of a SIB feasibility, this could be of advantage. The program's emphasis on a multi-level approach by engaging parents and communities in the intervention may also lead to sustained behavior change. Moreover, the needs of the target group are evaluated and explicitly addressed to provide each municipality with a tailored intervention program. MUN-SI clearly defines its outcomes, which are evaluated through the efforts of CEIDSS. The theory of change is comparable to the other models. The limitation of MUN-SI is the lack of evidence, which needs to be improved.

JOGG's partnerships with local governments, schools, and businesses allow for more comprehensive and coordinated efforts to address childhood obesity, fulfilling the multi-level criteria. Moreover, the program is based on a strong evidence-based approach that has been implemented and evaluated for a long period in different settings and countries, suggesting that it could be scaled up and applied in other contexts. Outcomes are clearly structured and evaluated, although the latter can still be improved. The main limitation of JOGG in the context of this thesis is its cultural fit. However, on the basis that interventions of JOGG can easily be adapted, this limitation could be diminished. In addition to that, the EPODE approach underlying JOGG aims to address multiple factors contributing to childhood obesity. These are aligned with the causes of childhood obesity, suggesting that the social issue could be addressed in the context of Portugal.

Table 1 summarizes the assessment of the programs. A percentage was calculated based on the number of criteria achieved, whereby a maximum of three points were attainable for each criterion. In summary, the most suitable model is JOGG, followed by MUN-SI. Given the Portuguese context of this thesis, and the fact that both are part of the EPODE International Network, the suggestion is to use a combination of both programs regarding the intervention model.

Assesment Criteria	JHB	AFHK	JANPA	MUN-SI	JOGG
Social Issue	☆☆☆	☆☆☆	☆☆☆	☆☆☆	☆☆☆
Outcome	☆☆☆	☆☆	☆☆	☆☆☆	☆☆☆
Evidence	☆☆☆	☆☆	☆☆	☆	☆☆☆
Theory of Change	☆☆	☆☆	☆☆	☆☆	☆☆☆
Evaluation	☆☆	☆	☆☆	☆☆	☆☆
Multi-level	☆	☆☆☆	☆☆	☆☆☆	☆☆☆
Cultural Fit	☆	☆	☆	☆☆☆	☆
Total	71%	67%	67%	81%	86%

Table 1: Determining the suitability of an intervention model for a SIB

4. Determining the Feasibility of a JOGG/MUN-SI SIB

As outlined in chapter 3.4, the MUN-SI and JOGG intervention programs demonstrated the most significant outcomes in addressing childhood obesity, thus, making it interesting to assess whether a SIB constitutes a suitable financing method to enable a combination of MUN-SI and JOGG- program interventions to address childhood overweight and obesity in Portugal. In line with the research question, this chapter will focus on determining the feasibility criteria of a SIB in Portugal to tackle childhood overweight and obesity in Portugal. The framework of the potential JOGG/MUN-SI SIB, inspired by the JOGG/MUN-SI program, is outlined in the first step. In the next step, the feasibility of the SIB is assessed based on three main criteria.

4.1. Framework of a JOGG/MUN-SI SIB

Based on the SIB framework outlined and inspired by successful childhood obesity prevention programs JOGG and MUN-SI, the potential JOGG/MUN-SI SIB framework presents an innovative approach to addressing childhood obesity in Portugal and would involve multiple key stakeholders (see Figure 3).

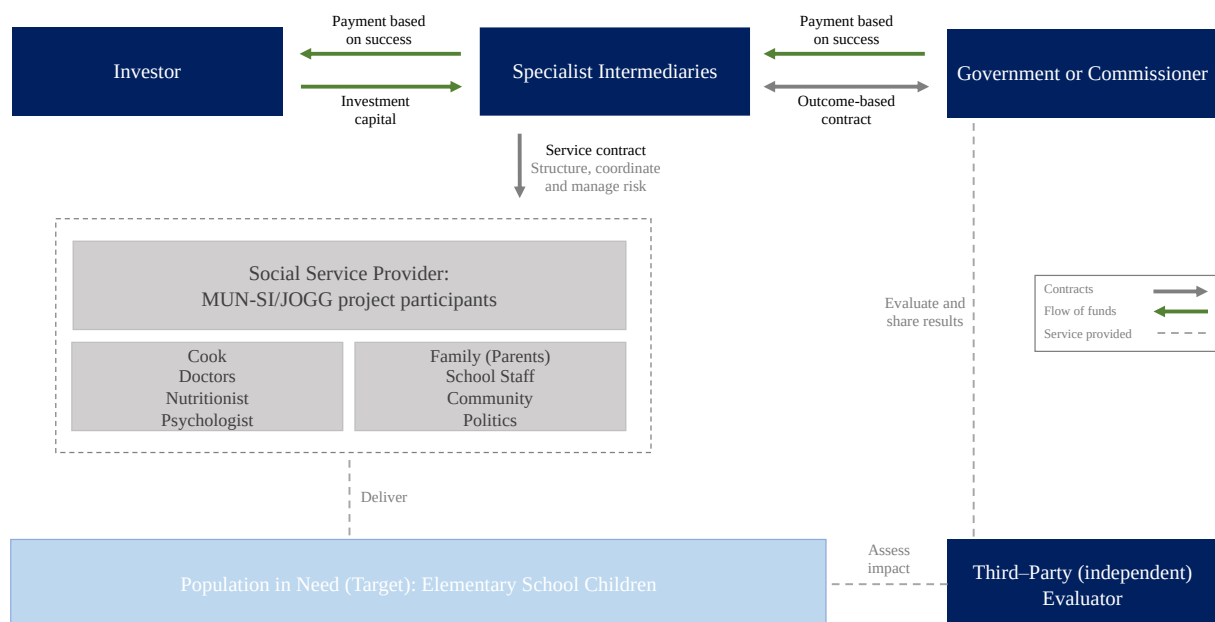


Figure 3: JOGG/MUN-SI Social Impact Bond Structure

Investors in SIBs, designed to tackle childhood obesity, can include impact investors motivated by both financial returns and the measurable impact on the health outcomes of children. Moreover, private individuals interested in promoting healthy lifestyles and preventing chronic diseases may also provide upfront capital. Non-profit organizations focused on improving health outcomes or private sector companies driven by their corporate social responsibility, and the desire to improve their public image are also potential sources of investment (see Figure 3). *Commissioners* may be a government agency or a consortium of government agencies responsible for addressing health-related issues in Portugal. The National Health Service (Serviço Nacional de Saúde) in Portugal is a potential candidate for serving as the commissioner for a SIB aimed at reducing childhood obesity rates. Other government agencies such as the Ministry of Health, Ministry of Education, and the Portuguese Directorate-General for Health (Direção-Geral da Saúde) may also play a supportive role in a SIB tackling childhood obesity. In addition to government agencies, local municipalities or districts, health agencies, and other community organizations may also be considered potential commissioners, depending on the specific design and implementation of the SIB (see Figure 3).

Service Providers may include organizations with experience and expertise in delivering effective interventions to address the problem. Educational providers, such as schools and their staff, are vital in offering nutrition education programs, healthy food options, and physical activity. Healthcare providers such as psychologists, nutritionists, cooks, and doctors offer interventions such as counseling, medical assessments, and treatment plans. Private service providers such as community members and family members promote healthy eating and activity habits (see Figure 3).

Intermediaries should have technical expertise in designing SIBs that target health outcomes such as childhood obesity and ensure that all stakeholders work together effectively in the Portuguese cultural and political environment (see Figure 3). One important intermediary that

could support the implementation of the childhood obesity SIB in Portugal is 'Maze Impact'. Maze is an intermediary that helped to structure and launch the first SIB in Portugal in January 2015 (Anselmo 2022). In addition, 'Portugal Social Innovation', another intermediary, is a public initiative that mobilizes European Funds to promote social innovation and boost the social investment market in Portugal (Portugal Inovação Social n.d.).

The target population or beneficiaries of the JOGG/MUN-SI SIB consists of elementary school children in a school on the Azores between the age of 5 and 12, regardless of their weight. However, chapter 5.1 will further elaborate on the target population at hand.

4.2. SIB Feasibility Criteria

Transitioning from the framework of the JOGG/MUN-SI SIB targeting childhood obesity in Portugal, it is crucial to delve deeper into the specific criteria necessary for the feasibility of such a project. A feasibility study is a critical step in developing an effective SIB program, as it assesses the SIB's potential success and risks. In line with various research papers, there are no standardized criteria to measure the feasibility of a SIB, thus, leading to a varying range of different feasibility criteria. Therefore, this chapter mainly focuses on the following three main criteria: (i) *meaningful and measurable outcomes for a clearly defined target population* (ii) *prior evidence of success in achieving outcomes*, and (iii) *reasonable time horizon to achieve outcomes* (UNDP 2021; KPMG 2013).

(i) *Meaningful and measurable outcomes for a clearly defined target population.* Since the entire cashflow of a SIB mechanism is based on the achievement of predefined outcomes, the outcomes should have a meaningful and significant impact on the defined JOGG/MUN-SI SIB target population – for example, having children's grades (obesity affects the psyche and therefore also the grades) instead of BMI as an outcome of the program does not yield to a meaningful impact in the form of reducing obesity for the children at hand. While focusing not only on the reduction of BMI but also on healthy eating behaviors and activity

levels, the JOGG/MUN-SI SIB effectively addresses the leading root causes of this issue, and thus, fulfils the criteria of meaningful outcomes that target a reduction in childhood obesity. Moreover, if those outcomes are not measurable and linked to the target population, it is difficult to measure the success and areas of improvement of the intervention. Since the BMI, healthy eating patterns, and activity levels can be tracked with various methods and are easy to implement and adapt due to the flexibility of the project approach; the JOGG/MUN-SI SIB fulfils the second outcome criteria as well.

(ii) *Prior evidence of success in achieving outcomes.* As the heart of the SIB lies in private funding for social public sector interventions, it is more than crucial to building trust and credibility with future investors of the SIB to secure their investment. As investors get financial returns based on the achievements of outcomes, a track record of successful outcomes of the defined intervention reduces the perceived risk of investing in the SIB. In sum, if a SIB intervention has a good track record of success in achieving the desired outcomes, the financial viability of this SIB is enhanced by attracting even more investors who aim to get a favorable rate of return (Nazari Chamaki, Jenkins, and Hashemi 2019; Fraser et al. 2020). On the other hand, the evidence of the success of similar interventions holds the service provider accountable to reach the desired intervention results of the SIB. Since the MUN-SI program measured a reduction of 11.2 % in the prevalence of overweight and 10.3 % of obesity over ten years and the JOGG project measured a reduction in obesity prevalence of 9.09 %P (see chapter 5.5.), the evidence of success regarding these two programs builds a promising case for scaling and replicating these interventions in the form of a JOGG/MUN-SI SIB for tackling childhood obesity in Portugal.

(iii) *Reasonable time horizon to achieve outcomes.* For a SIB to be feasible, the desired outcomes must be achieved in a reasonable time horizon. Since investors expect to see the

SIB program demonstrate positive results as soon as possible, but in a maximum of 5 to 6 years, previous time horizons of achieving similar outcomes are crucial to assess (OECD 2016; Arias et al. 2017). However, it is vital to balance a short enough timescale between the intervention, impact measurement, and payment to instill investor confidence and a long enough timescale for monitoring, learning and adjustment to ensure a sustainable long-term SIB success (OECD 2016; Davies 2014). In the last ten years, the MUN-SI program successfully reduced childhood obesity within two consecutive years. The JOGG program decreased childhood obesity within 2 to 4 years. Thus, it can be assumed that a replication of the JOGG/MUN-SI interventions in the form of a SIB in Portugal would yield similar results (Chrodis n.d.; Youth Health Community n.d.) As provided by chapter 5.5., this assumption is proved, since the potential JOGG/MUN-SIB provides a robust investment case for potential investors, which would get a 43 % return in Year 4. In addition, the cost savings to the commissioner/government must equal the sum of the costs incurred by providers to derive the SIB interventions plus the payments to the investors. As outlined later in chapter 5.5, the modelled JOGG/MUN-SI SIB would provide potential governmental savings of 688,556 EUR.

Based on the three main SIB feasibility criteria above, the JOGG/MUN-SI SIB can be defined as feasible for effectively addressing childhood obesity in Portugal. As mentioned above, while the feasibility criteria for a SIB encompass essential considerations such as meaningful and measurable outcomes, prior evidence of outcome success, and a reasonable time to achieve those outcomes, there are additional criteria that warrant extensive future research that is out of the scope for this thesis. These criteria may entail the Portuguese government support and legal structures in place to support and enforce the SIB, the presence of interested impact investors and outcome payer(s), and appropriate service providers (Gustafsson-Wright, Gardiner, and Putcha 2015). Having evaluated the feasibility of the JOGG/MUN-SI SIB to tackle childhood

obesity in Portugal, the next step is to delve deeper into the SIB feasibility study by modeling the JOGG/MUN-SI SIB in detail.

5. Modelling of SIB

The modelling of a SIB involves several steps. First, the target population and the intervention model used to achieve the desired social outcomes are analyzed (*Intervention scope*). Secondly, the *intervention costs* were calculated to determine the financial resources to launch and sustain the project. Thirdly, the *public sector value* created by the SIB for JOGG/MUN-SI project is evaluated. Fourthly, the *payment mechanism* was built, settling the relevant outcome metrics and the reward for achieving them. The fifth step is to develop the *investment structure*, which brings together all of the preceding findings and shows how they work together to achieve the desired results.

5.1. Intervention Scope

Target population. As recommended in chapter 3, this model adopts a broad approach, focusing on a multi-component program. Consequently, the project's target population does not include demographic or behavioral risk factors. This pilot program targets an elementary school in a rural area namely in the Azores, as it has one of the highest rates of overweight and obesity among children in Portugal, at 35.9 % (A. Rito et al. 2021). Thus, the eligibility criteria for the study entail elementary school children aged between 5 to 12 regardless of their weight. Intermediary target groups are families (parents), school staff (teachers), health professionals (doctors, psychologists, nutritionists, cooks) and local policymakers.

Cohort delivery model. The program is expected to last four years, aligning with the elementary school timeframe. Regarding target size, at the beginning of the intervention, 336 students participate, given that one grade consists of four classes with 21 students each, based on the average class size in Portugal (OECD 2022). Moreover, the number of students starting school each year equals the number leaving elementary school, which amounts to 84 students per year.

Therefore, the cohort size remains the same throughout the program. However, the overall target population increases by 84 incoming students each year, thereby amounting to 588 students overall. As the program focuses on elementary school children, students leaving school after grade four will stop participating in the program.

Intervention model. Figure 4 gives an illustration of the project tailored to the target population used for this program, which was derived from interventions of existing programs, namely MUN-SI in Portugal and JOGG in the Netherlands (see Excel-file 1.1. Intervention Model). The program combines the most suitable aspects of both, given the Portuguese context. Thereby, it focuses on eight pillars that address two main causes of childhood obesity: environmental and behavioral factors. To target the first cause, four pillars, also called intervention areas, were established:

- (i) *School.* This intervention area specifically focuses on school-based topics, such as healthy lunches and nutritional education. The interventions include but are not limited to increasing water intake while decreasing the sweet beverage intake, improving canteens by making the meals healthier and offering daily vegetables and fruits in the breaks, as well as implementing nutrition education, e.g., cooking classes (Chrodis n.d.). Furthermore, the teachers undergo training to impart the principles of the intervention program in their classes and guarantee adherence to the regulations. Additionally, they receive psychological instruction to assist in promoting the mental and emotional well-being of the children. This approach aims to ensure educators are equipped with the necessary skills to create a safe learning environment. This will be measured by the percentage of children consuming vegetables and fruits at least once daily. The interventions mentioned will be implemented at the start of the intervention program in Year 1 and will focus on the children and the school predominantly. During the third and fourth year, while continuing the intervention

programs, the focus will expand to local communities and to a national level, given the success in the first years.

- (ii) *Work*. This area aims to encourage a healthy work environment through healthy canteens or the promotion of active transportation modes. As this area is relevant for adolescents rather than elementary school children, it will not be considered for this program. However, the flexibility of the intervention model based on JOGG suggests this pillar, given a target group that includes adolescents up to 19 years.
- (iii) *Neighbourhood*. An important aspect of this program is the inclusion of the local community, including supermarkets and local shops to enhance easier access to healthy food. Thus, partnerships with these are aimed to be mainly formed during the last two years of the intervention model, whilst the first years focus on creating or renovating playgrounds and green spaces in the community to promote physical activity. Considering the project's limited scope, as it focuses solely on one municipality, the intervention model incorporates a partnership over the four years with only one sports club/gym to enable children to join a club at discounted rates and does not include a renovation or building of a leisure option for now. This can be considered when scaling up the project. The outcome metric to be measured after the program is the proportion of green spaces and playgrounds in the city.
- (iv) *Family*. The intervention aims to increase awareness in families to improve eating patterns at home, achieved through regular information sessions in school, cooking workshops and various child-school-parent activities.

As for the behavioral factors causing childhood obesity, three additional intervention areas were determined:

- (i) *Leisure*. Improving children's free-time activities from focusing on computer games and watching TV to playing outside while being physically active is the goal of this intervention

area. This program does not incorporate specific interventions as other areas already address them.

- (ii) *Media*. This program includes a free online toolkit and an inspiration kit addressing physical activity after school and aiming to increase social media awareness of children and family members. Moreover, it is possible to introduce advertisements on TV in the later years of the intervention, however, as this program targets one school only, this option will not be executed.
- (iii) *Sport*. This intervention area is very important to tackle childhood obesity and is included in other areas already like the partnership with local sports club. In addition, the program aims to introduce several interventions to increase further physical activity of children, such as the “Daily Mile” (move for 15 minutes every day during school hours, equivalent to walking one mile.).
- (iv) *Evaluation*. In the first two years, the focus lies on measuring the children’s BMI as well as their eating and physical activity patterns while further planning intervention programs and searching for possible partnerships. During the latter half of the program, the interventions are also evaluated through feedback sessions from all involved stakeholders in order to identify possible gaps or failures in the model.

5.2. Intervention Costs

The structure and the amount of intervention costs depend highly on the intervention scope and cohort size. Thus, these costs are separated by program categories and per year. There are two main categories of costs: (i) intervention costs including school, neighborhood, family, media, evaluation as well as (ii) project management and general costs (overhead costs). These costs begin in Year 0 when the evaluation process is initiated to determine the current state of the school, followed by initial actions to implement the intervention measures. Table 2 shows the total cost per category over the four years for all participating children. These costs are

estimated based on the intervention structure of MUN-SI and JOGG and were determined through research and expert agreement. As previously stated, the intervention model is not tailored to specific target groups. Thus, all children undergo the same intervention program, regardless of weight. Consequently, all costs are separated equally between the children and are consistent over time. The estimated costs have been calculated, assuming an inflation rate of 2 %, the average inflation rate over the last 10 years in Portugal (Pordata 2023) (see Excel-file “1.6. Intervention Costs”).

Cost description		Total	Share
Intervention Costs	EUR	254.129	91 %
School	EUR	195.536	70 %
Neighborhood	EUR	24.192	9 %
Family	EUR	10.485	4 %
Media	EUR	5.800	2 %
Evaluation	EUR	18.116	6 %
Project management & general costs (10% of costs)	EUR	25.413	9 %
Share M&G of intervention costs	%	10 %	
Total costs without inflation	EUR	279.542	100 %
Total costs with inflation (2 %)	EUR	288.041	

Table 2: Summary of total intervention cost over the 4 years

In general, these costs include materials used for different activities with the children and are therefore variable, depending on the cohort size. "School" costs refer to all interventions integrated into the school day, accounting for around 70 % of the total costs. The cost factors mainly focus on dietary improvements, nutrition knowledge and increased physical activity. As mentioned in chapter 5.1. “Intervention Scope” the programme integrated healthy food in the cafeteria and during breaks. It is assumed that the children already receive a range of meals at school subsidized by the state. Therefore, replacing the previous meal with healthy options increases costs only slightly (Assumption: 0.2 EUR per meal). Furthermore, new sports equipment for breaks and physical education classes, as well as various materials for project weeks about nutrition basics are included in this cost factor. The knowledge learned during the project week is complemented by materials like workbooks used in the classroom. Furthermore, the training sessions for educators are also encompassed in this area. As mentioned,

“neighbourhood” includes reduced memberships in sports clubs. The “family” cost factor consists of diverse training and additional documents for the parents. “Media” includes the cost of implementation and maintaining the online tool kit that gamifies the learning experience about healthy lifestyles for children after school. Moreover, the “evaluation” is also a cost factor, as a doctor is involved at the beginning and every end of the year to take the BMI. In addition to the intervention costs, management, and general cost (incl. personal costs, insurance etc.) must be included, calculated as 10 % of all the interventions costs. These costs represent fixed costs and account for only 9 % of total costs.

Overall, the intervention model costs 288,041 EUR for all respective years, with 214 EUR for one child per year (see Appendix 14). Based on these costs, outcome payments and cost savings to the government are calculated below.

5.3. Cost Savings

This chapter summarizes the calculation of expected cost savings for the government as a result of the intervention. The base case is assuming a 2 % inflation rate p.a. and an expected lifetime of an adult in Portugal of 82 years. Important to note is that the target childhood group has an average assumed age of 8.5 years (uniformly distributed from age 5 to 12). Therefore, after another 11 years, a child is expected to reach adulthood on average and cost the state 1,241 EUR vs 248 EUR as a child due to the increased occurrence of costly illnesses and decreased productivity when obese (overweight: 370 EUR vs 96 EUR). The government savings are the expenses the government would have had to bear in case an obese or overweight child would have stayed obese or overweight during his entire adulthood. Total savings over the remaining lifetime of 102,464 EUR for former obese children and 100,739 EUR for former overweight children are calculated. Dividing these total costs by 73 years the cost savings per child per year are computed. Thus, 1,308 EUR for an obese child and 1,404 EUR for an obese child can be

saved annually. These savings will be used to calculate the payout for the investors (see 8.6. Payment mechanism).

5.4. Outcome Metrics

The evaluation of childhood obesity and the selection of appropriate outcome metrics have sparked a controversial debate. The goal is to identify the most suitable measurement tool that effectively captures the complex nature of this issue.

After careful consideration, the SIB will be based on the measurement of the BMI for primary outcome metrics as previously recommended, drawing upon its previous usage in assessing the success of the chosen projects JOGG and MUN-SI, its simplicity and global comparability. Specifically, the success of the intervention will be assessed by evaluating the children who have successfully reduced their BMI from a value previously indicating overweight or obesity to a value within the normal BMI range. The measurement will take place at the end of each year of intervention and will be performed by professionals to prevent any potential measurement error or manipulation of results. By targeting the normalization of BMI, the SIB will aim to not only address the immediate concern of obesity but also promote sustainable lifestyle changes that will benefit children in the long term. Ongoing monitoring and evaluation allow to continuously refine and adapt the intervention strategies to optimize outcomes and improve the children's overall health. The progress of the interventions will be measured against previously established success rates. The target values are based on the projected ten-year success rate of the MUN-SI project. The prevalence of overweight children was reported to decrease 11.2 % within the ten years, while the prevalence of obese children decreased by 10.3 %. If the total of each individual rate of 10.3 % and 11.2 % is achieved equally per year, the model assumes a yearly success rate of 1.12 % for overweight children and 1.03 % for obese children. However, to obtain a comprehensive understanding of the interventions' effectiveness, a combination of primary and intermediary metrics is used, instead of only focusing on the

physical outcome measures with the BMI. It is important to note that the intermediate outcome metrics are not directly linked to payouts for investors and therefore do not provide direct financial incentives. Instead, they will serve as indicators to assess the short-term success of the interventions. By employing these metrics, the model aims to gain insights into crucial aspects of children's health: Physical activity and nutrition. To collect data for these metrics, the SIB will rely on family questionnaires, ensuring a holistic perspective by involving parents or guardians in the evaluation process. However, even though the questionnaires offer valuable insights, the evaluation through family members might be prone to bias and based on subjective assumptions, disqualifying these metrics as primary outcome metrics for this model.

With regards to physical activity, our target measurement is a weekly participation of 420 minutes, aligning with the recommendations set forth by the World Health Organization (WHO), recommending that children participate in at least 60 minutes of moderate physical activity each day to ensure physical health. Given that children should participate for 60 minutes each day for seven days a week, the weekly participation equals 420 minutes. By emphasizing the significance of physical activity, the SIB aims to promote healthier lifestyles and combat the rising rates of childhood obesity.

The inclusion of nutrition as a key aspect of evaluation is imperative. By examining the food consumption patterns, the dietary habits that may contribute to childhood obesity are better understood. Using family questionnaires, valuable information is gathered regarding the types of food consumed, enabling us to identify potential areas for improvement and implement targeted interventions. The target value will be based on previous success rates within the MUN-SI project, utilizing its measurement of positive perception of foods, such as vegetables and fruits as part of the children's nutritional daily routine. Data published by the project stated an increase of children's preference for fruits and vegetables throughout the years of 16 % from 2014 to 2015, 2.3 % from 2015 to 2016 and 11.9 % in 2017 to 2018. Assuming that the

preference simultaneously leads to an increase of consumption, the averaged value of 10 % will be used as the target value, indicating success of the interventions targeting nutritional behavioral patterns.

In conclusion, the selection of outcome metrics for evaluating childhood of the SIB will prioritize the multifaceted approach, measuring physical, behavioral, and nutritional metrics. Building upon previous analysis, the BMI has emerged as a suitable measurement tool to encompass weight. The decrease of overweight and obese children by 1.12 % and 1.03 % will be directly linked to the investors' payout by measuring. By prioritizing physical activity, targeting a weekly participation of 420 minutes a week, and healthy nutrition, with an increase of fruit and vegetable consumption by 10 %, the SIB aims to continuously measure the interventions against these targets to ensure the most efficient approach in the fight against childhood obesity. As prioritizing accuracy and gaining comprehensive perspectives is vital, the combination of measurements of the BMI by professionals and family questionnaires will provide a continuously reliable basis for evaluation.

5.5. Payment Mechanism

The payment mechanism describes how payments for success are made. It is important to clarify that outcome payments compensate investors who assume the financial risk associated with the program. The payment mechanisms for this project are tied to the primary outcome metrics discussed in the previous chapter, specifically the weight prevalence measured by BMI. The investors' payout is contingent upon achieving the target success rates of 1.12 % per year for overweight children and 1.03 % for obese children, totaling an overall success rate of 4.48 % and 4.12 % over the whole intervention period of four years, respectively. If the success rates are met, investors will receive a single payment in Year 4 amounting to 43 %¹ of the total

¹ The payout rate of 43% is an assumption based on the Sensitivity Analysis as it is the first payout rate that generated a positive investor IRR.

savings per child over their remaining lifetime of 73 years, provided that the child reduces their BMI to a normal range. The total savings per child throughout their lifetime is 101,602 EUR, calculated by averaging the total cost savings over the lifetime of an obese child of 102,464 EUR and an overweight child of 100,739 EUR. The metric of the average was used due to challenges in predicting the child's weight development in future lifetime within the range of overweight and obesity.

Considering the target population of 156 obese and overweight children, totaling 99 overweight and 57 obese children, achieving success rates of 4.48 % and 4.12 % would result in approximately 6.78 children successfully reducing their BMI to a normal range. Multiplying the number of children with the individual savings leads to a total governmental saving of 688,556 EUR throughout the whole intervention of four years. Assuming a payout rate of 43 % the investors receive a payout of 296,079 EUR at the end of the intervention.

When considering the total amount of years needed for the potential savings to cover the intervention costs per obese or overweight child, two different approaches can be considered. The first approach of payment mechanism I is based on the total savings during the child's remaining lifetime, calculated equally throughout the years, with the total savings divided by 73 years, resulting in a yearly saving of 1,392 EUR per child. With the intervention costs per child adjusted for inflation at 857 EUR, this method covers the costs in the first year.

The second payment mechanism II follows a weighted savings approach, accounting for a gradual increase in savings during the early years of life and a more rapid increase starting in year 12 (turning adult), as health costs tend to rise with age. In this method, the savings exceed the costs by Year 3, with a total saving of 1,053 EUR.

5.6. Public Sector Value

For this purpose of evaluating the public sector savings, the project IRR without investors is evaluated in the first step. To ensure the profitability of a SIB for the investors and the

government, it is essential that the IRR without investors needs to be positive. This is the case for the MUN-SI/JOGG project as a slightly positive return is calculated (see Excel-file 1.4. Cost savings). This demonstrates that successful interventions implemented early in a child's life have the potential for the government to save money. Therefore, this model presents a good foundation for developing a SIB.

Moving on to the potential cost savings for the government through a SIB for this intervention. By developing a SIB for the mentioned project, the risk of not achieving the success rate of 4.48 % (overweight) and 4.12 % (obese) over the whole intervention period of four years is transferred to the investor, who pays the cost of the intervention. In exchange for the reduced risk, the government gives the investor a certain percentage of the savings, namely 43 % of the total cost savings. Thus, the public sector value is calculated by subtracting the costs for the intervention and the outcome payments from the calculated cost savings. Assuming that the success rate is achieved, the government is projected to have a financial surplus of 104,436 EUR.

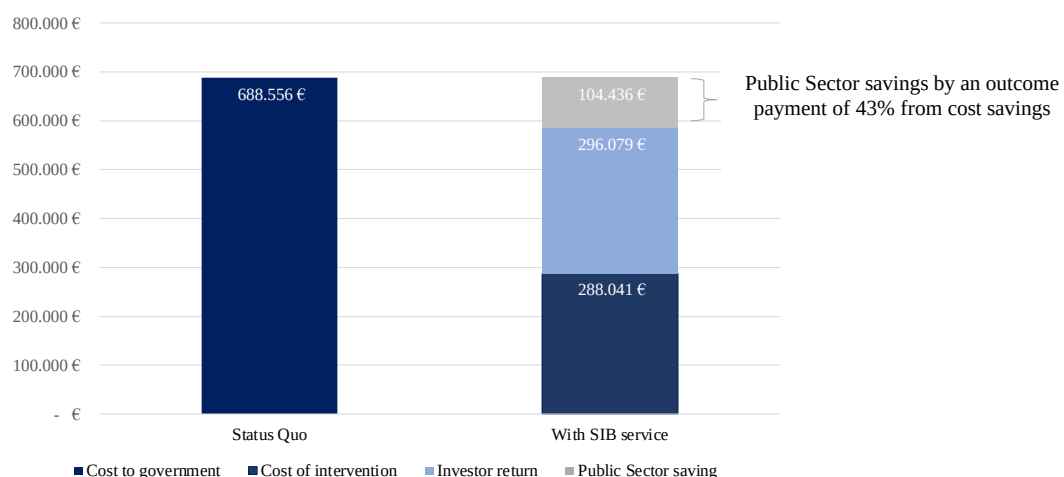


Figure 4: Public Sector Value Structure

5.7. Investment Structure

The following chapter explains the financial statement of the investor in accordance with the payment mechanisms in the previous chapter. For this, the Income Statement, Cash Flow Statement, and Investor IRR will be described (see Excel-file “1.7. Financial Statement”).

Income Statement. The revenue of the project comes from the outcome payments to the investors, which amount to 296,079 EUR as explained in the last subchapter. The amount will only be paid out in the program's last year, thus setting revenue in the first years to zero. In order to calculate the profit, the intervention costs, following delivery costs, need to be deducted, which amount to 69,885 EUR in Year 0, due to investments made prior to the start of the interventions. During the following years, an inflation of 2 % p.a. is taken into account, thereby increasing the delivery cost each year, whereas no additional delivery costs are considered in the last year, as the intervention ends. The cumulative delivery costs in Year 4 equals negative 288,041 EUR. While the profit in the last year accounts for 296,079 EUR, the cumulative project profit is 8,039 EUR, given that costs are lower than the revenue.

Cash Flow Statement. The cash flow statement distinguishes between operating and financing cash flow. For the operating cash flow, all payments and revenues related to the operation of the project are considered. The cash revenue, therefore, equals 296,079 EUR in the last year of the project, while the cash delivery costs are equal to the delivery costs of the interventions each year. The financing cash flow is calculated by summing up the investments made into the project and deducting the payouts to the investors. Given that payouts will only be considered in Year 4 and investments start in Year 0, the financing cash flow in Year 0 amounts to positive 69,885 EUR. In the following years, the financing cash flow equals the positive delivery cost amount, as no other investment is made in the project. As Year 4 is the last year of the project, and no additional investments will be considered, the financing cash flow in Year 4 equals negative 296,079 EUR. To assess both operating and financing cash flows in relation to each other, the net cash flow is calculated, which is the sum of both. Since operating and financing cash flow amount to the same number, with the only difference being that one is a positive and the other a negative number, the net cash flow sums up to zero. The cash balance at the

beginning of each period was also calculated and compared to the cash balance at the end of the period and equalled net cash flow.

Investor IRR. The calculation of the Internal Rate of Return (IRR) is a crucial step in assessing the profitability of this SIB and provides investors with critical information to facilitate their investment decision-making. The investor IRR calculation only takes into account the financing cash flows, as otherwise costs would be considered twice and thereby produce an incorrect result. The IRR is computed by setting the net present value of all cash flows to zero. The calculation shows a positive IRR of 1 %, making the SIB profitable to investors. Although it is a rather low number, investors might be interested in investing in this SIB since the outcome is not only financially based, but the social aspect plays an important role. Nevertheless, the following subchapter will analyze the sensitivity of some variables used regarding investor IRR.

6. SIB as a Business Case

The following chapter focuses on the analysis of the business case and aims to provide a comprehensive overview of the project's profitability across different scenarios and variations in key variables. To present these findings effectively, a sensitivity analysis and a scenario analysis were conducted, revealing potential project opportunities and risks.

The analysis is based on the baseline values of 101,620 EUR as total savings per successful child, resulting in a total of 688,556 EUR in public savings and 288,041 EUR in total intervention costs. The payout rate describes the percentage of the overall governmental savings generated by the intervention that will be used to repay investors for their initial investment, along with a surplus. The base case assumes a payout rate of 43%, implying a single payout of 296.079 EUR for the investors. The reasoning behind the choice of rate will be explained in more detail in the subchapter 7.1. the sensitivity analysis for the payout rate.

6.1. Sensitivity Analysis

The sensitivity analysis plays a crucial role in evaluating the potential financial outcomes of a SIB, providing investors with a broader perspective on the project's profitability. By adjusting different variables and assessing their impact on the investment structure, the analysis reveals potential weak points and offers valuable insights into the project's financial performance (Stanciu et al. 2009). In the context of this model, variables of the project's key assumptions, namely the success rate, the payout rate and potential changes of the total intervention costs were analyzed. The changes were then examined on total payouts to the investors and the Investor internal rate of return (IRR).

Payout rate. The payout rate is a significant factor in assessing the investor returns and our project's financial viability. The rate was evaluated ranging from 20 % to 60 % to explore various scenarios for investors, see table 3. Using an excel data tool, the results were calculated by replacing the original value in the formula with each percentage of payout. The results first indicated a positive development with an Investor IRR of 1 % at a payout rate of 43 %, as stated in table 3. At this payout rate, the IRR increased by 14 % in comparison to the previously strong negative IRR at a 30 % payout rate. Consequently, the assumption of a 43 % savings rate was adopted for further evaluations due to its positive IRR, as it signifies a financially viable project that holds appeal for investors. Although profitability based on IRR is only slightly positive, the payoff of 43 % of the total lifetime savings of a single successful child of 43,689 EUR covers the intervention costs of 857 EUR for additional 50.96 children in a new intervention cycle. This illustrates the sustainability of the intervention in addressing childhood obesity over the long term. It is however further worth noting that while a higher payout rate is desirable, each increase simultaneously reduces government savings and may affect the project's overall acceptance. For example, a payout rate of 50 % resulted in a total payout of 344,278 EUR and a positive IRR of 7 %, with a governmental saving of 56,238 EUR. However, a further increase

to 60 % proved to be unprofitable, as the costs of the intervention and the payout totaled 701,174 EUR and outweighed the total governmental savings of 688,556 EUR.

	20 %	30 %	43 %	50 %	60 %
ABSOLUT PAYOUT	137,711	206,567	296,079	344,278	413,134
IRR	-28 %	-13 %	1 %	7 %	15 %

Table 3: Sensitivity analysis of the payout rate

Success Rate. One of the most influential aspects when considering the profitability of this model is the success rate. The results were calculated based on the assumption of equal success rates among obese and overweight children, ranging between 4 % and 12 % in total, with a baseline of 8.6 %. The chosen success rate underlying this model was calculated referencing a conservative estimate of the project MUN-SI, which increases the relevance of the analysis for higher success rates. The findings indicated that even a small increase in the success rate can significantly impact the Investor IRR. For instance, a 1.4 % increase to a success rate of 10 % resulted in a 6 % rise in the IRR, while further increasing the success rate to 12 % raised the IRR to 15 %. Since the interventions originally taken by MUN-SI were optimized and broadened, it can be assumed that the increase in success rate to 10 % or 12 % is realistic and therefore allows for a more optimistic forecast of project profitability.

	4.0 %	6.0 %	8.6 %	10.0 %	12.0 %
ABSOLUT PAYOUT	136,183	204,275	296,079	340,458	408,550
IRR	-28 %	-13 %	1 %	7 %	15 %

Table 4: Sensitivity analysis of the costs of the success rate

Costs of Intervention. Intervention costs play a crucial role in evaluating the project's profitability and sustainability. Unforeseen changes within the intervention costs introduce potential risks for the investors. To comprehensively analyze potential consequences, an increase and decrease of intervention costs by 10 % and 20 % relative to the original costs were considered. The delta to the original costs was added and subtracted to the annual costs in Y0. The findings revealed that the profitability of the project appears to be more volatile in cost decreases. Lowering the costs by 20 % raised the IRR by 11 % while an increase of 20 % only

decreased the IRR by 7 %. This indicates that cost reductions have a more significant impact on project profitability compared to cost increases, emphasizing the potential benefits of cost reduction strategies in improving the project's overall financial performance. Potential cost-saving measures in our project could involve costs that are incurred as part of the school costs, as these represent 70 % of our total costs. Existing government subsidies could, for instance, potentially cover the total cost of meals provided by the school or the healthy breaks, which would significantly impact our project finances and lead to a further increase in IRR.

	↓20 %	↓10 %	↓↑ 0%	↑ 10%	↑ 20%
IRR	12 %	6 %	1 %	-3 %	-6 %

Table 5: Sensitivity analysis of the costs of intervention

In summary, the sensitivity analysis provided essential insights into the profitability of this model by evaluating variables such as success rate, payout rate, and intervention costs. The results underscore the importance of a balanced payout ratio, with a 43 % savings rate being the most efficient assumption due to its positive impact on the investor's IRR. In addition, the analysis highlighted the importance of the success rate, illustrating that even small increases can significantly improve the investor's IRR. Furthermore, the potential benefits of cost-reduction strategies became apparent during the analysis, as reducing intervention costs had a stronger positive impact on profitability compared to cost increases.

6.2. Scenario Analysis

Another important analysis tool is the scenario analysis. It provides valuable insights into potential risks or improvements in planning, strategy optimization and general outlook. By looking at different scenarios, decision makers can gain a deeper understanding of the potential outcomes of the project to maximize success and effectively manage risks (A. Hayes 2022).

In the context of our model, intervention costs are one of the main components affecting project profitability. The costs cover an annual number of 336 children, however, not all of them are eligible for the outcome payments, as the BMI of 180 of them is already in the normal range at

the start of the intervention. Since this severely affects the IRR of the model, a scenario was calculated which considers an intervention model that focuses only on overweight and obese children. To calculate the profitability of this scenario, the total costs were adjusted to only the obese and overweight children, excluding those in the normal BMI range. The costs were lowered to that of the total of 156 children, covering 99 overweight and 57 obese children, rather than the usual 336 students per year. The total inflation-adjusted cost of this intervention scenario was 133,733 EUR. With the other assumptions held constant, the Investor Internal Rate of Return (IRR) in this scenario was calculated to be 35 %. This indicates a potentially very profitable project under these specific conditions. However, it is important to consider the limitations and implications of this scenario. Because most of the interventions target environmental changes, such as school and meal programs, implementation of the reduced scenario would exclude more than half of the annual student population from overall health-related improvements in circumstances. However, this approach tends to be discriminatory and unrealistic in practice, as it does not ensure equality and inclusivity within the intervention program. Specifically targeting children based on their weight status might also lead to bullying and thus an overall decrease in the well-being of the children in the intervention. Furthermore, as one of the SIB's main goals is awareness and prevention, the initiatives could also positively impact children with BMIs in the normal range in their potential future weight development and thus represent government savings, although these impacts cannot yet be quantified. Therefore, a holistic approach that considers the different needs of all students, regardless of their current BMI status, is critical.

7. Limitations

The following chapter will discuss the limitations of this feasibility study by dividing this part into two categories: Data and project limitations. Starting with the first, the amount of available data and studies regarding overweight and obesity are insufficient and outdated. While some

studies were available to identify the causes of the social issue, e.g., the COSI study, there was no analysis of the correlation between these factors in the Portuguese population. Thus, this makes it difficult to get meaningful interpretations. Therefore, further research should be done and updated regarding factors of childhood overweight and obesity in Portugal. In addition, already existing intervention programs are limited in their accessibility to information regarding program structure, costs, and outcomes. Moreover, the social impact evaluation is not always measured, or if done, it is neither continuously nor adequately evaluated. This makes it difficult to analyze an intervention model and thus, makes it difficult to understand their social impact. The most prevalent issue regarding project limitations is the complexity of this topic. Several factors influence and impact a child's weight differently. Moreover, all trends cannot be considered and differ between populations and regions worldwide. The lack of understanding of the impacts on the child presents a challenge in interpreting the results, especially when evaluating which factor influences the individual most.

Deciding on the most suitable outcome metric poses a challenge as no measurement considers all these factors influencing the child. Most of the studies use BMI as a measure to validate the weight change over the years. Even though BMI is used most of the time as an outcome measurement, its limitations should be considered in further research and limit this project's ability to interpret the results. Furthermore, intermediate measures should also be considered as they better evaluate short-term behavioral changes without focusing on weight as the primary outcome. Considering these measures would go beyond the scope of this thesis and is complicated to measure as these factors rely on the reliability of the parents. Another limitation to consider is the potential for side effects, such as the influence on previously normal-weight children to avoid becoming overweight or obese in the future. While this could lead to cost savings, it is important to note that this aspect was not accounted for in this intervention model, thus representing a potential source of bias.

In addition, regarding the target group, including all children in the evaluation and success rate is difficult. Given that after every school year, children enter and leave elementary school, it is complicated to measure the impact of the intervention program based on the duration of the child's participation. The scenario analysis highlights that solely focusing on one grade or only on overweight or obese children can be another option. Nevertheless, this approach can lead to discrimination, perpetuating a vicious circle in which a child overeats due to psychological factors, such as mobbing.

As the intervention program is mainly focusing on one school on the Azores and its municipality, the individuality in the implementation of the program varies on the infrastructure of the community and the size. Consequently, costs also differ between regions. Moreover, costs could increase by integrating more complex interventions and stakeholders, such as local politicians. For the sake of simplicity, this research disregards these.

To sum it up, the lack of data and the complexity of the social issue limits the implementation, structure, and evaluation. Existing and further research should account for these factors.

8. Conclusion

Overweight and obesity remain a pressing and costly problem in Portugal, with an annual financial burden on the government of up to 3 bn EUR. Early intervention is crucial so that long-term consequences can be mitigated. Despite its increasing significance, governments often struggle to address and prioritize prevention measures effectively. This creates the need for innovative solutions such as a SIB to fill the gap. By reducing financial and implementation risks for the government and providing an option for investors to achieve both social and financial objectives, SIBs offer a promising financing mechanism to address this issue. In light of this context, our analysis confirms the feasibility of implementing a SIB as a viable approach to tackle childhood overweight and obesity in Portugal. The proposed SIB employs a multifaceted intervention strategy that targets both nutritional and behavioral changes, aiming

for sustainable reductions in childhood obesity rates. The objective goes beyond immediate weight reduction within the program, encompassing the prevention of further weight gain. The ultimate goal is not only short-term weight reduction but also long-term cost reduction in government healthcare expenditures, alongside an improvement in the quality of life resulting from the weight loss of the children.

Although the financial returns of the project are modest, with an IRR of 1 %, the selected results indicate that a reasonable payout rate of 43 %, based on conservative calculations, can cover the intervention costs for a significant number of about 51 children. This highlights the long-term sustainability of the SIB in effectively addressing childhood obesity. Furthermore, to enhance the financial sustainability of the model, it is worth exploring the utilization of existing government subsidies to reduce costs and consider additional funding sources.

The interventions draw on findings and outcomes from established projects such as the JOGG/MUN-SI project, which are adapted to the specific cultural context of Portugal, ensuring the project's success. By leveraging existing knowledge and tailoring interventions to align with the Portuguese cultural context, we increase the probability of achieving positive outcomes.

However, it is important to acknowledge that continuous improvement and refinement of the SIB model are necessary. Collaboration with stakeholders, including government agencies and relevant organizations, will facilitate the fine-tuning of the intervention approach, optimization of cost-effectiveness, and overall enhancement of the impact on childhood obesity in Portugal. Finally, the analysis conducted in this thesis marks the pioneering application of a SIB in the context of childhood obesity in Portugal. Consequently, it serves as a valuable foundation for future research in this area.

9. Appendix

List of Appendices

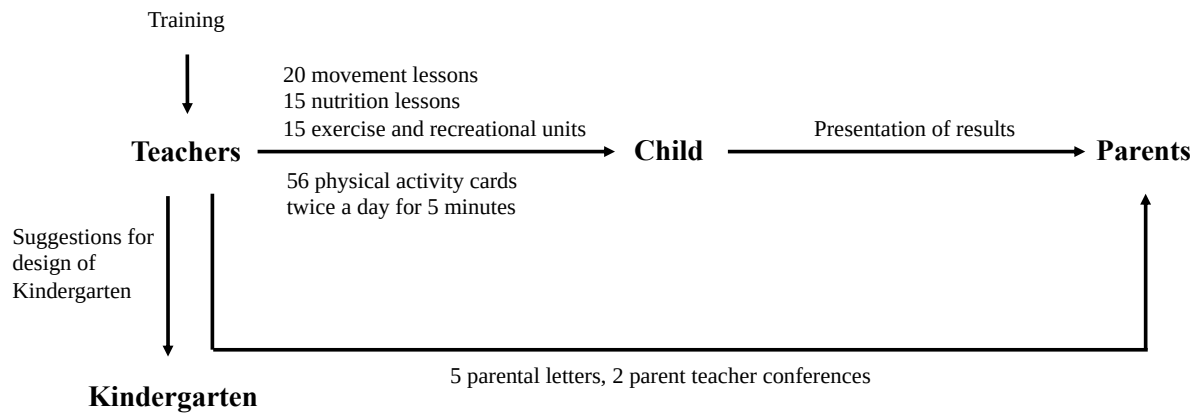
Appendix 1	Overview Intervention Models
Appendix 2	Structure of Join the Healthy Boat - Kindergarten
Appendix 3	JANPA Work Packages Overview
Appendix 4	EPODE Methods, Progress and international Development
Appendix 5	OECD best Practice Assessment of JOGG Approach
Appendix 6	Intervention Model JOGG/MUN-SI
Appendix 7	Average Annual Cost per Child
Appendix 8	Table of Abbreviations

1. Appendix – Overview Intervention Models

	Description	Target Group	Country / Area	Methodology	Eligibility Criteria	Intervention (area)	Costs	Outcome Metric	Impact
Join the Healthy Boat	School-based program that aims to promote healthy eating habits and physical activity	0-10 years	Germany	Comprehensive, sustainable and participatory approach	no specific	Educational materials for teachers and parents, physical activity sessions	Cost per student 25 EUR; cost saving between 1,789 EUR and 1,963 EUR if effective	Dietary behaviors, Physical activity, Childhood obesity, Parental engagement, Academic performance	Improved dietary behaviors, increased physical activity, reduced prevalence of childhood obesity, improved academic performance
	Non-profit organization that focuses on improving children's health by promoting healthy eating habits and physical activity in schools	6-19 years	USA	Whole School, Whole Community, Whole Child model; Family-school partnerships	no specific	Variety of resources, training, and grants; Nourished, Connected, Energized programs	Revenue of 2.9 m USD in 2021 through grants and contributions; Cost of 3.7 m USD in 2021	Improved school nutrition environments using their school health index; physical activity, childhood obesity rates, health behaviors, cost savings	Increased nutrition awareness in 90% of the students, increased physical activity
JANPA	European project that aims to prevent and reduce the prevalence of overweight and obesity in children and adolescents; involves 26 countries; focuses on developing and implementing effective policies and interventions to promote healthy eating and physical activity	EU population: 0-17 years in children, educational bodies, parents, decision-makers	EU	Comprehensive and multi-sectoral approach; combination of evidence synthesis, policy analysis, and stakeholder engagement; different work packages	no specific	School-based interventions, community-based interventions, policy interventions	Budget of 2 m EUR, of which 1.2 m EUR funded by EU	Obesity rates, diabetes prevalence, and other related health outcomes; changes in knowledge, attitudes, and behavior related to nutrition and physical activity; changes in the availability and accessibility of healthy food options, and changes in the physical environment that promote physical activity	Development of frameworks, guidelines, online toolkits for sharing best practices; contribution to EU policy development
	Community-based program that aims to prevent and reduce childhood obesity	Children 3-10 years	Portugal	Multi-component and multi-level approach; comprehensive and integrated, targeting multiple factors that influence childhood obesity	no specific	Awareness, Research, Healthy School, Active City, Health and Nutrition Training, Family	n.a.	Obesity rates (BMI), Parental involvement, Physical activity, Dietary habits, Awareness and Knowledge	Improving healthy behaviors (increased physical activity, increased knowledge of Mediterranean Diet, reducing the percentage of childhood obesity (reduction in BMI)
JOGG	Community-based program aimed at preventing and reducing childhood obesity by promoting healthy lifestyle choices	Children and young people aged 0-19 years old, as well as their families	Netherlands	Community-wide approach; uses a multi-level approach	no specific	Promoting healthy eating habits, encouraging physical activity, creating healthy environments, empowering parents, engaging communities	Funding by government and private partners; Participation fee for JOGG municipality between 5,000 EUR and 10,000 EUR	Obesity rates (BMI), changes in the number of minutes of physical activity per day, changes in the intake of healthy foods and drinks, changes in knowledge, attitudes, and behaviors related to healthy eating and physical activity, level of partnership and collaboration between these organizations	210 municipalities, huge network of more than 2,000 sports clubs, 1,000 schools, 800 coaches, 46 suppliers, 1,400 companies; percentage of overweight children decreased by 9 % compared to non-JOGG municipalities

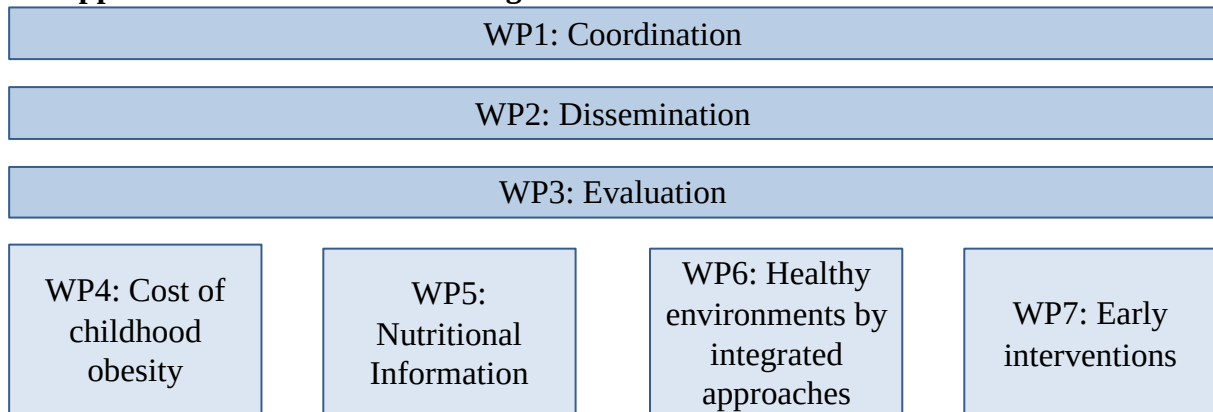
Overview of intervention models introduced in chapter 3 (Sources according to chapter 3)

2. Appendix – Structure of Join the Healthy Boat – Kindergarten



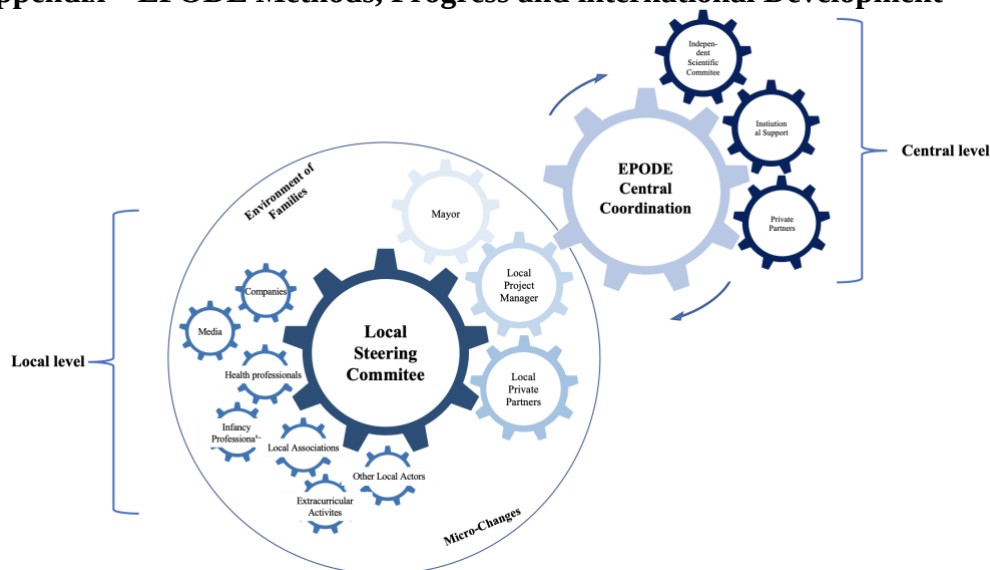
Overview of the intervention program Join the Healthy Boat – Kindergarten (Wartha et al. 2016)

3. Appendix – JANPA Work Packages Overview



Overview of JANPA Work Packages (Quilling et al. 2020; Balanda et al. 2017)

4. Appendix – EPODE Methods, Progress and international Development



EPODE approach (J. -M. Borys et al. 2012)

5. Appendix – OECD best Practice Assessment of JOGG Approach

Criteria	Assessment
Effectiveness 	Over 95 000 life years (LYs) and 13 089 disability-adjusted life years (DALYs) are expected to be gained by scaling up JOGG across the Netherlands by 2050. By reducing rates of overweight and obesity, JOGG can prevent several forms of chronic disease cases, the majority of which would be musculoskeletal disorders or cardiovascular diseases.
Efficiency 	JOGG is not only cost effective, but also cost saving across the majority of OECD and EU27 countries
Equity 	JOGG is designed to reduce health and social inequalities by reaching low socio-economic status (SES) groups, as it aimed to address the lack of access to healthy food options and make outdoor environment friendlier for physical activity for children living in low SES neighbourhoods.
Evidence-base	The quality of evidence used for this case study is "strong to moderate" in areas related to data collection methods and selection bias for two studies used as effectiveness sources Typical to most public health studies, the design of the intervention does not allow blinding and measurement
Extent of coverage	JOGG reaches approximately 30% of children aged 0-19 years of age in the Netherlands.

OECD assessment of JOGG (OECD n.d.)

6. Appendix – Intervention Model JOGG/MUN-SI

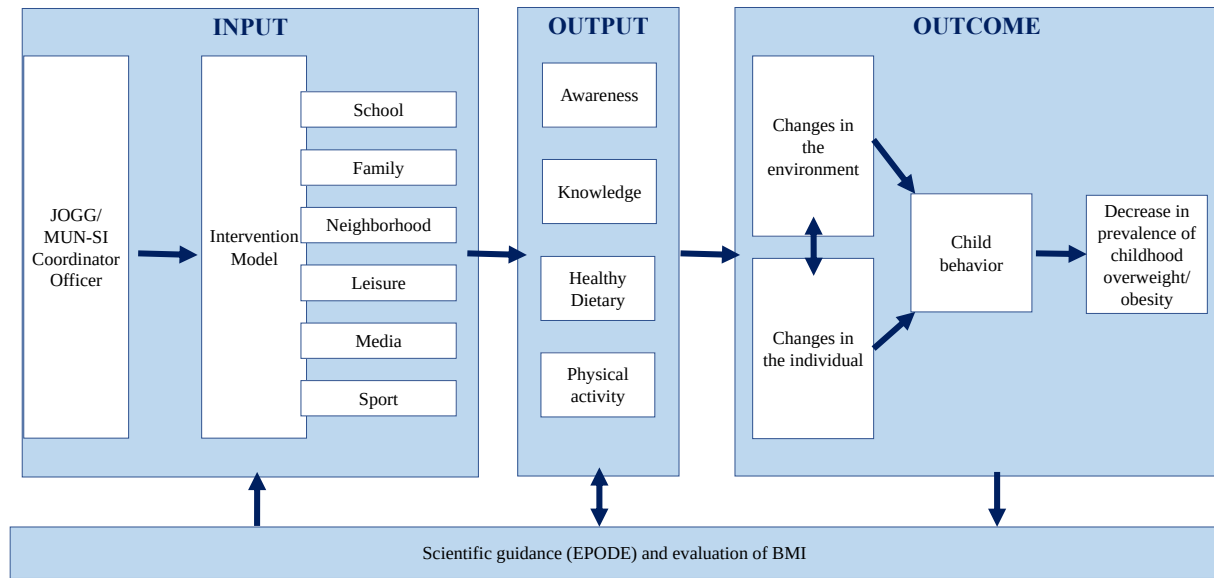


Illustration of the JOGG/MUN-SI Project for an elementary school on the Azores

7. Appendix – Average Annual Cost per Child

Average annual cost per child		
School	EUR	145
Neighborhood	EUR	18
Family	EUR	8
Media	EUR	4
Evaluation	EUR	13
Total costs for intervention	EUR	189
Management & General	EUR	19
Overall total costs	EUR	208
Overall total costs with inflation p.a. per child	EUR	214
Children in target group	#	336

Table 6: Overview average cost per child per year

8. Appendix – Table of Abbreviations

AFHK	Action for Healthy Kids
Approx.	approximately
BIA	Bioelectrical Impedance Analysis
BMI	Body Mass Index
CEIDSS	Centre for Study and Research on Social Dynamics and Health
Chafea	Consumers, Health, Agriculture, and Food Executive Agency
CVD	Cardiovascular Diseases
EU	European Union
Et al.	and others
GDP	Gross Domestic Product
IRR	Internal Rate of Return
JANPA	Joint Action on Nutrition and Physical Activity
JHB	Join the Healthy Boat
JOGG	Jongeren op Gezond Gewicht
LEP	Leptin
MC4R	Melanocortin 4 gene
MSD	Musculoskeletal Disorders
MUN-SI	Programa de Promoção de Saúde Infantil em Municípios
NASH	Non-alcoholic steatohepatitis
OECD	Organization for Economic Development and Cooperation
OSA	Obstructive sleep apnea
PNPAS	Promotion of Healthy Eating
SIB	Social Impact Bonds
SES	Socioeconomic status
SPV	Special Purpose Vehicle
US	United States

- *Appendix* -

WHR	Waist to Hip Measurement
WHO	World Health Organization
WHtR	Waist to Height Measurement
WSCC	Whole School, Whole Child, Whole Community

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