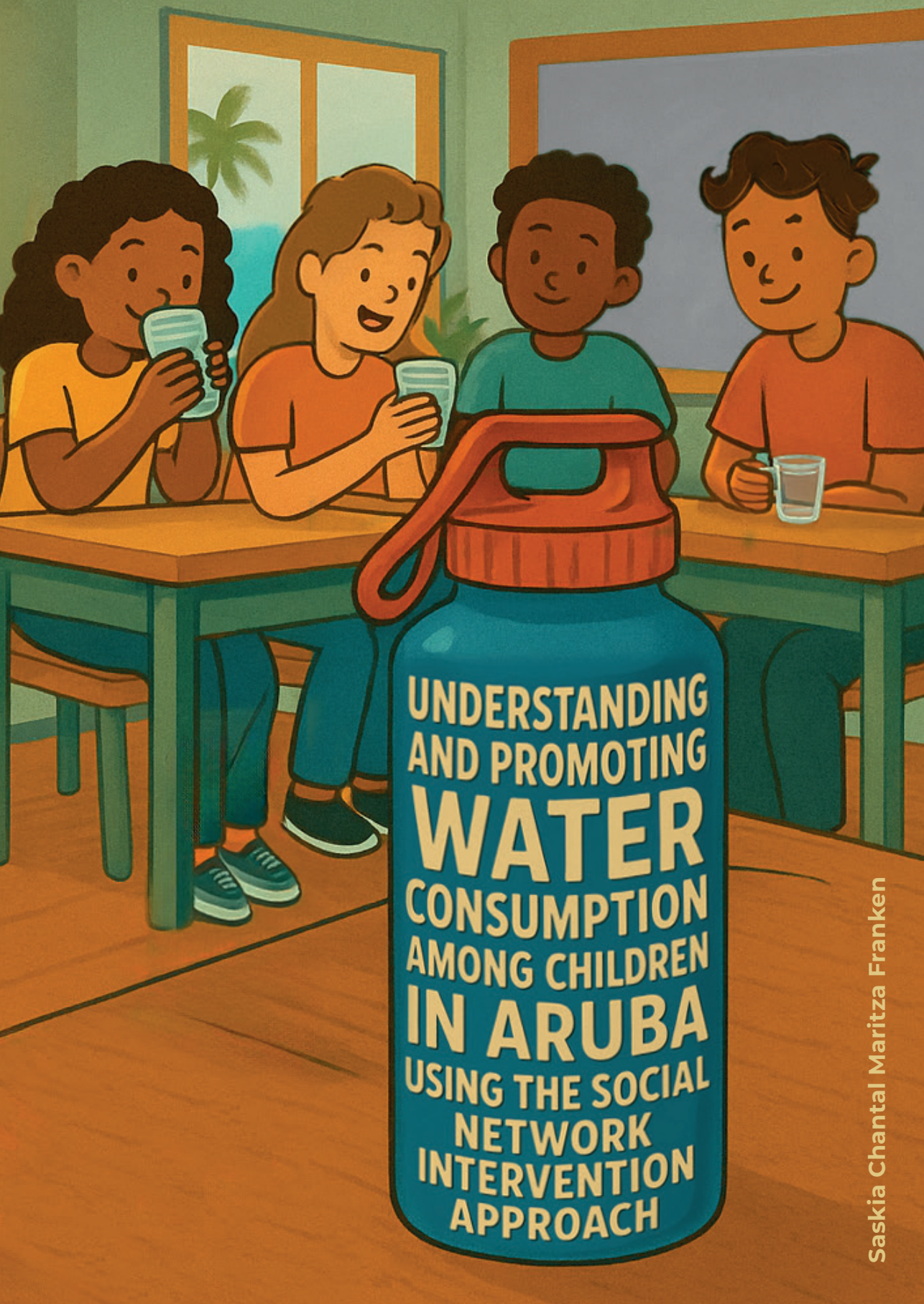

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Understanding and Promoting Water Consumption Among Children in Aruba Using the Social Network Intervention Approach

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Understanding and Promoting Water Consumption Among Children in Aruba Using the Social Network Intervention Approach

Het begrijpen en promoten van waterconsumptie onder kinderen op Aruba met behulp van de sociale netwerk interventiebenadering

Thesis

to obtain the degree of Doctor from the
Erasmus University Rotterdam
by command of the
rector magnificus

prof.dr.ir. A.J. Schuit

and in accordance with the decision of the Doctorate Board.

The public defense shall be held on
Thursday 30 October 2025 at 10:30 hrs
by
Saskia Chantal Maritza Franken
born in Amsterdam.

Erasmus University Rotterdam

Doctoral Committee

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	Dr. R.N.H. de Leeuw

To all of you who contributed in various ways to making this research a reality.

University of Aruba

The University of Aruba
financially supported this research.

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Chapter 1

General Introduction

GENERAL INTRODUCTION

Childhood overweight and obesity present a critical global health concern, threatening children's health and requiring action to address this issue (WHO, 2024). According to the World Health Organization (WHO) growth charts, a child is considered overweight or obese if their body mass index (BMI) is respectively one or two standard deviations higher than the average BMI of children their age and sex (WHO, 2024). The WHO estimated that 20% of children and adolescents aged 5 to 19 were overweight or obese in 2022, a concerning increase from 8% in 1990 (WHO, 2024). Childhood overweight and obesity have psychosocial consequences as they intensify stigma, discrimination, and bullying, which impact their quality of life (WHO, 2024). Additionally, being overweight in childhood increases the risk of developing non-communicable diseases (NCDs) early in life, such as type 2 diabetes and cardiovascular diseases (WHO, 2024). Furthermore, obese children are at a higher risk of remaining obese into adulthood, thereby increasing the risk of developing NCDs and potentially leading to premature death (Di Cesare et al., 2019; Park et al., 2012; WHO, 2023a).

This problem is especially worrisome among islands in the Caribbean region. A comparison of world regions has shown that the highest prevalence of these unhealthy weights is found among islands in the Caribbean (NCD Risk Factor Collaboration, 2024). For example, on one of the Caribbean islands, Aruba, overweight and obesity rates are double the WHO estimate, with studies showing that 42.7% of the age group 10 to 11 years (Department of Public Health Aruba [DPH], 2013a) and 39.4% of the age group 12 to 18 (DPH, 2013b) were overweight. Of these, 15.7% and 19.7%, respectively, were obese. Given these alarmingly high childhood obesity rates in Aruba and the broader Caribbean region, action is required to improve these children's health (Caribbean Public Health Agency, 2015). Therefore, this dissertation aims to contribute to improving children's health in Aruba.

Alignment: Small Island Contributing to Big Global Goals

Improving children's health in Aruba aligns with and contributes to broader global initiatives, particularly the United Nations' Sustainable Development Goals (SDGs; "The 17 Goals", 2024). These SDGs represent an international effort to address various global challenges. While the SDGs apply to children globally, they refer to small island states as populations requiring more attention (United Nations [UN] Department of Economic and Social Affairs [DESA], 2023). With this research project in Aruba, I respond to the United Nations' call for

increased attention to small island populations. Goal 3 of the SDGs specifically focuses on health and well-being, which is particularly relevant for children in the Caribbean, given the high obesity rates.

This global goal aligns with the fundamental principle that children have the right to health and well-being as declared by the United Nations Convention on the Rights of the Child (UNCRC, 1989) and is reinforced through SDG 3 related to health and well-being ("The 17 Goals", 2024). Building on these principles, children in the Caribbean have the fundamental right to health-promoting activities and interventions (Healthy Caribbean Coalition, 2022a). These activities and interventions can help reduce the strain on public healthcare systems in the Caribbean (Alcaraz et al., 2023; Cho et al., 2019). The focus on Aruba contributes to children's fundamental rights and Caribbean-based literature, potentially informing future health interventions across similar island contexts.

A Weighty Weight-Gain Contributor: Sugar-Sweetened Beverages Consumption

One of the major factors associated with childhood obesity is the consumption of sugar-sweetened beverages (SSBs)—including soda, sweetened fruit drinks, sports drinks, and sweetened milk beverages (Jakobsen et al., 2023; Luger et al., 2017; Malik et al., 2006; WHO, 2015, 2023c). This association underscores the need to tackle children's beverage choices as a strategy to address the problem of childhood obesity. Therefore, the WHO recommends discouraging sugar consumption, particularly through the consumption of SSBs (WHO, 2015, 2023c). They urge to limit children's sugar intake to less than six teaspoons per day to prevent adverse health effects. A single can of SSB contains approximately ten teaspoons of sugar, quickly leading to overconsumption and underscoring the importance of promoting water consumption as a healthy choice (Inchley et al., 2017; WHO, 2015). This global call to reduce SSB consumption is especially needed in the Caribbean, where not only are obesity rates high, but SSB consumption is also very high.

Singh, Micha, Khatibzadeh, Shi, et al. (2015) analyzed SSB consumption among 21 world regions and found that adults in the Caribbean region consumed the most SSBs, with an average consumption of 455 ml (15.4 oz) of SSBs per day. This consumption is five times higher than in Western Europe, where the average is approximately 92 ml (3.1 oz) per day. This pattern of high SSB consumption among adults has also been found among children, as indicated by the findings of Ooi et al. (2022). The researchers identified the

Americas region, including the Caribbean islands, as having the highest SSB consumption among children (ages 2 to 18), averaging approximately 385 ml (13 oz) daily. Research indicates that a promising strategy to discourage SSB consumption is to replace it with water consumption (Duffey & Poti, 2016; Zheng, Allman-Farinelli, et al., 2015).

The Healthy Choice: Water Consumption

Among many beverage choices, water distinguishes itself as nature's hydrating beverage and calorie-free thirst quencher. Research has shown that promoting water is a promising strategy for improving health outcomes (Chouraqui, 2023; Jequier & Constant, 2010), such as preventing weight gain (Çıtar Dazıroğlu & Acar Tek, 2023; Stookey, 2010; Zheng, Rangan, et al., 2015) and dental cavities (Kim, 2021). Beyond these essential health benefits of water, it also offers other practical advantages. Water is readily available and sustainable, requiring no packaging or processing, unlike SSBs. Although it is known that water consumption is healthy, studies worldwide have revealed that children consume insufficient amounts of water (Bottin et al., 2019; Suh & Kavouras, 2019).

Interventions to address children's water consumption have received much research attention in the Global North, such as North America and Western Europe (Franse et al., 2020; Vargas-Garcia et al., 2017; Vezina-Im & Beaulieu, 2019). Unfortunately, the Caribbean region, particularly in Aruba, is where scientific contributions to research on interventions promoting children's water consumption are relatively underrepresented compared to the Global North (Caribbean Public Health Agency, 2015; Franse et al., 2020; Singh, Micha, Khatibzadeh, Shi, et al., 2015). Given the high rates of obesity and SSB consumption, combined with children's tendency to consume insufficient amounts of water, there is a need for health interventions in the Caribbean that encourage children to choose water as a healthy alternative to SSBs.

Promoting Water Consumption Using Social Network Intervention

Interventions that use social networks are shown to be effective in promoting health-related behaviors, like water consumption (Franse et al., 2020; Hunter et al., 2019; Latkin & Knowlton, 2015). An important element of social network intervention as a method is appointing individuals as 'influential peers' in a particular network who then spread specific targeted messages or behaviors throughout their networks (Valente, 2012). Peer influencers refer to individuals

whom other peers look up to, respect, want to be like, regard as good leaders, or go to for advice (Campbell et al., 2008; Smit et al., 2016; Starkey et al., 2009).

Among such interventions, Smit et al. (2016) developed *Share H_2O*, an intervention designed to influence water consumption among schoolchildren in the Netherlands. The intervention achieved this successfully by training nominated peer influencers to promote water consumption among their peers at school. The review of Franse et al. (2020) regarding interventions promoting water consumption even concluded that the use of peer influence in the *Share H_2O* intervention was the most effective intervention strategy for increasing children's water consumption.

As members of the Dutch Kingdom, the established relationship between Aruba and the Netherlands enhanced our capacity to gauge the potential fit of *Share H_2O* for the Aruban context. Thus, the potential of *Share H_2O* was supported both by this existing connection and by research on social networks and social norms. Studies have shown that peer influence can have a more significant impact in relatively small, closely connected social communities (Christakis & Fowler, 2011). Given Aruba's small size and closely connected socio-cultural community, using social networks could be particularly appropriate and effective for behavioral change. Once my research demonstrates that social network intervention through *Share H_2O* is effective for Aruba, the next step would be to adapt the intervention specifically for the Aruban context. To determine elements that could be adapted, factors that influence water consumption could be investigated. In intervention research, adaptation has been defined as "intentional modification(s) of an intervention to achieve better fit with a new context" (Movsisyan et al., 2021, p. 2).

The effectiveness of social network intervention, like *Share H_2O*, can be attributed to the social norms exerted by influential peers operating through these networks. These social norms are influential because individuals tend to be receptive to the dietary consumption behaviors they perceive from others in their networks (Cruwys et al., 2015; Higgs, 2015; Robinson et al., 2014; Salvy et al., 2012). Within these networks, literature has identified two distinct social norms shaping behavior: perceived descriptive and injunctive norms (Cialdini et al., 1990). The 'perceived descriptive norm' refers to an individual's perception of how most people behave. Therefore, it considers these to be normal modeled behavior, such as the extent to which peers consume water and SSBs. The 'perceived injunctive norm' refers to an individual's perception of other people's beliefs regarding specific behavior, for example, the extent to which peers verbally approve water consumption or verbally disapprove of

SSB consumption. From this perspective, the role of social norms could be examined in social network intervention.

Building on this understanding of the influence of social networks and social norms, this dissertation aims to investigate the effectiveness of social network intervention in promoting water consumption among schoolchildren in Aruba. To investigate this, I followed a stepwise approach by determining the potential of social network intervention for Aruba, identifying theory-based water consumption determinants, and examining the effectiveness of an adapted intervention in the Aruban context. These three steps in my journey are detailed in the dissertation overview below.

DISSERTATION OVERVIEW

The general objective of this dissertation was to investigate the effectiveness of social network intervention to promote water consumption among schoolchildren in Aruba. This objective was divided into three interconnected aims: (1) To examine whether a social network intervention also has potential for Aruba, I replicated and tested the effectiveness of the Dutch evidence-informed *Share H_2O* intervention in Aruba in a pilot study. In the intervention, a subgroup of children was trained as peer influencers to encourage water consumption among their peers, as an alternative to SSBs. (2) To explore how the intervention could be adapted by investigating Aruba's most important theoretical determinants of water consumption. (3) To examine the effectiveness of the *Kies Awa* (translation: *Choose Water*) social network intervention, which is an adapted intervention based on the two preceding Aruba-specific groundwork studies.

Outline

This dissertation presents three empirical studies in Chapters 2-4. Each chapter represents a published peer-reviewed article. Each study's aims and methodology are briefly described below. This dissertation ends with a General Discussion in Chapter 5.

Chapter 2—Piloting an Intervention Using Children's Social Networks at Schools

The pilot study aimed to examine whether social network intervention also has potential for Aruba. This study involved replicating a cluster randomized

controlled trial in schools that tested the effectiveness of the Dutch *Share H_2O* intervention (Smit et al., 2016) on Aruban children's water consumption, SSB consumption, and intentions to drink more water and fewer SSBs. The trial included 377 participants (M_{age} = 11 ± SD_{age} = 0.98; 54% girls) randomly assigned to the intervention or control groups. In the intervention group, sociometric-nominated peer influencers were trained to promote water consumption, as an alternative to SSBs. Thus, children in the intervention group were exposed to peer influencers promoting water consumption, while the children in the control group were not. While maintaining the intervention design of *Share H_2O*, I expanded the study by including a moderation analysis of how perceived descriptive and injunctive norms interacted with the intervention outcomes. This chapter has been published as an article in the *Journal of Environmental Research and Public Health* by Franken, Smit, and Buijzen (2018).

Chapter 3—Understanding the Behavioral Determinants of Water Consumption

The study aimed to gain more insight into the most important theoretical determinants of water consumption among adolescents in Aruba and compare them to those in the Netherlands. By applying a theoretical model developed by Smit et al. (2018), dominant theoretical perspectives in public health, including theories of planned behavior (attitude, behavioral intentions, norms, perceived behavioral control), social norms (descriptive and injunctive norms), and self-determination theory (i.e., intrinsic motivation) were integrated. This integrated model helped me determine which concepts significantly influence water consumption. This study included collected survey data from 1,584 adolescents from Aruba and the Netherlands (M_{age} = 12.34; SD_{age} = 2.14; 52% girls). This chapter has been published as an article in *Dialogues of Health* by Franken, Smit, de Leeuw, van Woudenberg, Burk, Bevelander, and Buijzen (2023).

Chapter 4—Examining the Effectiveness of *Kies Awa*, a Social Network Evidence-Based Adapted Intervention Promoting Water Consumption

This study aimed to examine the effectiveness of the *Kies Awa* social network intervention on children's water and SSB consumption, with the intervention being adapted based on evidence from the preceding two groundwork studies described in Chapters 2 and 3. In addition, this study also aimed to determine the moderating role of descriptive and injunctive norms. Key adaptations entailed adding roleplay and educational materials appropriate for Aruba's

context to the intervention. Using a cluster randomized control trial, schools were randomized to one of two clusters: the *Kies Awa* intervention group, which had 156 participants (M_{age} = 11.08, SD_{age} = 1.00; 53.8% girls), or the control group where no intervention occurred which had 144 participants; M_{age} = 11.32, SD_{age} = 0.96; 52.8% girls). This chapter has been published as an article in the *Journal of Public Health* by Franken, Smit, de Moor, de Leeuw, and Buijzen (2025).

Chapter 5—General Discussion

This General Discussion chapter summarizes and discusses the main findings of the three empirical studies, then reflects on the general limitations, gives implications and recommendations for future research and practice, and finalizes with a conclusion.

RESEARCH ETHICS

The research project of Saskia C. M. Franken was supervised by Moniek Buijzen, Crystal R. Smit, and Rebecca N. H. de Leeuw, initially through a hospitality agreement with the Behavioural Science Institute at Radboud University. Following the employment transition of Moniek Buijzen and Crystal R. Smit to Erasmus University Rotterdam, the supervision continued under an agreement with the Erasmus School of Social and Behavioural Sciences.

Saskia C. M. Franken is employed at the University of Aruba, who covered the research costs leading to this dissertation, with the exception of the open science article publication costs of Chapter 4, which was covered by the Erasmus University Rotterdam. Moniek Buijzen, Crystal R. Smit, Thabo J. van Woudenberg, William J. Burk, Kirsten E. Bevelander, are affiliated with the "*MyMovez*: Social Network Implementation of Health Campaigns," financed by the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013)/ ERC Grant Agreement 617253, which facilitated the supervision of this research project.

This dissertation complies with ethical guidelines for scientific research. The Ethics Committee of the Faculty of Social Sciences at Radboud University, Nijmegen, the Netherlands, approved the data collection procedures (ECSW2014-1003-203). The studies were preregistered with the Central Committee on Research Involving Human Subjects (CCMO): NL-OMON20508 (https://onderzoekmetmensen.nl/en/trial/20508, Chapter 2)

and NL-OMON26157 (https://onderzoekmetmensen.nl/en/trial/26157, Chapter 4). Additionally, the methodological description regarding a sub-dataset (Chapter 3) was registered on the Open Science Framework (OSF; https://osf.io/unmgp). The deidentified datasets are publicly available on the University of Aruba Repository: https://hdl.handle.net/20.500.14473/914 (Chapter 2), https://hdl.handle.net/20.500.14473/916 (Chapter 3) https://hdl.handle.net/20.500.14473/1167 (Chapter 4).

Author contributions were distributed across various aspects of the research process: Saskia C. M. Franken is the primary researcher. The conceptualization and study design were collaboratively developed by Saskia C. M. Franken, Crystal R. Smit, Rebecca N. H. de Leeuw (except Chapter 2), and Moniek Buijzen. Crystal R. Smit, Rebecca N. H. de Leeuw, and Moniek Buijzen were the developers of the original intervention. Saskia C. M. Franken coordinated school visits, collected data, and provided intervention training in Aruba (Chapters 2, 3, and 4). Data collection in the Netherlands was conducted by Crystal R. Smit, Kirsten E. Bevelander, and Thabo J. van Woudenberg (Chapter 3). Saskia C. M. Franken analyzed the data with statistical guidance from Crystal R. Smit across Chapters 2, 3, and 4, complemented by statistical expertise from William J. Burk (Chapter 3) and Marleen M. H. de Moor (Chapter 4), while Rebecca N. H. de Leeuw and Moniek Buijzen provided a critical review of the analyses. Saskia C. M. Franken authored all chapters in this dissertation, and Crystal R. Smit, Rebecca N. H. de Leeuw, and Moniek Buijzen helped with writing. Additional chapter-specific reviews were provided by Kirsten E. Bevelander, William J. Burk, Thabo J. van Woudenberg (Chapter 3), and Marleen M. H. de Moor (Chapter 4). Each contributing author has reviewed and accepted responsibility for the content of the respective chapters submitted as articles for peer-reviewed publication.


2

Chapter 2

Piloting an Intervention Using Children's Social Networks at Schools

This chapter is published: Franken, S. C. M., Smit, C. R., & Buijzen, M. (2018). Promoting water consumption on a Caribbean island: An intervention using children's social networks at schools. *International Journal of Environmental Research and Public Health, 15*(4), 713. https://doi.org/10.3390/ijerph15040713

ABSTRACT

Sugar-sweetened beverage (SSB) consumption and the associated childhood obesity are major concerns in the Caribbean, creating a need for interventions promoting water consumption as a healthy alternative. A social network-based intervention (SNI) was tested among Aruban children to increase their water consumption and behavioral intention to do so and, consequently, to decrease SSB consumption and the associated behavioral intention. In this study, the moderating effects of descriptive and injunctive norms were tested. A cluster randomized controlled trial was completed in schools (mean age = 11 years ± SD = 0.98; 54% girls). Children were assigned to the intervention group (IG; *n* = 192) or control group (CG; *n* = 185). IG children were exposed to peer influencers promoting water consumption and CG children were not. Regression analyses showed that water consumption increased for IG children with a high injunctive norm score (p = .05); however, their intention to consume more water remained unchanged (p = .42). Moreover, IG children showed a decrease in SSB consumption (p = .04) and an increase in their intention to consume less SSB (p = .00). These findings indicate that SNIs are a promising instrument for health behavioral changes for Aruba and other islands in the Caribbean region.

INTRODUCTION

The magnitude of the childhood obesity problem as a part of public health has been recognized worldwide (WHO, 2016) as well as in the Caribbean region (Caribbean Public Health Agency, 2015; Government of Aruba & Special Committee on Obesity, 2008; Greaux et al., 2013; Pan American Health Organization [PAHO]]/WHO & Caribbean Community and Common Market [CARICOM], 2006; Schwiebbe et al., 2011; Traboulay & Hoyte, 2015; Visser, 2008). This certainly applies to Aruba, an island in the Caribbean and a constituent country of the Kingdom of the Netherlands, where a large proportion (43%) of a sample of primary school-aged children were categorized overweight or obese (DPH, 2013a). An explanation might lie in the consumption of sugar-sweetened beverages (SSB; Malik et al., 2013; Martin-Calvo et al., 2014; WHO, 2015), which is the highest in the Caribbean region compared to 21 other world regions (Singh, Micha, Khatibzadeh, Shi, et al., 2015). Caribbean-based behavioral health intervention studies among children are scarce and have not targeted beverage consumption behavior (Caribbean Health Research Council, 2011; Francis et al., 2010; Tull et al., 2019). Furthermore, most intervention research on this topic has focused on the North American and European regions (Avery et al., 2015; Singh, Micha, Khatibzadeh, Lim, et al., 2015; Singh, Micha, Khatibzadeh, Shi, et al., 2015; Smit et al., 2016; Vargas-Garcia et al., 2017), so more research to investigate the effectiveness of interventions in other world regions is required. Given this, investigating an intervention program that aims to stimulate water consumption and, by doing so, reduce the consumption of SSB in a Caribbean context was deemed essential.

This study investigated the efficacy of an intervention that incorporates the social networks of Aruban children in their schools. The social network approach involves peer nominations to identify the most influential individuals in the peer network. We assumed that this approach would be appropriate for the Aruban context, given the island's relatively small and closely connected social community (Christakis & Fowler, 2011). Thus, the social environment may play a crucial influential role in such a setting. Several studies have found that social networks influence the consumption behavior of individuals (Campbell et al., 2008; Salvy et al., 2012; Smit et al., 2016; Valente & Davis, 1999). An important explanation lies in individuals' innate tendency to be sensitive to social norms they perceive from others in their network (Cruwys et al., 2015; Herman & Polivy, 2005; Higgs, 2015; Patrick & Nicklas, 2005; Pettigrew et al., 2015; Rivis & Sheeran, 2003; Robinson et al., 2014; Salvy et al., 2012; Wouters

et al., 2010). However, despite the acknowledged importance of the social environment, the underlying mechanism of social norms is unclear.

Social norms are defined as “implicit codes of conduct that provide a guide to appropriate action” (Higgs, 2015, p. 38). Two types of social norms can be distinguished (Cialdini et al., 1990). First, the “perceived descriptive norm” (PDN) refers to an individual’s perception of how most people behave and therefore consider these to be normal modeled behavior, for example, the extent to which peers consume water (PDNW) and SSB (PDNS). Second, the “perceived injunctive norm” (PIN) refers to an individual’s perception of other people’s beliefs regarding certain behavior, for example, the extent to which peers verbally approve of a child consuming water (PINW) or verbally disapprove of a child consuming SSB (PINS). Consequently, PDN and PIN present in social networks might moderate (i.e., interact with) the efficacy of social network intervention. Thus, these norms may influence the change in the consumption behaviors of these children. Therefore, their roles were investigated in this study.

Thus, the objectives of this study were: (1) to test the efficacy of a social network-based intervention promoting water consumption in schools; and (2) to determine the degree to which PDN and PIN moderate the effect of the social network-based intervention. We hypothesized that children who are exposed to the social network-based intervention promoting water consumption would report an increase in their water consumption (H1a) and this effect would be stronger for children with a high PDNW (H1b) and high PINW (H1c; involving a positive PIN). The intervention would also result in a decrease in SSB consumption (H2a) and this effect would be stronger for children with a low PDNS (H2b) and a high PINS (H2c; involving a negative PIN). Furthermore, the expectation was that the children in the intervention group would have a greater intention to consume more water (H3a) and this effect would be stronger for children with a high PDNW (H3b) and high PINW (H3c). Additionally, children’s intention to consume less SSB would increase (H4a) and this effect would be stronger for children with a low PDNS (H4b) and a high PINS (H4c).

MATERIALS AND METHODS

Design

The study was designed as a cluster randomized control trial, using the *Share H_2O* intervention conducted by Smit et al. (2016) in the Netherlands. The *Share H_2O* intervention is based on social network principles, using influential peers to target primary school children's water consumption behavior. The focus of the *Share H_2O* intervention matched the objective of our study of improving children's consumption behaviors. The intervention design involved two aspects: (1) identifying and training the most influential children as peer influencers (PIs) to promote water consumption and (2) asking the PIs to promote water consumption among children in their social networks at schools. All children completed the same pre- and post-intervention measures. A researcher unaffiliated with this study randomly allocated the participating schools into the intervention or control group. To avoid the risk of contamination of the intervention group by the control group in this relatively small island setting, randomization was partly restricted based on the location of the schools and the number of students per school. In the control group, no intervention occurred.

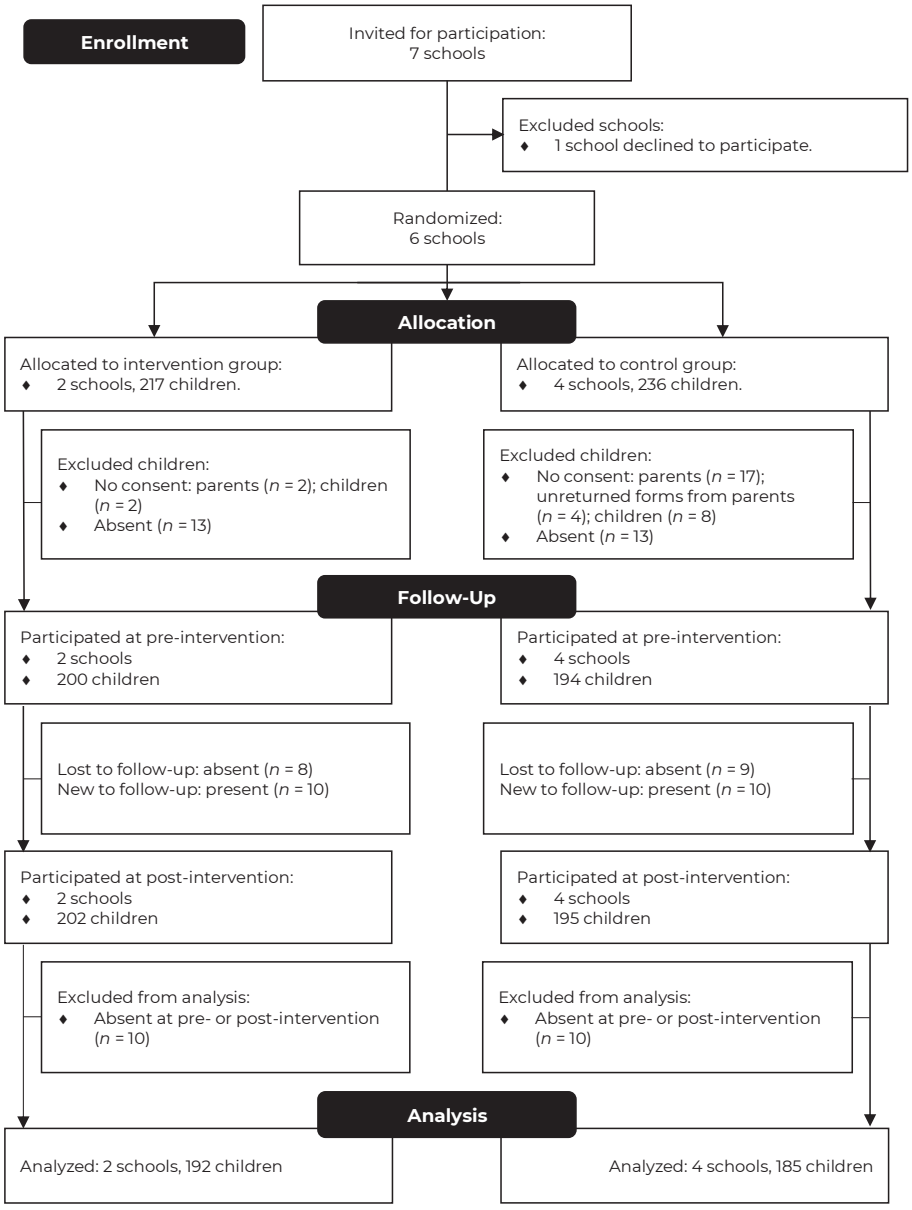
Participants

Figure 1 displays the workflow used for recruitment, allocation, and number of participants in the intervention and control group at both measurements. The objective was to include 400 5th and 6th grade primary school children in the study. Therefore, six schools were approached to participate. One of these schools declined because of their involvement in another project, therefore, a seventh school was contacted. All the participating schools were not involved in any other health programs. After obtaining active informed consent from the head of the Aruban educational inspection, the schoolboard, and principals of the participating schools, randomization was performed. With permission from the principals and classroom-teachers, 453 parents received a letter with detailed information about the research project, giving them the opportunity to indicate whether or not they preferred their child to participate (passive informed consent). At the request of one principal, parents in that school in the control group had to provide active consent. Before handing out the questionnaires pre-intervention, children provided their active assent by signing a form indicating whether they would like to participate or not. The final sample for analysis included 377 children (54% girls) between 10 and 14 years old (mean = 11.4 ± SD = 0.98), with 192 in the intervention and 185 in the

control group. Forty-two children in the intervention classes were selected as PIs and underwent the training program.

Figure 1

Flow Diagram of Participants



Procedure

The intervention lasted eight weeks from January until March 2016. Before and after the intervention, children completed a paper-and-pencil questionnaire to determine their demographic information, consumption behavior, and behavioral intention to consume more water and less SSB. Data collectors primarily offered children the questionnaire in the official language, Papiamento. A small number of children (17) who lacked fluency in this language received a Dutch version, because this is the language used in Aruban educational settings. Following the study of Smit et al. (2016), a selection procedure was used to identify the peer influencers (PIs) in the social networks at the schools using sociometric data provided by the children (see Section 2.5). These selected children were approached and then trained to become PIs to promote water consumption among their peers. To determine whether the children were aware of the purpose of the social network influence component of the project, they were asked during post-intervention measurement to describe the purpose of the study. Most children reported an association with water and SSB consumption; only the PIs were aware of the peer influencer component. The intervention procedure received approval by the Ethics Committee of the Faculty of Social Sciences at Radboud University: ECSW2014-1003-203. The present study was registered at the Netherlands Trial Registry: NTR5646.

Water Promotion Intervention Training

The purpose of the training was to provide the PIs the knowledge and skills to promote water consumption within their social networks in their schools. The training was offered by the first author during school hours and lasted approximately 90 min. The purposes of the training were: (1) to teach the PIs about the benefits of water consumption, (2) to motivate PIs to formulate their own arguments for consuming (more) water, (3) to teach PIs how to promote water consumption during peer interaction within their social networks, and (4) to encourage PIs to be an example to others by consuming (more) water in the proximity of other children in their social network. For this latter purpose, the PIs received a reusable water bottle. At the end of the training, the children were asked if they accepted their role of peer influencer, which all of them did. For a detailed description of the interactive elements and the theoretical foundations of the training, please refer to the publication of Smit et al. (2016). Furthermore, PIs received additional support by means of follow-up training sessions in weeks two and five of the intervention period. Support consisted

of discussions about their experiences as PIs and to refresh the information that was shared during the training.

Measures

Influential Peer Nominations

To identify PIs in the social networks in the intervention schools, the selection procedure was based on five sociometric questions that children answered during pre-intervention measurement. The children wrote down a maximum of five names of classmates whom they "respected," "wanted to be like," "looked up to," "went for advice," and "regarded as good leaders". Of these nominations, 15% of the boys and 15% of the girls with the most nominations were invited to attend the training (Campbell et al., 2008; Smit et al., 2016; Starkey et al., 2009).

Water and Sugar-Sweetened Beverages Consumption

At pre- and post-intervention measurement, water consumption was measured by asking children how much water (0 = zero glasses to 8 = eight glasses) they drank on a normal school day and weekend day (Haerens et al., 2008; Smit et al., 2016). To facilitate the estimation of number of glasses, the children were told that a glass represents a can, a bottle, or a package. A total score for water consumption was constructed by averaging the school day and weekend day items, which demonstrated acceptable internal consistency (Spearman–Brown$_{pre}$ = 0.68; Spearman–Brown$_{post}$ = 0.66). At pre- and post-intervention measurement, SSB consumption was measured by asking how many glasses of juice, soft drinks, and energy and sport drinks they consumed (0 = zero glasses to 8 = eight glasses) on a normal school day and weekend day (Haerens et al., 2008; Smit et al., 2016). Each category had examples of brands or names for types of SSB. A total score for SSB consumption was constructed by calculating an average of the sum of the school day items and the sum of the weekend day items. The six items demonstrated good internal consistency (Cronbach's alpha$_{pre}$ = 0.77; Cronbach's alpha$_{post}$ = 0.75).

Water and Sugar-Sweetened Beverages Consumption Intention

Children's intention to consume more water was measured by asking them the following three questions at both time-points: "Do you intend to drink more water?", "Do you intend to drink more water during the next month?", and "Do you intend to drink more water during the next year?" (1 = no, definitely not; 2 = no, I do not think so; 3 = yes, I think so; 4 = yes, definitely so; Kassem et al., 2003; Smit et al., 2016). These items were averaged to create a water

consumption intention scale, which demonstrated good internal consistency (Cronbach's $alpha_{pre}$ = 0.75; Cronbach's $alpha_{post}$ = 0.82). Behavioral intention to consume less SSB was measured at both time points by asking the same three questions (e.g., "Do you intend to drink less sugar-sweetened beverages?"). These items were averaged to create an SSB consumption intention scale, which demonstrated a good internal consistency (Cronbach's $alpha_{pre}$ = 0.85; Cronbach's $alpha_{post}$ = 0.88).

Perceived Descriptive Norm Related to Water Consumption and Sugar-Sweetened Beverages Consumption

The moderators, PDNW and PDNS, were measured by asking the children how often their friends consumed water and SSB (van der Horst et al., 2007). The response categories for these four questions ranged from 1 = never; 2 = a few times; 3 = many times; to 4 = always.

Perceived Injunctive Norm Related to Water Consumption and Sugar-Sweetened Beverages Consumption

The moderators, PINW and PINS, were measured by asking children how often their friends approved of them consuming water and how often their friends disapproved of them consuming SSB (van der Horst et al., 2007). The response categories for these four questions ranged from 1 = never; 2 = a few times; 3 = many times; to 4 = always.

Thirst Level

To control for individual differences, the children were presented with a 15 cm visual analogue scale (VAS) to measure the extent to which they felt thirsty before filling out the questions (Bevelander et al., 2012; van Laerhoven et al., 2004). The scale ranged from 0 = not thirsty at all to 15 = very thirsty.

Statistical Analysis

Before conducting the main analyses to test the hypotheses, several preparatory analyses were conducted. First, we assessed skewness and kurtosis to confirm the normal distribution of the dependent variables. Second, a randomization check was conducted by means of independent samples *t*-test and Pearson's chi square test to assess whether the randomization resulted in a balanced distribution across the intervention and control group. Third, to determine whether thirst, sex, and age were correlated with the dependent and moderating variables, Pearson's correlation analyses were conducted.

Then, for the main analyses, we conducted linear regression analyses for water and SSB consumption behavior, for water and SSB behavioral consumption intention, and for PDNW, PINW, PDNS, and PINS by using PROCESS (SPSS version 2.16.3, SPSS Inc., Chicago, IL, U.S.) developed by Hayes (2012). This SPSS macro centered the variables for the intervention group, PDNW, PINW, PDNS, and PINS before running the analyses. Significant interaction effects were further interpreted using simple slopes analysis, to interpret the effect of the intervention on children with a low degree of PDN or PIN (1 standard deviation (SD) below the mean) versus children with a high degree (1 SD above the mean) for each dependent variable. Finally, to determine the effect of training on the consumption behavior and behavioral consumption intention of the PIs themselves, paired sample *t*-tests were conducted as additional analyses. All analyses were run using SPSS version 24 (SPSS, Inc., Chicago, IL, U.S.). All tests were considered statistically significant at $p \leq .05$.

RESULTS

Preparatory Analyses

Skewness and kurtosis tests led to transforming the SSB consumption variable. The randomization analyses for the variables at pre-intervention demonstrated no differences ($p > 0.05$) between the intervention and the control groups, except for water consumption, PDNW, and PINW. Because these differences may have consequences for the main analyses, standardized *z*-values were created and included in the analyses instead of the raw values. The means and SDs for all variables at pre-intervention for the two groups are summarized in Table 1.

Table 1
Descriptive Statistics for the Intervention and Control Groups Pre-Intervention [1,2,3]

Measure	Intervention (n = 192)	Control (n = 185)	p [4]
Age (years)	11.4 ± 0.9 (10–14)	11.4 ± 1.0 (10–14)	0.72
Boys/girls (*n*/*n*)	93/99	82/103	0.42
Thirst (15-cm Visual Analogue Scale)	5.8 ± 4.4 (0–15)	5.9 ± 4.7 (0–15)	0.83
Water consumption (i.e., glasses)	4.7 ± 1.9 (1–8)	4.3 ± 1.9 (1–8)	0.02
SSB [5] consumption (i.e., glasses)	5.2 ± 3.5 (0–20)	4.9 ± 3.0 (0–16)	0.27
Water consumption intention	3.4 ± 0.6 (1–4)	3.4 ± 0.7 (1–4)	0.75
SSB consumption intention	2.9 ± 0.8 (1–4)	2.9 ± 0.8 (1–4)	0.40
PDNW [6]	2.8 ± 0.7 (1–4)	2.6 ± 0.8 (1–4)	0.04
PINW [7]	2.7 ± 1.0 (1–4)	2.4 ± 1.0 (1–4)	0.00
PDNS [8]	2.8 ± 0.7 (1–4)	2.9 ± 0.7 (2–4)	0.06
PINS [9]	1.8 ± 0.8 (1–4)	1.6 ± 0.8 (1–4)	0.22

[1] n = 377.
[2] Values are presented as means ± standard deviations.
[3] Values in parentheses denote the minimum and maximum of the response categories.
[4] p values reflect the differences in the means between the two groups by independent samples t-test or Pearson's chi square test.
[5] Sugar-sweetened beverage.
[6] Perceived descriptive norm related to water consumption.
[7] Perceived injunctive norm related to water consumption.
[8] Perceived descriptive norm related to SSB consumption.
[9] Perceived injunctive norm related to SSB consumption.

With the four dependent and the four moderating variables in the overall sample, Pearson's correlation analyses showed that they were significantly correlated with thirst, sex, and age at the pre-intervention and/or at post-intervention measurements. Thirst was significantly correlated with water consumption (r_{pre} = 0.13, p = .01; r_{post} = 0.18, p = .00), but not with post-intervention water consumption intention (r_{pre} = 0.13, p = .01; r_{post} = 0.08, p = .14), nor with SSB consumption (r_{pre} = 0.07, p = .18; r_{post} = 0.03, p = .54). Furthermore, thirst was significantly correlated with post-intervention SSB consumption intention (r_{pre} = 0.03, p = .57; r_{post} = 0.13, p = .02), but not with any of the moderating variables. Sex was not significantly correlated with water consumption (r_{pre} = −0.07, p = .16; r_{post} = −0.05, p = .33), but was correlated with post-intervention SSB consumption (r_{pre} = −0.05, p = .30; r_{post} = −0.11, p = .04). In addition, sex was correlated with the behavioral intention to consume more water (r_{pre} = 0.08, p = .12; r_{post} = 0.13, p = .02), and with the intention to consume less SSB post-intervention (r_{pre} = 0.09, p = .07; r_{post} = 0.13, p = .01), and with PINW pre-intervention (r_{pre} = 0.12, p = .02; r_{post} = 0.05, p = .30), but not with the other moderators. Age was significantly

correlated with post intervention water consumption (r_{pre} = −0.00, p = .97; r_{post} = −0.11, p = .04), but not with SSB consumption (r_{pre} = −0.02, p = .70; r_{post} = −0.02, p = .71). Age was also correlated with the behavioral intention to consume more water post-intervention (r_{pre} = −0.08, p = .12; r_{post} = −0.11, p = .04) and with the behavioral intention to consume less SSB (r_{pre} = −0.10, p = .05; r_{post} = −0.13, p = .02), but was not correlated with any of the moderating variables. Because thirst, sex, and age were correlated with certain dependent and moderating variables at certain time points, they were included as covariates in the analyses to ensure they did not confound the effect.

Main Analyses

Water and Sugar-Sweetened Beverages Consumption

Tables 2 and 3 show the results of the efficacy of the intervention and moderators on water consumption and SSB consumption, respectively. For water consumption, the main effect of the intervention was nonsignificant (p = .50). The interaction term for the intervention and PINW was significant (p = .03). Further interpretation of the simple slopes of this interaction revealed that the intervention was significant for children in the intervention group with high PINW (β = 0.49; SE = 0.25; t = 2.00; p = .05; 95% CI: 0.01, 0.97), but not for children with a low PINW (β = −0.19; SE = 0.24; t = −0.77; p = .44; 95% CI: −0.66, 0.29; Figure 2). This significant interaction meant that after the intervention period, children with high PINW in the intervention group drank 0.50 units (i.e., glasses) more than children in the control group with high PINW (mean 4.81 and mean 4.31, respectively). In addition, after the intervention period, children with low PINW in the intervention group drank less units of water than children in the control group with low PINW (see Figure 2), but this difference of 0.18 units was not significant (mean 4.34 and mean 4.52, respectively). For SSB consumption (Table 3), the main effect of the intervention was significant (p = 0.04). PDNS and PINS did not moderate the effect of the intervention on SSB consumption. This result meant that after the intervention period, children in the intervention group consumed 0.14 units (i.e., glasses) less SSB compared to children in the control group (mean 4.80 and mean 4.94, respectively). Thus, these results indicate that the intervention significantly increased water consumption among children with a high PINW. Furthermore, the intervention significantly reduced SSB consumption for the children in the intervention group, as compared to the control group. Hence, these findings support H1c and H2a and do not support H1a, H1b, H2b, and H2c.

Table 2

Moderated Regression Analysis Examining the Interaction Effects Between Intervention Group, Perceived Descriptive Norm Related to Water Consumption (PDNW) and Perceived Injunctive Norm Related to Water Consumption (PINW) on Water Consumption Over Time [1]

Variable	Water Consumption T2 (n = 342)					
	β	SE β	t	p	95% CI	
					Lower	Upper
Constant	6.96	1.08	6.45	.00	4.84	9.08
Intervention (predictor)	0.12	0.18	0.67	.50	−0.23	0.47
PDNW T1 (moderator)	0.03	0.09	0.34	.74	−0.15	0.22
PINW T1 (moderator)	0.06	0.09	0.75	.45	−0.11	0.24
Intervention X PDNW (interaction term)	−0.13	0.18	−0.70	.49	−0.48	0.23
Intervention X PINW (interaction term)	0.38	0.17	2.20	.03	0.04	0.71
Water consumption T1 (covariate)	1.01	0.09	10.81	.00	0.83	1.19
Thirst T1 (covariate)	0.01	0.02	0.45	.65	−0.04	0.06
Thirst T2 (covariate)	0.05	0.02	2.34	.02	0.01	0.10
Sex (covariate)	−0.07	0.19	−0.37	.71	−0.43	0.30
Age (covariate)	−0.24	0.09	−2.62	.01	−0.42	−0.06
Overall model: $F(10, 331) = 17.17$, $p = .00$, $R^2 = 0.35$						

[1] T1 = pre-intervention and T2 = post-intervention.

Figure 2

Interaction Effects Between the Intervention Group or Control Group and Low or High Perceived Injunctive Norm Related to Water Consumption (PINW) for Post-Intervention Water Consumption

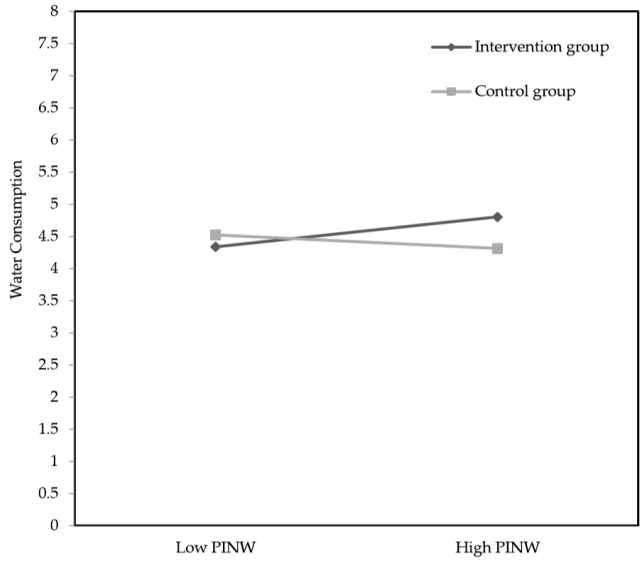


Table 3

Moderated Regression Analysis Examining the Interaction Effects Between Intervention Group, Perceived Descriptive Norm Related to SSB Consumption (PDNS) and Perceived Injunctive Norm Related to SSB Consumption (PINS) on Sugar-Sweetened Beverage (SSB) Consumption Over Time[1]

Sugar-Sweetened Beverages Consumption T2 (n = 350)						
Variable	β	SE β	t	p	95% CI	
					Lower	Upper
Constant	0.95	0.38	2.49	.01	0.20	1.71
Intervention (predictor)	−0.12	0.06	−2.02	.04	−0.24	0.00
PDNS T1 (moderator)	0.01	0.05	0.20	.84	−0.08	0.10
PINS T1 (moderator)	0.05	0.04	1.30	.19	−0.03	0.13
Intervention X PDNS (interaction term)	−0.04	0.09	−0.45	.65	−0.22	0.14
Intervention X PINS (interaction term)	−0.08	0.08	−1.00	.32	−0.23	0.08
SSB consumption T1 (covariate)	0.61	0.05	11.79	.00	0.51	0.72
Thirst T1 (covariate)	−0.01	0.01	−1.07	.28	−0.02	0.01
Thirst T2 (covariate)	0.01	0.01	0.98	.33	−0.01	0.02
Sex (covariate)	−0.11	0.06	−1.69	.09	−0.24	0.02
Age (covariate)	0.00	0.03	−0.05	.96	−0.06	0.06
Overall model: $F(10, 339) = 17.02$, $p = .00$, $R^2 = 0.36$						

[1] T1 = pre-intervention and T2 = post-intervention.

Water and Sugar-Sweetened Beverages Consumption Intention

Tables 4 and 5 show the results of the effect of the intervention and the moderators on the behavioral consumption intention to consume more water and less SSB, respectively. The intervention had no significant effect on the behavioral intention to consume more water (p = .42), nor was this effect moderated by PDNW or PINW. For the intention to consume less SSB, the effect of the intervention was significant (p = .00), but was not moderated by PDNS or PINS. This entailed that after the intervention period, children in the intervention group had a 0.35 greater intention-score to consume less SSB than children in the control group (mean 3.08 and mean 2.73, respectively). These findings indicate that the intervention did not affect the intention to consume more water, but did increase children's intention to consume less SSB. Furthermore, the effect of the intervention on both these dependent variables was not moderated by social norms. Accordingly, these findings supported H4a and not H3a, H3b, H3c, H4b, or H4c.

Table 4

Moderated Regression Analysis Examining the Interaction Effects Between the Intervention Group, Perceived Descriptive Norm Related to Water Consumption (PDNW) and the Perceived Injunctive Norm Related to Water Consumption (PINW) on the Behavioral Intention to Consume More Water Over Time[1]

Behavioral Intention to Consume More Water T2 (n = 342)						
Variable	β	SE β	t	p	95% CI	
					Lower	Upper
Constant	1.97	0.45	4.42	.00	1.09	2.84
Intervention (predictor)	0.05	0.06	0.80	.42	−0.07	0.17
PDNW T1 (moderator)	0.07	0.04	1.84	.07	−0.00	0.14
PINW T1 (moderator)	0.00	0.03	0.14	.89	−0.06	0.07
Intervention X PDNW (interaction term)	−0.04	0.07	−0.61	.54	−0.18	0.10
Intervention X PINW (interaction term)	−0.04	0.07	−0.54	.59	−0.18	0.10
Behavioral intention to consume more water T1 (covariate)	0.57	0.06	9.25	.00	0.45	0.69
Thirst T1 (covariate)	−0.00	0.01	−0.60	.55	−0.02	0.01
Thirst T2 (covariate)	0.01	0.01	0.92	.36	−0.01	0.02
Sex (covariate)	0.16	0.07	2.37	.02	0.03	0.29
Age (covariate)	−0.06	0.03	−2.06	.04	−0.13	0.00
Overall model: $F(10, 331) = 13.06$, $p = .00$, $R^2 = 0.34$						

[1] T1 = pre-intervention and T2 = post-intervention.

Table 5

Moderated Regression Analysis Examining the Interaction Effects Between Intervention Group, Perceived Descriptive Norm Related to SSB Consumption (PDNS) and Perceived Injunctive Norm Related to SSB Consumption (PINS) on the Behavioral Intention to Consume Less Sugar-Sweetened Beverages (SSB) Over Time [1]

Variable	Behavioral Intention to Consume Less SSB T2 (n = 346)					
	β	SE β	t	p	95% CI	
					Lower	Upper
Constant	1.91	0.51	3.74	.00	0.91	2.91
Intervention (predictor)	0.30	0.08	3.93	.00	0.15	0.46
PDNS T1 (moderator)	0.00	0.05	0.02	.98	−0.10	0.10
PINS T1 (moderator)	0.11	0.05	2.16	.03	0.01	0.20
Intervention X PDNS (interaction term)	−0.11	0.11	−1.04	.30	−0.33	0.10
Intervention X PINS (interaction term)	0.14	0.10	1.46	.14	−0.05	0.33
Behavioral intention to consume less SSB T1 (covariate)	0.46	0.06	7.66	.00	0.35	0.58
Thirst T1 (covariate)	−0.01	0.01	−0.73	.47	−0.03	0.01
Thirst T2 (covariate)	0.02	0.01	2.37	.02	0.00	0.04
Sex (covariate)	0.19	0.08	2.44	.02	0.04	0.34
Age (covariate)	−0.07	0.04	−1.68	.09	−0.14	0.01
Overall model: $F(10, 335) = 14.02$, $p = .00$, $R^2 = 0.32$						

[1] T1 = pre-intervention and T2 = post-intervention.

Additional Analyses

Water and Sugar-Sweetened Beverages Consumption Behavior and Behavioral Consumption Intention of Peer Influencers

The paired sample t-test of the consumption behavior and behavioral consumption intention of the PIs (n = 41) revealed similar patterns to the main analysis. On average, the PIs showed an increase in water consumption ($mean_{pre}$ = 4.56, SE = 0.30; $mean_{post}$ = 4.94, SE = 0.27) and a decrease in SSB consumption ($mean_{pre}$ = 4.67, SE = 0.41; $mean_{post}$ = 3.96, SE = 0.37). The change in water consumption was not significant ($t(40) = -1.15$, $p = .26$), but was significant for SSB consumption ($t(40) = 2.10$, $p = .04$). The intervention had a significant positive effect on PIs' intention to consume more water ($mean_{pre}$ = 3.46, SE = 0.09; $mean_{post}$ = 3.65, SE = 0.11; $t(40) = -2.48$; $p = .02$), and a marginally significant positive effect on their intention to consume less SSB ($mean_{pre}$ = 3.02, SE = 0.12; $mean_{post}$ = 3.31, SE = 0.12; $t(40) = -1.93$; $p = .06$).

DISCUSSION

Given the importance of SSB consumption in childhood obesity, water consumption intervention is needed worldwide, and especially in the Caribbean region (Caribbean Health Research Council, 2011; Malik et al., 2013; Martin-Calvo et al., 2014; Singh, Micha, Khatibzadeh, Shi, et al., 2015; WHO, 2015). However, intervention research focusing on increasing water consumption to combat obesity has focused primarily on North America and Europe (Avery et al., 2015; Singh, Micha, Khatibzadeh, Lim, et al., 2015; Singh, Micha, Khatibzadeh, Shi, et al., 2015; Vargas-Garcia et al., 2017). Therefore, the present study was conducted in the Caribbean, investigating the efficacy of a social network-based intervention wherein influential children in primary school classrooms promoted water consumption among their peers. Results showed that the intervention increased water consumption, but only for children who felt that their peers thought they should drink more water (i.e., perceived injunctive norm). Children's intention to consume more water remained unchanged. In addition, the intervention led to a reduction in SSB consumption and an increase in intentions to consume less SSB. The study highlights the important role of the social environment, demonstrating that children who are sensitive to what their peers think about the behavior targeted in the intervention are more susceptible to the impacts of the social network-based interventions.

Notably, we used the exact same intervention that was conducted in the Netherlands, allowing a comparison of the outcomes between the two countries. In both studies, the findings indicate that the intervention positively changed water and SSB consumption. However, the impact was contingent on the perceived injunctive norm in the present study, indicating an effect in Aruba that is weaker compared to the Netherlands (Smit et al., 2016). A possible explanation might lie in Aruba being situated in a tropical climate, which may naturally spur children to frequently consume water, making the encouragement to consume more water less applicable to Aruban children. This may be different for the Dutch target group, because they live in a temperate climate and may therefore be less naturally inclined to consume water. Of course, this assumed ceiling effect remains speculative and further research is needed for decisive conclusions.

Similar to the Dutch intervention and consistent with our expectations, this Caribbean intervention reduced SSB consumption. Moreover, children indicated a greater intent to consume less SSB. This finding is in line with previous studies showing that a constructive direct focus on a single behavior with positive health consequences can indirectly affect associated unhealthy

behaviors (Driskell et al., 2008; Hedrick et al., 2017; Nigg et al., 1999; Smit et al., 2016). For water-promoting interventions, this may imply that children understand the implicitly promoted message that SSB consumption is in fact unhealthy. This study demonstrates that this indirect mechanism holds true for social network-based interventions.

Some strengths, limitations, and suggestions for future research should be considered in the interpretation of our findings. To the best of our knowledge, this study was the first to determine the role of perceived social norms in a social network-based intervention. Our findings indicate that perceived social norms can moderate the efficacy of the intervention, dependent on the type of social norm and type of behavior in question. This is in line with the general assumption in the literature that perceived social norms affect food and beverage consumption (Cruwys et al., 2015; Herman & Polivy, 2005; Higgs, 2015; Patrick & Nicklas, 2005; Pettigrew et al., 2015; Rivis & Sheeran, 2003; Robinson et al., 2014; Salvy et al., 2012; Smit et al., 2016; Wouters et al., 2010). However, further research is needed to pin-point the components of the PI-training that lead to which types of changes in perceived descriptive and injunctive norms, and how to best measure these mechanisms to clarify what changes PIs activate in their social environments regarding beverage consumption behaviors. Another strength of this study is that it is one of the few scientifically conducted interventions targeting children's health related behaviors in the Caribbean region. Therefore, this study may serve as a regional benchmark for designing future interventions. Furthermore, the statistically significant effects for consumption behaviors and behavioral intentions involved relatively small differences in units and scores; however, even a small behavioral change and its corresponding caloric change per day could have health consequences over time. For example, a 12-oz serving of SSB contains about 10 teaspoons of sugar (140–150 calories) and eliminating this daily consumption or having the intention to eliminate it would contribute to preventing a child from gaining weight (Malik et al., 2013). In addition, by adopting an existing intervention, the outcomes of both studies could be compared so we were therefore able to confirm that a social network-based approach is successful in changing water and SSB consumption behaviors.

A limitation of this study is that children self-reported their behaviors and results may have been different if water consumption was measured directly, for example, by means of observations at school or using flow meters attached to the schools' water fountains (Loughridge & Barratt, 2005; Smit et al., 2016). Furthermore, due to the social network-based approach, an unavoidable limitation of this study is that individual participants could not

be randomized across conditions. Inherent to the principles of social network-based intervention, the only way to execute the study was using cluster randomization. Additionally, we did not measure the long-term effects of the intervention. Future research could investigate long-term effects, including changes in children's weight. Furthermore, future research could consider other significant people in the social environment, such as parents, who play a role in children's dietary behaviors (Mantziki et al., 2017; van der Horst et al., 2007). To gain a better understanding of children's beverage consumption behavior and to design intervention studies in the Caribbean, future research could examine the role of demographic factors and other behavior related factors, such as attitude and motivation regarding the consumption of water and SSB, which have been shown to be important predictors of consumption behavior (Kassem et al., 2003; Malik et al., 2013; Mazarello Paes et al., 2015; Pettigrew et al., 2015).

Conclusions

This study highlights the promising role of incorporating the influence of social networks in interventions when promoting healthy beverage consumption behavior among children in Aruba and, possibly, for other Caribbean islands. In addition, the role of social norms on children's water consumption behavior was highlighted. This research shows that a constructive focus on a single positive behavior can lead to significant changes in unhealthy behaviors. The findings fill a gap in the existing knowledge about Aruba in the field of children's water and SSB consumption behavior. However, in its entirety, the Caribbean region needs more research attention to determine how to promote the essential consumption of water.


3

Chapter 3

Understanding the Behavioral Determinants of Water Consumption

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ABSTRACT

Substituting the consumption of sugar-sweetened beverages (SSB) with that of water can have a positive effect on adolescents' health. However, despite the attention on this topic in the Global North, it is relatively understudied in other regions of the world, such as the Caribbean. To guide the development of future interventions, understanding the factors determining water consumption among Caribbean adolescents is important. This study examined the behavioral determinants of water consumption among adolescents in Aruba (the Caribbean) and compared them to those in the Netherlands (Western Europe). We used a theoretical model that integrates the dominant theoretical perspectives in the field of public health, including theories of planned behavior, social norms, and intrinsic motivation. This cross-country study included 1,584 adolescents from Aruba and the Netherlands (52% girls; *M* = 12.34 years; *SD* = 2.14). The data were analyzed using regression analyses. This study found that in Aruba, adolescents with higher scores of intrinsic motivation, friends' descriptive norms, attitudes, and behavioral control regarding water consumption drank more water. Moreover, the associations between water consumption and both intrinsic motivation as well as friends' descriptive norms for adolescents in Aruba were stronger than those found in the Netherlands. These associations imply that it is even more important for Aruban adolescents than Dutch adolescents to be intrinsically motivated or to perceive their friends often consuming water to drink more water. The cross-country comparison implies that future interventions in Aruba aimed at increasing adolescents' water consumption as an alternative to SSB should focus on enhancing their intrinsic motivation while considering their friends' social norms.

INTRODUCTION

The consumption of sugar-sweetened beverages (SSBs) is associated with a greater risk of dental decay (Valenzuela et al., 2021; WHO, 2016), weight gain (Malik et al., 2013), type 2 diabetes (Wang et al., 2015), and cardiovascular diseases (Malik & Hu, 2019). Despite the evidence that high intake of SSB is related to negative health effects, the consumption of SSBs remains high among adolescents. In the Caribbean, the consumption of SSBs, including soda, sweetened juice drinks, sweetened milk drinks, and energy drinks is more than four times higher than in Western Europe (Singh, Micha, Khatibzadeh, Shi, et al., 2015). Several approaches in health interventions can reduce SSB consumption (Vargas-Garcia et al., 2017). One possible way is promoting water consumption, which has zero calories, as an alternative to SSB consumption. Several longitudinal studies have reported that replacing SSB with water exhibits a beneficial effect on children's body weight (Hu, 2013; Zheng, Allman-Farinelli, et al., 2015). However, the water intake of adolescents remains relatively low in numerous countries around the globe, especially in the Global South (Adams et al., 2020; Chouraqui, 2023; Rodríguez et al., 2022). In Aruba, an island in the Caribbean, the water consumption among primary school children is also low (Franken et al., 2018).

While considerable research has been conducted on promoting water consumption and reducing the consumption of SSBs in the Global North (Franse et al., 2020; Singh, Micha, Khatibzadeh, Shi, et al., 2015), this topic remains under-researched in the Global South, especially in the Caribbean region. To improve health interventions in the Caribbean, it is crucial to gain a better understanding of the factors that determine Caribbean adolescents' water consumption. Therefore, this study aims to understand the behavioral determinants of water consumption among adolescents in Aruba and to compare them with the Western European country of the Netherlands. This comparison provides guidance as to the design and implementation of future interventions in the Caribbean.

Comparing Water Consumption Determinants Across the Caribbean and Western Europe

Over the past decade, several European countries have examined the behavioral determinants of water consumption (Franse et al., 2019) and interventions aimed at promoting water consumption (Franse et al., 2020). Particularly, researchers in the Netherlands have developed interventions to reduce SSB consumption by promoting water consumption (Smit et al., 2021a; van de Gaar

et al., 2014). Recently, an integrated theoretical model was applied by Smit et al. (2018) to understand the determinants of water consumption among Dutch adolescents. However, to the best of our knowledge, researchers have not yet compared the determinants of water consumption in the Southern Caribbean and North-western Europe. Furthermore, they have not examined the behavioral determinants of water consumption among Caribbean adolescents. This study aims to fill this knowledge gap by investigating whether the theoretical determinants applied in the model of Smit et al. (2018) for the adolescents of the Netherlands can be generalized to adolescents of Aruba. To this end, we compare the determinants of water consumption between adolescents from Aruba and the Netherlands.

Theoretical Determinants of Water Consumption

The integrated model applied by Smit et al. (2018) incorporated determinants from various dominant theoretical perspectives in the field of public health. The model included determinants from the theory of planned behavior (Ajzen, 1991), social norms (Higgs et al., 2019), and intrinsic motivation (Ryan & Deci, 2017).

Theory of Planned Behavior

The theory of planned behavior (TPB; Ajzen, 1991) is one of the most commonly applied theoretical perspectives to predict behavioral changes in dietary patterns. It states that behavior is predicted by an individual's intention to perform a certain behavior, which is influenced by their (a) attitude toward the behavior, or the evaluation of the behavior, (b) subjective norms, or the perception of what others consider appropriate regarding the behavior, and (c) perceived behavioral control, or the perception that one is able to and is in control of their behavior. Several cross-sectional studies related to dietary patterns have demonstrated that these constructs directly affect behavior, and indirectly through behavioral intentions (Riebl et al., 2015). Thus, we will examine whether intention, attitude, subjective norms, and behavioral control are associated with adolescents' water consumption in Aruba.

Social Norms

The integrated model described by Smit et al. (2018) broadens the conceptualization of TPB's subjective norms by distinguishing between different types and sources of normative influences. Recently, the literature on social norms has provided comprehensive insights into the social norm

mechanisms influencing dietary intake (Higgs et al., 2019). This has highlighted the need to differentiate between the two types of social norms—descriptive norms (i.e., perceptions of the prevalence of others' behavior) and injunctive norms (i.e., perceptions of whether others approve or disapprove of the behavior; Cialdini et al., 1991)—as well as between the two main influencing sources: parents and friends (Robinson et al., 2014). The effects of normative influences vary across dietary behaviors (Robinson et al., 2014). Therefore, a broader conceptualization of the norms facilitates a deeper understanding of adolescents' consumption behavior in Aruba. Thus, we integrated a broader conceptualization of the social norms construct with both descriptive and injunctive norms involving water consumption from both parents and friends.

Intrinsic Motivation

Smit et al. further expanded the TPB model (2018) by including individuals' motivation to engage in healthy behavior. The self-determination theory, a prominent theory of human behavior, shows that motivation, particularly intrinsic motivation, is an essential determinant of behavioral change (Ryan & Deci, 2017). Intrinsic motivation refers to the inner drive of individuals to perform a behavior because it is inherently interesting or enjoyable (Ryan & Deci, 2017). Moreover, individuals who are intrinsically motivated tend to adopt and maintain healthy lifestyle patterns over time (Hagger & Chatzisarantis, 2009). Therefore, we examined intrinsic motivation as a potential determinant of water consumption among adolescents in Aruba.

Study Aims

This study had two objectives. First, to identify the most important determinants for adolescents in Aruba, this study aimed to examine the determinants from various theoretical perspectives, namely intention, attitude, behavioral control, descriptive norms and injunctive norms of parents and friends, as well as intrinsic motivation. Second was to investigate whether the determinants of water consumption differ between adolescents in Aruba and those in the Netherlands.

MATERIALS AND METHODS

Aruba and the Netherlands

Aruba is separated from the Netherlands by the North Atlantic Ocean, yet, despite having relatively different cultural backgrounds, they share Dutch nationality. Aruba is an island situated in the Southern Caribbean and is the smallest of the four constituent countries of the Kingdom of the Netherlands. The official languages of Aruba are Papiamento and Dutch. Further, the Netherlands is a country located in North-Western Europe and is the largest of the four constituent countries of the Kingdom of the Netherlands. The official language of the Netherlands is Dutch. The Netherlands has a temperate maritime climate, while Aruba has a hot, semi-arid climate. Thus, the geographical location, land area size, primary language, and climate differ between the two countries; however, safe tap water is available in both countries.

Participants and Procedure

The sample for this cross-country study consisted of three similar datasets: two datasets from Aruba and one from the Netherlands. The first dataset from Aruba was collected from six secondary schools [*n* = 398; see Franken et al. (2022) for methodology description]. The second Aruban dataset consisted of the baseline data from a water promotion intervention study conducted in six primary schools [*n* = 394; see Franken et al. (2018) for project description. The dataset from the Netherlands was collected from 13 primary schools (*n* = 355) and eight secondary schools (*n* = 437) that participated in the first wave of the *MyMovez* project [see Bevelander et al. (2018) for the study protocol]. Consequently, 1,584 adolescents were included in the analysis, 52% of whom were female. Moreover, the adolescents' ages ranged between 8 and 18 years (*M* =12.34; *SD* = 2.14).

Before each of the three datasets was collected, school directors were asked to provide their consent to conduct the study at their schools. In both countries, informed consent was obtained from parents and assent from adolescents [see Bevelander et al. (2018), Franken et al. (2018; 2022) for the protocol and detailed procedures]. In Aruba, the majority of questionnaires were completed in Papiamento. In the Netherlands, questionnaires were completed in Dutch. The Ethics Committee of the Faculty of Social Sciences at Radboud University approved the data collection procedures in Aruba (ECSW2014-1003-203) and the ethical review board of the European Research Council (617253) approved the *MyMovez* project in the Netherlands.

Measures

An overview of all the study variables (water consumption, intention, attitude, behavioral control, descriptive and injunctive norms of parents, descriptive and injunctive norms of friends, as well as intrinsic motivation) and the covariates (country of residence, thirst level, sex, age, and SSB consumption) are presented in Table 1. Since the constructs used across the three datasets are mostly similar, the three datasets were merged after adjustments

Table 1

Overview of Measures

Measure	Primary schools, Aruba	Secondary schools, Aruba	Primary and secondary schools, the Netherlands
Water consumption: [a]	How much water do you drink on (1) a normal school day and (2) a normal weekend day? The questionnaire illustrated that a glass also represents a bottle, a can, or a package to facilitate participants' quantity estimation. Answer categories 0 (*zero glasses*) to 8 (*eight glasses or more*). [b]	Idem.	How much water did you drink yesterday? This question was asked on three different days. The questionnaire illustrated that a glass also represents a bottle, a can, or a package to facilitate participants' quantity estimation. Answer categories 0 (*zero glasses*) to 7 (*seven glasses or more*). [b]
Behavioral intention: [c]	Do you intend to drink more water? 1 (*no, certainly do not*) to 4 (*yes, certainly do*).	Idem.	Question idem, 1 (*no, certainly do not*) to 6 (*yes, certainly do*).
Attitude:	I find drinking water... (a) 1 (*very unpleasant*) to 4 = (*very pleasant*), and (b) 1 (*very distasteful*) to 4 (*very tasteful*). [b] Spearman-Brown = .74	Idem.	Idem. Spearman-Brown = .85
Behavioral control: [c]	Do you think you will succeed in drinking more water? 1 (*no, certainly do not*) to 4 (*yes, certainly do*).	Question idem, 1 (*not certain*) to 4 (*very certain*).	Question idem, 1 (*no, certainly do not*) to 6 (*yes, certainly do*).
Descriptive norm parents: [c]	How often does your (1) father, (2) mother drink water? 1 (*never*) to 4 (*always*). [d] Spearman-Brown = .51	Does your (1) father, (2) mother ever drink water? 1 (*no, never*) to 4 (*yes, often*). [d]	How often do your parents drink water? 1 (*never*) to 6 (*always*).
Descriptive norm friends: [c]	How often do your friends drink water? 1 (*never*) to 4 (*always*).	How many of your friends drink water? 1 (*nobody*) to 4 (*most or all of them*).	How often do your friends drink water? 1 (*never*) to 6 (*always*).
Injunctive norm parents: [c]	How often does your (1) father, (2) mother approve that you drink water? 1 (*never*) to 4 (*always*). [d] Spearman-Brown = .85	Does your (1) father, (2) mother approve that you drink water? 1 (*no, absolutely not*) to 4 (*yes, a lot*). [d]	Do you experience that your parents think you should drink water? 1 (*no, certainly do not*) to 6 (*yes, certainly do*).

Measure	Primary schools, Aruba	Secondary schools, Aruba	Primary and secondary schools, the Netherlands
Injunctive norm friends: [c]	How often do your friends approve that you drink water? 1 (*never*) to 4 (*always*).	Do your friends approve that you drink water? 1 (*no, absolutely not*) to 4 (*yes, a lot*).	Do you experience that your friends think you should drink water? 1 (*no, certainly do not*) to 6 (*yes, certainly do*)
Intrinsic motivation: [c]	How often do you drink water because you... (a) like it?, (b) enjoy it?, (c) think it is pleasant?, (d) choose to do so yourself? 1 (*never*) to 4 (*always*). [b] Spearman-Brown = .86	Do you drink water because you... a, b, c idem. Question d: always do so? 1 (*not true*) to 4 (*very true*). [b]	Do you drink water because you... a, b, c idem. Question d: want this yourself? 1 (*no, certainly do not*) to 6 (*yes, certainly do*). [b] Spearman-Brown = .85
Thirst level:	How thirsty are you at this moment? Thirst level was measured with a Visual Analog Scale (VAS): 0 cm (*I am not thirsty*) to 15 cm (*I am very thirsty*).	Question idem, 1 (*not thirsty*) to 4 (*very thirsty*). [e]	Question idem, VAS: 0 cm (*not thirsty*) to 15 cm (*very thirsty*).
Sex:	Coded 0 (*boys*), 1 (*girls*).	Idem.	Idem.
Age:	Open question.	Idem.	Idem.
Sugar-sweetened beverage consumption: [a]	How many glasses of (a) juice drinks, (b) soda, and (c) energy and sports drinks do you drink on (1) a normal school day and (2) a normal weekend day? The same illustration used for water consumption was applied here. Answer categories 0 (*zero glasses*) to 8 (*eight glasses or more*). [b]	Idem.	How many glasses of (a) juice drinks, (b) soda, and (c) energy, and (d) sports drinks do you drink? This question was asked on three different days. The same illustration used for water consumption was applied here. Answer categories 0 (*zero glasses*) to 7 = (*seven glasses or more*). [b]

Note. [a] Before aggregating the Aruban and Dutch databases, Aruban participants who answered 8 were recoded with 7 such that the final sample consisted of an equal score range.
[b] A total score was attained by averaging the scores for the subitems.
[c] Before merging the databases, the scores for the Aruban adolescents were divided by 4 and multiplied by 6 to attain an equal score range.
[d] Before aggregating the databases, a parent score was constructed for the Aruban adolescents by averaging the father and mother items.
[e] Before aggregating the databases, the 4-point scale answers were divided by 4 and multiplied by 15 to acquire an equal range of answer scores in the final sample.

Statistical Analysis

The study variables were analyzed using descriptive statistics. Pearson correlations were performed for Aruba and the Netherlands to examine bivariate associations between all study variables. The primary analyses consisted of two multiple regression analyses, in which four covariates (sex, age, thirst, and SSB consumption) and the focal variables (intention, attitude, behavioral control, descriptive and injunctive norms of parents and friends, and intrinsic motivation) were included. First, the Aruban samples (n = 792) were analyzed to determine the main effects of each behavioral determinant of adolescents' water consumption. The second analysis was performed on all three samples (N = 1,584) and included the same variables as the first analysis, as well as the main effects of country, and X interactions between country and the behavioral determinants. Furthermore, interaction terms were created between the country of residence and the mean-centered behavioral determinants. Statistically significant interactions were further examined using simple slope analyses across two levels of moderator (low level -1 *SD*; high level +1 *SD*). All analyses were performed in SPSS version 28 (SPSS, Inc., Chicago, IL, U.S.), and the SPSS PROCESS macro (version 4; Hayes, 2013) was used for probing the statistically significant interactions.

RESULTS

Descriptive Statistics

Table 2 presents the mean and standard deviation of all the study variables.[1] The *t*-tests showed that all variables differed significantly between the two countries (p < .05, two-tailed), except for thirst (p = .44). Moreover, Pearson's correlations in Table 3 indicate significant positive associations between Aruban adolescents' water consumption and their behavioral determinants—intention, attitude, behavioral control, parents' and friends' descriptive norms, parents' injunctive norms, and intrinsic motivation. Table 4 shows Pearson's correlations for Dutch adolescents, indicating significant positive associations between water consumption and their behavioral determinants—attitude, behavioral control, parents' and friends' descriptive norms, and intrinsic motivation.

1 The skewness of the covariate SSB consumption was 1.58, indicating that the distribution was positively skewed. However, our study's results remained the same irrespective of whether untransformed or transformed scores were used. Therefore, the untransformed measure is used in all the analyses.

Table 2

Descriptive Statistics for the Total Sample and by Country of Residence

	Total		Aruba		the Netherlands	
	N = 1,584		*n* = 792		*n* = 792	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*
Thirst level	6.47 (0–15)[b]	3.57	6.54 (0–15)	3.74	6.40 (0–15)	3.38
SSB consumption [a] (i.e., glasses)	1.11 (0–7)	1.14	1.80 (0–7)	1.14	0.41 (0–7)	0.58
Water consumption (i.e., glasses)	3.76 (0–7)	1.83	4.49 (0–7)	1.75	3.02 (0–7)	1.59
Behavioral intention	4.59 (1–6)	1.43	4.99 (2–6)	1.13	4.10 (1–6)	1.60
Attitude	3.33 (1–4)	0.69	3.37 (1–4)	0.64	3.29 (1–4)	0.73
Behavioral control	4.94 (1–6)	1.27	4.87 (2–6)	1.21	5.03 (1–6)	1.33
Descriptive norm parents	4.82 (1–6)	1.14	5.21 (2–6)	0.90	4.33 (1–6)	1.22
Descriptive norm friends	4.01 (1–6)	1.29	4.32 (2–6)	1.29	3.63 (1–6)	1.19
Injunctive norm parents	4.98 (1–6)	1.36	5.16 (2–6)	1.17	4.74 (1–6)	1.55
Injunctive norm friends	3.61 (1–6)	1.67	3.92 (2–6)	1.53	3.20 (1–6)	1.76
Intrinsic motivation	4.52 (1–6)	1.27	4.40 (2–6)	1.24	4.64 (1–6)	1.29

[a] Sugar-sweetened beverages.
[b] Ranges are presented in parentheses.

Table 3

Pearson Correlations Among the Variables for Adolescents in Aruba

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Thirst level	..	.17**	.11**	.11**	.09*	.04	-.01	.09*	.02	-.01	.00	.01
2. Age			.10**	.07*	-.01	-.16**	-.25**	.39**	.19**	-.16**	.07	-.21**
3. SSB consumption [a]				.14**	-.07	-.16**	-.10**	.06	.01	-.03	.01	-.15**
4. Water consumption					.12**	.32**	.21**	.17**	.22**	.10**	.00	.38**
5. Behavioral intention						.27**	.43**	.12**	.00	.19**	.02	.32**
6. Attitude							.39**	.05	.10**	.21**	.00	.63**
7. Behavioral control								-.01	.01	.25**	-.00	.44**
8. Descriptive norm parents									.34**	.11**	.07*	.13**
9. Descriptive norm friends										.03	.10**	.16**
10. Injunctive norm parents											.02	.33**
11. Injunctive norm friends												.04
12. Intrinsic motivation												..

Note. N = 792.
[a] Sugar-sweetened beverages.
*p < .05.
**p < .01.

Table 4

Pearson Correlations Among the Variables for Adolescents in the Netherlands

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Thirst level	..	-.10**	.12**	.03	.03	-.02	.06	-.06	-.04	-.02	.02	-.00
2. Age			-.01	.16**	-.12**	-.05	-.05	-.07	.00	-.06	.01	-.01
3. SSB consumption [a]				.09**	.09*	-.17**	-.06	-.07	.05	-.12**	.13**	-.09*
4. Water consumption					.01	.24**	.13**	.12**	.09*	.07	.08	.21**
5. Behavioral intention						.25**	.42**	.21**	.20**	.23**	.25**	.29**
6. Attitude							.34**	.18**	.19**	.14**	.13**	.67**
7. Behavioral control								.21**	.18**	.19**	.18**	.36**
8. Descriptive norm parents									.47**	.35**	.18**	.21**
9. Descriptive norm friends										.18**	.29**	.26**
10. Injunctive norm parents											.49**	.09*
11. Injunctive norm friends												.16**
12. Intrinsic motivation												..

Note. N = 792.
[a] Sugar-sweetened beverages.
*p < .05.
**p < .01.

Main Analyses

Water Consumption Determinants for Aruban Adolescents

Table 5 presents the results of the first regression analysis. This regression investigated the theoretical determinants of adolescents' water consumption in Aruba. The model showed that the variables explained 25% of the variance in water consumption for adolescents in Aruba (F [12, 726] = 20.11, p = <.001). Furthermore, the analysis revealed significant associations between the water consumption of adolescents in Aruba and their intrinsic motivation, attitude, descriptive friends' norms, and behavioral control. Accordingly, adolescents with higher scores for intrinsic motivation, attitude, friends' norms, and behavioral control consumed more water.

Table 5

Regression Results Between Behavioral Determinants and Water Consumption of Aruban Adolescents

Determinant	*b*	*SE B*	*β*	*p*	95% CI [b]
Constant	-1.35	0.61	..	.026	-2.55, -0.16
Thirst level	0.03	0.02	.06	.080	-0.00, 0.06
Sex [a]	-0.29	0.11	-.08	.012	-0.51, -0.06
Age	0.09	0.03	.12	.001	0.04, 0.15
Sugar-sweetened beverage consumption	0.27	0.05	.18	<.001	0.17, 0.37
Behavioral intention	-0.05	0.06	-.03	.376	-0.16, 0.06
Attitude	0.30	0.12	.11	**.009**	0.08, 0.53
Behavioral control	0.12	0.06	.09	**.029**	0.01, 0.23
Descriptive norm parents	0.05	0.07	.03	.501	-0.10, 0.20
Descriptive norm friends	0.16	0.05	.12	**<.001**	0.06, 0.25
Injunctive norm parents	-0.01	0.05	-.01	.813	-0.12, 0.09
Injunctive norm friends	-0.03	0.04	-.03	.401	-0.10, 0.04
Intrinsic motivation	0.45	0.06	.32	**<.001**	0.32, 0.57

Note. N = 792.
Significant variables (p < .05) appear in bold.
R = .50, R_2 = .25, F (12, 726) = 20.11, p = <.001.
[a] 0 = boys, 1 = girls.
[b] Confidence interval.

Comparing Water Consumption Determinants Between Aruba and the Netherlands

The results of the second regression analysis are presented in Table 6. This analysis examined the differences between water consumption determinants among adolescents in Aruba (n = 792) and the Netherlands (n = 792). The overall model was statistically significant (R = .60, R_2 = .36, F (21, 1243) = 33.92, p = < .001). Water consumption in both Aruba and the Netherlands was significantly positively associated with attitude (p = .006), behavioral control (p = .019), intrinsic motivation (p = < .001), and descriptive norm of friends (p = < .001). Moreover, the interaction term between intrinsic motivation and the country was significant for water consumption (b = -0.34, SE = 0.10, $ß$ = -.15, p = < .001, 95% CI [-0.53 to -0.15]). In addition, the interaction term between friends' descriptive norm and the country was significant for water consumption (b = -0.17, SE = 0.08, $ß$ = -.08, p = .030, 95% CI [-0.33 to -0.02]).

Table 6

Regression Analysis Examining the Interaction Effects Between Country of Residence and Behavioral Determinants on Water Consumption

Determinant	*b*	*SE B*	*β*	*p*	95% CI [c]
Constant	-1.63	0.57	..	.005	-2.75, -0.50
Thirst level	0.02	0.01	.04	.102	-0.00, 0.04
Sex [a]	-0.22	0.09	-.06	.009	-0.39, -0.05
Age	0.12	0.03	.15	<.001	0.07, 0.17
Sugar-sweetened beverage consumption	0.27	0.05	.17	<.001	0.18, 0.36
Country of residence [b]	-0.97	0.13	-.26	<.001	-1.22, -0.72
Behavioral intention	-0.06	0.06	-.04	.317	-0.16, 0.05
Attitude	0.31	0.11	.11	.006	0.09, 0.53
Behavioral control	0.13	0.06	.09	.019	0.02, 0.24
Descriptive norm parents	0.03	0.07	.02	.682	-0.11, 0.17
Descriptive norm friends	0.15	0.05	.11	<.001	0.06, 0.24
Injunctive norm parents	-0.01	0.05	-.01	.857	-0.11, 0.09
Injunctive norm friends	-0.03	0.04	-.03	.348	-0.10, 0.04
Intrinsic motivation	0.46	0.06	.31	<.001	0.33, 0.58
Country X Behavioral intention	-0.05	0.07	-.03	.505	-0.19, 0.09
Country X Attitude	0.16	0.17	.04	.344	-0.17, 0.49
Country X Behavioral control	-0.09	0.08	-.04	.285	-0.24, 0.07
Country X Descriptive norm parents	0.13	0.10	.06	.167	-0.06, 0.32
Country X Descriptive norm friends	-0.17	0.08	-.08	**.030**	-0.33, -0.02
Country X Injunctive norm parents	0.03	0.07	.02	.643	-0.11, 0.18
Country X Injunctive norm friends	0.05	0.06	.03	.428	-0.07, 0.16
Country X Intrinsic motivation	-0.34	0.10	-.15	**<.001**	-0.53, -0.15

Note. N = 1,584.
Significant variables (p < .05) appear in bold.
R = .60, R_2 = .36, F (21, 1243) = 33.92, p = < .001.
[a] 0 = boys, 1 = girls.
[b] 0 = Aruba, 1 = the Netherlands.
[c] Confidence interval.

We performed simple slopes analyses to further interpret these two statistically significant interactions. In Figure 1, the significant interaction is depicted with water consumption (controlled for thirst level, sex, age, and SSB consumption) on the *y*-axis, low (-1 *SD*) and high (+1 *SD*) intrinsic motivation on the *x*-axis, as well as separate regression slopes for adolescents from each country. Both

simple slopes revealed a significant positive association between intrinsic motivation and water consumption, with intrinsic motivation being more strongly associated with water consumption for adolescents in Aruba (*b* = 0.64, SE = 0.05, *t* = 14.13, *p* = < .001, 95% CI [0.55, 0.73]) than for adolescents in the Netherlands (*b* = .28, SE = 0.04, *t* = 6.53, *p* = < .001, 95% CI [0.19, 0.36]).

Figure 1

Associations Between Intrinsic Motivation and Water Consumption for Adolescents Residing in Aruba and the Netherlands

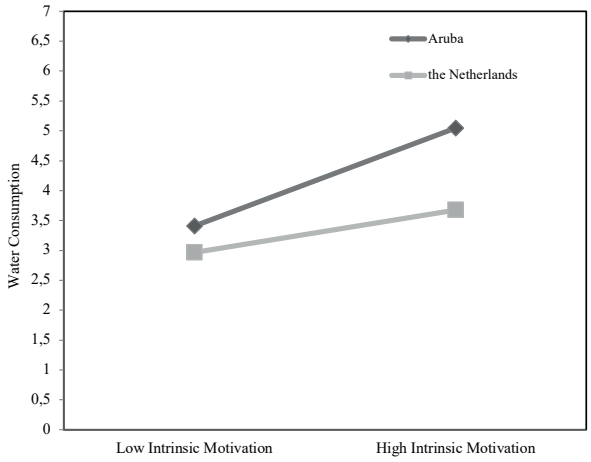
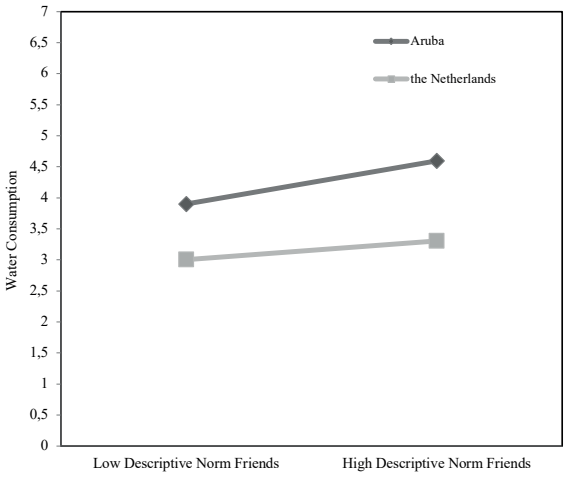


Figure 2 presents the significant interaction between water consumption (controlled for thirst level, sex, age, and SSB consumption) on the *y*-axis, low (-1 *SD*) and high (+1 *SD*) descriptive friends' norms on the *x*-axis, and two regression slopes representing adolescents from each country. The simple slopes revealed significant positive associations between descriptive friends' norms and water consumption, with descriptive norms being more strongly related to water consumption among Aruban adolescents (*b* = 0.27, SE = 0.05, *t* = 5.82, *p* = < .001, 95% CI [0.18, 0.36]) compared with Dutch adolescents (*b* = 0.12, SE = 0.05, *t* = 2.19, *p* = .029, 95% CI [0.01, 0.22]).

Figure 2

Associations Between Descriptive Norm of Friends and Water Consumption for Adolescents Residing in Aruba and the Netherlands



DISCUSSION

The present study was the first cross-country study to examine the determinants of water consumption among adolescents on an under-researched Caribbean Island (Aruba) and to compare them with those of a well-researched Western European country (the Netherlands). Several theoretical constructs were identified as unique behavioral determinants of water consumption among adolescents in Aruba. Our findings showed that intrinsic motivation to consume water was the most important determinant for Aruban adolescents' water consumption. In addition, we found that Aruban adolescents consumed more water when they had a favorable attitude, had a higher perception that they were able to consume more water, and had a higher perception that their friends often consumed water. Furthermore, when comparing the determinants between Aruba and the Netherlands, the associations between water consumption and both intrinsic motivation and friends' descriptive norms were stronger for adolescents in Aruba than those in the Netherlands.

The Most Important Determinants of Water Consumption Among Aruban Adolescents

Water consumption among Aruban adolescents is uniquely explained by higher levels of intrinsic motivation, a positive attitude towards water consumption, higher levels of behavioral control, and higher descriptive norms of friends' water consumption. Among these determinants, intrinsic motivation to drink water was the most significant. This finding contributes to the accumulating evidence that intrinsic motivation plays an important role in explaining health-related behaviors, including those of Aruban adolescents (Ng et al., 2012; Ryan & Deci, 2017). Additionally, this is consistent with the findings in the Netherlands, indicating that intrinsically motivated adolescents consumed more water over time (Smit et al., 2018).

Furthermore, friends' descriptive norms were associated with the water consumption of Aruban adolescents, rather than parents' descriptive norms or the injunctive norms of friends or parents. This provides further evidence that it is important to differentiate between the types (descriptive, injunctive) and sources (parents, friends) of norms for understanding adolescents' water consumption behavior (Cialdini et al., 1991; Robinson et al., 2014; Zheng, Allman-Farinelli, et al., 2015). The finding that adolescents consume more water when they perceive that their friends do is consistent with research showing that adolescents tend to follow the modeled consumption behavior of their friends (Cruwys et al., 2015). However, it is possible that only friends are a social source of influence because adolescents in this age group spend more time at school and are therefore more exposed to their friends' behavior than that of their parents (Borner et al., 2015).

In addition, behavioral attitude and control were found to influence the water consumption of Aruban adolescents. These direct associations between the constructs of the theory of planned behavior and the reported behavior of Aruban adolescents were similar to those found in previous literature (Riebl et al., 2015). These findings indicate that Aruban adolescents tend to consume more water when they have a more favorable attitude and perceive that they are capable of drinking more water.

Moreover, there was no association between adolescents' intentions to consume water and their actual consumption. This finding supports the "intention-behavior gap" that has been found in other studies (Sheeran, 2002), particularly with regard to water consumption (Smit et al., 2018). This gap implies that individuals often intend to pursue a healthy behavior, but do not act upon their intentions (Sheeran, 2002). This study shows that having

the intention to consume more water does not imply that individuals actually consume more water.

Differences Between Determinants of Aruba and the Netherlands

The associations of intrinsic motivation and descriptive norms of friends with water consumption were stronger for adolescents from Aruba compared to those from the Netherlands. This difference in strength indicates that it is even more important for Aruban adolescents to be intrinsically motivated or to perceive their friends often consuming water to be inclined to drink even more water than Dutch adolescents. An explanation for a stronger association between intrinsic motivation and water consumption could be that the minimum physiological needs for water may vary according to geographical location and climate (Chouraqui, 2023). Consequently, the stronger association of motivation could be due to Aruba's hot, semi-arid climate that incites an innate physiological need to quench thirst with water compared to the more temperate climate of the Netherlands (Franken et al., 2018).

In terms of descriptive norms, despite the fact that these countries are constituent members of the Kingdom of the Netherlands, there may be relative culture-based value differences. Relatively speaking, Arubans value being connected to other individuals within their social environment, compared to Dutch people, who have more individualistic values and weaker social ties (Merz et al., 2009). Consequently, these differences in values explain why adolescents in the collectivistic Aruban community are more inclined to consume water when they observe their friends doing so than the adolescents from the individualistically inclined Dutch community (Smit, 2021). Thus, the results suggest an amplified interplay between environmental factors and adolescents' behavioral determinants that influence water consumption. In the future, this study could be replicated, and the relationship between water consumption and these climactic and culture-based value factors could be examined.

Although a further examination of water and SSB consumption is beyond the scope of our research aims, and caution should be taken with the interpretation of the self-reported units (i.e., glasses) of these fluids, the results reveal that consumption patterns differ between Aruba and the Netherlands. This study reports (Table 2) that despite Aruban adolescents reporting consuming more water (4.49 units, i.e., glasses, during a normal school day) compared to Dutch adolescents (3.02 units), the amounts of water consumed in both

countries are nevertheless insufficient. Regarding fluid intake, Aruban health authorities recommend only consuming water or beverages containing no calories (Directie Volksgezondheid, DVG [Department of Public Health Aruba, DPH] & Instituto pa Deporte, Educacion Fisico y Recreacion [Institute of Sports, Physical Education, and Recreation, IDEFRE], 2012). They recommend that children 9 to 12 years and adolescents 13 to 18 consume 6 to 8 and 7 to 8 glasses of fluids respectively. Thus, this study also highlights that adolescents do not meet the recommended guidelines for beverage consumption. Inadequate water consumption has also been detected in earlier Aruban studies (DVG, 2018; Franken et al., 2018) and in many other countries around the globe, which further underscores the need to promote this behavior in the future (Chouraqui, 2023).

Moreover, our SSB consumption findings for Aruba and the Netherlands align with global and regional consumption patterns. Our findings reveal that the SSB consumption pattern for Aruban adolescents is more than four times higher than in the Netherlands, respectively 1.8 and 0.41 units (i.e., glasses) of SSB during a normal school day. This finding is similar to the global patterns laid out by Singh et al. (2015), demonstrating that SSB consumption in the Caribbean is more than four times as much as in Western-European countries—1.93 and 0.39 servings of SSBs, respectively. Especially for Aruba, this is worrisome because a can of SSB contains around 10 teaspoons of free sugar, while the World Health Organization encourages countries to reduce free sugar intake among children and adults to less than six teaspoons to prevent health-related complications (Inchley et al., 2017; WHO, 2015). These high-SSB consumption patterns in the Caribbean underline the recognized urgency among policymakers to facilitate healthier lifestyles in the Caribbean (Caribbean Public Health Agency, 2015; Healthy Caribbean Coalition, 2019, 2022b; Stuurgroep Scol Saludabel, 2011).

Strengths and Limitations

This study addressed a gap in the current literature by providing theory-based knowledge about the determinants of water consumption for the Caribbean island of Aruba. In doing so, this study reveals that the theoretical determinants applied in the model of Smit et al. (2018) for the adolescents of the Netherlands can be generalized to adolescents of Aruba. Therefore, this study may provide theory-based support for policymakers, institutions, and researchers in future public health promotion activities worldwide, especially in the Caribbean region.

Several methodological limitations should be considered. The cross-sectional design prevents us from establishing causal relationships between the theory-based determinants and water consumption. Therefore, a future longitudinal study may provide insight into the directionality among the variables.

Another limitation of this study is the generalizability of its findings. Although a quarter of all Aruban primary and secondary schools participated in the study, caution should be exercised when generalizing our findings. Additionally, it may not be possible to generalize the water consumption determinants that play a role in Aruba to other islands in the Caribbean because of factors such as distinctive sociodemographic backgrounds, socioeconomic status, ethnic backgrounds, and educational levels (Franse et al., 2019). Consequently, generalizing this study's findings for the population of adolescents in Aruba or the Caribbean may have limitations.

Furthermore, although safe tap water is available in Aruba and the Netherlands, this is not always the case in other countries. In some Caribbean islands and other countries in the Global South, access to—and affordability and availability of—safe drinking water are limited (Adams et al., 2020; Chouraqui, 2023; Rodríguez et al., 2022). Therefore, this issue potentially limits our findings' generalizability. Moreover, further future research is required before the implementation of water consumption promotion campaigns for positive health outcomes in the Global South can be considered (Adams et al., 2020; Chouraqui, 2023; Rodríguez et al., 2022).

Future Research Implications

This study established a focused groundwork for future health-related research in the Caribbean region by building on the knowledge of water consumption from the Global North. The cross-country findings indicate that promoting water consumption appears to be a promising research route for Aruba to encourage healthier lifestyles. Accordingly, Aruba should implement interventions that integrate motivational methods derived from the self-determination theory (Gillison et al., 2019; Ryan & Deci, 2017) and social norm principles (Cruwys et al., 2015; Higgs et al., 2019; Robinson et al., 2014).

The *Share* H_2O program in the Netherlands is a social network-based behavioral-change intervention approach that incorporates motivational techniques and social norm mechanisms (Smit et al., 2021a). This program exposed participants to peer influencers in their social network who promoted water consumption. The peer influencers' intrinsic motivation to drink more water and model this behavior to others was encouraged during

the intervention training sessions. In the future, tailoring this program could lead to greater efficacy in Aruba than in the Netherlands, considering the differences between Aruba and the Netherlands in terms of the determinants of water consumption. Furthermore, there are other types of interventions and complementary measures that reduce SSB consumption or increase water consumption effectively (Vargas-Garcia et al., 2017), which can be considered in future research.

Conclusion

This study highlights that intrinsic motivation to drink water is the most important determinant of water consumption among Aruban adolescents. In addition, friends' descriptive norms, attitudes, and behavioral control are considered to be important for Aruba. It has been found that Aruban adolescents with higher levels of these determinants consume more water. Furthermore, the comparison between Aruba and the Netherlands in terms of the determinants has demonstrated that there is a stronger association between intrinsic motivation and friends' descriptive norms on the one hand and water consumption on the other hand for Aruba than for the Netherlands. According to our findings, water consumption promotion interventions that focus on increasing the intrinsic motivation to drink water and the social norms concerning water drinking are likely to be effective in Aruba. Finally, the findings of this study highlight the importance of extending the research area to include more countries from the Global South. By moving beyond countries from the Global North, we can gain knowledge that can contribute to equality and a healthy environment for all human beings.


4

Chapter 4

Examining the Effectiveness of *Kies Awa*, a Social Network Evidence-Based Adapted Intervention Promoting Water Consumption

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ABSTRACT

This study examined the effect of the evidence-based adapted social network intervention named *Kies Awa* (translation: *Choose Water*) on children's water and sugar-sweetened beverages (SSB) consumption. It also examined the moderating role of children's descriptive and injunctive norms of water and SSB consumption on the intervention's effect. We conducted a cluster randomized control trial (RCT) where schools were randomized to one of two clusters: the intervention group (IG; *Kies Awa* intervention; 156 participants; M = 11.08, SD = 1.00; 53.8% girls) or the control group (CG; no intervention; 144 participants; M = 11.32, SD = 0.96; 52.8% girls). The primary outcome measure was water consumption and the secondary outcome was SSB consumption. Linear mixed modeling analyses showed that water consumption increased significantly more among IG participants than in the CG (β = 0.141; p = .015). The effect on SSB consumption was moderated by perceived injunctive norms, which refer to social disapproval of consuming SSBs. Specifically, the intervention reduced SSB consumption for participants reporting high levels of injunctive norms (β = -0.052; p = .037). These findings suggest that *Kies Awa*, an evidence-based adapted intervention, could be implemented in other Caribbean islands to improve children's water consumption. This approach could be integrated into school health programs, contributing to public health. These findings may help achieve the United Nations' goal of ensuring healthy lives for all children, even in under-researched world regions.

INTRODUCTION

Water consumption is related to better health outcomes (Chouraqui, 2023; Jequier & Constant, 2010), such as the prevention of obesity (Çıtar Dazıroğlu & Acar Tek, 2023; Stookey, 2010) and dental cavities (Kim, 2021). Concerningly studies from around the world have revealed that children consume insufficient amounts of water (Bottin et al., 2019; Suh & Kavouras, 2019), coupled with excessive amounts of sugar-sweetened beverages (SSBs; Singh, Micha, Khatibzadeh, Shi, et al., 2015). The consumption of SSBs by children, including soda, sweetened fruit drinks, sports drinks, and sweetened milk beverages, has consistently been linked to weight gain (Jakobsen et al., 2023; Luger et al., 2017; Malik et al., 2006), dental decay (Kusama et al., 2022), type 2 diabetes (Yoshida & Simoes, 2018), and cardiovascular diseases (Vos et al., 2017). Compared with other regions, the Caribbean region has the highest SSB consumption rates (Singh, Micha, Khatibzadeh, Shi, et al., 2015) and high obesity rates among children (Caribbean Public Health Agency, 2015). These high rates put children in the Caribbean at high risk for health issues, requiring the promotion of good health practices among them.

Considering the context of inadequate water consumption and excessive SSB consumption, along with tendencies of early-life choices persisting into adulthood (Mikkila et al., 2005; Movassagh et al., 2017; Rodger & Papies, 2022), targeting community health promotion strategies for children becomes an important health investment approach to create 'well-being societies' (WHO, 2021). Hence, researchers have implemented interventions aimed at promoting water consumption to reduce SSB consumption among children. Overall, these interventions effectively improved beverage consumption patterns (Avery et al., 2015; Franse et al., 2020; Vargas-Garcia et al., 2017). However, most of these interventions have been implemented in North America and Europe, which highlights the importance of conducting research outside of these WEIRD countries (Western, Educated, Industrialized, Rich, and Democratic) to inform strategies in other parts of the world that are under-researched. In doing so, contributions are made to the Sustainable Development Goals (SDGs) of the United Nations ("The 17 Goals", 2024), more specifically, Goal 3, which addresses children's health and well-being. These SDGs serve all children worldwide while referring to small island states as populations requiring more attention (UN DESA, 2023). Giving this attention contributes to ensuring that children in all regions have an equal right to exposure to health-promoting activities.

Research on interventions aimed at promoting water consumption to reduce SSB consumption in the Caribbean region, including the Caribbean

island Aruba, is scarce and much needed (Caribbean Public Health Agency, 2015). For these reasons, two studies specifically related to improving and understanding water consumption were conducted. The first underscores the potential of continuing the path of a water promotion intervention approach rooted in social networks by successfully utilizing peers at schools (Franken et al., 2018). The second study confirms the importance of conducting research in the region by showing behavioral differences between the Caribbean and Europe, specifically regarding factors that influence water consumption (Franken et al., 2023). More specifically, this study indicated that the intrinsic motivation to consume water was more important for adolescents from Aruba than for those from the Netherlands. Therefore, the present study aimed to examine the effectiveness of a social network, evidence-based adapted intervention promoting water consumption and thereby reducing SSB consumption among children in Aruba. This strategy may contribute to better short- and long-term health outcomes and reduce the strain on public healthcare systems (Alcaraz et al., 2023; Cho et al., 2019).

Social Network Interventions

Social network interventions designate a set of individuals as 'influential peers' to spread specific messages or behaviors throughout a network (Valente, 2012). Such interventions have shown promising results in changing health behaviors (Christakis & Fowler, 2011; Latkin & Knowlton, 2015), including increasing children's water consumption and reducing SSB consumption (Smit et al., 2021a; Smit et al., 2016). In Aruba, Franken et al. (2018) implemented the *Share* H_2O program, a social network intervention (SNI) originally developed in the Netherlands by Smit et al. (2016) that successfully increased water consumption and reduced SSB consumption among children in a Dutch study. This pilot SNI executed in Aruba also demonstrated similar effects in the intervention group. That is, water consumption increased among children in Aruba who were receptive to friends' injunctive norms. Injunctive norms refer to individuals' perceptions of whether others approve or disapprove of a particular behavior (Cialdini et al., 1991). In addition, SSB consumption decreased among children in the Aruban study, regardless of perceived social norms. Building upon these promising findings, we continued to pursue the path of this SNI approach for health promotion in school communities in Aruba. The findings and experience of this pilot study were used as input to adapt the intervention further to the Aruban context.

Adapting Social Network Interventions to the Local Context

The *Share H_2O* intervention (Smit et al., 2016) was implemented in Aruba in the same way as in the Netherlands (Franken et al., 2018), and the findings described above served as input for adapting the intervention to Aruba's context. In addition, to adapt the intervention further, we used insights from a recent cross-country comparison of behavioral determinants. This cross-country research (Franken et al., 2023) revealed that, in comparison to the Netherlands, intrinsic motivation and friends' descriptive norms were more strongly associated with water consumption for individuals in Aruba. Intrinsic motivation refers to an individual's innate desire to drink water because it is inherently enjoyable (Ryan & Deci, 2017). Friends' descriptive norms here refer to individuals' perceptions of the frequency of others drinking water (Cialdini et al., 1991). This study also showed that, for Aruba, favorable attitudes toward water consumption and the perception of having behavioral control over water consumption were key factors. Attitude refers to individuals' positive evaluations of water consumption, and behavioral control refers to individuals' perceptions that one is able to and is in control of their water consumption behaviors (Ajzen, 1991).

Thus, the two previous studies particularly showed that perceived injunctive and descriptive norms play an important role in Aruba. Furthermore, the cross-country comparison highlighted that water consumption factors differ between the Caribbean and Western Europe, which underlines the importance of considering these countries' distinctive geography and culture when adapting interventions to the regional context (Barrera et al., 2013; Kumanyika, 2008). Therefore, the present study examined the effectiveness of an evidence-based adapted intervention for promoting water consumption, further examining the role of descriptive and injunctive norms. The details of the adaptations and reasons for doing so are described in the Methods section.

Study Aims

The objectives of this study are to (1) test the effect of the evidence-based adapted social network intervention named *Kies Awa* (which translates to *Choose Water*) on children's water and SSB consumption and (2) examine the moderating role of children's descriptive and injunctive norms of water and SSB consumption on the intervention's effect.

METHODS

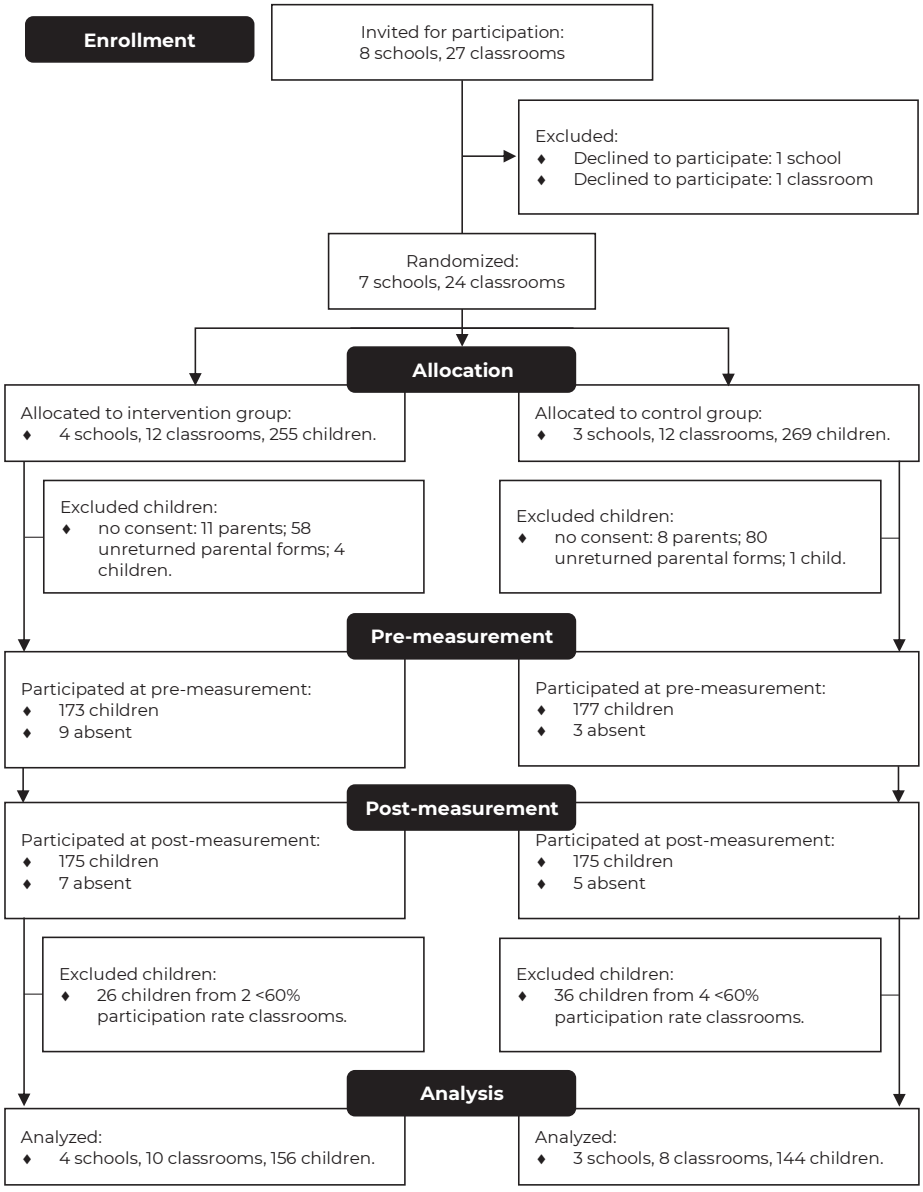
Design

This study used a cluster randomized control trial (RCT) with schools as the unit of randomization. The participating schools were randomly assigned to one of two clusters: the intervention group (*Kies Awa* intervention) or the control group (no intervention). A randomized block design ensured balanced sample sizes among the groups. In addition, randomization was restricted based on the proximity of school locations to prevent contamination between the groups in the relatively small island setting. In the intervention group, participants were exposed to trained classroom peer influencers (PIs) promoting water consumption over SSB consumption (Franken et al., 2018; Smit et al., 2021a), while no intervention occurred in the control group. The primary outcome measure was water consumption and the secondary outcome was SSB consumption.

Using G*Power 3.1 (Faul et al., 2009), the sample size for this study was calculated based on the pilot SNI in Aruba (Franken et al., 2018), which found a small intervention effect size for water and SSB consumption (β = 0.12 and β = -0.12, respectively) that was then converted to Cohen's *f* (*f* = 0.12). For a repeated-measures ANOVA with an interaction between two groups and two repeated measures (power = 0.80, α = 0.05), 140 participants were needed. To anticipate non-response, attrition, and missing data, a much larger number of participants were recruited (see Figure 1 for the CONSORT flow diagram of participants).

Figure 1

CONSORT Flow Diagram of Participants



Procedure

The intervention lasted eight weeks, from January to March 2019. Pre-measurements were conducted one week before the intervention started. Participants completed paper-and-pencil questionnaires at their schools before and after the intervention, available in both Papiamento and Dutch, the official languages in Aruba. The pre-measurement questionnaire contained questions related to their demographic information, water and SSB consumption, as well as questions regarding their descriptive and injunctive norms of water and SSB consumption. At pre-measurement, the intervention group participants also answered sociometric nomination questions to identify PIs.

The same consumption and behavior-related questions were answered at post-measurement in the eighth week of the intervention. At post-measurement, participants were also asked to explain the purpose of the research to determine their awareness of the social network component. Among them, none expressed awareness of the purpose of incorporating PIs to promote water consumption. The procedures of this study were approved by the Ethics Committee of the Faculty of Social Sciences at Radboud University (ECW2014-1003-203) and followed the data management protocol of the Behavioural Science Institute of Radboud University. This RCT study was preregistered (2018-12-20) and its main ID number is NL-OMON26157 (https://trialsearch.who.int/Trial2.aspx?TrialID=NL-OMON26157).

Participants

Figure 1 illustrates the CONSORT flow diagram of participants in this study. Eligible participants were 5th and 6th-grade public primary school children in Aruba whose schools met the criteria of not being involved in other curriculum-based health programs and not having participated in the pilot SNI. Eight schools (27 classrooms) were invited to participate. Active consent was obtained from the head of the educational inspection, school board, principals, and parents/caregivers. One principal and one teacher from another school declined participation, leaving seven schools. Four schools (255 children) were randomly assigned to the intervention group, and three schools (269 children) were assigned to the control group.

Of the 524 invited children, 19 parents did not give active consent, and 138 did not submit consent forms. Before the pre-measurement questionnaires were distributed, the children provided assent by signing a form, and five declined to participate. At pre-measurement, 12 children were absent. Similarly, due to absenteeism, 12 children could not complete the questionnaire at

post-measurement. After data collection, six out of the 24 classrooms had a participation rate of less than 60%, which may hinder the examination of the effects of the SNI (Marks et al., 2013; Smit et al., 2021a). For this reason, two classrooms from the intervention group and four from the control group were excluded from the analysis. The final analytical sample consisted of 7 schools with 18 classrooms and 300 participants aged 9 to 14. Of these, the intervention group included 4 schools with 10 classrooms and containing 156 participants (*M* = 11.08, *SD* = 1.00; 53.8% girls), while the control group included 3 schools, 8 classrooms, 144 participants (*M* = 11.32, *SD* = 0.96; 52.8% girls).

The Social Network Intervention

This study aimed to examine the effectiveness of an adapted SNI for promoting the healthy behavior of choosing water consumption over SSBs. The Aruban intervention, *Kies Awa* (Choose Water), was based on the Dutch *Share* H_2O intervention (Smit et al., 2021b), which utilized self-determination theory (SDT) techniques (Deci & Ryan, 1985; Ryan & Deci, 2017). We made two key adaptations for Aruba. We provide a brief overview of the intervention's approach before describing the two key adaptations.

Intervention Approach

The Aruban intervention resembles the Dutch intervention in that it involved identifying PIs from each classroom, providing them with training, and offering follow-up support sessions. The training, facilitated by the first author, lasted 90 minutes. The training had two objectives. The first objective was to help PIs develop intrinsic motivation for water consumption through training materials that emphasize the benefits of water and drawbacks of SSBs, as well as by supporting their personal reasons for choosing water (Smit et al., 2021b). The second objective was to empower PIs to motivate their classmates to consume more water through two strategies: modeling the behavior (i.e., descriptive norms) by consuming more water themselves and communicating (i.e., injunctive norms) about consuming water (Cialdini et al., 1991). By practicing these skills, they also learned skills to address potential difficulties they may face in their role. Follow-up sessions were conducted during Week 3 and Week 6 to provide general support, facilitate sharing experiences, and review information. For a description of the SDT-based techniques and training components, refer to Smit et al. (2021b).

Kies Awa: *Adaptations to the Aruban Context*

We made two key adaptations to the training of the original Dutch *Share H_2O* intervention for the Aruban *Kies Awa* intervention: (1) adding roleplay techniques and (2) incorporating educational materials appropriate for Aruba.

Regarding the first adaptation, adding roleplay techniques allowed PIs to practice promoting water consumption and apply their knowledge in real-life school settings (Lanigan, 2011; Lloyd et al., 2011). We added roleplay as a behavioral change technique for two reasons. The first reason was to address the social norms associated with water consumption identified as an important behavioral determinant in previous Aruban research (Franken et al., 2018; Franken et al., 2023). Through roleplay, PIs were encouraged to model the behavior of water consumption (to influence perceived descriptive norms) and to communicate about it (to influence perceived injunctive norms). In doing so, they motivated their classmates to increase their water consumption. During the main roleplay assignment, PIs engaged in various simulated scenarios. Working in pairs, they customized the scenarios to their preferences and discussed possible interactions between the 'peer influencer' and the 'classmate.' They then acted out their scenario, allowing other PIs to observe. To provide a clear understanding of their role through this roleplay assignment, the trainer enacted an example script where the classmate expressed thirst after playing tag at school, and the peer influencer recommended consuming water to quench thirst and regain energy, suggesting that they fill their water bottles at the water cooler.

The second reason to add roleplay as a behavioral change technique was to emphasize the importance of intrinsic motivation for water consumption in Aruba (Franken et al., 2023). Roleplay and discussions also served to encourage PIs to initiate water consumption autonomously and by spreading this behavior, motivating classmates to do the same (Ryan & Deci, 2017; Smit et al., 2021b; Soenens & Vansteenkiste, 2010). Through discussions and roleplay, PIs learned to identify opportunities (e.g., feeling thirsty after exercise) and difficulties (e.g., not having easy access to water in classrooms) and develop strategies to benefit from opportunities (e.g., encourage filling water bottles at water coolers) or face difficulties (e.g., encourage carrying a reusable water bottle to school).

During the roleplay assignment, PIs also learned to consider their own perspectives and those of their classmates regarding water consumption. They also learned to provide their classmates with reasons to, for example, choose to consume water after physical exercise at school instead of SSBs. By modeling

and communicating about water consumption with their classmates, the PIs fostered a social environment that promoted intrinsic motivation among their classmates to consume more water as well (Smit et al., 2021b). In addition, throughout the training, the PIs practiced their role through roleplay activities such as pouring water for each other, drinking together, communicating about it, and using positive nonverbal cues (e.g., nodding or thumbs-up).

Regarding the second adaptation, we incorporated educational materials appropriate for the Aruban context to provide PIs with more relevant reasoning to increase water consumption and to encourage PIs to promote water consumption among their classmates. The first reason to incorporate context-appropriate materials was to account for the important factors of having favorable attitudes toward water consumption and positive perceptions of behavioral control regarding water consumption that were identified in previous Aruban research (Ajzen, 1991; Franken et al., 2023). For example, given that environmental preservation is a concern in Aruba, we made it more meaningful for PIs by emphasizing the environmental benefits of consuming water during the training. The materials included visual imagery and discussions emphasizing the ease of increasing water consumption, its positive impact on personal health, and the island's natural environment, wildlife, and marine ecosystems. To achieve these positive impacts, we emphasized the use of reusable water bottles (Smit et al., 2021b) to contribute to reducing the high amounts of litter associated with SSBs (de Scisciolo et al., 2016; Debrot et al., 2014; Hartley et al., 2015).

The second reason was that the original *Share H_2O* intervention materials were designed for a Dutch audience, requiring adaptations to align with Aruba's specific context. To establish a stronger connection between the intervention and the local context and encourage PIs to consume more water and less SSBs, we incorporated pictures of children and nature that resonated with the PIs. Additionally, we included recent Aruban consumption data to underscore the alarming levels of sugar intake among children in Aruba (Franken et al., 2018). As part of the training, the children also learned the skill of reading nutrition facts labels, enabling them to calculate the high number of teaspoons of sugar in SSBs. This knowledge was aimed at reinforcing their understanding that water consumption is essentially the only healthy option because it does not contain sugar.

Measures

Sociometric Peer Nominations

During pre-measurement at intervention schools, participants nominated PIs by writing a maximum of five names of classmates on five sociometric questions. These questions asked whom in their classroom they "wanted to be like," "looked up to," "respected," "regarded as good leaders," and "went for advice" (Campbell et al., 2008; Starkey et al., 2009). The role of a PI was offered to 15% of males and 15% of females, with most nominations preserving the sex distribution in each classroom (Campbell et al., 2008; Starkey et al., 2009). Due to the absence of two nominated peers from different classrooms, the next two most nominated peers were invited to participate. A total of 38 participants from ten intervention classrooms (M = 4 children per classroom, SD = 0.21) accepted the invitation and were trained as a PI to promote water consumption (50% females; M age = 11.3, SD = 1.01).

Water Consumption

Water consumption was measured by asking participants at pre- and post-measurement how much water they drank during a normal school day. The answer options ranged from 0 = *zero glasses* to 7 = *seven or more glasses*. To facilitate participants' quantity estimation, the questionnaire illustrated that a glass also represents a bottle, a can, or a package (Franken et al., 2023; Smit et al., 2018).

Sugar-Sweetened Beverages Consumption

SSB consumption was measured by asking participants at pre- and post-measurement how many glasses of (a) sweetened juice drinks, (b) soda, and (c) energy and sports drinks they drank on a normal school day. The answer options ranged from 0 = *zero glasses* to 7 = *seven or more glasses*. Examples of SSB brands or names were given. To facilitate participants' quantity estimation, the questionnaire illustrated that a glass also represents a bottle, a can, or a package (Franken et al., 2023; Smit et al., 2018). The average response across the three SSB consumption items was used to obtain each participant's total SSB consumption score.

Descriptive Norms of Water and Sugar-Sweetened Beverages Consumption

Participants' perceptions of their classmates' water and SSB consumption were measured at pre- and post-measurement by asking, "How often do your

classmates consume water/SSB?" The answer categories ranged from 1 = *never* to 6 = *always* (Franken et al., 2023; Smit et al., 2018).

Injunctive Norms of Water and Sugar-Sweetened Beverages Consumption

Participants' perceptions of receiving approval from their classmates to consume water and disapproval to consume SSBs were measured at pre- and post-measurement by asking, "How often do your classmates approve/disapprove that you drink water/SSB?" Answer categories ranged from 1 = *never* to 6 = *always* (Franken et al., 2023; Smit et al., 2018).

Thirst Level

Thirst level was included as a covariate given that it correlates with the beverage consumption of the participants (Franken et al., 2018; Smit et al., 2018). Therefore, before participants completed the questionnaire at pre- and post-measurement, they were asked to indicate their thirst level by answering "How thirsty are you now?" using a visual analog scale (VAS) of 16 cm ranging from 0 = *not thirsty at all* to 16 = *very thirsty* (Bevelander et al., 2012).

Statistical Analyses

The mean and standard deviation were examined for each variable. Independent samples *t*-tests were used to determine whether the scores differed between the intervention group and control group at pre-measurement and post-measurement for all study variables. Pearson's correlations between the study variables were examined.

For the main analyses, we executed Linear Mixed Modeling (LMM) analyses in JASP Version 0.18.2 Intel (JASP Team, 2024) to examine the effect of the intervention on the study outcomes of water consumption and SSB consumption. These regression-based hierarchical models take into account the four-level hierarchical structure of our dataset (Field, 2013). Water and SSB consumption represented separate dependent variables for every child in a treatment group (intervention or control) in a classroom at a school. Repeated measures (level 1) were nested within children (level 2), who were nested within classes (level 3), which were nested within schools (level 4). We constructed our model in four steps to find the best-fitting model. To compare the models and to test whether predictors contribute to the explanation of the change in water consumption and SSB consumption, model fit was evaluated with an X^2 difference test, which is calculated as the difference between the deviance

statistics (-2 log-likelihood) of the two models that are compared (Hox et al., 2017).

In the first step, for both outcomes, we ran a model that included four levels with time (pre- or post-measurement) as a fixed effect (predictor). With this model, we determined whether significant clustering (dependency in the data) occurred. For this purpose, we calculated intra-class correlations (ICC) for levels 2 (individuals), 3 (classes), and 4 (schools). If the ICC at a particular level was below .05, it indicated that no substantial clustering occurred at that level and that it could be removed from the model (Field, 2013). In the second step, we removed those levels that displayed an ICC < .05. In the third step, we added along with time, the treatment group, and the interaction effect between treatment group and time as fixed effects. The significance of the treatment by time interaction effect was tested for our first objective regarding the main effect of *Kies Awa* on children's water and SSB consumption. In the fourth step, we added the covariate thirst level to examine whether our results changed after controlling for thirst level. Then, to further examine the model findings for changes in water and SSB consumption between pre- and post-measurement for each treatment group, we conducted paired sample *t*-tests.

For the second objective regarding testing for the moderating effect of children's descriptive and injunctive norms of water and SSB consumption on the intervention's effect, we included three-way interaction effects (treatment by time by norm) for each norm in each outcome model. To further understand the effect of the intervention on participants with low (1 *SD* below the mean) versus high (1 *SD* above the mean) levels of social norms for water and SSB consumption, significant interaction effects were further interpreted using simple slope analysis.

To explore the effect of the training on the PIs, we conducted two additional analyses. Paired sample *t*-tests were conducted to determine the impact of the training on the water and SSB consumption of the PIs. In addition, to explore the extent to which PIs used water promotion strategies, we computed means, standard deviations, and percentages (with a positive score of 3 or higher) for their post-measurement answers to questions regarding how often they used modeling and communication strategies to promote water consumption among their classmates (scale from 1 = *never* to 6 = *always*; Smit et al., 2021b).

RESULTS

Descriptives

Descriptive statistics showed that participants' pre-measurement consumption averaged 3.93 (*SD* = 1.83) glasses of water and 1.06 (*SD* = 0.91) glasses of SSBs daily. Table 1 provides means, standard deviations, and (non) significant differences for all variables by intervention and control groups at pre-measurement and post-measurement. Table 2 shows Pearson's correlations between the study variables.

Table 1

Descriptive Statistics for the Intervention and Control Groups at Pre-Measurement and Post-Measurement[1]

Measure	Pre-measurement							Post-measurement						
	Intervention			Control				Intervention			Control			
	M	*SD*	Range	*M*	*SD*	Range	p^2	*M*	*SD*	Range	*M*	*SD*	Range	p^2
Thirst (16-cm Visual Analogue Scale)	6.1	5.5	0-16	6.5	5.1	0-16	.486	7.9	5	0-16	7.3	4.3	0-16	.333
Water consumption (i.e., glasses)	3.7	1.8	0-7	4.2	1.8	0-7	.009	3.9	1.9	0-7	4.0	1.7	0-7	.822
Sugar-sweetened beverages consumption (i.e., glasses)	1.0	0.8	0-3.7	1.2	1	0-6.7	.092	1.0	0.9	0-4.7	1.0	1.1	0-6	.543
Descriptive norm water consumption	4.2	1.2	2-6	4.0	1.2	1-6	.250	4.2	1.2	1-6	4.1	1.2	1-6	.163
Descriptive norm sugar-sweetened beverages consumption	3.8	1.2	1-6	4.2	1.2	1-6	.019	4.1	1.2	1-6	4.5	1.3	1-6	.009
Injunctive norm water consumption	3.8	1.6	1-6	3.6	1.7	1-6	.381	3.4	1.7	1-6	2.8	1.7	1-6	.005
Injunctive norm sugar-sweetened beverages consumption	2.3	1.5	1-6	2.2	1.3	1-6	.288	2.3	1.5	1-6	1.9	1.4	1-6	.056

[1] N = 300; 156 participants were in the intervention group and 144 participants were in the control group.
[2] p values reflect the differences in the means between the intervention and control groups at pre-measurement or post-measurement by independent samples t-tests.

Table 2

Pearson Correlations Among the Variables at Pre-measurement (T1) and Post-measurement (T2)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Thirst level T1	–	.425**	.218**	.084	.097	-.017	.078	.160**	.081	.077	-.023	-.022	-.027	-.084
2. Thirst level T2			.172**	.156**	.047	.040	.132*	.137*	-.090	.083	.229**	.187**	.037	-.007
3. Water consumption T1				.413**	.195**	.111	.076	.050	.058	.154*	.139*	.009	.056	-.029
4. Water consumption T2					.141*	.197**	.125*	.172**	.109	.081	.084	.076	.124*	.040
5. Sugar-sweetened beverages consumption T1						.498**	.029	-.022	.130*	.082	.038	-.018	.108	-.036
6. Sugar-sweetened beverages consumption T2							-.019	.076	.078	.068	.046	.062	.046	.031
7. Descriptive norm water consumption T1								.355**	-.029	-.113	.261**	.205**	.212**	.110
8. Descriptive norm water consumption T2									-.022	-.024	.256**	.339**	.125*	.071
9. Descriptive norm sugar-sweetened beverages consumption T1										.377**	-.069	-.043	-.108	-.060
10. Descriptive norm sugar-sweetened beverages consumption T2											-.081	-.096	-.119*	-.111
11. Injunctive norm water consumption T1												.315**	.297**	.169**
12. Injunctive norm water consumption T2													.141*	.421**
13. Injunctive norm sugar-sweetened beverages consumption T1														.230**
14. Injunctive norm sugar-sweetened beverages consumption T2														–

Note. $N = 300$. * $p < .05$ and ** $p < .01$ indicate statistical significance.

Main Analyses

The Effect of Kies Awa *on Water Consumption*

To determine the effectiveness of *Kies Awa* for water consumption, we constructed four linear mixed effects models. Table 3 contains the results of the fixed effects and variance estimates for water consumption. The results of the first model determined to what extent we should take into account the hierarchical structure of our dataset. The total variance was split into four levels. The ICCs for water consumption were 0.377 (level 2), 0.042 (level 3), and 9.812^{-10} (level 4). This indicated a significant clustering of repeated measurements within children but not between children in the same classrooms and schools. Therefore, the class and school levels were removed from the model. The two-level model did not fit the data significantly worse than the four-level model (X^2 change = 5.675(2), $p > .05$; see Model 2, Table 3). Next, along with time, the treatment group and the interaction effect between time and treatment group were included in the model (see Model 3, Table 3). The model fit significantly improved with the addition of these fixed effects (X^2 change = 8.153(2), $p < .05$). It also showed a significant interaction effect between time and treatment group on water consumption ($p = .023$). In the fourth step, thirst level was added to the model (see Model 4, Table 3). This improved the fit of the model as well (X^2 change = 90.397(1), $p < .01$), and the interaction effect between time and treatment group remained significant after controlling for thirst level ($p = .015$; see Model 4, Table 3). This indicates that children in the intervention group consumed significantly more water units (i.e., glasses) over time compared to children in the control group after controlling for thirst level. Further examination of this effect by means of paired samples *t*-test showed a significant increase in water consumption in the intervention group ($M_{pre} = 3.63$, $SE = 0.15$; $M_{post} = 3.94$, $SE = 0.16$; $t(140) = -1.83$, $p = .035$) and a marginally significant decrease in water consumption in the control group ($M_{pre} = 4.20$, $SE = 0.15$; $M_{post} = 3.98$, $SD = 0.14$; $t(138) = 1.45$, $p = .075$).

Table 3

Multilevel Regression Analysis Examining the Fixed Effects of the Intervention on Water Consumption Over Time

Effect	Model 1		Model 2		Model 3		Model 4		Model 5A		Model 5B	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Fixed effects												
Intercept	3.946**	0.123	3.955**	0.088	3.960**	0.088	3.576**	0.136	2.975**	0.288	3.223**	0.200
Time	-0.022	0.057	-0.020	0.058	-0.018	0.057	0.020	0.059	0.261	0.236	-0.192	0.146
Treatment group					0.151	0.088	0.139	0.087	0.341	0.274	0.367	0.172
Time * treatment group					0.130*	0.057	0.141*	0.058	0.040	0.235	0.386*	0.146
Thirst level							0.057**	0.015	0.056**	0.015	0.055**	0.015
Descriptive norm									0.146*	0.063		
Time * treatment group * descriptive norm									0.021	0.056		
Injunctive norm											0.101*	0.044
Time * treatment group * injunctive norm											-0.067	0.039
Random components												
Child level variance	1.223		1.357		1.354		1.274		1.243		1.259	
Class level variance	0.138											
School level variance	3.187×10^{-9}											
Residual variance	1.887		1.890		1.855		1.818		1.816		1.790	
Deviance (-2 log-likelihood)	2269.692		2275.367		2267.214		2176.817		2133.980		2111.599	
X^2 change test			5.675(2), $p > .05$		8.153(2), $p < .05$		90.397(1), $p < .01$		42.837(4), $p < .01$		65.218(4), $p < .01$	

Note. The treatment group was coded as 0 (control group) or 1 (intervention group).
The final model (Model 4) was built in steps and represents the best-fitting model.
Model 1: model with time; Model 2: model with level 1 main effects; Model 3: model with between-level interaction terms; Model 4: model with the covariate thirst level.
* $p < .05$, ** $p < .001$.

The Effect of Kies Awa *on Sugar-Sweetened Beverages Consumption*

For SSB consumption, the same four steps were taken to determine the effectiveness of *Kies Awa*, and the results are shown in Table 4. In the first model, the ICCs for SSB consumption were 0.488 (level 2), 2.797×10^{-10} (level 3), and 0.003 (level 4). This indicates a significant clustering of repeated measurements within children but not between children in the same classrooms and schools. Therefore, the class and school levels were removed from the model. The two-level model did not fit the data significantly worse than the four-level model (X^2 change = 0.13(2), $p > .05$; see Model 2, Table 4). Next, along with time, the treatment group, and the interaction effect between time and treatment group were included in the model (see Model 3, Table 4). The model fit was not significantly improved by the addition of these fixed effects (X^2 change = 2.762(2), $p > .05$). It also showed a nonsignificant interaction effect between time and treatment group on SSB consumption ($p = .325$). Next, thirst level was added to the model (see Model 4, Table 4). Model 4 resulted in a good fit of the model (X^2 change = 48.411(1), $p < .01$) but yielded a nonsignificant interaction effect between time and treatment group ($p = .458$; see Model 4, Table 4). This indicated that SSB consumption did not significantly decrease in children in the intervention group over time compared to that in children in the control group after controlling for thirst level. Further examination of these results by means of paired samples *t*-test confirmed that the units (i.e., glasses) of SSBs consumed did not change significantly for children in the intervention group ($M_{pre} = 0.97$, $SE = 0.07$; $M_{post} = 0.99$, $SE = 0.07$; $t(142) = -0.19$, $p = .432$), nor for children in the control group ($M_{pre} = 1.15$, $SE = 0.08$; $M_{post} = 1.05$, $SD = 0.09$; $t(138) = 1.16$, $p = .123$).

Table 4

Multilevel Regression Analysis Examining the Fixed Effects of the Intervention on Sugar-Sweetened Beverage Consumption Over Time

Effect	Model 1		Model 2		Model 3		Model 4		Model 5A		Model 5B	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Fixed effects												
Intercept	1.030**	0.053	1.034**	0.047	1.036**	0.047	0.922**	0.071	0.726**	0.146	0.802**	0.093
Time	0.022	0.028	0.022	0.028	0.022	0.028	0.040	0.030	-0.015	0.115	-0.023	0.060
Treatment group					0.063	0.047	0.067	0.047	-0.152	0.140	0.046	0.075
Time * treatment group					0.028	0.028	0.022	0.029	0.142	0.115	0.135*	0.060
Thirst level							0.016*	0.008	0.016*	0.008	0.017*	0.008
Descriptive norm									0.044	0.032		
Time * treatment group * descriptive norm									-0.028	0.027		
Injunctive norm											0.051	0.027
Time * treatment group * injunctive norm											-0.052*	0.025
Random components												
Child level variance	0.431		0.434		0.431		0.401		0.397		0.393	
Class level variance	2.470×10^{-5}											
School level variance	0.003											
Residual variance	0.449		0.449		0.447		0.461		0.461		0.457	
Deviance (-2 log-likelihood)	1500.902		1501.032		1498.270		1449.859		1422.859		1405.916	
X^2 change test			0.13(2), $p > .05$		2.762(2), $p > .05$		48.411(1), $p < .01$		27(4), $p < .01$		43.943(4), $p < .01$	

Note. The treatment group was coded as 0 (control group) or 1 (intervention group).
The final model (Model 4) was built in steps and represents the best-fitting model.
Model 1: model with time; Model 2: model with level 1 main effects; Model 3: model with between-level interaction terms; Model 4: model with the covariate thirst level.
* $p < .05$, ** $p < .001$.

The Moderating Effect of Social Norms on the Effect of Kies Awa *on Water Consumption*

To test whether social norms influenced the effectiveness of *Kies Awa* on water consumption, we conducted moderation analyses for descriptive norm (Model 5A) and injunctive norm (Model 5B) separately (see Table 3). Model 5A, which included a three-way interaction term between the treatment group, time, and descriptive norm of water consumption, resulted in a significant improvement in the model fit (X^2 change 42.837(4), $p < .01$), but the three-way interaction term was nonsignificant ($p = .700$; see Model 5A, Table 3). Model 5B resulted in a good fit of the model (X^2 change 65.218(4), $p < .01$), but the three-way interaction term for the treatment group, time, and injunctive norm of water consumption was nonsignificant ($p = .086$; see Model 5B, Table 3). These findings indicated that children's perceived social norms in the intervention group did not moderate the effect of the intervention on water consumption.

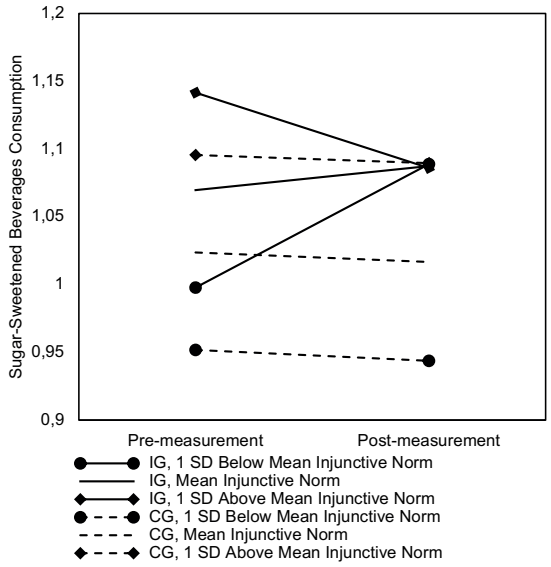
The Moderating Effect of Social Norms on the Effect of Kies Awa *on Sugar-Sweetened Beverages Consumption*

For SSB consumption, we also conducted moderation analyses for descriptive norm (Model 5A) and injunctive norm (Model 5B) separately (see Table 4). Model 5A resulted in a good fit (X^2 change 27(4), $p < .01$) but yielded a nonsignificant three-way interaction term for the treatment group, time, and descriptive norm of SSB consumption ($p = .297$; see Model 5A, Table 4). Model 5B resulted in a good fit of the model (X^2 change 43.943(4), $p < .01$), and a significant three-way interaction term for the treatment group, time, and injunctive norm of SSB consumption ($p = .037$) was found (see Model 5B, Table 4). The simple slopes of this significant interaction showed that, over time, in the intervention group, SSB consumption was reduced for children with high levels of injunctive norm, SSB consumption remained stable for those with mean levels of injunctive norm, and SSB consumption increased for those with low levels of injunctive norm. In the control group, SSB did not change much regardless of the levels of injunctive norm. These slopes indicated that the effect of *Kies Awa* on SSB consumption depended on the level of injunctive norm. Figure 2 illustrates these slopes of the interaction effects between the intervention group or

control group and low, mean, or high injunctive norm of SSB consumption for predicted SSB consumption.

Figure 2

Interaction Effects between the Intervention Group or Control Group and Low, Mean, or High Injunctive Norm of Sugar-Sweetened Beverages Consumption for Predicted Sugar-Sweetened Beverages Consumption



Note. IG = intervention group; CG = control group; SD = standard deviation. The sugar-sweetened beverages consumption predictions include a mean thirst level covariate.

Additional Analyses

We conducted two additional analyses to explore the effect of the training on PIs. First, a paired sample *t*-test was conducted to examine the impact of the training on the water and SSB consumption of the PIs (n = 38). After the training, the water consumption of the PIs significantly increased compared to that before the training (M_{pre} = 3.46, SE = 0.30; M_{post} = 4.41, SE = 0.28; $t(36)$ = -4.99, p = < .001). However, there was no significant reduction in SSB consumption (M_{pre} = 0.84, SE = 0.12; M_{post} = 0.82, SE = 0.12; $t(37)$ = 0.19, p = .850). These results indicate that after attending the training, the PIs consumed more water but not less SSBs.

Second, to explore which strategies the PIs applied to promote water consumption among their classmates after the training, we calculated means, standard deviations, and percentages (scoring ≥ 3). PIs indicated that they

used modeling strategies, such as consuming water in each other's presence (*M* = 4.68, *SD* = 1.47) and consuming water together with each other (*M* = 3.95, *SD* = 1.51), which were used by 95% and 86% of PIs, respectively (scoring ≥ 3). Additionally, the PIs indicated using communication strategies, such as expressing approval for their classmates' water consumption (*M* = 3.59, *SD* = 1.46) and reminding their classmates about water consumption (*M* = 3.68, *SD* = 1.29), which were used by 78% and 89% (scoring ≥ 3) of the PIs, respectively. These explorative results suggest that during the intervention period, PIs used both modeling strategies and communication strategies within their social network. However, the PIs indicated the use of more modeling strategies than communication strategies.

DISCUSSION

This study examined the effectiveness of *Kies Awa*, a social network intervention aimed at promoting water consumption and reducing SSB consumption among primary school children in Aruba. In addition to assessing the intervention's effect on consumption behaviors, the study also tested whether the prevailing social norms interacted with the intervention's effectiveness. The findings suggest that *Kies Awa* had a significant impact on increasing overall water consumption but did not reduce overall SSB consumption. Furthermore, the study revealed that injunctive norms, which refer to perceived disapproval from classmates regarding the consumption of SSBs, interacted with the effect of *Kies Awa* on SSB consumption. This interaction effect indicates that the *Kies Awa* intervention leads to a reduction in SSBs only among children who already experienced that their peers disapprove of their consumption of SSBs.

Children's Water Consumption and the Social Environment

Children exposed to the *Kies Awa* intervention reported an increase in water consumption compared to children in the control group. Thus, it seems that incorporating PIs into interventions to promote water consumption can be a successful strategy for improving the water consumption of their peers in their social network at school. These findings are in line with research showing that peers in the social environment can play a role in influencing the food and beverage consumption of others (Herman & Polivy, 2005; Hermans et al., 2012; Higgs, 2015; Johnsunderraj et al., 2023; Lakin et al., 2003; Robinson et al., 2014; Salvy et al., 2012; Wouters et al., 2010).

However, the current study showed a more substantial effect on water consumption than a previously piloted social network intervention in Aruba. This previous pilot, a replication from the Netherlands, was implemented without adaptation to the local context (Franken et al., 2018). Consequently, it did not lead to an overall increase in water consumption, but only an increase was found among children who reported higher levels of perceived approval for their water consumption (i.e., injunctive norms) at the beginning of the intervention. The present study's main effect underscores the importance of evidence-based adaptations to interventions in a local context, as this approach resulted in a more substantial effect. This finding supports research emphasizing the importance of adapting interventions for better effectiveness in different community contexts (Barrera et al., 2013; Kumanyika, 2008).

Children's Sugar-Sweetened Beverages Consumption and the Social Environment

We found that the effect of the *Kies Awa* social network intervention on children's SSB consumption depended on children's prevailing perceived injunctive norm about SSB consumption. Specifically, children in the intervention group who reported perceiving disapproval from others about their SSB consumption (i.e., high injunctive norm) before the intervention consumed less SSBs after being exposed to the intervention. Conversely, they consumed more SSBs when they did not perceive disapproval (i.e., low injunctive norm). This finding is in line with previous studies that found that normative peer influence plays a crucial role in shaping children's dietary behaviors (Herman & Polivy, 2005; Higgs, 2015; Robinson et al., 2014; Salvy et al., 2012; Wouters et al., 2010).

However, the present study's findings differ from those of a previously piloted study that found an overall reduction in SSB consumption without interactions with prevailing social norms (Franken et al., 2018). One possible reason for the less uniform effect on SSB consumption among the classmates of the PIs in the present study is that the PIs did not consume less SSBs after the training; thus, classmates were not given the example of consuming less SSBs during the intervention. In contrast, in the pilot study, PIs did give the example of consuming less SSBs, which could have led to a reduction in overall SSB consumption among their peers. Thus, both of these studies highlight that exposure to modeled behavior influences consumption behavior within SNIs, which is consistent with previous research (Latkin & Knowlton, 2015; Salvy et al., 2012; Smit et al., 2021b).

Implications for Future Research

Concerning their beverage consumption, the children in this study did not meet the guidelines recommended by the Aruban health authorities, which state that children aged 9 to 12 should consume six to eight glasses of water or non-caloric beverages daily (DVG & IDEFRE, 2012). This public health issue of inadequate hydration among children has also been found in other countries worldwide (Bottin et al., 2019; Suh & Kavouras, 2019). Although water consumption improved after *Kies Awa*, the amount of water consumed by children, approximately four glasses, was still inadequate. Therefore, water consumption must be addressed further.

Additionally, the study findings indicate that children consumed approximately one glass of SSB daily. This daily SSB consumption is problematic, as even one serving of approximately 330 milliliters contains, on average, ten teaspoons of sugar (140–150 calories). Research has shown that eliminating such daily SSB consumption could prevent children from gaining weight (Malik et al., 2013; Zheng, Allman-Farinelli, et al., 2015). Addressing this daily SSB consumption in future research is important because recent research involving Aruban preschoolers demonstrated that they already show an unhealthy lifestyle characterized by excessive sugar consumption from SSBs and candies (Curet & Vermeulen, 2023).

Future research could also consider applying a mixed-methods approach to increase children's water consumption and reduce their SSB consumption, including for example, collaboration with PIs to improve the training materials of the intervention (Healthy Caribbean Coalition, 2022a; Smit et al., 2022; Zoellner et al., 2013). Furthermore, given our finding that *Kies Awa* can reduce SSB consumption among children who experience peers' disapproval regarding the consumption of SSBs, future co-created interventions could consider influencing injunctive norms related to SSB consumption. For example, through co-creation, PIs could be trained to discourage daily SSB consumption on school premises by suggesting the consumption of SSBs only during special occasions on weekends among their classmates. This approach could replace the one glass of daily SSB consumption in this study with one glass of water, bringing children closer to meeting the health authority guidelines. In addition, future interventions may consider targeting this SSB consumption issue directly rather than indirectly by promoting water consumption (Battram et al., 2016; Dibay Moghadam et al., 2020; Zoellner et al., 2024).

In addition, collaborating more closely with PIs could help clarify children's knowledge and determine the best approach to improve beverage consumption. Co-creation also fosters children's advocacy, increasing their intrinsic motivation and that of others in their social environment to consume adequate beverages (Gillison et al., 2019; Healthy Caribbean Coalition, 2022a; Smit et al., 2021a).

After all, as adults, we should support children in cultivating healthy behaviors at a young age (Fernandez-Jimenez et al., 2018; Vargas et al., 2013) to prevent adverse health effects when they reach adulthood (Hu, 2013; Zheng, Allman-Farinelli, et al., 2015). This approach could be integrated into school health programs. Furthermore, changing behaviors later in life may be even more challenging (Abrignani et al., 2019; Hu, 2013; Kelsey et al., 2014). Thus, children would benefit from future community intervention endeavors aimed at improving their beverage consumption.

Strengths, Limitations, and Implications

Interpreting our findings requires consideration of strengths, limitations, and implications. A strength of this study is that *Kies Awa* builds not only on a Dutch evidence-based intervention called *Share H_2O* but also on evidence from two previous Aruban studies. This approach resulted in a more substantial effect. Therefore, we recommend that future intervention research and practice apply such an evidence-based approach in new contexts to help contribute to public health. Furthermore, this research contributes to the SDGs addressing children's health ("The 17 Goals", 2024). These goals are intended for all children worldwide, while particularly referring to small island states, such as Aruba, as populations requiring more attention (UN DESA, 2023). Hence, given that children are vulnerable members of populations, we contribute to children's right to expose them to health-promoting activities and interventions in under-researched regions such as the Caribbean (Healthy Caribbean Coalition, 2022a). This study also contributes to the growing body of evidence on the effectiveness of SNIs in promoting healthy behaviors (Campbell et al., 2008; Chung et al., 2017; Cruwys et al., 2015; Kelly et al., 1991; Latkin & Knowlton, 2015; Robinson et al., 2014; Sebire et al., 2018; Story et al., 2002; Valente et al., 2003).

In addition to using self-reported measures, future research could use additional water consumption measures, such as analyzing urine samples (Armstrong et al., 2013), observing water consumption (Beets et al., 2014), or attaching flowmeters to water coolers (Loughridge & Barratt, 2005; Smit et al., 2021a). Furthermore, we collected data only once after the intervention period,

limiting the examination of mediation analyses and long-term effectiveness. Future research could incorporate additional time points to measure the perception of norms as mediating variables. Additional time points would facilitate assessing whether pre-measurement water consumption predicts norms (i.e., mediators) and subsequently predicts post-measurement water consumption (Fairchild & McQuillin, 2010). Furthermore, while examining these long-term effects, the effects on preventing dental caries (Kim, 2021) and weight gain among children (Çıtar Dazıroğlu & Acar Tek, 2023; Stookey, 2010) could also be investigated.

Conclusion

The social network intervention *Kies Awa* successfully promotes water consumption among children in Aruba, extending this approach beyond WEIRD countries. The next step is to discover ways the intervention can decrease SSB consumption more effectively for all children. The findings of this study demonstrate the importance of adapting interventions to suit new contexts. Furthermore, the knowledge acquired in this study can serve as input for intervention development that aims to motivate children in all parts of the world to consume more water, and with that, we can play our part in achieving Goal 3 of the SDGs, which is to ensure a healthy life for all children ("The 17 Goals", 2024). In the end, adults are responsible for implementing health-related policies so that children, who are vulnerable society members, live in community environments, such as schools, that encourage healthy behaviors (Healthy Caribbean Coalition, 2022a). Such school environments increase the likelihood of meeting health authorities' recommended guidelines and contributing to the development of healthier adults.


5

Chapter 5

General Discussion

GENERAL DISCUSSION

The general objective of this dissertation was to investigate the effectiveness of social network intervention as a method to promote water consumption among schoolchildren in Aruba. This general objective was structured around three empirical studies that (1) determined the potential of social network intervention for Aruba, (2) identified theory-based water consumption determinants, and (3) examined the effectiveness of an adapted intervention in the Aruban context. This General Discussion chapter summarizes and discusses the main findings of these studies, then reflects on the general limitations, gives implications and recommendations for future research and practice, and finalizes with a conclusion.

SUMMARY OF THE MAIN FINDINGS

The first study (Chapter 2) aimed to investigate whether social network intervention would have the potential for health promotion in Aruba. To determine the potential of this approach, I replicated and tested the effectiveness of the Dutch evidence-informed *Share H_2O* social network intervention targeting children's beverage consumption and behavioral intention (Smit et al., 2016). I also examined whether injunctive and descriptive norms of children's friends moderated the outcomes. Findings indicated that the intervention was promising because: (1) It improved water consumption when children experienced high injunctive norms. Thus, injunctive norms regarding water consumption moderated the effect of the intervention; (2) The intervention successfully decreased children's consumption of sugar-sweetened beverages (SSB); (3) The intervention effectively increased children's intention to consume fewer SSBs but did not increase children's intention to consume more water—potentially because their water intention scores at baseline measurement were already relatively high.

The second study (Chapter 3) investigated which theory-based factors were associated with adolescents' water consumption in Aruba and whether they differed from those in the Netherlands. This study aimed to acquire insight that could help adapt the intervention for the context of Aruba in the following intervention study. The findings indicated that: (1) Intrinsic motivation, attitude, descriptive norms of classmates, and perceived behavioral control were associated with water consumption among Aruban adolescents. (2) Adolescents' water consumption determinants differed between Aruba

and the Netherlands in that intrinsic motivation and descriptive norms played a more important role for Aruba than for the Netherlands.

The third study (Chapter 4) aimed to investigate whether the adapted social network intervention *Kies Awa* would effectively increase water consumption and decrease SSB consumption. The context adaptations were informed by the evidence from the preceding two groundwork studies. In addition, I examined whether injunctive and descriptive norms of children's classmates moderated the intervention. I found that the evidence-based adapted intervention was effective in: (1) Increasing children's water consumption overall, which was not moderated by social norms, and (2) Decreasing children's SSB consumption when children experienced disapproval from their classmates regarding SSB consumption. Thus, injunctive norms regarding SSB consumption positively moderated (i.e., increased) the effectiveness of the intervention on SSB consumption.

In sum, this dissertation project demonstrates that social network intervention can effectively promote water consumption among children in Aruba. Especially when context-appropriate adaptations have been implemented that account for previously acquired evidence. The progression from piloting the *Share H_2O* to testing the adapted *Kies Awa* intervention revealed that such adaptations enhance intervention effectiveness, resulting in an overall increase in children's water consumption.

DISCUSSION OF THE MAIN FINDINGS

I discuss the main findings from two complementary perspectives. First, from the perspective of the importance of advancing scientific research by implementing evidence-based interventions in underrepresented contexts regarding research endeavors. Then, from the perspective of enhancing peer influence within social network intervention.

The Importance of Adapting Existing Interventions in New Underrepresented Contexts

My research journey started with adopting *Share H_2O,* which showed promising results for using a social network approach to improve children's beverage consumption behavior (Chapter 2, Franken et al., 2018). Given these promising results, I explored how the intervention could be adapted to the context of Aruba. I did this by investigating the most important theoretical

determinants of water consumption in Aruba that could be incorporated into the subsequent intervention (Chapter 3, Franken et al., 2023). These two Aruba-specific studies provided unique insights to determine which aspects of the intervention content could be adapted to enhance effectiveness in subsequent interventions. Through this adaptation process, I developed *Kies Awa* (Chapter 4, Franken et al., 2025). This intervention approach and the stepwise project structure had not been previously implemented in Aruba, and thereby, I addressed a knowledge gap in Caribbean literature.

The study described in Chapter 4 (Franken et al., 2025) demonstrated that the evidence-based adapted social network intervention *Kies Awa* yielded more substantial results for water consumption than the preceding pilot intervention (Chapter 2, Franken et al., 2018). The preceding pilot study was implemented without adaptation (Franken et al., 2018), which may explain why it did not increase water consumption among the entire intervention group but only for a subgroup of children (dependent on a moderating social norm). On the other hand, the adapted intervention *Kies Awa* increased water consumption for the entire group of children. Thus, adopting and adapting an intervention yielded a more substantial result for the primary outcome of water consumption, compared to only adopting an intervention. This improved outcome corresponds with research indicating the importance of adapting interventions for enhanced effectiveness across different community contexts (Barrera et al., 2013; Movsisyan et al., 2021).

The Importance of Enhancing Peer Influence Within Social Network Intervention

The effectiveness of social network intervention as a method depends on peer influencers who spread specific targeted messages or behaviors throughout their networks (Valente, 2012). Peer influencers refer to individuals whom other peers look up to, respect, want to be like, regard as good leaders, or go to for advice (Campbell et al., 2008; Smit et al., 2016; Starkey et al., 2009). Given the promising findings in Chapter 2 regarding the use of peer influencers to change behavior, I adapted the social network intervention to equip the peer influencers better to be more capable of spreading the behavior. Therefore, to enhance peer influencers' capability, I made two key adaptations to the existing intervention described in Chapter 4: adding roleplay and including educational materials appropriate for Aruba's context.

Roleplay was added to the existing intervention as an evidence-based educational method that encourages children to embody the behavior

(Lanigan, 2011; Lloyd et al., 2011). This addition was based on my findings and in alignment with other research (Cruwys et al., 2015) showing that social norms play an important role in children's water consumption. Specifically, Chapter 2 revealed the importance of injunctive norms, while Chapter 3 highlighted the role of descriptive norms in Aruba. Another justification for adding roleplay was that it could impact peer influencers' intrinsic motivation to drink more water, which Chapter 3 showed as an important factor influencing water consumption (Franken et al., 2023; Ryan & Deci, 2017).

This roleplay component, and actually, the entire (adapted) training session, was geared to impact peer influencers' intrinsic motivation to consume more water themselves, and by doing so, they would spread this behavior through their social network (Franken et al., 2023; Ryan & Deci, 2017; Smit et al., 2021b; Soenens & Vansteenkiste, 2010). Thus, through roleplay and discussions, peer influencers' capability to promote water consumption was enhanced by engaging in activities related to the two norm-related mechanisms. Peer influencers engaged in exercises modeling water consumption (i.e., descriptive norms). They worked on developing their verbal and non-verbal skills to encourage their classmates to consume more water (i.e., injunctive norms).

The inclusion of educational materials appropriate for Aruba's context was based on the theory-based findings of Chapter 3, which indicated the importance of including materials that would correspond to enhancing children's favorable attitudes toward water consumption and positive perceptions of behavioral control regarding water consumption (Ajzen, 1991; Franken et al., 2023). Given Aruba's challenge with litter both on land and in the ocean (de Scisciolo et al., 2016; Debrot et al., 2014) and evidence that education on litter reduction can impact children's behavior (Hartley et al., 2015), I added more extensive material in the intervention to account for attitude and perceived behavioral control by emphasizing that water consumption produces no waste compared to purchasing SSBs, which generates packaging waste. Thus, I emphasized the dual benefits of water consumption on personal health and Aruba's natural ecosystems to encourage them to choose water.

These strategic adaptations of adding roleplay and educational material appropriate for the context of Aruba for *Kies Awa* seemed fruitful as they enhanced their ability to embody their peer influencer role better, which possibly contributed to the observed increase in water consumption among all children and not only among a subgroup of children as was found in the pilot study.

General Limitations

Some limitations could be considered when interpreting my findings. The first limitation concerns (inherently) generalizability. Although new valuable knowledge has been generated for the Caribbean, generalizing the findings to other small (Caribbean) islands may be limited. It is limited because of varying island populations with different socio-demographic backgrounds, socio-economic status, ethnic backgrounds, and educational levels (Franse et al., 2020; WHO, 2023b). Therefore, future research would benefit from creating context-specific adaptation while building upon these studies' seminal findings.

Second, alongside children's self-reported data, other ways of measuring water consumption directly could have been added to determine changes in water consumption. For example, flowmeters could have been attached to water coolers on school premises (Muckelbauer et al., 2009). Future studies could include such a tool to provide more objective data while validating the self-reported consumption data.

Last, my intervention studies had two measurement points: before and after the intervention. This single post-measurement limited us to performing mediation analyses and examining long-term effectiveness. Adding more post-measurements would have enabled us to measure how social norms mediate water consumption over time. In other words, it would show how pre-measurement consumption predicts the (mediating) social norms and subsequent consumption (Fairchild & McQuillin, 2010). Therefore, future intervention studies could implement a longitudinal approach.

Implications and Suggestions for Future Research and Intervention Practice

The findings in this dissertation confirm the effectiveness of social network intervention. They underscore the importance of implementing context-specific adaptations. Furthermore, these results highlight the important role of social norms in increasing water consumption. These insights emphasize the need to incorporate both the social environment and context-based adaptations into intervention policies and practices. Based on these findings, I propose four interconnected areas for future research and intervention practice. I propose to enhance peer influencers' capability to promote water consumption within their social networks through co-creation with children. In addition, I propose providing children with easier access to water in schools. I also recommend removing SSBs from school premises. Furthermore, I

propose to explore a synthesized holistic approach by integrating the social network intervention approach and changes within the environment of schools.

Enhancing Peer Influencers' Capability in Social Network Intervention Through Co-Creation with Children

Chapter 4 showed improvements in children's beverage consumption after participating in the social network intervention *Kies Awa*, which underscores the importance of implementing context adaptations. However, the findings also imply that children's consumption still remained below the recommended guidelines of consuming 6 to 8 glasses of non-caloric fluids daily (DVG & IDEFRE, 2012). This gap between actual and recommended consumption implies that more action is needed to address this public health concern of consuming insufficient water (Bottin et al., 2019; Suh & Kavouras, 2019). Given that Chapters 2 and 4 show the impact of peer influencers in changing behaviors within social networks, their role as peer influencers could be further enhanced to close the gap between actual and recommended consumption.

Therefore, future interventions using the social network approach could be further adapted by co-creating with peer influencers to enhance their capability as influencers. Co-creation with children ensures their right to have their voices heard. By listening to them, adults can better understand how to work with and for children to improve their nutrition (Drummond et al., 2009; Healthy Caribbean Coalition, 2022a). Such co-creation with children could lead to further adaptations of the training material to enhance effectiveness in meeting the recommended guidelines for water consumption because the materials would appeal more to peer influencers (Healthy Caribbean Coalition, 2022a; Smit et al., 2022; Zoellner et al., 2013). Consequently, the co-created training materials may motivate peer influencers even more to follow the recommended guidelines and, in doing so, spread this behavioral change within their social environment (Gillison et al., 2019; Smit et al., 2021a; Valente, 2012).

Furthermore, while children's voices are being heard during the co-creation process, children could be consulted as well regarding measuring additional health outcomes. Through conversations (qualitative research) with children and the support of other field practitioners, I could explore measuring the impact of the co-created intervention on, for example, preventing dental caries (Kim, 2021) and weight gain among children (Çıtar Dazıroğlu & Acar Tek, 2023; Stookey, 2010).

While exploring co-creation with children and measuring other health-related outcomes, I also suggest targeting other Caribbean islands with this intervention approach. While island contexts vary widely, many may have in common the context of relatively small and closely connected socio-cultural communities. In addition, other islands like Bonaire and Curaçao, which are also part of the Dutch Kingdom, have also been shown to have unhealthy weight patterns, indicating a need for health promotion interventions (Jansen & Verstraeten, 2013; Kist-van Holthe et al., 2018; Schwiebbe et al., 2012; Schwiebbe et al., 2011). In other words, given the effectiveness of *Kies Awa* in Aruba, this social network approach could also be potentially practical for Bonaire and Curaçao.

While expanding efforts to promote water consumption among children, researchers and policymakers could consider addressing external factors in children's environment at school as well. Addressing external environmental factors could give children the opportunity to achieve the recommended amounts of water consumption.

Increasing Easy Access to Water in Schools

Aside from the implications that context-adapted social network intervention is effective for increasing water consumption and that this dissertation indicates that children are not meeting the recommended daily water intake, the findings may also indicate a broader need for easier access to water in schools. Research has shown that increasing the availability of water coolers in schools increases water consumption among students (Muckelbauer et al., 2009). This finding underscores the importance of easy access to water as a crucial environmental factor in promoting water consumption.

During my school visits for data collection, I informally observed that some schools lacked (functional) water coolers for their children. Although these observations were not part of the formal data collection procedure, they provide contextual support for the need to improve water accessibility in schools so that children have the ability to engage with this health behavior. Fortunately, recognizing this need, a recent Aruban project, with the help of funding, has taken the initiative to install water coolers on school premises to improve children's access to cooled water ("Project announcement: Water cooler initiative in Aruba," 2023; Rotary Club Aruba, 2021). Given this ongoing water cooler project, research in the near future could investigate the impact of the suggested peer influencers' co-created social network intervention in

combination with giving children easier access to water by installing needed water coolers on school premises (Muckelbauer et al., 2009).

In Aruba, safe drinking water is available directly from the tap. However, as has been informally observed, it is not always readily available for children at schools. This situation is even more alarming in other Caribbean islands, where, for example, children in some areas of the Dominican Republic and Jamaica have no access to reliably safe drinking water (Libra & Baquero, 2022; Rodríguez et al., 2022). Hence, if this basic need, outlined in SDG 6.1 on access to safe and affordable drinking water ("The 17 Goals", 2024), is not met in Aruba and other islands in the Caribbean region, health promoters, educators, and institutions are constrained in effectively promoting water consumption to be able to meet the recommended guidelines for health.

Removing Sugar-Sweetened Beverages in Schools

The finding that injunctive norms regarding SSB consumption positively moderated (i.e., increased) the effectiveness of the *Kies Awa* intervention on SSB consumption implies the importance of incorporating social influence in intervention policy and practice to discourage this behavior particularly. However, alongside the indicated broader need for easier access to water in schools, children face another challenge to socially encourage peers to improve their beverage consumption to meet the recommended guidelines of consuming only non-caloric fluids (DVG & IDEFRE, 2012): heavily advertised SSBs.

Chapter 3 showed that Aruban children consumed four times more SSBs than Dutch children. This relatively high consumption in Aruba reflects a broader global disparity. Research shows that the Caribbean region has some of the highest SSB consumption worldwide (Ooi et al., 2022; Singh, Micha, Khatibzadeh, Shi, et al., 2015). This pattern underscores the need to investigate the extent to which SSBs are within easy reach of children on school premises in Aruba to contribute to children's right to health ("The 17 Goals", 2024; UNCRC, 1989).

WHO recommendations underscore this need for investigation. WHO urges children's sugar intake to be less than six teaspoons per day, and just one can of SSB contains more than this—that is, approximately ten teaspoons of sugar (Inchley et al., 2017; WHO, 2015). Limiting the consumption of SSBs is essential because this behavior seems to start at an early age. Much younger Aruban children (kindergarten) than in my studies (primary schools) already show excessive sugar consumption from SSBs and candies (Curet & Vermeulen,

2023). Thus, at an early age, children already do not meet the recommended guidelines for daily sugar limits and non-caloric beverages. These findings further underscore the need for more action to improve beverage consumption early in life in Aruba.

Addressing healthy behaviors early on in life could be done on a larger scale by involving school systems. Research supports the notion that exposing children to healthy school environments facilitates a healthier lifestyle (Goncalves et al., 2021). Given children's vulnerability, adults must facilitate environments where children can easily make healthy lifestyle choices. Experts have recognized this importance and advocated that children be exposed to healthy school environments (Healthy Caribbean Coalition, 2022a, 2022b; Scol Saludabel Aruba, 2023). In this context, the particular contribution of *Healthy Schools Aruba* (Scol Saludabel Aruba, 2023) is valuable as it currently provides a comprehensive approach (e.g., nutrition and physical activity) to improving children's lifestyles. Future research could involve collaboration between researchers, health professionals, and school officials to investigate more activities to improve the children's school nutrition environment (Goncalves et al., 2021; Pineda et al., 2021; Scol Saludabel Aruba, 2023; Vega-Salas et al., 2023).

From the perspective of recognizing the problematic association between SSB consumption and health (Jakobsen et al., 2023; Luger et al., 2017; Malik et al., 2006; WHO, 2015, 2023c), the impact of exposing children solely to water in schools could be investigated (Garde et al., 2018; Healthy Caribbean Coalition, 2022b; Raine, 2013; Scharf & DeBoer, 2016). Sole exposure to water in schools could be achieved in a more synthesized holistic way in the future.

Integrating Social and Environmental Aspects for Water Consumption Promotion

Building upon the aforementioned suggestions that are based on the findings of this dissertation, I propose a synthesized holistic approach that integrates the social network intervention method with changes in the school environment to impact children's water consumption. This strategy would simultaneously address social and environmental factors influencing children's water consumption. Specifically, this approach would combine two elements: enhancing *Kies Awa* intervention through co-creation with children to promote water consumption and implementing policy-driven changes in the school environment to facilitate sole access to water.

This proposed strategy aligns with the Capability, Opportunity, Motivation – Behavior (COM-B) system, which is a holistic behavioral change framework

identifying key factors for effective behavioral change (Michie et al., 2011). The COM-B system involves three aspects that should be addressed to change behavior positively: psychological and physical capability, physical and social opportunity, and reflective and automatic motivation. The usefulness of this system is supported by recent research showing that nutrition-related behaviors are indeed associated with an interplay of individuals' capabilities, opportunities, and motivations (Willmott et al., 2021).

Thus, from the perspective of the COM-B system, children could meet the recommended guidelines for non-caloric fluid consumption when approached more holistically. For example, by addressing children's external physical environments at school by installing more water coolers and removing SSBs on school premises, a child's *physical opportunity* and *automatic motivation* for behavioral change would be strengthened. These external environmental changes would facilitate children's water consumption while discouraging SSB consumption subconsciously or automatically, as it is the only healthy option physically available.

Furthermore, the co-created *Kies Awa* intervention would cater to children's *psychological and physical capability* of peer influencers within the school environment. The intervention, for example, enhances children's knowledge regarding the benefits of water consumption for the planet and health. It also addresses children's physical capability to carry and use water bottles. By enhancing children's water consumption knowledge, their understanding and conscious decision-making processes are improved as well, which relates to COM-B system's *reflective motivation* needed for behavioral change.

Additionally, because *Kies Awa* entails exposing children to peer influencers who promote water consumption in their social network at schools, it addresses COM-B system's *social opportunity* and *automatic motivation*. Children are exposed to a positive social norm regarding water consumption in their school environment, which may prompt them to consume more water.

In light of this COM-B system, future research and intervention practice in the Aruban context could investigate this proposed holistic strategy, combining a co-created version of the *Kies Awa* intervention with policy-supported sole access to water in schools. The need to facilitate and promote water consumption among schoolchildren in a more holistic way is further emphasized, given that early-life behaviors persist into adulthood (Movassagh et al., 2017; Rodger & Papies, 2022), making behavioral changes later in life potentially more challenging (Abrignani et al., 2019; Hu, 2013; Kelsey et al., 2014).

Thus, primarily encouraging the behavior of water consumption early in life at schools may serve children's health best and contribute to their right to a healthy environment. This approach could lead to more long-term and large-scale positive impacts on health (Ferreira-Junior et al., 2023; Healthy Caribbean Coalition, 2022a). By implementing such strategies in schools, children's health and well-being may improve and may potentially shape lifelong healthy behaviors contributing to public health.

Conclusion

This dissertation sheds light on Aruba, an island in the underrepresented Caribbean region, regarding beverage consumption intervention research. I demonstrated the important role of implementing a context-adapted social network intervention wherein peer influencers promote water consumption. Water consumption improved after the *Kies Awa* intervention, but my findings showed that children still needed to meet the recommended guidelines regarding non-caloric fluids. Future interventions could explore a holistic approach where children co-create the social network intervention material, combined with improved water and SSB consumption-related policies in the school environment. The research evidence provided may offer helpful information for policymakers, health professionals, and school systems to develop healthier school environments collaboratively. Children worldwide have the right to a fair chance at a healthy childhood by growing up in school environments that encourage an even healthier lifestyle.

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SUMMARY IN ENGLISH

This summary provides an overview of this dissertation, titled "Understanding and Promoting Water Consumption Among Children in Aruba Using the Social Network Intervention Approach." The dissertation comprises a general introduction (Chapter 1), followed by three empirical studies, each outlining its aims and findings (Chapters 2, 3, and 4), and ends with a general discussion and conclusion (Chapter 5).

Chapter 1—General Introduction

Childhood overweight and obesity present a critical public health concern, with the World Health Organization (WHO) estimating that 20% of children and adolescents aged 5 to 19 were overweight or obese in 2022, an increase from 8% in 1990. These unhealthy weights are a problem among Caribbean islands as well. Scientific research and intervention endeavors in the Caribbean region are needed. However, the Caribbean region is underrepresented in these endeavors compared to North America and Western Europe. Within the Caribbean, Aruba is worrisome because health authorities found percentages of overweight and obesity that are twice as high as the WHO's estimate. To contribute to the United Nations' Sustainable Development Goals and children's right to health, this research project aimed to contribute to improving children's health in Aruba.

One of the major factors associated with childhood obesity is the consumption of sugar-sweetened beverages (SSBs). Researchers have found high SSB consumption patterns in the Caribbean. Water represents the only natural calorie-free fluid. Promoting water consumption is a promising strategy for improving health results, such as preventing weight gain and dental cavities. Despite this knowledge, studies worldwide have shown that children consume insufficient amounts of water, which is also the situation in Aruba. This highlights a knowledge gap regarding water consumption promotion in Aruba.

Interventions that use social networks are shown to be effective in promoting health-related behaviors, like water consumption. Social network intervention entails appointing individuals as influential peers (e.g., individuals whom other peers respect, want to be like, and regard as good leaders) in a particular network who then spread specific targeted messages or behaviors in their network. Within these social networks, social norms are influential because individuals tend to be receptive to the perceived dietary behaviors (i.e.,

descriptive norm) and perceived approval or disapproval of the dietary behavior (i.e., injunctive norm) within their social network.

The general objective was to investigate the effectiveness of using social network intervention in promoting water consumption among schoolchildren in Aruba. This general objective was structured around three research aims. The first aim was to determine the potential use of social network intervention. The second aim was to identify theory-based water consumption determinants. The third aim was to investigate the effectiveness of an adapted intervention in the context of Aruba.

Chapter 2—The Potential of Using Children's Social Networks at Schools

A pilot study was executed to examine the potential of using social network intervention in Aruba. Through replication of the Dutch *Share H_2O* intervention, this study tested the effectiveness of the intervention on Aruban children's water consumption, SSB consumption, and intentions to drink more water and fewer SSBs. It also tested the potential moderating effect of perceived descriptive and injunctive norms on the results. The *Share H_2O* intervention entailed identifying and training a selected subgroup of children as peer influencers to promote water consumption among children in their school social networks. In the intervention group, children were exposed to peer influencers promoting water consumption, while the children in the control group were not.

Findings demonstrated that using social network intervention was promising because it improved water consumption when children experienced approval from their classmates regarding water consumption (i.e., positive moderation effect of injunctive norms). It also decreased children's SSB consumption. Furthermore, the intervention effectively increased children's intention to consume fewer SSBs, but it still did not increase children's intention to consume more water—probably because their water intention scores at baseline measurement were already relatively high.

Chapter 3—The Behavioral Determinants of Water Consumption

Potential theory-based determinants associated with adolescents' water consumption in Aruba were examined and compared to those in the Netherlands. Through the application of a model that integrated dominant theoretical perspectives in public health—including theories of planned

behavior (attitude, behavioral intentions, norms, perceived behavioral control), social norms (descriptive and injunctive norms), and self-determination theory (i.e., intrinsic motivation)—the most important water consumption determinants were identified.

Findings demonstrated that intrinsic motivation, descriptive norms of classmates, attitude, and perceived behavioral control were associated with water consumption among Aruban adolescents. Furthermore, it showed that the association between water consumption and both intrinsic motivation and descriptive norm in Aruba was stronger than in the Netherlands. This implied that it is even more important for Aruban adolescents than Dutch adolescents to be intrinsically motivated or to perceive their friends often consuming water to drink more of it themselves.

Chapter 4—The Effectiveness of *Kies Awa*, a Social Network Evidence-Based Adapted Intervention Promoting Water Consumption

Informed by findings from the preceding Aruba-specific studies (Chapters 2 and 3), the social network evidence-based adapted intervention *Kies Awa* (translation Choose Water) was developed. Key adaptations to the original intervention material entailed adding roleplay and educational materials to fit the Aruban context better. Children in the *Kies Awa* group were exposed to peer influencers promoting water consumption, while the children in the control group were not. The effectiveness of this *Kies Awa* intervention on children's water and SSB consumption was examined, and the moderating effect of descriptive and injunctive norms on the intervention's effectiveness was examined as well.

Findings demonstrated that the evidence-based adapted *Kies Awa* intervention effectively increased children's water consumption overall, which was not moderated by social norms. It was also effective in decreasing children's SSB consumption when children experienced disapproval from their classmates regarding SSB consumption (i.e., injunctive norm) at the start of the intervention.

Chapter 5—General Discussion

The discussion highlighted that the adapted *Kies Awa* intervention resulted in a more substantial overall increase in children's water consumption compared to the previous piloted study. This indicates that social network intervention is effective and indicates the importance of adapting intervention material within social network intervention in underrepresented contexts like Aruba in terms of health interventions. This means incorporating the social environment and context-based adaptations into intervention policy and practice is important.

Before discussing the implications and suggestions for future research and intervention practice, the general limitations were addressed. This concerned limited generalizability, self-reported data, and limited measurement points.

The chapter pointed out that despite improvements in beverage consumption after *Kies Awa*, children still did not meet the recommended guidelines regarding non-caloric fluid consumption. To address this challenge, the discussion proposed four interconnected areas for future research and intervention practice: enhancing peer influencers' water promotion capabilities through co-creation, improving water access in schools, considering the removal of SSBs from school premises, and exploring a synthesized holistic approach. This holistic approach could entail enhancing *Kies Awa* intervention through co-creation and implementing policy-driven changes in the school environment to facilitate sole access to water.

The dissertation highlights that children deserve a fair chance at a healthy childhood by growing up in school environments that encourage an even healthier lifestyle. Therefore, the dissertation concluded by emphasizing children's global right to a healthy childhood.

SAMENVATTING IN HET NEDERLANDS

Deze samenvatting geeft een overzicht van dit proefschrift getiteld “Het begrijpen en promoten van waterconsumptie onder kinderen op Aruba met behulp van de sociale netwerk interventiebenadering.” Het proefschrift bestaat uit een algemene inleiding (Hoofdstuk 1), gevolgd door drie empirische studies, elk met hun doelstellingen en bevindingen (Hoofdstukken 2, 3 en 4), en eindigt met een algemene discussie en conclusie (Hoofdstuk 5).

Hoofdstuk 1—Algemene inleiding

Overgewicht en obesitas bij kinderen vormen een ernstig probleem voor de volksgezondheid, waarbij de Wereldgezondheidsorganisatie (World Health Organization; WHO) schat dat 20% van de kinderen en adolescenten tussen 5 en 19 jaar in 2022 overgewicht of obesitas had, een stijging ten opzichte van 8% in 1990. Deze ongezonde gewichten zijn ook een probleem op de Caribische eilanden. Wetenschappelijk onderzoek en interventie-inspanningen in de Caribische regio zijn nodig. Echter, de Caribische regio is ondervertegenwoordigd in deze inspanningen vergeleken met Noord-Amerika en West-Europa. Binnen het Caribisch gebied is Aruba zorgelijk omdat gezondheidsautoriteiten overgewicht- en obesitaspercentages vonden dat twee keer zo hoog is als de schatting van de WHO. Om bij te dragen aan de Duurzame Ontwikkelingsdoelen (‘Sustainable Development Goals’) van de Verenigde Naties en het recht van kinderen op gezondheid, had dit onderzoeksproject tot doel bij te dragen aan de verbetering van de gezondheid van kinderen op Aruba.

Een van de belangrijkste factoren die verband houden met kinderovergewicht is de consumptie van suikerhoudende dranken (‘sugar-sweetened beverages;’ SSBs). Onderzoekers hebben hoge consumptiepatronen van SSBs in het Caribisch gebied gevonden. Water is de enige natuurlijke calorie-vrije vloeistof. Het bevorderen van waterconsumptie is een veelbelovende strategie voor het verbeteren van gezondheidsresultaten, zoals het voorkomen van gewichtstoename en tandbederf. Ondanks deze kennis hebben studies wereldwijd aangetoond dat kinderen onvoldoende water consumeren, wat ook de situatie is op Aruba. Dit benadrukt een kennisklоof met betrekking tot de bevordering van waterconsumptie op Aruba.

Interventies die gebruik maken van sociale netwerken blijken effectief te zijn in het bevorderen van gezondheidsgerelateerd gedrag, zoals waterconsumptie. Sociale netwerk interventie houdt in dat individuen worden aangesteld als beïnvloeders van leeftijdsgenoten (‘peer influencers,’ e.g., individuen die door

andere leeftijdsgenoten worden gerespecteerd, die op hen willen lijken en die zij als goede leiders beschouwen) in een bepaald netwerk die vervolgens specifieke gerichte boodschappen of gedragingen verspreiden binnen hun netwerk. Binnen deze sociale netwerken zijn sociale normen invloedrijk omdat individuen geneigd zijn ontvankelijk te zijn voor het waargenomen voedingsgedrag (i.e., descriptieve norm) en de waargenomen goedkeuring of afkeuring van het voedingsgedrag (i.e., injunctieve norm) binnen hun sociale netwerken.

Het algemene doel was om de effectiviteit van het gebruik van sociale netwerk interventie bij het bevorderen van waterconsumptie onder schoolkinderen op Aruba te onderzoeken. Dit algemene doel was gestructureerd rond drie onderzoeksdoelen. Het eerste doel was om het potentiële gebruik van sociale netwerk interventie te bepalen. Het tweede doel was het identificeren van op theorie gebaseerde determinanten van waterconsumptie. Het derde doel was om de effectiviteit van een aangepaste interventie aan de context van Aruba te onderzoeken.

Hoofdstuk 2—Het potentieel van het gebruik van de sociale netwerken van kinderen op scholen

Een pilotstudie was uitgevoerd om het potentieel van het gebruik van sociale netwerk interventie op Aruba te onderzoeken. Door replicatie van de Nederlandse *Share H_2O* interventie testte deze studie de effectiviteit van de interventie op de waterconsumptie, SSB-consumptie en intenties van Arubaanse kinderen om meer water en minder SSBs te drinken. Het testte ook het potentiële modererende effect van waargenomen descriptieve en injunctieve normen op de resultaten. De *Share H_2O* interventie omvatte het identificeren en trainen van een geselecteerde subgroep kinderen als 'peer influencers' om waterconsumptie te bevorderen onder kinderen in hun schoolnetwerken. Kinderen in de interventiegroep werden blootgesteld aan leeftijdsgenoten die waterconsumptie bevorderden, terwijl de kinderen in de controlegroep dat niet werden.

De bevindingen toonden aan dat het gebruik van sociale netwerk interventie veelbelovend was omdat het de waterconsumptie verbeterde wanneer kinderen goedkeuring van hun klasgenoten ervoeren met betrekking tot waterconsumptie (i.e., een positief modererend effect van injunctieve normen). Het verminderde ook de SSB-consumptie van kinderen. Bovendien verhoogde de interventie effectief de intentie van kinderen om minder SSBs te consumeren, maar verhoogde niet de intentie van kinderen om meer

water te consumeren—waarschijnlijk omdat hun waterintentie scores bij de basismeting al relatief hoog waren.

Hoofdstuk 3—De gedragsdeterminanten van waterconsumptie

Potentiële theorie-gebaseerde determinanten geassocieerd met de waterconsumptie van adolescenten op Aruba werden onderzocht en vergeleken met die in Nederland. Door de toepassing van een geïntegreerd model dat dominante theoretische perspectieven in de volksgezondheid bevat—inclusief theorieën over gepland gedrag (houding, gedragsintenties, normen, waargenomen gedragscontrole), sociale normen (descriptieve en injunctieve normen) en zelfdeterminatietheorie (i.e., intrinsieke motivatie)—werden de belangrijkste determinanten van waterconsumptie geïdentificeerd.

De bevindingen toonden aan dat intrinsieke motivatie, descriptieve normen van klasgenoten, houding en waargenomen gedragscontrole geassocieerd werden met waterconsumptie onder Arubaanse adolescenten. Verder bleek dat de associatie tussen waterconsumptie en zowel intrinsieke motivatie als descriptieve norm op Aruba sterker was dan in Nederland. Dit impliceerde dat het voor Arubaanse adolescenten nog belangrijker is dan voor Nederlandse adolescenten om intrinsiek gemotiveerd te zijn of te ervaren dat hun vrienden vaak water drinken om zelf meer water te drinken.

Hoofdstuk 4—De effectiviteit van *Kies Awa*, een op bewijs gebaseerde aangepaste sociaal netwerk interventie ter bevordering van waterconsumptie

Op basis van resultaten uit de voorgaande Aruba-specifieke onderzoeken (Hoofdstukken 2 en 3), werd de op bewijs gebaseerde aangepaste interventie *Kies Awa* (vertaling Kies Water) ontwikkeld. Belangrijke aanpassingen aan het oorspronkelijke interventiemateriaal omvatten het toevoegen van rollenspellen en educatief materiaal om beter aan te sluiten bij de Arubaanse context. Kinderen in de *Kies Awa* groep werden blootgesteld aan leeftijdsgenoten die waterconsumptie bevorderden, terwijl de kinderen in de controlegroep dat niet werden. De effectiviteit van deze *Kies Awa* interventie op de water en SSB-consumptie van kinderen werd onderzocht, en het modererende effect van descriptieve en injunctieve normen op de effectiviteit van de interventie werd ook onderzocht.

De bevindingen toonden aan dat de op bewijs gebaseerde aangepaste *Kies Awa* interventie effectief de waterconsumptie van kinderen in het algemeen

verhoogde, wat niet werd gemodereerd door sociale normen. Het was ook effectief in het verminderen van de SSB-consumptie van kinderen wanneer kinderen afkeuring van hun klasgenoten ervoeren met betrekking tot SSB-consumptie (i.e., injunctieve norm) aan het begin van de interventie.

Hoofdstuk 5—Algemene discussie

De discussie benadrukte dat de aangepaste *Kies Awa* interventie leidde tot een grotere algehele toename in waterconsumptie van kinderen vergeleken met de eerdere pilotstudie. Dit geeft aan dat sociale netwerk interventie effectief is en geeft het belang aan van het aanpassen van interventiemateriaal binnen sociale netwerk interventie in ondervertegenwoordigde contexten zoals Aruba voor wat betreft gezondheidsinterventies. Dit betekent dat het belangrijk is om de sociale omgeving en contextgebaseerde aanpassingen in interventiebeleid en -praktijk door te voeren.

Voordat de implicaties en suggesties voor toekomstig onderzoek en interventiepraktijk werden besproken, werden de algemene beperkingen behandeld. Dit betrof de beperkte generaliseerbaarheid, zelf-gerapporteerde data en beperkte meetpunten.

Het hoofdstuk wees erop dat ondanks verbeteringen in drankconsumptie na *Kies Awa*, kinderen nog steeds niet voldeden aan de aanbevolen richtlijnen omtrent calorie-vrije vloeistofconsumptie. Om deze uitdaging aan te pakken, stelde de discussie vier onderling verbonden gebieden voor toekomstig onderzoek en interventiepraktijk voor: het verbeteren van de capaciteiten van 'peer influencers' door middel van co-creatie om waterconsumptie te promoten, het verbeteren van toegang tot water op scholen, het overwegen om SSBs van schoolterreinen te verwijderen en het verkennen van een gesynthetiseerde holistische aanpak. Deze holistische aanpak kan inhouden dat de *Kies Awa* interventie wordt verbeterd door middel van co-creatie en dat beleidsgestuurde veranderingen in de schoolomgeving worden doorgevoerd om toegang tot alleen water te vergemakkelijken.

Het proefschrift benadrukt dat kinderen een eerlijke kans verdienen op een gezonde jeugd door op te groeien in schoolomgevingen, dat een nog gezondere levensstijl bevordert. Het proefschrift werd daarom afgesloten met de nadruk op het wereldwijde recht van kinderen op een gezonde jeugd.

RESUMEN NA PAPIAMENTO

E resumen aki ta duna un bista di e disertacion titula “Comprension y promocion di consumo di awa bou di muchanan na Aruba uzando e metodo di intervencion di red social.” E disertacion ta consisti di un introduccion general (Capitulo 1), sigui pa tres estudio empirico, cada uno cu su metanan y resultadonan (Capitulonan 2, 3, y 4), y ta termina cu un discusion general y conclusion (Capitulo 5).

Capitulo 1—Introduccion general

Obesidad y sobrepeso di muchanan ta un problema serio di salud publico, y e Organizacion di Salud Mundial (‘World Health Organization,’ WHO) ta calcula cu 20% di mucha y adolescente cu tin edad di 5 pa 19 tabata tin sobrepeso of obesidad na 2022, un crecimento for di 8% na 1990. E pesonan insaludabel aki ta un problema tambe den islanan di Caribe. Investigacion scientifico y esfuersonan pa interveni ta necesario. Sinembargo, Caribe ta menos representa den esaki compara cu America Norte y Europa Occidental. Den Caribe, Aruba ta preocupante pasobra autoridad riba tereno di salud na Aruba a haya porcentahe di sobrepeso y obesidad dos biaha mas halto cu e calculacion di WHO. Pa contribui na e Metanan di Desaroyo Sostenibel (‘Sustainable Development Goals’) di Nacionnan Uni y e derecho di mucha riba salud, e proyecto di investigacion aki tabatin como meta pa contribui na mehoracion di salud di mucha na Aruba.

Un di e factornan principal asocia cu obesidad di mucha ta e consumo di bebidanan cu sucu (‘sugar-sweetened beverages,’ SSB). Investigadornan a encontra patronchinan di consumo halto di SSB den Caribe. Awa ta e unico bebida natural sin caloria. Promove e consumo di awa ta un strategia prometedor pa mehora resultadonan di salud, manera preveni subimento di peso y cavidad oral (i.e., putrimento di djente). Apesar di e conocemento aki, estudionan mundial a demostra cu muchanan no ta consumi suficiente awa, locual tambe ta e situacion na Aruba. Esaki ta enfatisa un falta di conocemento tocante e promocion di consumo di awa na Aruba.

Intervencionnan cu ta uza red social a mustra di ta efectivo den promove comportacion relaciona cu salud, manera consumo di awa. Intervencion di red social ta encera indica individuonan como influenciadornan di pareu (‘peer influencers,’ e.g., individuonan cu otro ta respeta, kier ta manera nan, y ta considera nan como bon lider) den un red particular, y siguientemente nan ta plama mensahenan specifco of comportacion specifco den nan red. Den e rednan aki, normanan social ta influencial pasobra individuonan tin

e tendencia di ta receptivo na comportacion di dieta percibi (i.e., norma descriptivo) y na aprobacion of desaprobacion di comportacion di dieta percibi (i.e., norma injunctivo) den nan red social.

E obhetivo general tabata pa investiga e efectividad di e uzo di intervencion di red social pa promove e consumo di awa bou di muchanan di scol na Aruba. E obhetivo general aki tabata structura den tres meta di investigacion. E prome meta tabata pa determina e uzo potencial di intervencion di red social. E di dos meta tabata pa identifica determinantenan di consumo di awa basa riba teoria. E di tres meta tabata pa investiga e efectividad di un intervencion adapta na e contexto di Aruba.

Capitulo 2—E potencial di e uzo di rednan social di mucha na scolnan

A realiza un estudio piloto pa investiga e potencial di uza intervencion di red social na Aruba. Pa medio di replica e intervencion Hulandes *Share H_2O*, e estudio aki a test e efectividad di e intervencion riba consumo di awa, consumo di SSB, y intencion di muchanan na Aruba pa bebe mas awa y menos SSB. Tambe a test e efecto moderador potencial di e normanan descriptivo y injunctivo percibi riba e resultadonan. E intervencion *Share H_2O* tabata encera identifica y train un subgrupo selecta di mucha como 'peer influencers' pa promove consumo di awa bou di muchanan den nan red social di scol. Den e grupo di intervencion, muchanan tabata exponi na 'peer influencers' cu tabata promove e consumo di awa, mientras cu e muchanan den e grupo di control no.

Resultadonan a demostra cu e uzo di intervencion di red social tabata prometedor, pasobra e a mehora consumo di awa ora muchanan a experiencia aprobacion di compañeronan di nan klas pa locual ta trata consumo di awa (e.g., efecto di moderacion positivo di normanan injunctivo). Tambe e a reduci e consumo di SSB di muchanan. Ademas, e intervencion a efectivamente aumenta e intencion di muchanan pa consumi menos SSB pero e no a aumenta e intencion di muchanan pa consumi mas awa—posiblemente pasobra nan scorenan di intencion di consumi awa tabata relativamente halto caba na e inicio di midimento.

Capitulo 3—E determinantenan di comportacion di consumo di awa

Determinantenan potencial basa riba teoria asocia cu consumo di awa di adolesentenan na Aruba a wordo investiga y compara cu esunnan na Hulanda. Dor di aplica un modelo integral cu ta encera e perspectivanan teoretico dominante den salud publico—incluyendo teoria di comportacion planea (actitud, intencion di comportacion, normanan, control di comportacion percibi), normanan social (normanan descriptivo y injunctivo), y teoria di autodeterminacion (i.e., motivacion intrinsico)—e determinantenan mas importante di consumo di awa a wordo identifica.

Resultadonan a demostra cu motivacion intrinsico, normanan descriptivo di compañeronan di klas, actitud, y control di comportacion percibi tabata asocia cu consumo di awa di adolesentenan na Aruba. Ademas, a demonstra cu e asociacion entre e consumo di awa y ambos e motivacion intrinsico como normanan descriptivo na Aruba tabata mas fuerte cu e asociacionnan na Hulanda. Esaki ta implica cu ta mas importante ainda pa adolesentenan di Aruba, compara cu e adolesentenan di Hulanda, pa ta intrinsicamente motiva of pa percibi cu nan amigonan ta consumi awa pa nan mes bebe mas di dje.

Capitulo 4—E efectividad di *Kies Awa*, un intervencion di red social adapta basa riba evidencia pa promove consumo di awa

Informa dor di resultadonan di estudionan specifico haci na Aruba anteriormente (Capitulonan 2 y 3), a desaroya *Kies Awa,* un intervencion adapta basa riba evidencia. Adaptacionnan clave na e material di intervencion original a inclui agrega material di wega di rol ('roleplay') y material educativo pa cuadra miho cu e contexto di Aruba. E muchanan den e grupo di *Kies Awa* a wordo exponi na 'peer influencers' cu a promove e consumo di awa, mientras e mucha den e grupo di control no. E efectividad di e intervencion *Kies Awa* riba e consumo di awa y SSB di mucha a wordo investiga, y tambe e efecto di moderacion di e normanan descriptivo y injunctivo riba e efectividad di e intervencion a wordo investiga.

Resultadonan a demostra cu e intervencion adapta basa riba evidencia *Kies Awa* a efectivamente aumenta e consumo di awa di mucha en general, locual no a wordo modera dor di normanan social. E tabata efectivo tambe den baha e consumo di SSB di muchanan ora e muchanan a experiencia desaprobacion di nan compañeronan di klas pa locual ta trata e consumo di SSB (i.e., norma injunctivo) na cuminsamento di e intervencion.

Capitulo 5—Discusion general

E discusion a enfatisa cu e intervencion adapta *Kies Awa* a resulta den un aumento general mas substancial den consumo di awa di mucha compara cu e estudio piloto anterior. Esaki ta indica cu intervencion di red social ta efectivo y cu e ta importante pa adapta material dentro di intervencion di red social den contextonan menos representa, manera Aruba, encuanto intervencionnan di salud. Esaki ta nifica cu ta importante pa incorpora e ambiente social ('social environment') y adaptacionnan basa riba contexto dentro di maneho y practica di intervencion.

Promer cu a discuti tocante e implicacionnan y sugerencianan pa investigacion y practica di intervencion den futuro, a atende cu e limitacionnan general. Esakinan tabata tin di haber cu generalisacion, dato auto-raporta, y puntonan di midimento limita.

E capitulo a señala cu apesar di mehoracionnan den consumo di bebidanan despues di *Kies Awa*, muchanan ainda no a cumpli cu e guianan recomenda encuanto consumo di likido sin caloria. Pa atende e reto aki, e discussion a propone cuatro area interconecta pa investigacion y practica di intervencion den futuro: mehora e capacidad di 'peer influencers' pa promove consumo di awa pa medio di co-creacion, mehoracion di acceso na awa na scolnan, considera elimina SSB for di scolnan, y explora un metodo sintetisa holistico. E metodo holistico por ensera mehora e intervencion *Kies Awa* pa medio di co-creacion y implementa cambionan di medida den e ambiente di scol pa facilita acceso solamente na awa.

E disertacion ta enfatisa cu muchanan merece un chance husto pa un unfancia saludabel dor di lanta den un ambiente di scol cu ta encurasha un estilo di bida ainda mas saludabel. Pa esey, e disertacion ta conclui enfatisando e derecho global di mucha riba un infancia saludabel.

CURRICULUM VITAE OF SASKIA C. M. FRANKEN

Through my work and interests, I consider myself a community contributor to the beautiful Caribbean island of Aruba (born in Amsterdam, the Netherlands, in 1978). My interests span behavioral change, social influence, health promotion, health interventions, nature conservation, personal development, marketing, and branding. These interests have been shaped by my academic journey, observations, readings, interactions, and experiences.

My academic journey began with a Bachelor of Business and Management in Marketing at Hogeschool van Arnhem en Nijmegen (University of Applied Sciences), the Netherlands, following my secondary education in Aruba. I furthered my education with a Master of Science in Business Administration, specializing in Marketing, from Radboud University, Nijmegen, the Netherlands.

I have been contributing to the education of future marketing and business professionals since 2008 as a Marketing lecturer at the Faculty for Accounting, Finance, and Marketing at the University of Aruba. My ongoing responsibilities include teaching, contributing to curriculum development, and engaging in academic-related committees.

Contributing to the Aruban community through research has always been valuable to me. I developed a passionate interest in health-related behavior, sparked by my personal observations, literature review, and community engagement in the area of health in Aruba. This curiosity led me to meet Prof. dr. Moniek Buijzen and dr. Crystal R. Smit (she is also from Aruba and was then a PhD candidate herself), and a collaboration was initiated.

Under their guidance and with the support of the University of Aruba, I embarked on my journey as an external PhD candidate at the Behavioural Science Institute of Radboud University in 2015. Rebecca N. H. de Leeuw joined the team later on. In 2020, following the employment transition of Moniek and Crystal, I completed my research in 2025 at the Erasmus School of Social and Behavioural Sciences at Erasmus University Rotterdam.

For correspondence, please contact me at saskia.franken@ua.aw
or visit my website at www.saskiafranken.com.

PORTFOLIO

Publications

Franken, S. C. M., Smit, C. R., de Moor, M. H. M., de Leeuw, R. N. H., & Buijzen, M. (2025). Promoting water consumption among children through a social network intervention: A cluster randomized controlled trial on a Caribbean island. *Journal of Public Health (Berl.).* https://doi.org/10.1007/s10389-024-02386-w

Franken, S. C. M., Smit, C. R., de Leeuw, R. N. H., van Woudenberg, T. J., Burk, W. J., Bevelander, K. E., & Buijzen, M. (2023). Understanding the behavioral determinants of adolescents' water consumption: A cross-country comparative study. *Dialogues in Health*, *2*, 100101. https://doi.org/10.1016/j.dialog.2023.100101

Franken, S. C. M., Smit, C. R., & Buijzen, M. (2018). Promoting water consumption on a Caribbean island: An intervention using children's social networks at schools. *International Journal of Environmental Research and Public Health*, *15*(4), 713. https://doi.org/10.3390/ijerph15040713

Conference Presentations

- *Understanding the behavioral determinants of adolescents' water consumption: A cross-country comparative study.* Online pitch and poster presentation at NWO Dutch *Caribbean Research Week* (Nederlandse Organisatie voor Wetenschappelijk Onderzoek [Dutch Research Council]), June 2023.
- *A culturally tailored social network-based intervention promoting water consumption in Caribbean schools: A cluster randomized control trial*. Presentation, International Society of Behavioral Nutrition and Physical Activity (ISBNPA) conference/ #ISBNPAXChange Initiative, June 2020.
- *A health promotion campaign for Aruba— the process of tailoring a social network-based intervention.* Presentation at an NWO information and network event, 'Expanding scientific research in the Dutch Caribbean' hosted by the University of Aruba, November 2019.
- *Understanding determinants of water consumption behaviors among youth: A comparison between a Caribbean and European context*. Poster presentation, ISBNPA conference, Prague, Czech Republic, June 2019.
- *De effectiviteit van het gebruik maken van de sociale omgeving voor gezondheids-campagnes op Aruba [The effectiveness of using the social environment for health campaigns in Aruba]*. Presentation at a healthy lifestyle symposium at the University of Aruba, April 2019.

- *The promotion of water drinking behaviors among children in a Caribbean island: A social network randomized control trial*. Poster presentation at ISBNPA conference, Victoria, Canada. June 2017.

Symposium Organization and Hosting

Samen op weg naar een gezonde leefstijl bij jongeren [Together towards a healthy lifestyle for young people]. Personally hosted and co-organized with Crystal this public symposium at the University of Aruba in April 2019. It was offered by the visiting *MyMovez* team from the Netherlands.

PhD Courses

- *Open Science Framework hands-on tutorial*, Erasmus University Rotterdam, April 2022.
- *Research Presentation Skills*, Behavioral Science Institute (BSI), Radboud University Nijmegen (RU), Spring 2018.
- *Research Publishing Skills*, BSI, RU, Spring 2018.
- *Research Data Management*, BSI, RU, Spring 2018.

Research-Related Courses and Workshops

- *Building your research profile*. University of Aruba Research Center workshop, January 2025.
- *Kickstart your journal article*. Workshops online, Fall 2022.
- *How to motivate the family to change? Applying Motivational Interviewing spirit & skills*. ISBNPA workshop, June 2019.
- *Using your research to influence policy: An overview and practical strategies*. ISBNPA workshop, June 2019.
- *Achieving your goals and performing more successfully in your PhD*. Radboud University, January 2018.
- *Utilising social networks for behaviour change in complex interventions*. ISBNPA workshop, June 2017.
- *Health promotion with indigenous communities*. ISBNPA workshop, June 2017.
- *English language for academic purposes*. Durham University, Summer school program, July 2016.
- *Writing: A tool to express your knowledge*. Workshops, October 2015.
- *Questionnaire design for social surveys*. Coursera course by Michigan University, December 2014.
- *Basics of health economics*. E-learning course from The World Bank, October 2014.

- *Viable alternative of development; Philosophy of science; Research philosophy.* Courses PhD Research School, University of Aruba, certificate February 2012.

Open Science Practices

Two preregistered randomized controlled trials, one published methodology description of a sub-dataset, and three published open datasets.

Professional Development

- NWO Dutch Caribbean Research Week live event in Aruba, November 2024.
- Turning the Tide: Climate Change, Social Change, and Islandness conference, conference hosted at the University of Aruba, October 2023.
- ISBNPA conference, Uppsala, Sweden, June 2023.
- The British Feeding and Drinking Group conference, online, April 2022.
- Caribbean Public Health Agency (CARPHA) conference, Port of Spain, Trinidad & Tobago, June 2019.
- Multi-method research in behavioural science symposium, Radboud University, January 2018.
- Radboud University PhD day, October 2016.
- International Communication Association (ICA) conference, San Juan, Puerto Rico, May 2015.

Research Visits

Alongside online meetings, in-person visits occurred for in-depth support and resources.

- The Netherlands:
  - Erasmus University Rotterdam: short-term visit in June 2023.
  - Radboud University Nijmegen: short-term visit in June 2019, approximately one month in January 2018, and approximately two months in October–November 2016.
- Aruba:
  - In-person meetings took place in August 2021 and December 2019.
  - In April 2019, supervisors and the *MyMovez* team visited the University of Aruba.

Community Involvement in Public Health

Engagement with public health-related activities, including:

- Contributed to developing a *National multi-sectoral action plan for the prevention and control of noncommunicable diseases 2020 – 2030.* Meetings hosted by the Pan American Health Organization and/or the Department of Public Health Aruba, 2019.
- Co-initiated the institutionalization of National Health Accounts Aruba. A collaboration between the Department of Public Health Aruba, Central Bureau of Statistics Aruba, and the University of Aruba, 2014-2016.
- Conducted and presented two satisfaction studies for 'Algemene Ziektekosten Verzekering' (AZV; the National Health Insurance of Aruba): one assessing opinions of caregivers and the other those of residents through surveys, 2013-2015.

Additional Academic Research and Presentation Experience

Conducted two research projects on consumers' clothing attribute preferences, shopping behaviors, and retail store selection within Aruba's multicultural small-island retail context. Findings were presented at two international conferences in 2013: an oral presentation at the international conference of the European Institute of Retailing and Services Studies (EIRASS), Philadelphia, USA; and a poster presentation at the American Psychological Association (APA) Convention, Honolulu, Hawaii.

Academic Engagement and Contributions

Involvement in academic-related roles at the Faculty for Accounting, Finance, and Marketing at the University of Aruba, carried out at various periods from 2008 to the present, including:

- Development and teaching of new curriculum modules in marketing, including Promotional Campaign Effectiveness, SPSS, Consumer Behavior, and Marketing Research.
- Teaching marketing modules, including Business Intelligence, Feasibility Study, Marketing Strategy, and (International) Marketing Management.
- Contributions to various committees, including the Exam Committee, Research Line Committee, Research Center Council, Interfaculty Quality Assurance Meetings, and Human Resource Hiring Committees.
- Involvement in curriculum development and accreditation/ visitation-related activities within the faculty.

- Supervision of student work related to marketing, including projects, internships, and theses.
- Support for student learning and development through one-on-one research consultations, counseling sessions, and enrichment through previous student field trips to Ecuador, the USA, and the Galapagos Islands.

Teaching Qualifications

- Basic Qualification Examination (BKE), University of Aruba, certificate December 2024.
- Academic Learning Certificate (BKO). A teaching qualification at higher education level, University of Aruba, certificate January 2019.

ACKNOWLEDGMENTS

It is with immense gratitude that I write this final section of my dissertation. I am deeply grateful to the many individuals who, through their contributions before and during this period, made it possible.

I extend my thanks to the **University of Aruba** and the **Faculty for Accounting, Finance, and Marketing (FEF)** for facilitating such an experience. My profound gratitude goes to my research supervising committee, whose guidance, along with the support of **Erasmus University Rotterdam (EUR)** and **Radboud University Nijmegen (RU),** was instrumental in making all of this happen: **Prof. dr. Moniek Buijzen (EUR, promotor), Dr. Crystal Smit (EUR, co-promotor)**, and **Dr. Rebecca de Leeuw (RU, co-promotor).**

Moniek, I will be forever grateful for your swift response to my research inquiry and for our meeting at a conference in Puerto Rico, where we discussed the outline of this beautiful research project. Met heel mijn hart masha danki dat je mij als een long-distance external PhD candidate hebt aangenomen en mij gedurende al deze jaren hebt begeleid.[1] [2] Moniek, thank you for all the insightful conversations, critical comments, tough talks, and encouraging words throughout this project. Your work inspired me even before we met, and during our collaboration, I continued to admire you in so many ways. I also thank the ***MyMovez*** team members for their hospitable and supportive vibes. Seeing all of you in our aula at the University of Aruba and at my home, a few years later, is a treasured memory. Moniek, hopi danki voor alle verrijkende ervaringen zodat ik nu de leukste dag van mijn professionele leven kan beleven zoals jij dat zo mooi hebt benadrukt.[3]

Crystal, thank you for all your advice, support, and all our sweet yet critical conversations. I appreciate you sharing with me *ShareH_2O*, the "(grand)parent" of *Kies Awa*. Together, as Arubans, we contributed to the Aruban community, making this project even more special. Thank you for always being there for me, whether from afar or during my in-person visits; it truly made a difference

1 I have chosen to express some heartfelt messages in our primary language of communication, Dutch or Papiamento. However, for inclusivity, I have included English translations in the footnotes.

2 With all my heart, thank you so much for accepting me as a long-distance external PhD candidate and for guiding me throughout all these years.

3 Moniek, thank you so much for all the enriching experiences, so that I can now experience the most enjoyable day of my professional life, as you so beautifully emphasized.

in making me feel at home at these universities. Having co-organized the symposium with you for the Aruban public was a memorable event. Through that experience, we got to know each other better, for which I am grateful. Crystal, hopi danki pa tur e experiencianan involvidabel![4]

Rebecca, thank you so much for your critical and provocative questions, which helped me look at things differently and broaden my view of the scientific world. I truly enjoyed our talks, where we shared thoughts about our world and potential future research topics. Although you joined the supervision team a bit later, I experienced you as the anchor in this project, helping me maintain an overview to navigate this unique journey. I appreciate your prompt replies to my questions, which helped me stay on course. I am grateful you were so hospitable to Patrick and me at your home in the Netherlands and that we could meet your adorable family. Rebecca, hopi danki voor al onze momenten samen![5]

As a team, **Crystal**, **Rebecca**, and **Moniek**, I also want to express my profound appreciation for our more personal conversations. You have taught me a lot—thank you for your support and sincere interest in wanting to guide me through this endeavor while being far from each other. I am grateful that you kept faith in me to complete this project, which was a huge motivator for me to keep going. Together, we completed a project on a small island that contributed to big world goals. Ik waardeer de mooie bloemen en lieve woorden die ik van jullie op bijzondere momenten heb gekregen, masha danki![6]

My deepest gratitude goes to the **University of Aruba**. I envisioned a PhD trajectory after learning about a job position there. As a young university, it had not yet established a clear structure for such new positions, and we faced considerable challenges in pursuing research and in finding the professorial guidance to direct it. Yet this challenging phase only solidified my passionate commitment to push forward and find the guidance necessary to truly embark on this PhD journey. Therefore, I want to acknowledge both the individuals who supported me prior to and during the dissertation period. I am especially grateful to former rector **Dr. Lydia Emerencia**, who planted the seed for this scientific endeavor, and former rector **Dr. Glenn Thodé**, for his support and

4 Crystal, thank you so much for all the unforgettable experiences!

5 Rebecca, thank you so much for all our moments together!

6 I appreciate the beautiful flowers and kind words I received from you at special moments, thank you very much!

sincere interest in my work. I also want to thank **Dr. Glenn Sankatsing** and **Dr. Cees Hamelink**, who established the first PhD Research School at the University of Aruba, and **Dr. Eric Mijts**, who recently opened the Research Center, for providing their support, courses, and activities that were all related to research. I am grateful for the support of **Dr. Viola Heutger** during her brief time as rector. I also appreciate the encouragement from the interim rectors **Dr. Mieke de Droog** and **Sue-Ann Lee, MSc**, who is currently the rector. I would also like to express my appreciation to the Board of Trustees of the University of Aruba for their commitment to and support of the university's ambitions. Thank you all for strategically encouraging and fostering a scientific community in Aruba, which led to this accomplishment; therefore, I also extend my congratulations to you, pabien!

Heartfelt appreciation goes to the (former) deans at the **FEF**: **Widya Matawlie, Paul Vandormael, Kitty Groothuijse, Joost Jacobs**, and **Reint Schutter**. I deeply value both my educational responsibilities and research endeavors. Navigating the inherent challenges of balancing and prioritizing these tasks within the faculty presented unique challenges. Yet, your support and understanding allowed me to find the guidance necessary from universities in the Netherlands to initiate and complete this research project to fulfill this academic job position. For this, I am very grateful. I thank my FEF students as well for their sincere interest in my work. My gratitude also goes to my current and past colleagues at the FEF. FEF team, I thank you for your collegiality and all our exchanges; they all played a role in completing this journey.

I am grateful to the (former) members of the Human Resources department—**Laura Knijff, Naomi van Slijpe, Ana-Maria Tromp, Michelle Mendes, Charmaine Pappers**, **Rozetti Dijkhoff**, and **Frances Figaroa**—for their supportive words to find my way to embark on a research project and to complete it. I also thank my colleagues **Patrick Arens** and **Javier Rasmijn** for approving and processing research-related costs. The job position, time, and finances provided by the University of Aruba were invaluable in completing this dissertation. Masha danki!

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Now, I would like to acknowledge some of my friends, family, and my husband who supported me during this journey.

The genuine interactions with some of my closest friends were instrumental in accomplishing this dissertation. I met each of you at the University of Aruba, and our individual friendships blossomed beautifully: **Nadia Dresscher, Thais Nierop**, and **Madhu Jadnananansing**. The unique support and connection I found in each of you helped me enjoy the good laughs and moments, while also coping with the blood, sweat, and tears that came with this dissertation—even way before embarking on it. Thank you for your beautiful, wise, and rich energy that undoubtedly influenced me to not put this "child" for adoption ;-). You are the best "peer influencers!" Ik wil dat je weet dat dankzij onze vriendschap—deepened by unique insights from both our personal and professional life—termina e proyecto aki tabata posibel, hopi danki![7]

A big hug and thank you goes to my parents, sisters, and close family: **Elizabeth, Franklyn, Braula, Daisy, Mirjam, Nathaly, Julitza, Patricia, Kevin, Jaïndrah, Jaythan, Emily**, and **Jacqueline** for our exchange of love, help, space, encouragement, appreciation, admiration, and care. Daisy, I fondly cherish the moments you helped me with some of the tasks. Famia, cu henter mi curazon masha danki pa a scucha y sinti cu mi tur locual mi tabata comparti cu boso![8]

7 I want you to know that thanks to our friendship—deepened by unique insights from both our personal and professional lives—completing this project was possible, thank you very much!

8 Family, thank you from the bottom of my heart for listening and for feeling with me what I was sharing with you!

Patrick Fortin, my dearest husband. Each time I try to acknowledge your role in this dissertation journey, my eyes fill with grateful tears. I sincerely appreciate and admire you as a human being even more because you took up all the unpaid "managing and coaching roles" this project required as well ;-). Patrick, un miyon di danki pa a yudami goza di bida mientras cu mi ta dal un "last lap" mas cu un mescla di musica, bailamento, gozo, spierpijn, cansancio y laatste loodjes—loodjes cu ta parse mas barancanan di Ayo y Casibari ;-).[9] I am very grateful that I could share the energetic kickoff, the joys, and the challenging phases of this journey with you. Patrick, I feel happy to celebrate this special life accomplishment together with you!

I am grateful to have been inspired by other researchers, and I sincerely hope this work, in turn, inspires future research, especially at the **University of Aruba** and throughout the **Caribbean** region, as an equally important region of this beautiful **world**.

Cu amor,

Saskia C. M. Franken

9 Patrick, a million thanks for helping me enjoy life while I was taking one more "[carnival parade] last lap" with a mix of music, dancing, joy, muscle soreness, tiredness, and "final heavy weights"—weights that seem more like the boulders of Ayo and Casibari ;-).

The consumption of sugar-sweetened beverages is a major factor associated with childhood obesity in the Caribbean and worldwide. This dissertation focuses on Aruba, a Caribbean island where this issue demands attention. In this context, **Saskia C. M. Franken** examines the effectiveness of a social network intervention wherein peer influencers promote water consumption as a healthy beverage alternative among schoolchildren, and also explores the role of children's social norms. Through three empirical studies, she examined the potential of using a social network intervention approach for the Aruban context, identified important factors that influence water consumption, and examined the effectiveness of the context-adapted *Kies Awa* (Choose Water) social network intervention. The findings provide evidence that the social network intervention approach can effectively increase water consumption, especially after implementing evidence-based adaptations. This dissertation also proposes areas for further research and action to continue encouraging children to meet recommended water consumption guidelines. This work offers valuable insights for those seeking to create healthier school environments for children.