

The risk factors of diabetes mellitus type 2 **in Sint Maarten**

and the barriers to a healthy lifestyle of diabetics

A mixed-method study



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by

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Declaration:

Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.

The thesis "Risk factors of diabetes mellitus type 2" is my own work.

Signature:



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Abbreviations

AUC:	American University of the Caribbean
BMI:	Body mass index
CVR:	Cardiovascular risk
DBP:	Diastolic blood pressure
DM2:	Diabetes mellitus type 2
FH:	Family history
FPG:	Fasting plasma glucose
GDP:	Gross domestic product
Glucfasting↑	High fasting plasma glucose level*
Gluc200↑	High plasma glucose level above 200mg/dl*
HbA1c:	HemoglobinA1c
HBP:	High blood pressure*
HBP American:	High blood pressure according to American guidelines*
HChol:	High cholesterol level*
HCW:	High waist circumference*
HT:	Hypertension
IDIs:	In-depth interviews
IDF:	International Diabetes Federation
KAs:	Key actors
LFC:	Time to last food-or beverage- consumption (in hours)
NCD:	Non communicable disease
NIPA:	National Institute for Professional Advancement
PI:	Principal investigator
PMH:	Past medical history
PHSDL:	Public health, social development and labor
SBP:	Systolic blood pressure
SES:	Socio-economic status
STEPS:	WHO STEPwise approach to chronic risk factor surveillance
SZV:	Social health insurance (Sociale ziektekostenverzekering)
WC:	Waist circumference
WHO:	World Health Organization

*For more information see methodology, page 14 and 15.

Abstract

Background: In Sint Maarten diabetes mellitus type 2 (DM2) is a growing public health concern. The wide variety in the population's country of origin, income and education-level urges the need for knowledge about Sint Maarten's risk factors of DM2 and barriers to a healthy lifestyle.

Methods: A mixed-method study was carried out: A cardiovascular risk-screening among adults (n=588), was performed in Sint Maarten in 2016. Analysis and statistical tests were done to assess the DM2-prevalence and risk factors. In-depth interviews (n=20) were conducted to identify factors influencing lifestyle-choices and to explore the knowledge of DM2 and offered services.

Results: The DM2-prevalence of the study population (age 20-83) was 11.5%. Risk factors of DM2 were older age, family history positive for DM2 and a high waist circumference. The prevalence of central obesity (67% vs. 23%) and physical inactivity (74% vs. 57%) was significantly higher among females than males. The prevalence of hypertension was higher among males (58% vs. 44%). Barriers to a healthier lifestyle were; lack of knowledge, underestimating body size, costs of healthy food, bad eating habits, lack of social support and unmet needs of healthcare-services.

Conclusion and recommendations: The DM2-prevalence found is among the highest in the world. The risk factors for developing DM2 were similar to other studies done in the Caribbean. The high prevalence of hypertension needs further study and the obesity-problem should be addressed. Possible solutions for the knowledge- and support-gap are setting up a diabetes center and integrating social media in healthcare.

Keywords: diabetes mellitus type 2, Sint Maarten, Caribbean, obesity, hypertension

Word count: 13125

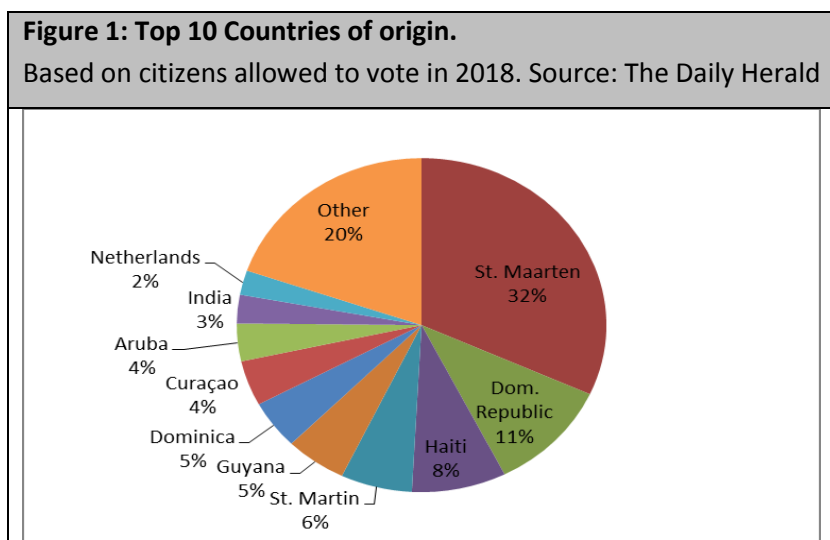
1) Introduction

Working as a medical doctor I have seen the burden diabetes mellitus type 2 (DM2) has on the population of Sint Maarten. In the general practice, the difficulties patients have in adjusting their lifestyle and accepting that they have to take medication, most of the time lifelong. In the emergency room, undetected diabetes patients came in with life-threatening situations when having a diabetic ketoacidosis. But also, in the elderly home, where there are so many patients with amputated toes, feet or complete legs; the result of years of uncontrolled diabetes.

In 2016 I was the medical doctor involved in the Health bus Project in which inhabitants of St Maarten, were screened for the risks of cardiovascular disease. Screening on diabetes was one of the main targets of this project. In this thesis the data from this project will be combined with the outcome of individual interviews with DM2 patients. I hope that this thesis will give a better inside in the size of the DM2-problem in St Maarten and its determinants, all in order to wake up policy makers to take this seriously and get into action.

2) Background information

Saint Martin is an island in the Caribbean Sea approximately 240 kilometers east from Puerto Rico. The French and Dutch colonists claimed the 87 km²-island in the 17th century¹. In the 18th and 19th century the Dutch participated in large transatlantic slave trade and although Sint Maarten was used more as a trade entrepôts than a plantation complex, there were slaves from African origin working on the sugarcane plantations and at the salt pond².



Today, the northern part of the island is still part of the French Republic (called Saint Martin) and the southern part; called Sint Maarten, is one of four constituent countries within the Kingdom of the Netherlands¹. Sint Maarten is Caribbean's most densely populated country with a population surpassing 40,000⁴. The origin of the population is very diverse as can be seen in Figure 1. The official language on the island is English, but for many people Spanish, French, Creole or Dutch is their native language. Illiteracy rates have been reduced from 8.6% in 1992 to 4.1 % in 2001, more recent data is unfortunately unknown³. In 2001 the island did have one of the highest illiteracy rates among Caribbean countries³.

On September 6th, 2017 Sint Maarten was severely hit by category 5 hurricane Irma. Damages suffered on the Dutch-side were estimated to be 1.38 billion USD or around 129% of the gross domestic product (GDP) ⁴. The main source of income for the people on the island is tourism, which was severely affected by the destruction of the airport, hotels and restaurants. The economy was contracted in the aftermath of the hurricane with

approximately 12%, but growth is expected starting 2019 and the island should be back on its pre-Irma GDP level in 2025⁴.

Although Sint Maarten is considered a high-income country with a current GDP per capita of a little over 25000 USD, there is a high poverty rate⁴. Twenty-seven percent of the country's households are considered poor, living on incomes at or below the minimum wage of 850 USD per month⁴. This wage is very low, taking into consideration that the prices for food and basic supplies are relatively high because almost all need to be imported to the island. It's unknown how many people of this vulnerable group were affected by the hurricane, but experience from other countries that suffered a natural disaster is that the poor tend to be disproportionately affected. After the hurricane also the unemployment rate increased, from 6.2% in 2017 to 9.9% in 2018, which might have led to more poverty on the island⁴. Youth unemployment even increased to 17.9% in the same year⁴. In 2011 most people had health insurance (82%). But this number might be significantly lower after Irma, because of the higher unemployment rate⁴.

3) Problem statement and justification

The rising prevalence of DM2 and the decreasing age on which the disease develops is a worldwide concern⁵. In 2017 it was estimated that worldwide one in twelve people above 20 years of age had DM2 (8.4%)⁶. The region with the highest DM2-prevalence (10.8%) was Northern America and the Caribbean (NAC)⁶. Four years earlier (in 2013) the Middle East region had the highest DM2-prevalence (10.9%) and the NAC-region with 9.6% was still listed number two⁷. Although the Middle-East region decreased their prevalence rate between 2013 and 2017, the NAC unfortunately didn't. In the same study of 2013, it showed that of the NAC-countries, the top 10-countries ranked by prevalence are all located in the Caribbean, with Sint Maarten being number 6 with an estimated DM2-prevalence of 14.2%⁷.

The prevalence of DM2 is higher in Sint Maarten than in most other countries in the world. The most recent data of diabetes prevalence of the International Diabetes Federation (IDF), estimated the DM2-prevalence to be 13.2% among adults age 20-99 in 2017⁶. According to the Collective Preventive Services of the Ministry of Public Health Social Development and Labor (PHSDL), DM2 was in 2012 the second leading cause of mortality with 16%, just below ischemic heart disease contributing for 25% of the deaths⁷.

The risk factor for developing DM2: being overweight or obese, seems to be contributing considerably to the global increase of DM2-prevalence. Obesity-prevalence has nearly tripled since 1975 and more than 50% of the world's population is overweight or obese⁸. In Sint Maarten, the prevalence of being overweight or obese is even worse; more than 75% of the adult population had a BMI above 25 in 2015⁹. It has been proven in several studies that losing weight reduces cardiovascular risk, especially in diabetics that are overweight¹⁰. The most commonly used interventions worldwide to reduce weight are having a healthier diet and being more physically active. Another possibility to reduce weight is by having gastric bypass surgery. On the island of Sint Maarten this kind of surgery is not offered and insurance companies have always been reluctant to cover this procedure, which puts more focus on the lifestyle interventions to reduce weight.

Aims and scope of this research

To develop diabetes programs for intervention and prevention more research is needed:

- Quantitative research to define the demographic characteristics of the population with diabetes and to identify their risk factors
- Qualitative research to explore the diabetes-related knowledge, the attitudes and practices towards lifestyle interventions and their knowledge of interventions.

4) Objectives

General objective:

To provide an insight into the diabetes mellitus type 2- prevalence and its determinants in the adult population of Sint Maarten in order to inform and recommend policymakers to strengthen their prevention and intervention programs.

Specific objectives

1. To inform policymakers about the current scope of the DM2-problem and the barriers experienced by the population to adjust to a healthy lifestyle
2. To recommend policymakers in strengthening their prevention and intervention programs to reduce diabetes mellitus type 2 in Sint Maarten.

Objectives in order to reach specific objectives above:

3. To quantify the diabetes mellitus type 2-prevalence in Sint Maarten.
4. To determine the prevalence of risk factors of diabetes mellitus type 2 in Sint Maarten
5. To explore the knowledge of diabetics concerning the causes and consequences of DM2 and their knowledge on lifestyle interventions.
6. To identify socio-cultural and economic factors influencing choices made, concerning diet and physical activity.
7. To identify the knowledge and perception of services, that are being offered to promote a healthy diet and active lifestyle.

5) Methodology

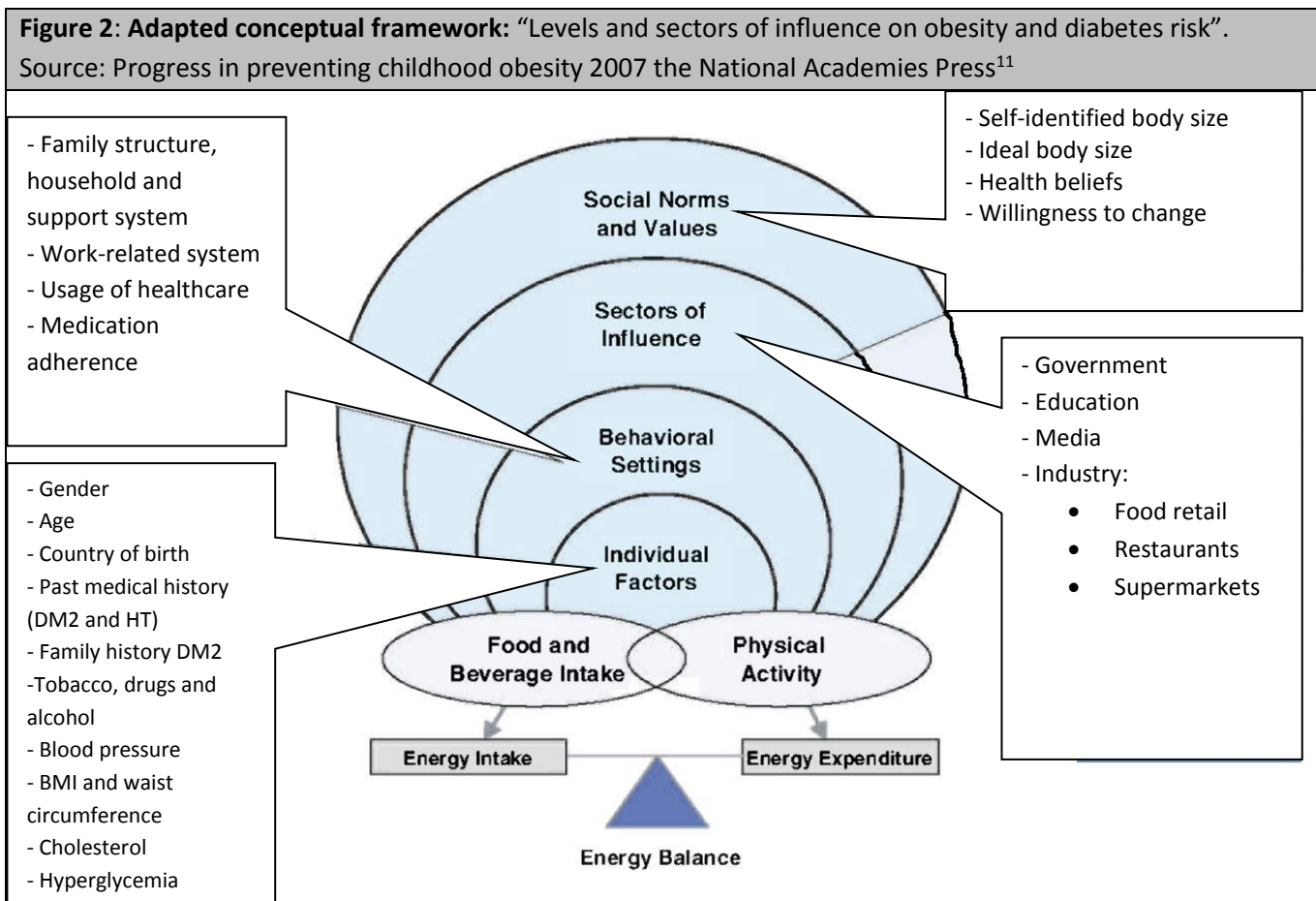
A mixed-methods approach was performed to combine the quantitative data, extracted from a cardiovascular risk (CVR)-screening, with the qualitative data, collected through in-depth interviews (IDIs). The data of the CVR-screening was analyzed to assess the DM2-prevalence and its risk factors, while the interviews were conducted to explore the knowledge, attitudes and practices related to DM2 and lifestyle.

5.1 Institution context

The research was conducted under the supervision of the Royal Tropical Institute (KIT), Amsterdam, The Netherlands.

5.2 Conceptual framework

In this study, a socio-ecological perspective has been chosen to explore the factors that are influencing the risk of developing diabetes mellitus type2 (see figure 2). The conceptual framework has been adapted from its original to make it more focused on adults and diabetes instead of children and obesity. This framework looks beyond the individual to evaluate multiple determinants that increases the risk of developing diabetes. In this study we have tried to explore factors from all levels; behavioral factors, social norms and values, but also the influence of sectors like the government, education, media and the food industry.



5.3 Quantitative data

Review CVR-screening

Data was extracted from data collected during a CVR-screening, which took place from June till October 2016. The CVR-screening was a project set up as a partnership between four parties: the Ministry of PHSDL, SZV (the social health insurance), the American University of the Caribbean (AUC) and the National Institute for Professional Advancement (NIPA). The project aimed to improve awareness and to educate about cardiovascular risks. The screenings took place on 23 different dates on 11 different locations on the Dutch side of Sint Maarten (34 km²). Medical students from the AUC and nurses in training from NIPA started collecting data after receiving informed consent (see Annex 1). Participants in this screening were a convenience sample of adults (>18 years of age). All participants voluntarily joined in the event, there was no reward given. Data collection did not stop even when the required sample size was reached, as data collection was not the primary aim of the project. The required sample size to estimate the proportion of DM2 in the population would have been 177. Used for this calculation was the estimated DM2-prevalence rate of 13.2% as shown in the IDF Diabetes Atlas of 2017, a desired precision of 0.05 and a confidence interval of 0.95 in a population of 40000^{6,12}.

Detailed histories were taken, which took approximately 30 minutes before starting any physical examination. During the physical examination glucose and cholesterol screenings were done. Heights, weight, waist- and hip-circumference were measured. The blood pressure was measured at the beginning of the physical measurements and again at the end. Education about diet was provided for all participants, for which the quality was ensured by a dietitian, working with the students. Any participant with a result above the recommended guidelines in blood pressure, glucose or cholesterol, was seen by the local physician present, who was also the principal investigator (PI). She provided extra explanation and always advised a follow up with a general practitioner when necessary. When they were not insured, they were seen free of charge at Bushroad Clinic and a social worker was present to help apply for insurance, where possible.

Quantitative data processing

To assure the quality of the data during the data collection the PI always screened the finished form. If there was anything missing or wrongly documented, the PI would give feedback to the students as soon as possible. At the end of each day, the PI would give a small summary on the number of people that were seen and difficulties that were encountered. Small adjustments were then made on the protocol if necessary. All data were processed in the computer within 48 hours. For this study, only data from the CVR-screening were extracted that were necessary to assess the DM2- prevalence and its risk factors in the population of Sint Maarten. The data collected was anonymously saved and kept under lock and key.

Quantitative data analysis

Data were entered into an excel spreadsheet and then imported into a statistical software package (STATA, IC15.1). In STATA all the descriptive statistics were generated and multiple statistical tests were performed. T-tests and chi-square tests were performed for comparing female and male participants, but also for comparing the DM2- with the no DM2-group. For the association between risk factors and DM2, a multivariate logistic regression test was done.

Used definitions for physical (in)activity, high waist circumference, high cholesterol, high blood pressure and DM2-diagnosis are described below:

Physical activity and physical inactivity

SR-physical activity: Positive if participant answered “yes” to the question “Do you do any physical activities? “

Physical inactivity is based on WHO’s recommended level of physical activity for adults aged 18-64 years¹³:
“At least 150 minutes of moderate-intensity aerobic physical activity throughout the week”.

Physical inactivity: Positive in participants that reported being active for 30 minutes, less than five times per week or less than 150 minutes per week in total.

High waist circumference

Participants with a positive high waist circumference (HWC) were considered to have central obesity, also known as abdominal obesity. Cut-offs for high waist circumference used were based on recommendations from the Dutch general practitioners association in which a positive HWC was related to an elevated risk on morbidity (including DM2) and mortality¹⁴.

HWC = Positive in:

- female participants that had a waist circumference of 88cm or more
- male participants that had a waist circumference of 102cm or more

High cholesterol (HChol)

HChol = Positive in participants with measured plasma cholesterol of 200mg/dl or more. Cut-off is based on the cut-off used by the local laboratory (Sint Maarten Laboratory Services).

High blood pressure

The systolic blood pressure (SBP) and the diastolic blood pressure (DBP) were measured twice; one time at the beginning of the screening and one time at the end. In the results the average of these two measurements will be shown. The prevalence of having a high blood pressure (HBP) was measured by combining the participants with an elevated blood pressure, according to European guidelines¹⁵, with the participants with a past medical history (PMH) of hypertension (HT). Because the United States used different cut-off values for having a high blood pressure when analyzing, also high blood pressure according to American guidelines was calculated¹⁶.

HBP = Positive in participants with:

- an average systolic blood pressure of 140 or above
- an average diastolic blood pressure of 90 or above
- a past medical history of hypertension

HBP American = Positive in participants with:

- an average systolic blood pressure of 130 or above
- an average diastolic blood pressure of 80 or above
- a past medical history of hypertension

DM2-diagnosis

The DM2-group in the analysis consisted of the participants with a positive PMH of DM2 plus the participants that had hyperglycemia. The WHO diagnostic-criteria for hyperglycemia used were: fasting plasma glucose \geq 126mg/dl or 2 hour plasma glucose \geq 200mg/dl ¹⁷.

In this study the variables of hyperglycemia were named Glucfasting \uparrow and Gluc200 \uparrow .

Glucfasting \uparrow = Positive in participants with a plasma glucose-level of 126mg/dl or above and a last food- or beverage-consumption eight hours or more before the test.

Gluc200 \uparrow = Positive in participants with a plasma glucose-level of 200 mg/dl or above and a last food- or beverage-consumption two hours or more before the test.

DM2-group Positive in participants with:

- a positive Glucfasting \uparrow
- a positive Gluc200 \uparrow
- a PMH of DM2

5.4 Qualitative data

In-depth interviews with DM2 patients

At each side general practitioners randomly asked DM2-diagnosed adults to voluntarily participate in this research. The PI followed up with participants who were willing and available to be interviewed. Saturation was reached after 17 adults were interviewed (residency: Cole bay n=1, St Johns n=2, Philipsburg n=3, Saunders n=3, Cul de Sac n= 3 and Dutch Quarter n=5). All interviews were conducted in English. The PI ensured that there was a large variety of participants considering age, gender, socio-economic status and income (see annex 6). All participants agreed to the informed consent provided before the interview. Interviews were conducted in primary health centers or at a private aesthetic clinic in Simpson Bay from May till July 2019. The in-depth interviews consisted of 12 open-ended questions concerning three topics: knowledge on lifestyle and DM2, socio-cultural and economic factors that influence lifestyle choices and knowledge and perception of services. The topic list can be found in annex 4. Interview times ranged from 15 to 61 minutes.

In-depth interviews with key actors

Three in-depth interviews (IDIs) were conducted with health professionals that are working daily with DM2-patients. Questions asked were similar to the questions asked to the primary participants (the DM2-patients), but they were transformed into more general questions (e.g. 'How do most people on the island find out they are having diabetes?' instead of 'How did you find out you have diabetes?'). This adjusted topic list can be found in annex 5.

Qualitative data analysis

The IDIs with DM2-patients and with key actors were all tape-recorded. Collected data was transcribed as soon as possible, preferably within 24 hours, to monitor the results during the study and to discover when saturation had been reached. No adjustments to the research were made during the collecting of data. The data collection-tract of the study was done only by the PI, which ensured the consistency of the data. The data collected was anonymously saved and kept under lock and key and after 2 years it will be destroyed. The PI speaks and reads English, but it is not her native language, therefore there was assistance during the coding, conducting the results, and making the report, to ensure that no misinterpretations were made related to language-barriers. The assistance came from one of the general practitioners who worked in the Bushroad Clinic for over 20 years. All data was written down in Word and afterwards processed into categories in another Word document, where it was coded and ordered per objective by the PI. Coding was done according to the issues listed in the topic list (annex 4). Coding, listing, analyzing and finalizing the report were all done by the PI.

6) Results

During the CVR-screening information was collected of 588 adults. Only the data of participants above 20 years of age was analyzed (n=566), because in literature DM2-prevalence is also most often presented as prevalence in adults age 20-99 years. All data of the 20 in-depth interviews have been used. All tables and figures below are data from the CVR-screening, except for table 10 and 11, which were derived from the IDIs.

6.1 Quantitative results

6.1.1 Individual factors

Gender, age and country of birth

More females (57.8%) than males participated. Significant gender differences were found in having a PMH of hypercholesterolemia, a family history (FH) of DM2, tobacco-use, alcohol-use, drug-use and level of physical activity (for more details see the concerning individual factors below).

The average age of participants was 45.7 years (SD± 13.5).

Most participants of the screening were born in Sint Maarten (16.5%) followed by Dominican Republic (13.2%), Jamaica (11.6%), Dominica (10.6%) and Haiti (10.1%) (table 2). More than half (62%) of all participants were born in one of these 5 countries.

Table 1: Prevalence of individual risk factors for developing diabetes mellitus type 2

Risk factors	Total	Female	Male	p-value
Age (n=566)(yrs)	45.7 ± 13.5	44.8±13.2	46.9±13.9	0.06
Past medical history of hypertension (n=563)	25,8%	27.4%	23.5%	0.3
Past medical history of diabetes mellitus type 2 (n=561)	10.7%	12.4%	8,4%	0.3
Past medical history of hypercholesterolemia (n=563)	17.9%	21.2%	13.5%	<0.01
Family history of diabetes mellitus type 2 (n=560)	28.9%	43.3%	24.5%	<0.05
Tobacco use(n=558)	12.0%	9.4%	15.6%	<0.05
Alcohol use (n=556)	52.2%	45.1%	61.6%	<0.001
Excessive alcohol* (n=556)	7.8%	5.5%	10.9%	<0.05
Drugs use (n=503)	6.2%	3.8%	9.5%	<0.01
SR-physical activity** (n=550)	61.5%	56.0%	69.0%	<0.001
Physical inactivity*** (n=536)	67.0%	74.4%	56.6%	<0.001

* Excessive alcohol: Consuming more than one alcoholic beverage per day or more than five per week.

**SR-physical activity: Self-reported being physically active.

*** Physical inactivity: Doing Physical activities less than 150 minutes per week.

Table 2: Top 10 most common countries of birth of the participants			
Country of birth	Percentage	Country of birth	Percentage
Sint Maarten	16.5%	Curacao	4.1%
Dominican Republic	13.2%	India	2.6%
Jamaica	11.6%	Aruba	2.3%
Dominica	10.6%	Venezuela & St Martin (French side)	Both 2.1%
Haiti	10.1%		
Guyana	6.7%		

Past medical history and family history

One in four (25.8%) participants had a PMH of HT and one in ten (10.7%) had a PMH of DM2. A significant difference between female and male participants was found in PMH of hypercholesterolemia and FH of DM2; both are more common in women. Twenty-one percent of females compared to 13.5% of males had a PMH of hypercholesterolemia. Female participants stated almost twice as often as male participants, that they had a family member that was affected by DM2, respectively 43.3% and 24.5% (see table 1).

Tobacco, drugs and alcohol

Male participants significantly used more often tobacco, alcohol and drugs than their female counterparts. One in six male (15.6%) used any kind of tobacco, whereas less than one in ten (9.4%) female used tobacco. Sixty-one percent of males consumed alcohol and 10.9% of all males used more than the recommended alcohol consumption of 1 drink per day or 5 drinks per week. Forty-five percent of females consumed alcohol and 5.5% used more than the recommended alcohol consumption (see table 1).

Physical activity

Women were significantly less active than men; 56% of female participants indicated that they did any kind of exercise or physical activity against 69% of male participants. Three quarter (74.4%) of all females moved less than the recommended 150 minutes per week, in males more than half (56.6%) did not exercise enough (see table 1).

Blood pressure

The average SBP and the average DBP were both significantly higher for male than for female participants (see table 3). When adding the participants with a PMH of HT to the participants with a high SBP (>140) or DBP (>90), 44% of females had hypertension and 58% of males had hypertension (HBP). When adjusting to the American guidelines 71% of women and 80% of men had hypertension (HBP American). In table 4 the high blood pressure measurements are shown for male and female with and without a PMH of HT. Of the 247 participants that had hypertension according to our measures used, 145 (59%) were diagnosed before. At least 57% of the diagnosed participants were on treatment for HT, 23% admitted not to use any medication. Less than half of the diagnosed participants (43%) had a blood pressure that was according to the European standards in the normal range (see figure 3).

Table 3: Average blood pressure and prevalence of “high blood pressure” and “high blood pressure American” (n=493).

	Total	Female	Male	p-value
Systolic blood pressure (mmHg) (SBP)	132.9±20.1	128.6±19.8	138.7±19.1	<0.001
Diastolic blood pressure (mmHg) (DBP)	84.4±11.0	83.1±10.2	86.1±11.8	<0.01
SBP>=140 or DBP>=90	39.8%	31.5%	51.2%	<0.001
HBP*	50.1%	44.4%	58.0%	<0.01
SBP>=130 or DBP>=80	70.6%	65.0%	78.3%	0.001
HBP American**	74.4%	70.6%	79.7%	<0.05

* HBP: Prevalence of participants having a systolic blood pressure above 140 or a diastolic blood pressure above 90 or a past medical history of hypertension.

** HBP American: Prevalence of participants having a systolic blood pressure above 130 or a diastolic blood pressure above 80 or a past medical history of hypertension.

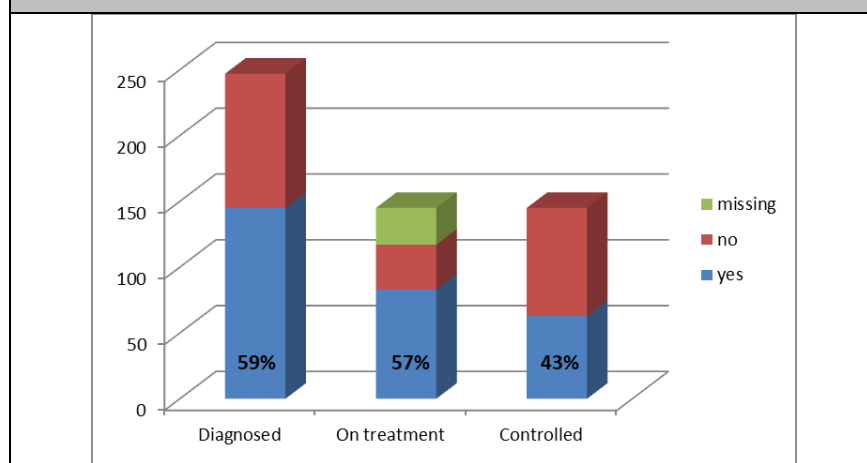
Table 4: Prevalence of high blood pressure measures of participants with and without past medical history of hypertension.

	Past medical history of hypertension	Systolic blood pressure (SBP) above 140	Diastolic blood pressure (DBP) above 90	SBP above 140 or DBP above 90	HBP[^]
Female (n=285)	No 203 (71.2 %)	34 (16.7%)	36 (17.7%)	45 (22.2%)	44%
	Yes 82 (28.8%)	35 (42.7%)	34 (41.5%)	45 (54.9%)	
Male (n=207)	No 156 (75.4%)	57 (36.5%)	48 (30.8%)	69 (44.2%)	58% ^{^^}
	Yes 51 (24.6%)	35 (68.6%)	30 (58.8%)	37 (72.5%)	
Total (n=492)	No 359 (73.0%)	91 (25.3%)	84 (23.4%)	114 (31.8%)	50%
	Yes 133 (27%)	70 (52.6%)	64 (48.1%)	82 (61.7%)	

[^]HBP: Prevalence of participants having a systolic blood pressure above 140 or a diastolic blood pressure above 90 or a past medical history of hypertension.

^{^^} significantly higher in female, than in male (p<0.001).

Figure 3: Overview of participants with hypertension: percentage being diagnosed, being on treatment and being controlled (n=493).



Body mass index (BMI) and waist circumference

Female participants had a significantly higher BMI than male, respectively 30.4kg/m² (SD±6.1) and 28.4kg/m² (SD±4.9) (see table 5). The percentage of females in the screening that was overweight (BMI>25) and the percentage that was obese (BMI>30) were both significantly higher in women, than in men. More than half (50.9%) of the females versus 31.9% of males were obese. There was no significant difference in absolute waist circumference (WC) between men and women. The prevalence of having a high waist circumference (HWC) was significantly higher in female than in male participants. Two third (67.8%) of female had a high waist circumference against 24.8% of male participants.

Table 5: Body mass index (BMI), waist circumference(WC) and cholesterol

		Total	Female	Male	p-value
BMI (n=559)	BMI (kg/m ²)	29.5 ± 5.7	30.4±6.1	28.4±4.9	<0.001
	BMI>25 -%	80.2%	83.1%	76.1%	<0.05
	BMI>30 -%	42.9%	50.9%	31.9%	<0.001
WC (n=550)	WC (cm)	93.5±13.1	93.4 ±13.6	93.8 ±12.5	0.36
	HWC*	49.7%	67.8%	24.8%	<0.001
Cholesterol (n=553)	Cholesterol (mg/dl)	192±48	192±50	193±44	0.32
	HChol**	42.5%	40.8%	44.5%	0.38

*HWC: high waist circumference of 88cm or more in females and 102cm or more in males.

**HChol: high cholesterol of 200mg/dl or more.

Cholesterol

Four out of ten (42.5%) had a high cholesterol level above 200 mg/dl (HChol). There was no significant gender-difference seen, respectively 192 mg/dl (SD±48) for females and 193 mg/dl (SD±50) for males.

Hyperglycemia

In table 6 an overview of high glucose measurements (=hyperglycemia) in combination with having a PMH of DM2 are shown. In 523 of the 552 glucose-measurements done, the time to last food-or beverage-consumption (LFC) was documented. Of the 29 glucose-measurements that were recorded without LFC, there were 3 among participants with a PMH of DM2. In total, 11 females and 5 males, had a glucose measurement above 200mg/dl, while LFC was more than 2 hours ago (=Gluc200 ↑). Three of these women were never diagnosed with DM2, all three of them had no insurance, and two of them didn't see a GP for more than 1 year. One female participant had a glucose-level above 126 mg/dl when her LFC was more than 8 hours before (=Glucfasting ↑), she was a known diabetic.

Table 6: Number of participants with hyperglycemia with and without past medical history (PMH) of diabetes mellitus type 2 (DM2).

	PMH of DM2	Gluc200 ↑* n=564	Glucfasting ↑** n= 564	Hyperglycemia (not diagnosed) + PMH of DM2
Female (n=300)	No	3	0	3+37= 40 (14.3%)
	Yes	8	1	
Male (n=223)	No	0	0	0+20 = 20 (9.0%) ***
	Yes	5	0	
Total (n=523)				60 /523 = 11.5%

* Gluc200 ↑: Amount of participants having a measured plasma glucose value above 200mg/dl and a last food or beverage consumption of 2 hours or more.

** Glucfasting ↑: Amount of participants having a measured plasma glucose value above 126 mg/dl and a last food or beverage consumption of 8 hours or more.

*** Not significantly different of female (p=0.12)

Medication-use in combination with hyperglycemia is summarized in table 7. Of the 60 participants that are considered to have DM2 according to our measurements and standards, 57 participants were already diagnosed (95%). Of the diagnosed participants >73% is using medication for DM2, but less than 77% are having a controlled glucose-measurement (see figure 4). Of the diabetes-patients that were using medication, 81% were using oral anti-diabetic drugs only, 12% used only insulin and 7% used both.

Figure 4: Overview of participants with DM2: percentage being diagnosed, being on treatment and being controlled (n=561).

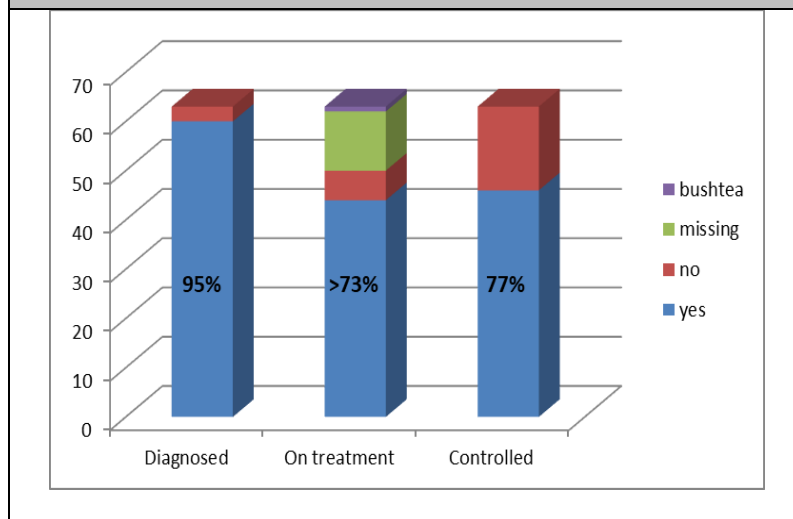


Table 7: Prevalence of past medical history (PMH) of diabetes mellitus type 2 (DM2), being diagnosed, being on medication and being controlled in diabetes mellitus type 2-participants.

PMH of DM2	Number	Prevalence
Female (n=324)	40	12.3%
Male (n=237)	20	8.4%
Total (n=561)	60	10.7%
Prevalence of diagnosed DM2		60/63 = 95%
PMH of DM2 on medication		
Female (n=40)	Yes	80%
	No	0
	Missing results	20%
Male (n=20)	Yes	60%
	No	15%
	Bush tea	5%
	Missing results	20%
Total (n=60)	Yes	73%
	No	5%
	Bush tea	2%
	Missing results	20%
PMH of DM2 and being controlled		
Female (n=40)		78%
Male (n=20)		75%
Total (n=60)		77%

Statistical results

Univariate chi-square tests, performed on the data, showed a positive association between having DM2 and the following risk factors; FH of DM2, PMH of hypertension, PMH of hypercholesterolemia and HWC ($p < 0.001$). Univariate t-tests showed a significantly higher value for age, SBP and waist circumference in the DM2-group than in the No-DM2 group ($p < 0.01$) (see table 8).

Table 9 shows that the odds of developing DM2 significantly increase with age ($OR = 1.06 \pm 0.01$ $p < 0.001$). DM2-participants were also more likely to have a positive family history of DM2 ($OR = 3.65 \pm 1.11$ $p < 0.001$) and a high waist circumference ($OR = 1.88 \pm 0.60$ $p < 0.05$).

PMH of hypertension and PMH of hypercholesterolemia were significantly higher for the DM2-group in the univariate chi-square test but in the multivariate logistic regression analysis they did not have an odds ratio that was of any significant relevance. This was also the case for SBP, which was significantly higher in the t-test for the DM2-group, but in the multivariate logistic regression test it had no significant odds ratio.

Table 8: Prevalence of risk factors for developing diabetes mellitus type 2 (DM2) in participants with DM2, compared to participants without DM2 (No-DM2).

Risk factors	DM2 (n=63)	No-DM2 (n=486)	p-value
Age (years)	55.1±10.3	44.6±13.4	<0.0001
Female sex	68.3%	56.4%	0.07
Excessive alcohol*	4.8%	8.2%	0.33
Tobacco	8.1%	12.2%	0.31
Family history of diabetes mellitus type 2	54.0%	25.9%	<0.0001
Past medical history of hypertension	49.2%	22.8%	<0.0001
Past medical history of hypercholesterolemia	36.5%	15.4%	<0.0001
Physical activity in amount of times 30 minutes/week	2.4±2.5	2.6±2.5	0.77
Average systolic blood pressure (mmHg)	141.4±20.5	131.8±19.8	<0.001
Average diastolic blood pressure (mmHg)	87.0±9.6	84.0±11.2	0.05
Cholesterol (mg/dl)	192.8±50.4	192.1±47.7	0.46
BMI (kg/m ²)	30.4±5.6	29.4±5.7	0.10
Waist circumference (cm)	98.1±11.7	93.0±13.2	<0.01
High waist circumference**	66.7%	45.3%	0.001

*Excessive alcohol: drinking more than 1 alcoholic drink per day or more than 5 per week.

** Waist circumference large: positive value when waist circumference was equal or above 88 cm for women or equal or above 102cm for males.

Table 9: Multivariate logistic regression: risk factors for developing diabetes mellitus type 2.

Risk factors	Odds Ratio	Std. Err.	z	P>z	95% Conf. Interval	
Age	1.060832	0.0151207	4.14	<0.001	1.031606	1.090886
Family history pos. diabetes mellitus type 2	3.655043	1.114703	4.25	<0.001	2.010462	6.644911
Past medical history of hypertension	1.661861	0.5248957	1.61	0.108	0.8948375	3.086349
Past medical history of hypercholesterolemia	1.228401	0.3834301	0.66	0.510	0.6662668	2.264812
Average systolic blood pressure (mmHg)	1.010301	0.0075377	1.37	0.170	0.9956347	1.025183
High waist circumference *	1.882247	0.6005508	1.98	0.047	1.007144	3.517721

* High waist circumference: positive value when waist circumference was equal or above 88 cm for women or equal or above 102cm for males.

6.1.2 Behavioral settings

Usage of healthcare

Overall female participants visited the general practitioner (GP) more often than male participants; 77.9% of female and 66.0% of male had a visit to a GP in the last 6 months. More than one in ten males (11.9%) hadn't seen their GP in the last 2 years, in females this percentage was 3.7%.

Insurance

Almost three out of four (73.9%) participants were insured. Female participants were more often insured; respectively 76.3% of women and 70.6% of men were insured. The three female that were newly diagnosed with diabetes were all three uninsured.

6.2 Qualitative results

In table 10 an overview of the participant's background and BMI can be found. Each participant's received a name (e.g. female1) to be able to identify which participant was responsible for which quote in the text below. For anonymity purposes it will not be specified which of the key actors was keyactor1, keyactors2 or keyactor3.

Table 10: Background info and measured body mass index of participants in-depth interviews.

Name	Age	Age DM2*	Recruitment**	Marital status	Amount of children	Country of birth	Income***	Education****	Body mass index (kg/m ²)
female1	74	66	Home	Single	0	Curacao	<1000	High	35.9
female2	67	61	BRC	Single	2	Dominica	<1000	Primary	36.7
female3	23	22	DQC	Married	2	St Maarten	1000-2000	High	38.1
female4	44	24	Uwila	Married	0	Hong Kong	2000-3000	Master	35.2
female5	37	35	BRC	Married	3	Guyana	>4000	High	21.5
female6	51	20	PMC	Married	4	St Maarten	1000-2000	SVS	44.8
female7	63	46	BRC	Divorced	2	Nevis	<1000	Primary	38.1
female8	69	40	PMC	Married	2	Aruba	1000-2000	High	28.7
male1	79	40	Home	Married	4	St Eustasius	<1000	SVS	28.7
male2	43	38	DQC	Married	2	Dominica	1000-2000	Primary	31.1
male3	63	48	Uwila	Married	7	Aruba	3000-4000	SVS	29.3
male4	50	33	DQC	Married	3	Haiti	<1000	SVS	28.3
male5	53	46	DQC	Married	3	India	3000-4000	High	31.6
male6	60	36	Uwila	Living together	3	Dominican Republic	1000-2000	High	24.7
male7	24	23	DQC	Single	0	Jamaica	1000-2000	High	28.7
male8	61	52	BRC	Married	1	Nederland	>4000	Bachelor	29.4
male9	66	56	URC	Divorced	1	Haiti	<1000	Primary	23.7

*Age DM2: Age on which they were diagnosed with diabetes mellitus type 2

**Recruitment: locations where they were recruited:

- Home: St Martin's home (elderly home)
- BRC: Bushroad Clinic
- DQC: Dutch Quarter Clinic
- Uwila: Uwila Clinic
- PMC: Philipsburg Medical Clinic
- URC: Union Road Clinic

*** Income: income in US-dollars per month per household.

****Education: highest finished education

High: High school

Primary: Primary school

SVS: Secondary vocational school

6.2.1 Individual factors

Gender, age and country of birth

Eight (47%) of the 17 primary participants were women. The participants from the IDIs had an average age of 54.5 years (SD \pm 16.2). The average age on which the IDI-participants were diagnosed with DM2 was 40.4 years (SD \pm 13.7). The IDI-participants were born in 13 different countries (see table 10).

Physical activity

Almost all participants answered that they were not participating in any sports or doing any physical exercises. Only one participant walked on a regular base (3-4 times a week). Two participants did mention that they had active jobs; one in construction, the other as a teacher in a school. Increasing activity level was mentioned by three participants spontaneously, as being an intervention after being diagnosed with DM2.

Barriers to being physically active

➤ *Time*

The main reason for not participating in any sports or physical activities was not having enough time because of work (n=7) or having children (n=1).

➤ *Physical complaints*

Other reasons mentioned were having physical complaints of their back, knees or feet (n=5).

➤ *Unsafe living-environment*

Living in an unsafe area was another reason mentioned by multiple participants as a barrier to go exercising. Improvements for safer walking like making more sidewalks (n=2) and having more street lights (n=1) were suggested. Two participants also expressed their concern about safety during cycling. One father stated that he rather not have his children playing outside, because there were too many rude children in his neighborhood:

“So I try not to let my children associate with them. Once the children come back from school they come in and that’s it, until I come home. When I come and they really want to go out in the yard, that’s okay. But they will not go in the road; they will stay in the yard. They would play among themselves.” (male2)

➤ *Economic*

The income of the household for the interviewed participants was in 12 out of 17 cases (70.6%) below 2000 USD per month (see table 10). Although most participants agreed that there were enough affordable possibilities to do sport or exercising on the island, two participants mentioned that going to a gym was too expensive for them.

➤ *Age*

One female and one male mentioned that they are not doing sports anymore because of their age, respectively 67 and 63 years old. This female participant explained:

“I am not involved in any sports now, you know at my age...you can do things but you do have limitations, cause certain things can also bring your pressure or your sugar up, you know. Especially excitement hey, that can raise your pressure too much. You just have to be mild. And then stress, worry, those things, try to have less

of that around you. Because when you worry and stress it also can raise your sugar level and it can affect your high blood pressure also.” (female2)

➤ *Availability of exercising program for persons with DM2*

None of the participants could mention any sport or exercise program that was currently active in Sint Maarten that was especially designed for diabetics to increase their physical activity-level. One of the key actors did explain that DM2-patients were able to see a physical therapist; covered by insurance, but only if they would have a demonstrable physical complaint.

Diet

Changing diet and taking medication were mentioned most often, as advisable change after being diagnosed with DM2. Reducing portion size was also advised to one participant. Advised diet changes were: reducing starch-containing foods, like rice and bread, but also the local ground provisions (roots) like yam, sweet potatoes, tannia and dasheen were often mentioned. Other diet changes advised were eating less sweet and drinking less alcohol, juice and sodas. Some were used to drinking juice or beers every day.

Barriers to a healthy diet

➤ *Eating habits*

The difficulties of changing to a diet with more vegetables and fewer carbohydrates are well illustrated by the comment of one man, who was born and raised in the Caribbean; he described how he was advised to eat more as he called it: “rabbit food”. Another female also explained that she still has to fight to eat lettuce. One young St Maartener explained that she had to give up a lot after being diagnosed with DM2:

“It affects-me really badly, because I know that I would have to cut down on certain food, that you know, everybody loves. Like pizza, starchy food, burgers, fries, juice and you know.” (female3)

➤ *Economic*

Fifteen of the 17 participants and all three key actors underlined how expensive healthy food, like vegetables and fruits, are in St Maarten. Some point out that the prices went up after hurricane Irma, making it for some people impossible to afford healthy food. One woman explained that she bought large frozen packs with vegetables to reduce the costs and another explained that she started planting vegetables herself for the same reason. Only two participants were not complaining about the prices of vegetables and fruits; one female with a high income (>\$4000) and a male who had an income under <\$1000.

➤ *Time*

Taking the time to make home-cooked meals, was according to almost all IDI-participants, a problem, especially for the ones that work till late. Instead it was easier and faster to choose a meal at one of the many fast-food restaurants (more info on work-related barriers see 6.2.2 and about the influence of the fast-food industry see 6.2.3).

6.2.2 Behavioral settings

Family structure, household and support system

Most participants of the IDIs were married (n=11), three were single, two divorced and one was living together. Eighty-two percent of the participants had children, with an average of 2.3 (± 1.8) child per person. Two of the participants lived in an elderly home. Five were sharing their house with three or more persons. Only one male participant was living alone.

Support in having a healthy diet

Most support was given to participants by family members and friends to live a healthier lifestyle. Partners often helped in providing healthier, home-cooked meals, although one female described that her ex-husband was having a negative influence on her diet:

“ Yes, the girl’s father was there, but you see the problem with him, he would cook a lot of starchy food, like provision and so. You know the sweet potato and those things that was what he grew up on. So it was only that in the house he would cook.” (female6)

Two of the key actors also describe this lack of family member involvement and support. Underlined was the importance of family members or friends to be supportive; all having a healthy diet together and being active together (e.g. going for walks). Especially the elderly, who were very often dependent on their family members, really need the support. Also for example when they need to visit the doctor because of unregulated glucose levels; they need somebody to bring them there.

Support in being physically active

Multiple participants explained that when you start walking or exercising that you will meet people, who will encourage you to continue the exercising. But often they went for a walk with a known friend or a family member.

Peer support in a diabetes-center

A wish for a center in St Maarten, where more education about diabetes will be given, was expressed by multiple people and one of the key actors. One female explained that she would like a gym or exercise center where people with DM2 could exercise, but also to meet others and talk about DM2-related problems;

“ I would like to have something like that. So we can come together and we can talk about what they went through. Through the history of what they went through, what they did to prevent certain stuff, how they stop, what motivation they get from others, like doctors. That kind of stuff .When I do bond with other people, who has it, it feels really good. It would be really nice.” (female3)

One female who didn’t get much support from her husband, while raising the children and trying to deal with her DM2, explained how she used to attend a group for people with DM2 to talk and learn more about a healthy diet:

“she [the leader of the support group] would weigh you and if you lose weight and then she would give you different things and everybody would tell what they went through for the week, what they eat what they did. It’s like sharing, you know, like feelings and helping you, motivating you sort of speak and it was good, but she had to go back to Holland”. (female7)

The same female also expressed the large support she got from her general practitioners, but the best consult was, when she one time had one of the doctors explaining her about her DM-medication and also writing it down on paper. This really helped her, because she explained she would get very nervous at the GP-office from time to time and then she would forget what exactly the doctor had said to her.

Work-related barriers

Multiple participants and all key actors stated a reason for failing to have a healthy meal is being too busy with work. One of the key actors described that some DM2-patients even are afraid to ask for a break to use their medication or to eat. They would have the fear of being fired, when they are demanding too many privileges.

One participant expressed her concerns for the children as well, because of the long working hours the parents make:

" You went to school you go home and nobody is there for you. Your parents just give you money; you go by McDonalds, by Burger King, by KFC. You buy food. It is not exactly healthy. It is a tummy filler, right? And sodas, they drink sodas all day. No water, right? I think the reason is that there is nobody to take care of them because the mother and the father they are working and they have to take care of themselves. It's ok for them to give them money but they don't tell them what to buy for it". (female1)

Medication adherence

Several participants (n = 6) admitted that they had not always been adhering to their medication and four participants did not take their DM2-medication every day. A 44-year old woman explained that she was just not a 'pill-person' and she took the medication only when she felt she needed it. Another female addressed her concerns of losing her hairline, because of all the medication that she was receiving. Others that were adhering did also express their concerns about using the medication;

" I read on the internet that most times the medication that are prescribed for diabetes don't address the root cause of the sickness. They cure the symptoms but not the root cause. So I think we should look at natural medication that actually treats the root cause. What in the first place is the reason that your body becomes resistant to insulin? And I think we need to find medicine that treat the root cause. I don't think somebody should be on diabetes medication for life, because this is a sickness that can't be cured ". (male5)

Other treatments used by participants were acupuncture (n=1) and bush tea from spice (=cinnamon), guave, mango leaves or moringa (n=4).

6.2.3 Sectors of influence

Health care

Dietitian consultations

One key actor explained that once diagnosed with DM2, people with insurance had the right to consult a dietitian six times a year, fully covered. Nine (53%) of the participants visited a dietitian to improve their diet of which three didn't find the sessions very helpful. Reasons were; finding it too complicated to measure the food intake with a scale (n=1), preferring to learn from a book (n=1) and not agreeing with the approach of the dietitian and rather working with a chart (n=1).

Reasons for not visiting the dietitian in the first place were; rather using the internet (n=4), having no time (n=2), never being referred by a doctor (n=1), not being able to go up the stairs to visit the dietitian (n=1). One

busy working male expressed that he would be interested in consulting a dietitian online or through an app, it would be a solution for him because in the current situation he couldn't find the time to visit a dietitian.

Doctor consultations

All key actors were underlining the importance of seeing a professional on DM2 regularly. By repeating information and taking the time to explain the disease, DM2-patients would receive better treatment and understanding. One key actor explained that GP's regularly do not explain what is necessary for appropriate treatment:

"Some of them come down to me and they don't even know how to use their medication. Especially, when it comes to the insulin and using the blood sugar meter to test. They don't know." (keyactor3)

Education

Knowledge before diagnosis

Most participants had prior knowledge about diabetes before being diagnosed. For ten of them the main reason was that they had a close relative; a parent or sibling that was already earlier diagnosed with DM2. Some describe not knowing anything about it and falling really ill, before being diagnosed. One older man described how he ended up in the intensive care with severe kidney failure secondary to his diabetes. Another example is a 24-year old man who was rushed into the emergency room after a black-out and was admitted with a severe diabetic ketoacidosis. In both cases, they feared for their lives. But these severe cases are the exceptions most participants found out by doing a blood check, for which they were sent by their general practitioner. Some had complaints, that made the doctor decide to send them for a blood test and others just found out through their yearly blood check. One of the participants found out that she had diabetes during her second pregnancy, after the delivery she was unable to get her blood glucose levels back to a normal level.

Knowledge of symptoms and consequences

A lot of the participants were aware of the symptoms of hyper- and hypoglycemia, they describe the frequent urination and the dry mouth or thirst they had. Consequences on the long term like amputations from legs, feet or toes were mentioned regularly as also retinopathy, nephropathy and cardiovascular disease. Sexual dysfunction or impotence was mentioned by three male participants. The links between having unregulated diabetes and complications were never clearly described. For example, one female described that multiple family members had an amputation of one or two legs, on the question how come they all lost a leg, she responded:

" No clue, like I said, they live in Curaçao and I am here so, I would only get a phone call and they would say your aunt just lost a leg because of the sugar and whatever whatever and that's it". (female6)

All three key actors found that the knowledge of the population about DM2 was insufficient. All three key actors had different solutions in mind; one was much in favor of increasing the number of diabetic nurses in the GP-offices and/or in the hospital next to the internal medicine specialist, another point out the importance that the diabetes foundation should have its own center where people can always come to visit and receive more information. The third key actor thought we have to come up with new solutions according to her the diabetic fairs, radio messages and information given by the GP's were not getting through to the people. Her suggestion was investing in social media and trying to find a 'new way', as the current one doesn't seem to work.

All key actors expressed the difficulties they had to communicate with some of the Creole speaking DM2-patients, because they couldn't understand English. Solutions used were: having people translating for them in Creole, using a lot of pictures or pictograms and using Creole YouTube videos.

Media

The majority of participants visited websites to look for diet advice (59%). Google or YouTube were mainly used to learn more on recipes, no specific websites were mentioned. Also, the radio was mentioned by one elderly lady, as a good source for info on health. One male from Haiti mentioned he learned most about a healthy diet in church, where they have a special health program. Three participants got most of their information about healthy diets from books.

Industry/ Fast-food restaurants

A reason, mentioned by all participants and key actors, why people in Sint Maarten were having an unhealthy diet, was the large amount of fast-food-restaurants available on the island. Reasons for choosing a meal in one of the fast-food restaurants instead of having a home-cooked meal were; working long days and consequently preferring an easy, quick, inexpensive meal that is available close by (n=7), really liking the taste(" it's too tempting") (n=4) and because there were not enough restaurants that were serving healthy food (n=2).

Four participants mentioned that the availability of fast food was not there in the country where they grew up, two of them also made the relationship between becoming diabetic and their move to Sint Maarten; they ate more fast food which made them gain weight, which in turn contributed to developing diabetes.

6.2.3 Social norms and values

Self-identified body size

Ten of the 17 participants identified themselves on the chart as having a slimmer body size, with a lower BMI, than they actually had. Two males and one female overestimated their body size, by pointing out a figure with a higher BMI, than they actually had (see table 11).

The key actors did notice that a lot of people in Sint Maarten underestimated their weight. One example given is the following:

"We weigh our patients regularly....and the majority, reacts ààh [shout] when they hear the amount. Before I weigh them and I tell them they are a bit overweight, they would say: Where? And they have [puts both hands approximately 0.5m in front of abdomen] such a belly. I say don't you see it?'". (keyactor2)

Ideal body size

Sixty-five percent of the interviewed (n=11) wanted their body size to be slimmer than what they thought they were at that moment. The only two who wanted to have a fuller body size were two male, both born in Haiti, both having an income <1000 USD per month, one having primary school as the highest education and one secondary vocational school. One of them described number 5, the figure with a BMI of 30, to be the most beautiful one. All others participants chose a figure of 4 or below as the most beautiful one. Three participants found, among others, number 1; the figure with a BMI of 17.5 one of the most beautiful sizes.

Reasons mentioned for wanting a slimmer body size were; because clothes would fit better (n=4), healthier (n=2), less tired or out of breath (n=2) and one participant mentioned that to his opinion *‘the whole of people tend to have more respect for people that are lean than those that are obese’* (male5). Reasons why the two participants found a bigger size more beautiful, was because it makes you more attractive and look stronger. One of the two also mentioned that a time when he was sick from yellow fever and he became very skinny, that people thought he had aids. That was a reason why he didn’t want to look skinny.

Another key actor did think that some DM2-patients have an ideal shape that is bigger, than what is actually healthy. She stated that some would think: *“If your skinny you’re not healthy, but if you have some meat on you, that’s healthy”*. (keyactor1)

Health beliefs

Bad eating habits, but also genetics; “ it runs in the family” or our family is “big-boned” were reported multiple times as being the cause of developing DM2. One participant from the Dominican Republic had a different theory on why there were so many people in the Caribbean diagnosed with DM2; He described a certain “higher power” where we had no control on. This “higher power” was controlled by the high power countries; United States, Russia, China and Germany, who were experimenting on the sea and in the air. This experimenting was in his opinion leading to DM2.

Willingness to change

All participants described their willingness to live a healthy life and change their lifestyle as necessary. Only one male participant (with a normal BMI) didn’t want to change anything about his current diet or physical activity level. The other man and woman with a normal BMI still wanted to improve their eating habits. Problems mentioned to make a change, were; the discipline to stick to a certain diet and cutting down on eating, and the discipline to exercise more. One man described this as follows:

“ I have been trying to follow my regimen as much as possible, but I think I should have a little more discipline to follow it better”. (male5)

One of the key actors emphasized that a large part of the population was not taking advices on risks seriously. Like the increased risk to develop DM2 of people with obesity or that of people that are physically inactive. They will only start changing their lifestyle after they have fallen ill:

Table 11: Self-identified body size compared with real body size and with ideal size.

Name	Body mass index	Real body size*	Self-identified body size	Ideal size
female1	35.9	5-6	6	2
female2	36.7	5-6	5	3
female3	38.1	6	5-6	3
female4	35.2	5-6	5	3
female5	21.5	3	2	2
female6	44.8	>6	5-6	1-3
female7	38.1	6	6	4
female8	28.7	5	3	1
male1	28.7	5	4	4
male2	31.1	5	5	4
male3	29.3	5	6	4
male4	28.3	4-5	3	4
male5	31.6	5	4-5	1-2
male6	24.7	4	4	4
male7	28.7	5	4-5	4
male8	29.4	5	5	3
male9	23.7	3-4	4-5	5
average	31.4			
* Real body size is the picture number that corresponds with the measured body mass index (see Annex 4)				

"...as long as it doesn't happen, you can talk to people as much as you want: you have to exercise, you have to diet, you have to take your medication. It doesn't work". (keyactor2)

Another key actor stated that some people that are being referred by their GPs to improve their diet were not showing up for a consultation. When asked why they never made contact, they would answer: *"I don't find I need a dietitian"*.

7) Discussion

This mixed-method study involved both a CVR- screening review, to collect information on the characteristics and the modifiable risk factors of DM2, as well as interviews to assess knowledge, practices and perceived barriers to a healthy lifestyle. Several important themes emerged from our results.

The DM2-prevalence in this study was 11.5% for adults, age 20-83 years old, which is lower than the most recent DM2-prevalence of 13.2%, estimated for 2017 in Sint Maarten by the IDF⁶. An underestimation of the DM2-prevalence in this study might be the result of less interest of persons with DM2 to participate in the CVR-screening. All tests conducted during this CVR-screening should, according to most used medical guidelines, already be done at least once a year in diabetics in the general practitioner's office.

Another reason for under diagnosing might have been that the glucose measurements were not hemoglobinA1c (HbA1c)-measures. Two participants for example that were not known with DM2 had a glucose measurement above 200 mg/dl, but because they had a food or beverage consumption one hour before testing they were not considered diabetic. Possibly if HbA1c was tested instead, which does not vary with food consumption, they would've turned out to be positive.

In a study among 939 Barbados-citizens differences were found between measuring fasting plasma glucose (FPG) and HbA1c in the same participant. Both are used for diagnosing DM2, but in this study the prevalence of undiagnosed diabetes was higher, but not significantly so, by HbA1c (4.9%) vs. FPG (3.5%). The prevalence of prediabetes was significantly higher by HbA1c compared to FPG: 41.7% vs. 15.0%¹⁸. Testing HbA1c instead of glucose most likely would've increased the DM2-prevalence in the Sint Maarten population too. The same applies to the number of diabetics that have a controlled blood sugar; 77% seems to be very high, measuring HbA1c possibly would have led to lower controlled percentages.

The results of the quantitative study showed that the accessibility to a GP, in order to be diagnosed with DM2, was good. Most participants had visited a GP in the last 6 months and 95% of the participants who were considered diabetic (according to WHO-guidelines), were already diagnosed with DM2. A plausible reason why the three females, which were newly diagnosed with DM2, weren't diagnosed before is that all three had no insurance and possibly therefore never had any blood tests done. The insurance rate found of 73.9% is most likely lower than it was in reality. Expected was that the screening would attract a high percentage of people without insurance because the screening was free of charge. On the other hand, currently after hurricane Irma, the unemployment rate has gone up and there might possibly be more uninsured persons now than in 2016, which in turn could lead to a higher percentage of undiagnosed persons with DM2.

In the systematic review of Sobers-Grannum et al. (2015) being female was a social determinant of diabetes in the Caribbean¹⁹. In our study, the prevalence of diabetes was also higher among women, but there was no significant difference ($p=0.07$).

In the scoping review of Bennet et al. (2015) the highest prevalence in a Caribbean population was found among Caribbean Blacks compared to West African Blacks and Caucasians but lower when compared to South Asian origin groups²⁰. Unfortunately our screening did not include data on ethnicity, but the majority of the study population was of Afro-Caribbean origin. The DM2-prevalence of 11.5%, found in our study, is among the highest, compared to the prevalence in the countries of origin of the participants, where the majority of the population is often of Afro-Caribbean descent too. The DM2-prevalence for adults (20-99 yrs. old) are respectively for Dominican Republic 8.2%, Jamaica 11.3%, Dominica 11.6%, Haiti 6.6%, Guyana 11.6%, Curacao 11.6%, India 10.4% Aruba 11.6% and Venezuela 6.5%⁶.

Another unfavorable high prevalence found among Caribbean Blacks or Afro-Caribbeans was found in the systematic review of Bidulescu et al. (2015): This study showed the highest hypertension-prevalence to be in Afro-Caribbeans compared to Caucasians, South-Asians and African blacks in the Cameroon²¹. In our study 44% of females and 58% of males above 20 years of age had hypertension. These percentages are more than twice as high as the global percentages found: In a worldwide study among more than 19 million participants collected in 2015 20% of women and 24% of men above 18 years of age had hypertension²². If we would use the American guidelines the hypertension-prevalence was, as expected even worse; respectively 70% in women and 80% in men. When using the European guidelines, still the hypertension prevalence was very high, also compared to the prevalence in Haiti and Jamaica, where the largest part of the population is of Afro-Caribbean descent as well. The hypertension-prevalence in these two countries was respectively 19 and 21% (Haiti) and 20 and 24% (Jamaica) for females and males^{23, 24}. Other factors like age, high BMI and low education level might have also played a role in the high hypertension prevalence found in Sint Maarten; these factors are proven to play an important role in developing hypertension in low- and middle-income countries²⁵.

The setting in which the blood pressure measurements took place might have also contributed to the higher hypertension-prevalence. The blood pressure measurements took place out in the open, where as a quieter, closed-off space might have had a positive effect on the blood pressure²⁶. On the other hand, all participants did sit down for approximately 30 minutes in the shade, before having their first blood pressure taken and only blood pressure data were analyzed from participants who had two measurements taken. Another problem could have been the cuff size; in the screening, a lot of participants were overweight or obese. When using a cuff that is too small, it will show higher readings of the blood pressure than the actual true value. The problem of being overweight might also have a direct connection to developing hypertension. The Framingham study performed in 2013 found being overweight or obese to be highly related to the risk of hypertension. The relative risk of male and female ranged from 1.5 to 1.7 in overweight and 2.2 to 2.6 in obese²⁷.

Striking is that the percentage that had a PMH of HT was higher in females than in males (27.4% and 23.5%), meaning that most undiagnosed HT-patients were male (see table 1 and table 4). Of the participants that were not having a PMH of HT; male participants were twice as often having an elevated blood pressure than female participants (44.2% vs 22.2%). This gender-difference might have occurred because women often get diagnosed with HT during pregnancy. The percentage of people with HT that were being diagnosed was 57% which is a little better than a country like Argentina (52.7%) but less than for example South Africa (61.5%) or Peru (69.0%)²⁵.

As mentioned before, it seems like the healthcare is in place, but talking from my own experience I think that the monitoring of hypertensive patients is not on an optimal level in Sint Maarten. Without having any official national guidelines, large differences in treatment can be found among different primary healthcare centers. Next to this, the general practitioners are often lacking the time to explain all patients the importance of adhering to medication and regular checking of blood pressure. Why almost half of the diagnosed patients are

not adhering to medication is to my belief not a financial reason, like in Sub Saharan Africa²⁸. The majority of the people have insurance on the island, which covers hypertension-medication. But also for the uninsured population, hypertension-medication can be purchased for relatively low-costs in St Maarten. Only 43% of the diagnosed hypertensive patients were showing a normal blood pressure, showing the high need for education on medication adherence and regular blood pressure checks.

The third very important finding is that the average BMI of females was 30.4 kg/m², meaning that on average women in Sint Maarten were obese. Overall the prevalence of being overweight or obese is concerning and it seems to rise. Seventy-five percent of the population in Sint Maarten had a BMI above 25 in 2015⁹; in our research it was already 80% of the St Maarten population above 20 years of age that was overweight or obese. Half (50.9%) of the female participants were obese, compared to one third (31.9%) of male participants. The systematic review of Sobers-Grannum et al. (2015) described Caribbean women to have an approximate threefold excess risk of obesity and consistently lower levels of physical activity, leading to a 50% excess risk of diabetes compared to Caribbean men¹⁵. Although being female is not a predictor of DM2 in our research, the obesity-prevalence of females is concerning. A prevalence of obesity this high hasn't been found in any other study done in the Caribbean (not in Bahamas, Barbados, Cuba, Grenada, Guadeloupe, Jamaica or Puerto Rico)¹⁵. The highest prevalence was found in Grenada where 42% of women were found to be obese²⁹. One study done in Puerto Rico did find a higher prevalence of obesity in males of 45% although this study was done among 10-19 years old boys²⁶. All other studies with participants in comparable age groups showed lower percentages for prevalence of obesity in men in the Caribbean¹⁵. With an overall prevalence of 42.9% of the population being obese Sint Maarten should actually be number 6 in the top 10 of fattest countries in the world, only leaving five other countries to have a more obese population³¹.

Although BMI in a lot of studies is found to be one of the predictors of DM2^{15, 27}, in this study there was no significant difference between the BMI in the DM2-group compared to the no DM2-group. On the other hand in the logistic regression the odds that DM2-participants were having central obesity (a high waist circumference) were significantly higher than in the no DM2 group. These results mean that measuring waist circumference is a more reliable measure to predict developing DM2, than BMI in Sint Maarten. A large study performed in Canada proved in 2007 already that waist circumference was a predictor for diabetes, beyond that explained by BMI and traditional cardio-metabolic risk factors³². The study of Mohammadifard et al. (2013) showed that in Iranian adults, BMI was a better predictor of DM2 than waist circumference in men; conversely, waist circumference was a better predictor in women³³. This gender difference concerning waist circumference being a predictor for diabetes was also found in a study done in the United Kingdom: In this study truncal obesity and insulin resistance accounted for a two-fold excess incidence of diabetes in Afro-Caribbean women, but not in men³⁴.

There was no significant difference in absolute waist circumference between men and women, but there was in high waist circumference (HWC). Two-third (67.8%) of females had a positive HWC against 24.8% of males, which might explain the nearly significant higher DM2-prevalence in women than in men, respectively 13.5% and 8.6% (p=0.07). The cross-sectional study, performed among 5786 adults aged 65 years and older, living in multiple cities in Latin America and the Caribbean, also found a higher prevalence of HWC in female compared to male adults. The prevalence of HWC in women ranged from 48.5% in Havana to 72.7% in Mexico City. Among men the prevalence of HWC ranged from 12.5% (Bridgetown) to 32.5% (Santiago)³⁵. The striking of this cross-sectional study is that the lowest HWC-prevalence of males and of females was measured in the only two Caribbean cities that were part of this study; Havana in Cuba and Bridgetown in Barbados. Even though this study was performed among an older population, this doesn't explain the large gap between the prevalence of HWC in Sint Maarten compared to the prevalence in Cuban women and Barbadian men, respectively a difference of 19.3% and 12.3%.

The main barriers to being physically active were having no time and having physical complaints. In a next research it would be interesting to find out how many hours on average persons in Sint Maarten work. The other problem that a lot of people with DM2 have physical complaints that make it more difficult for them to

participate in sports shows the need for adjusted physical therapy or gym-classes in this group. On the other hand it also shows the high need to start intervening earlier in life; often the physical complaints were related with arthrosis, which is a problem that is more common in persons that are overweight or obese.

The most important barriers to a healthy diet were having difficulties to adjust to a new diet, expensiveness of healthy food and having no time to cook. In a qualitative study performed among diabetic Afro-Caribbean women that moved to Florida, United States of America, similar struggles to modify their traditional Caribbean diet were seen³⁶. The perceived barrier that healthy food is too expensive might not be a good focus for an intervention. In a study done among poor women in Colombia, cash transfers were given in the hope that they would be able to buy healthier food. The result was that the women had an increase of average BMI (25.1 to 26.1) and an increase of prevalence of obesity (10.9% to 17.0%). The research proved that the extra available money was spent on food like meat, dairy, other fats, oils and cereals, but spending on fruits and vegetables remained unchanged³⁷.

Even though the majority of the participants were getting support from family and friends, there is a clear need for support from outside. Multiple participants expressed their wish to have support groups to improve their diet and physical activity-level. In the study of Simmons et al. (2015) group diabetes peer support was given during 8-12 months, which only showed a small improvement in blood pressure, but no other significant outcomes³⁸. Also having diet-consultations via their smart phone (an app or email), to save time was mentioned by participants. A literature review, done by Hunt (2015), did find that technological interventions had a positive impact on diabetes outcome including improvements in HbA1c- levels, diabetes self-management behaviors, and diabetes self-efficacy³⁹. Important is, in case any new support-group or technical intervention will be set up in Sint Maarten, that there should be thorough research to find out, which projects the diabetes-patients would actually attend. This research found that almost half of the diabetic participants never visited a dietitian although it is covered under their insurance for at least six consultations per year. The suggestion of one of the key actors to at least have more diabetic nurses on the island is according to research a good investment. In a study performed in primary health care centers in Ohio, United States of America, physician-nurse practitioner teams showed improved outcomes in care for chronic patients, compared to the traditional medical care. In the team-treated group, participants experienced significant improvements in mean HbA1c (70.7%, $p=0.02$) and high density lipoprotein cholesterol-level (+2.6 mg dL⁻¹, $p=0.02$), although 1-year costs for personnel were higher. Additionally, satisfaction with care improved significantly for team-treated subjects in several sub-scales⁴⁰.

In regards to having knowledge about DM2 and the consequences, the interviews showed that most diabetic-patients had a basic knowledge on the symptoms and consequences of the disease. Although it's concerning that some, having the disease already for many years, were still not able to see the link of having uncontrolled diabetes and having to amputate body parts.

Having an unhealthy diet was the most mentioned lifestyle cause for developing DM2. Being physically inactive was in almost all interviews not mentioned spontaneously as one of the lifestyle causes. The mentioned cause that moving to a more westernized country contributed to developing diabetes, was also found in the article of Brown, Avis and Hubbard (2007). In this study the health beliefs of Afro-Caribbean people with DM2 that moved to the United Kingdom were described. Their health beliefs were that lifestyle-factors such as obesity and lack of exercise were exacerbated by adapting from a Caribbean to a British lifestyle⁴¹.

In Sint Maarten the used interventions were more focused on diet, where participants received help of dietitians, internet and books, any specific help on exercising or doing sports was lacking. Not having much support to start doing sports or being more physically active on the island in general, might have contributed

to the high percentage of physical inactivity, respectively 74.4% and 56.6% for women and men. The percentage of participants, being physically active, was lower in this research, than the study of Chobanyan et al. (2015), respectively 61.5% versus 72.5%⁹. In our research, next to the question if participants were being active, we have tried to quantify, how many participants were physically active for at least 150 minutes per week. It seemed that of the participants that reported to be physically active a large part was not active for 150 minutes or more a week. Of the female participants 56% indicated to be active, but only 25% of all female participants were active for at least 150 minutes a week. In male participants 69% reported to be active, 43% of all males were active for 150 minutes or more. These results underline how important it is to quantify “physical activity” when measuring, because the results are very different.

The problems that single mothers in Sint Maarten do not find the time and possibilities to be physically active, have also been described in a qualitative study done in Barbados among seventeen women⁴². The problems described not being able to afford a gym membership were also mentioned in this study. Other barriers found in Barbados but not in Sint Maarten were: living in a small house; which made it impossible to exercise back home, limited possibilities for active commuting; it being too far and too hot and the gender-specific behavior to physical activity, where women rarely reported and were rarely seen by the researcher exercising with male⁴¹. The possibilities for active commuting, all participants in Sint Maarten agreed on, were not a problem.

Besides lifestyle-causes multiple participants also mentioned the cause of DM2 that it “runs in their family” or when talking about obesity that they are just “big-boned”. These notes raise the question if there is a genetic cause or that these family members are all sticking to a similar unhealthy lifestyle, leading to obesity and consequently DM2. No articles were found mentioning a gene in the Afro-Caribbean population that would predispose to DM2 or obesity.

Not all participants were adhering to their diabetes-medication and multiple participants mentioned the use of ‘bush’ to treat their diabetes. The qualitative study of Smith, among diabetic Afro-Caribbean women found similar belief in the efficaciousness of traditional Caribbean medicine, but also of prayer to treat DM2³⁶.

Unfortunately, most of the participants of the in-depth interview underestimated their own bodyweight. The study of Kuchler and Variyam (2003) pointed out that a large portion of the United States population that was overweight or obese were also underestimating their body weight, male more often than female⁴³. In this study the concern that information programs that link overweight and obesity with health risks might fail to induce diet and lifestyle changes when individuals fail to recognize that they are overweight or obese⁴³. Another study conducted among slum residents in Nairobi, Kenya also had a majority underestimating their body weight. What was different to our findings was that, in this study, more than one third preferred body sizes classified as overweight or obese⁴⁴. In our study only 1 out of 17 participants preferred a body size classified as overweight or obese.

A positive finding is that the majority of participants preferred a body shape that was considered healthy (a BMI between 20 and 25). My personal hypothesis, which I can now reject, was that a larger part of the population preferred a body size above a BMI of 25. A similar study, in which they also rejected their hypothesis, was a study among Ghanaian men and women. The hypothesis was that males preferred Ghanaian women to be of the larger, traditional body size. In this study the majority of men preferred a woman to be in the normal range of BMI as well⁴⁵. In the study of Gilbert et al. (2009) women in Colombia with higher education or who lived in wealthier neighborhoods identified ideal shapes that were thinner, than those identified by their less educated or poorer counterparts⁴⁶. This might also explain why the two males from

Haiti in this study who had a low income and a lower education level, than most other participants, identified their ideal shape to be thicker than others.

All participants in the interviews, except for one, were willing to change their lifestyle to improve their health. Unfortunately, even though they had this willingness to change, most participants were obviously not on the right track of living healthy yet. The average age on which the participants were diagnosed was at 40.4 years of age and the average age of all participants was 54.5 years, meaning that on average the participants were already having DM2 for 14 years. Still most participants (14 out of 17) were overweight or obese. On average the BMI was 30.4 kg/m², which is in the obese-category. Additionally most participants were currently not exercising or doing any physical activity at all. Only having the willingness to change is apparently not enough.

Study limitations

This study has several weaknesses that affect the generalizability of the results. First of all the participants attracted to the CVR-screening are possibly not a good representative of the population of Sint Maarten. It might be that uninsured participants that are at a higher risk of having undiagnosed disease were more attracted and that participant with a past medical history of DM2 or hypertension were attracted less. Participants were informed to join the CVR-screening through radio commercials, newspaper and by having people handing out flyers along the roadsides in the neighborhood where the screening took place. It might therefore also be possible that people that were less educated (that don't listen to radio or reading newspapers) or who were immobile were left out.

In the qualitative study an attempt was made to interview a large variety of persons with DM2 (different age groups, countries of birth, income level, education level and different recruitment areas), but it was still a convenience sample which is not a perfect representation of the population. Another limitation is that the amount of data collected is much more than that can possibly be analyzed for this thesis set amount of time and words.

An additional limitation to the study is the involvement of the principal investigator in the research area; she has worked as a medical doctor in a general practitioner's office in Sint Maarten for five years and some of the recruited participants in the qualitative study were known to her. This might have led to more desirable answers given by the participants, because of having a doctor-patient relationship.

8) Conclusion

This study provided an estimate of the DM2-prevalence in Sint Maarten of 11.5%.

Risk factors for developing DM2 in Sint Maarten identified were:

- ✓ older age
- ✓ having a family history of DM2
- ✓ having a high waist circumference
- ✓ having a past medical history of hypertension
- ✓ having a past medical history of hypercholesterolemia
- ✓ having an elevated systolic blood pressure

A multivariate regression showed that the odds that participants with DM2 had one of the first three mentioned risk factors was significantly higher than the odds that participants without DM2 had one of these risk factors: The diabetic participants were on average ten years older than the participants without DM2. Sixty-eight percent of them had a family member that was diagnosed with DM2, versus 26% of the participants without a family history of DM2. The percentage of participants that had a waist circumference that was too high (for female >88cm and for male >102 cm) was significantly higher in participants with DM2, respectively 67% and 45%.

Although not being statistically proven individual risk factors for developing DM2 in Sint Maarten, the two cardiovascular risk factors, hypertension and obesity, need to be mentioned, because of the extremely high prevalence in the population. Fifty percent of the screened participants had hypertension and 43% was obese. There was a significant gender difference between these two risk factors. Males were significantly more often hypertensive (58% vs. 44%) and females were significantly more often obese (51% vs. 32%). Female participants had an average BMI, in the obese-category, of 30.4kg/m². The percentage of obesity among women and men was higher in Sint Maarten than almost anywhere in the world.

One of the reasons, why the people in Sint Maarten were not changing their lifestyle was a lack of knowledge and motivation. They did have some basic knowledge, but they should be more aware of the consequences of long-term, uncontrolled DM2, like for example kidney failure and leg-amputations. If their awareness can be improved, this might motivate them to really have a healthy diet and to be more physically active. In the interviews almost all participants said they were motivated to change their lifestyle for a healthier one, but still most didn't adjust to a healthy lifestyle after being diagnosed with DM2 (on average 14 years before); The majority of the participants were still overweight or obese and almost all were not physically active. Without the motivation to live healthier, the obesity- and hypertension-prevalence will not decrease. Additionally, there will be no reduction in diabetes mellitus type 2-prevalence and the risk of cardiovascular disease will stay worryingly high.

Socio-cultural and economic factors that influenced the choices made concerning diet and physical activity were:

- Unhealthy eating habits; a lot of carb-containing meals and fast food.
- Economic; expensive healthy food
- Time; no time to cook healthy or exercise because of working hours or being a single parent
- Exercise areas not being safe; not everywhere sidewalks, bicycle lanes and street lights, but also some areas unsafe because of criminality.
- Underestimating body size
- Lack of social support from family members or friends

The health service on the island being offered to promote a healthy diet is a dietitian, which is covered under insurance for six sessions when diagnosed with DM2. Still half of the participants never visited a dietitian. Reasons for not visiting were; preference to use the internet, having no time, never being referred by a doctor and not being able to go up the stairs to visit the dietitian. No health services were found offering special physical activities for DM2-patients. Physical therapy was only covered in case a diabetes patient had a demonstrable physical complaint. Another mentioned service that was lacking was not having a place to visit that could provide more information on diabetes or a place that people with DM2 could visit to find support. DM2-oriented physical activity counseling was mentioned as support, but also mental support from peer groups could be helpful in trying to change lifestyle.

9) Recommendations

Recommendations to policy makers

Setting-up a national non-communicable disease (NCD) prevention plan

In order to prevent a cardiovascular catastrophe, a national prevention plan for the management and control of NCDs has to be set up. This plan was already mentioned in the WHO's Country cooperation strategic agenda (2015-2019) published in 2018⁴⁷. I know the Ministry of PHSLD has been working on a draft, but the final version hasn't been published as yet. I will mention the five, to my opinion, most important recommendations for Sint Maarten to be included in the prevention plan. The recommendations are partly derived from WHO's 'best-buys' concerning healthy diet and physical activity and adjusted to what is most relevant and feasible in Sint Maarten⁴⁸.

- Mass media campaign to reduce salt intake, to promote a healthy diet and to increase physical activity. Include social media and informative internet websites to reach as many people as possible.
- Implement nutrition and physical activity education and counseling in different settings (for example, in preschools, schools, workplaces and hospitals).
- Set up of a 'healthy living center' as a referral center for primary health care to:
 - provide information on healthy diets, physical activity and diabetes
 - provide physical activity counseling
 - find out on larger scale what the wishes are from diabetes-patients in terms of support, with the results of this research set up:
 - diabetes support groups and/or
 - start technology interventions
- Increase the number of sidewalks and bicycle lanes on the island and increase the safety in these areas by having more street lights and security.
- Stimulate the set-up of restaurants and supermarkets that sell affordable, healthy food.

Investing in more research for hypertension

With half of the adult population being hypertensive and almost half of them not being diagnosed, there is a very clear need to do more research on this topic. My recommendation is to first use WHO's STEPwise approach to chronic risk factor surveillance (STEPS) to collect more data⁴⁹. The results of this STEPS-survey will contribute to the above mentioned national prevention plan to manage and control NCDs. If the STEPS survey will have similar outcomes as this study, concerning the prevalence and diagnosis rate, a serious awareness campaign should be set up in order to reduce hypertension on the island.

Recommendations to primary health care staff

Setting up guidelines

Guidelines for the primary healthcare staff should be developed by the general practitioners associations (the Windward Islands Medical Association and the Sint Maarten Medical Association). These guidelines will ensure that all are following the same rules, when it comes to the prevention and control of non-communicable diseases, like hypertension and diabetes. Included in these guidelines should be the following important findings from the study:

- More effort should be made to educate patients on all risk factors of diabetes, especially the patients that have a family history of DM2.
- Blood pressure measurements should be on the priority list for every adult visiting the clinic.
- All diabetes and obese patient should be referred to a dietitian. On a next visit staff should actively ask if they went to see the dietitian.
- Waist circumference seems to be a more reliable measure to predict developing DM2 in Sint Maarten, than BMI. Therefore, measure waist circumference more often.

Negotiate with insurance-companies concerning DM2-nurses

To improve the health care, specialized diabetic nurses that support the general practitioners offices, could really make a difference. The general practitioners are advised to negotiate with the health-insurance SZV to get support in financing these specialized nurses, maybe one or two diabetic-nurses can rotate between all general practices.

Recommendations to citizens of Sint Maarten

Adults not diagnosed with diabetes mellitus type 2:

- Visit you general practitioner at least once a year to know your blood pressure, body mass index and waist circumference.
- In case one of these measures is high, take action:
 - Do a blood-test to find out if you have diabetes mellitus type 2.
 - Educate yourself (at the GP, at the dietitian, online).
 - Improve your diet.
 - Be more physically active: At least 150 minutes per week.
 - Follow up with your GP at least within 3 months to be sure that actions are leading to results.

Adults being diagnosed with diabetes mellitus type 2:

- Visit you general practitioner at least once every six months to know your blood pressure, body mass index, waist circumference and HbA1c-level.
- In case one of these measures is high, take action:
 - Educate yourself, especially on the long-term effects of having uncontrolled diabetes (at the GP, at the dietitian, online).

- Improve your diet.
- Be more physically active: At least 150 minutes per week.
- Follow up with your GP at least within 3 months to be sure that actions are leading to results.

References

- 1) Statistical yearbook 2017 published by the department of statistics Sint Maarten [Internet]. 2017 [cited 2019 Aug 5]. Available from: http://www.stat.gov.sx/downloads/YearBook/Statistical_Yearbook_2017.pdf
- 2) Vance Roitman J. Land of hope and dreams: slavery and abolition in the Dutch Leeward islands, 1825–1865, *Slavery & Abolition*. 2016; 37(2), 375-398.
- 3) UNICEF report: The situation of children and adolescents in Sint Maarten [Internet]. 2013[cited 2019 Aug 5]. Available from: https://www.unicef.nl/media/1359112/sint_maarten_sitan_public_version__28english_29.pdf.
- 4) World Bank Sint Maarten overview 2018 [Internet]. 2018 [cited 2019 Aug 15]. Available from: <https://www.worldbank.org/en/country/sintmaarten/overview>.
- 5) WHO fact sheet diabetes 2018 [Internet]. 2018 [cited 2019 Aug 5]. Available from: <https://www.who.int/news-room/fact-sheets/detail/diabetes>.
- 6) IDF Diabetes atlas 8th edition 2017 [Internet]. 2017 [cited 2019 Aug 5]. Available from: <https://diabetesatlas.org/resources/2017-atlas.html>.
- 7) PAHO-Sint Marteen 2015 document[Internet]. 2017 [cited 2019 Aug 5]. Available from: <https://www.paho.org/salud-en-las-americas-2017/?p=4304> .
- 8) World Health Organization fact sheet: Obesity and overweight [Internet]. 2019 [cited 2019 Aug 5]. Available from: <https://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight>.
- 9) Chobanyan N, Kruger A, Nebb S, Jackson G, Asin V, Natarajan R. et al. Evaluation of environmental risk factors for type 2 diabetes in Sint Maarten. *J Environ Anal Toxicol*. 2016; 6(4): 386.
- 10) Wing RR, Lang W, Wadden T.A, Safford M, Knowler WC, Bertoni AG. et al. and the Look AHEAD Research Group. Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care* 2011; 34(7): 1481-1486.
- 11) Koplan JP, Liverman CT, Kraak VJ. and Wisham SL. Progress in preventing childhood obesity. How do we measure up? Washington, DC: The National Academies Press 2007. <https://doi.org/10.17226/11722>.
- 12) Sample size to estimate a simple proportion [Internet]. 2019 [cited 2019 Aug 5]. Available from: <https://epitools.ausvet.io/oneproportion>.
- 13) WHO global strategy on physical activity, diet and health. Recommended levels of physical activity for adults aged 18 - 64 years [Internet]. 2019 [cited 2019 Aug 5]. Available from: https://www.who.int/dietphysicalactivity/factsheet_adults/en/.
- 14) NHG-standaard Obesitas [Internet]. 2019 [cited 2019 Aug 5]. Available from: <https://www.nhg.org/standaarden/volledig/nhg-standaard-obesitas#note-26>.
- 15) The Task Force for the management of arterial hypertension of the European Society of Cardiology (ESC) and the European Society of Hypertension (ESH). 2018 ESC/ESH Guidelines for the Management of Arterial Hypertension. *European Heart Journal* 2018; 39(33): 3021-3104.
- 16) 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol*. 2018;71:127-248.
- 17) WHO definition and diagnosis of diabetes mellitus and intermediate hyperglycemia [Internet]. 2006 [cited 2019 Aug 5]. Available from: https://www.who.int/diabetes/publications/Definition%20and%20diagnosis%20of%20diabetes_new.pdf.

- 18) Unwin N, Howitt C, Rose AM, Samuels TA, Hennis AJ, Hambleton IR. Prevalence and phenotype of diabetes and prediabetes using fasting glucose vs HbA1c in a Caribbean population. *J Glob Health*. 2017;7(2):1-23.
- 19) Sobers-Grannum N, Murphy MM, Nielsen A, Guell C, Samuels TA, Bishop L, Unwin N. Female Gender Is a Social Determinant of Diabetes in the Caribbean: A Systematic Review and Meta-Analysis. *PLoS ONE*. 2015;1-22.
- 20) Bennett NR, Francis DK, Ferguson TS, Hennis A, Wilks RJ, Harris E. et al. Disparities in Diabetes Mellitus among Caribbean Populations: A Scoping Review. *International Journal for Equity in Health* 2015;14(1): 23–23. doi: 10.1186/s12939-015-0149-z.
- 21) Bidulescu A, Francis D, Ferguson T, Bennett N, Hennis A, Wilks R.... U.S. Caribbean Alliance for Health Disparities Research Group (USCAHDR). Disparities in hypertension among black caribbean populations: A scoping review by the u.s. caribbean alliance for health disparities research group (uscahdr). *International Journal for Equity in Health* 2015;14:125-125. doi:10.1186/s12939-015-0229-0
- 22) NCD-RisC. Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19.1 million participants. *Lancet*. 2016; 389(10064):37–55.
- 23) WHO NCD report Haiti [Internet]. 2019 [cited 2019 Aug 5]. Available from: https://www.who.int/gho/countries/hti/country_profiles/en/.
- 24) WHO NCD report Jamaica [Internet]. 2019 [cited 2019 Aug 5] Available from: <https://www.who.int/gho/countries/jam/en/>.
- 25) Irazola, VE, Gutierrez L, Bloomfield G, Carrillo-Larco RM, Dorairaj P, Gaziano T. et al. Hypertension Prevalence, Awareness, Treatment, and Control in Selected LMIC Communities: Results From the NHLBI/UHG Network of Centers of Excellence for Chronic Diseases. *Global heart* 2016;11(1):47–59.
- 26) Myers MG, Godwin M, Dawes M, Kiss A, Tobe SW, and Kaczorowski J. Measurement of Blood Pressure in the Office Recognizing the Problem and Proposing the Solution *Hypertension* 2010;55:195–200.
- 27) Wilson PW, D'Agostino RB, Sullivan L, Parise H. and Kannel WB. Overweight and obesity as determinants of cardiovascular risk: the Framingham experience. *Arch Intern Med*. 2002 Sep 9; 162(16):1867-72.
- 28) Macquart de Terline D, Kane A, Kramoh K. E, Ali Toure I, Mipinda J. B, Diop I. B. et al. Factors associated with poor adherence to medication among hypertensive patients in twelve low and middle income Sub-Saharan countries. *PLoS One*. 2019;14(7):e0219266. Published 2019 Jul 10. doi:10.1371/journal.pone.0219266
- 29) Block RC, Dozier AM, Hazel-Fernandez L, Guido JJ, Pearson TA. An epidemiologic transition of cardiovascular disease risk in Carriacou and Petite Martinique, Grenada: the Grenada Heart Project, 2005–2007. *Preventing chronic disease*. 2012; 9.
- 30) Garza JR, Perez EA, Prelip M, McCarthy WJ, Feldman JM, Canino G, et al. Occurrence and correlates of overweight and obesity among island Puerto Rican youth. *Ethn Dis*. 2011;21(2):163–9.
- 31) Fattest countries in the world WHO[Internet]. Published 2019 Jan 10[cited 2019 Aug 5] Available from: <https://www.who.com.au/the-worlds-top-ten-fattest-countries>. [Accessed Aug 5th, 2019].
- 32) Janiszewski PM, Janssen I. and Ross R. Does Waist Circumference Predict Diabetes and Cardiovascular Disease Beyond Commonly Evaluated Cardiometabolic Risk Factors? *Diabetes Care* 2007;30(12):3105-3109.
- 33) Mohammadifard N, Nazem M, Sarrafzadegan N, Nouri F, Sajjadi F, Maghroun M and Alikhasi H. Body mass index, waist-circumference and cardiovascular disease risk factors in Iranian adults: Isfahan healthy heart program. *J Health Popul Nutr*. 2013;31(3):388–397. doi:10.3329/jhpn.v31i3.16831
- 34) Tillin T, Hughes AD, Godsland IF, Whincup P, Forouhi NG, Welsh P. et al. Insulin resistance and truncal obesity as important determinants of the greater incidence of diabetes in Indian Asians and African

- Caribbeans compared with Europeans: the Southall And Brent REvisited (SABRE) cohort. *Diabetes Care*. 2013;36(2):383–393.
- 35) Nam, S, Kuo, Y.-F, Markides, K. S. and Al Snih, S. Waist Circumference (wc), Body Mass Index (bmi), and Disability among Older Adults in Latin American and the Caribbean (Iac). *Archives of Gerontology and Geriatrics*, 2012;55(2):47.
 - 36) Smith C.A.S. Living with Sugar: Influence of Cultural Beliefs on Type 2 Diabetes Self-Management of English-Speaking Afro-Caribbean Women *J Immigrant Minority Health* 2012;14:640–647.
 - 37) Forde I, Chandola T, Garcia S, Marmot M.G. and Attanasio O. The impact of cash transfers to poor women in Colombia on BMI and obesity: prospective cohort study. *International Journal of Obesity* 2012; 36: 1209–1214.
 - 38) Simmons D, Prevost AT, Bunn C, Holman D, Parker RA, et al. Impact of Community Based Peer Support in Type 2 Diabetes: A Cluster Randomised Controlled Trial of Individual and/or Group Approaches. *PLOS ONE* 2015;10(3) Available from: <https://doi.org/10.1371/journal.pone.0120277>
 - 39) Hunt CW. Technology and diabetes self-management: An integrative review. *World J Diabetes*. 2015;6(2):225–233. doi:10.4239/wjd.v6.i2.225
 - 40) Litaker, D, Mion, L, Kippes, C, Mehta, N, Frolkis, J. and Planavsky, L. Physician - Nurse Practitioner Teams in Chronic Disease Management. The Impact on Costs, Clinical Effectiveness, and Patients' Perception of Care. *Journal of Interprofessional Care*. 2003; 17(3): 223–237.
 - 41) Brown K, Avis M, Hubbard M. Health beliefs of African-Caribbean people with type 2 diabetes: a qualitative study. *Br J Gen Pract*. 2007; 57(539):461–469.
 - 42) Alvarado M. Murphy M.M. and Guell C. Barriers and facilitators to physical activity amongst overweight and obese women in an Afro-Caribbean population: A qualitative study. *International Journal of Behavioral Nutrition and Physical Activity* 2015; 12:97
 - 43) Kuchler F. and Variyam J.N. Mistakes were made: misperception as a barrier to reducing overweight. *International Journal of Obesity* 2003; 27, 856–861.
 - 44) Ettarh R, Van de Vijver S, Oti S. and Kyobutungi C.. Overweight, obesity, and perception of body image among slum residents in Nairobi, Kenya, 2008-2009. *Prev Chronic Dis*. 2013 Dec 19;10:1-9.
 - 45) Jumah N.A, Duda R.B. Comparison of the perception of ideal body images of Ghanaian men and women *African Journal of Health Sciences* 2007;14(1-2):54-60.
 - 46) Gilbert-Diamond D, Baylin A, Mora-Plazas M. and Villamor E. Correlates of Obesity and Body Image in Colombian Women. *Journal of Women's Health*. 2009; 18(8):1145-1151.
 - 47) WHO country cooperation strategic agenda (2015-2019)[Internet]. Published 2018[cited 2019 Aug5]. Available from: <https://apps.who.int/iris/handle/10665/272619>.
 - 48) WHO: Tackling NCDs:"Best buys" and other recommended interventions for the prevention and control of noncommunicable diseases[Internet]. 2017 [cited 2019 Aug 5]. Available from: <https://www.who.int/ncds/management/best-buys/en/>.
 - 49) WHO STEPS Instrument - World Health Organization[Internet]. 2019 [cited 2019 Aug 5]. Available from: <https://www.who.int/ncds/surveillance/steps/instrument/en/>.

Annex 1: Informed consent form quantitative study



You are invited to take part in a voluntary health study at no cost to you

You may ask any questions during the screening and you are free to end the screening at any time.

What can you expect during the screening?

The intake and screening will take about 15 minutes of your time.

You will be checked by the physicians and nurses in training enrolled at AUC and NIPA who will ask questions about you and your health and perform the screenings.

Your height and weight will be measured and you will receive screening for hypertension, diabetes and cholesterol. We will do a finger prick to take a drop of blood to measure the amount of lipid (fat) and glucose (sugar). You will also be given information about changes in diet and daily exercise that could improve your health.

Your results will be reported to a Dutch- Licensed physician. If follow-up care is recommended, the physician will talk further to you.

What are the risks?

The finger prick to draw a blood drop may cause momentary discomfort.

Why should you participate?

You will receive free screening for chronic disease/ conditions that are prevalent on Sint Maarten, and after the screenings, you will receive a card listing with all the test results.

The results of the screening will provide the ministry and SZV with valuable information which will be used for the betterment of the public health on Sint Maarten.

You will allow physician-in-training to obtain valuable experience.

PERMISSION TO COLLECT, USE AND SHARE HEALTH INFORMATION

Your confidentiality is important to us.

As part of this study, we will collect, anonymously, health information from participants. We will only collect and use information needed for this study. No names, personal or identifying information will be shared with outside parties.

Once all personal identification is removed, the information might be used or released for other purposes without asking you. Results of the study may be presented in public talks or written articles, but no information will be presented that identifies you.

The health information we will collect and use for this study is:

- ✓ Blood pressure
- ✓ Weight and height
- ✓ Blood lipids
- ✓ Blood glucose
- ✓ Age
- ✓ BMI

Participant #:

CONSENT TO PARTICIPATE IN STUDY

By signing my name below, I confirm the following:

- I have read (or had read to me) this entire consent document. All of my questions have been answered to my satisfaction.
- The screening’s purpose, procedures, risk and possible benefits have been explained to me.
- I understand that the screenings are free and that I will receive the results of the screenings.
- I understand that I will not be paid for participation of the study.
- I agree to let the study team use and share the information gathered for this study.
- I voluntarily agree to participate in this research study. I agree to follow the study procedures as directed. I understand that I can end my participation at any time.

IMPORTANT: You will receive a copy of the description of the study, risks, benefits and protection of your identity. Please keep it where you can find it easily. It will help you remember what we discussed today.

Subject’s Signature	Date
Signature of Parent (incase under aged)	Date
Signature of Witness (if applicable)	Date

Sint Maarten Health Bus Program Visitor Form

Date	Patient Number #
Age	Sex <input type="radio"/> Female <input type="radio"/> Male
Area of residence	
Last visit GP <input type="radio"/> 0-6 months <input type="radio"/> 7-12 months <input type="radio"/> 13-24 months <input type="radio"/> >2 years <input type="radio"/> Unsure	
Insured <input type="radio"/> Yes <input type="radio"/> No	If insured, name of insurance? <input type="radio"/> SZV <input type="radio"/> Nagico <input type="radio"/> Fatum <input type="radio"/> Ennia <input type="radio"/> Sagicor <input type="radio"/> Other
Ever participated in a health screening offered by the healthbus? <input type="radio"/> Yes <input type="radio"/> No	If your answer is Yes, where and when?
Have you been diagnosed with Diabetes? <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure	If your answer is Yes at what age?

<p>Have you been diagnosed with Hypertension/high blood pressure?</p> <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure 	<p>If your answer is Yes at what age?</p>
<p>Have you been diagnosed with any Heart disease</p> <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure 	<p>If your answer is Yes at what age?</p> <p>And what was the diagnosis?</p>
<p>Have you ever been diagnosed with hypercholesterolemia/ high cholesterol?</p> <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure 	<p>If your answer is Yes at what age?</p>
<p>Have you been diagnosed with any tumors or cancer?</p> <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure 	<p>If your answer is Yes at what age?</p> <p>And what was the diagnosis?</p>
<p>Have you ever been diagnosed with a stroke?</p> <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure 	<p>If your answer is Yes at what age?</p>
<p>Have you ever been diagnosed with Sickle cell disease?</p> <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure 	<p>If your answer is Yes at what age?</p>

<p>Have you ever been diagnosed with Lung disease?</p> <p> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure </p>	<p>If your answer is Yes at what age?</p> <p>And what was the diagnosis?</p>
<p>Do any of the above conditions run in the family?</p> <p> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure </p>	

	Mother	Father	Siblings	Children
Diabetes				
Hypertension				
Heart disease				
Hyperchol.				
Tumor/cancer				
Stroke				
Sickle cell disease				
Lung disease				

<p>Are you currently using any medication?</p> <p> <input type="radio"/> Yes <input type="radio"/> No </p>	<p>If your answer is yes, Name, amount and dosage.</p>
<p>Are you currently smoking?</p> <p> <input type="radio"/> Yes <input type="radio"/> No </p>	<p>If your answer is yes how many pack years? (amount/day + years they are smoking!!)</p>

<p>Are you currently using any drugs?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>If your answer is yes what kind?</p> <p><input type="radio"/> Marijuana</p> <p><input type="radio"/> Cocaine</p> <p><input type="radio"/> XTC</p> <p><input type="radio"/> Heroin</p> <p><input type="radio"/> Other</p> <p>Amount you are using:</p>
<p>Do you use any alcohol?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>If your answer is yes, how many drinks on average per day?</p> <p><input type="radio"/> Occasionally 1 or 2</p> <p><input type="radio"/> 1/day</p> <p><input type="radio"/> 2/day</p> <p><input type="radio"/> Other:per day</p>
<p>Do you do any physical activities?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>If your answer is yes, how many times (30 mins) per week?</p> <p><input type="radio"/> 1x/ week</p> <p><input type="radio"/> 2x/week</p> <p><input type="radio"/> 3x/week</p> <p><input type="radio"/> 4x/ week</p> <p><input type="radio"/> 5x/week or more</p>

Measurements

Table 2:

<p>First Reading Blood pressure</p>	
<p>SBP</p>	
<p>DBP</p>	
<p>Heart rate/ pulse</p>	
<p>Height (in cm)</p>	
<p>Weight (in kg)</p>	

BMI	
Waist circumference (in cm)	
Hip circumference (in cm)	

Table 3

Hours ago last food consumption/sugar drink	
Glucose (mg/dl)	
Cholesterol (mg/dl)	

Table 4

Second Reading Blood pressure	
SBP	
DBP	
Heart rate/ pulse	
Any high readings? <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not sure	High BMI or high cholesterol => Explain options to lose weight, get referral from G.P to dietician or possible start medication! High Blood pressure or Glucose level => Send to doctor.

Health bus physician comments:

.....

.....

.....

.....
.....

Any additional comments

.....
.....
.....
.....
.....

Annex 3: Informed consent form: qualitative study

Adapted from: WHO 2011, ICF Template for qualitative studies

Informed Consent Form for adults that participate in an interview concerning:

The factors that influence the choices adults in Sint Maarten make concerning diet and physical activity.

Name of the principal investigator: _____

Name of organization: _____

This Informed Consent Form has two parts:

- Information Sheet (to share information about the study with you)
- Certificate of Consent (for signatures if you choose to participate)

You will be given a copy of the full Informed Consent Form

Part I: Information Sheet

Introduction

I am Mrs. K. Andeweg, a medical doctor that is doing research in collaboration with a supervisor of the Royal Tropical Institute (KIT) in Amsterdam, The Netherlands. We are doing research on experienced barriers to a healthy lifestyle. Having an unhealthy lifestyle might lead to developing diabetes, which is a common problem in Sint Maarten. I will give you information and invite you to be part of this research and in this way help us finding solutions to this problem. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about the research.

This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them of me or of another researcher.

Purpose of the research

Having diabetes is a common problem in Sint Maarten. We want to find out what the reasons are that people living in Sint Maarten are more often developing diabetes than people in other countries; special focus is if there are any problems they face to have a healthy lifestyle. We believe that you can help us finding out if and what these possible problems are. We would like to find out what adults already know about having a healthy lifestyle and where they learned about this topic. There will also be questions about what the ideas and

opinions are concerning lifestyle in your community. And we would like to find out if any of you know more about services in the area where you can go to if you want to improve lifestyle.

Type of Research Intervention

This research will involve your participation in an in-depth interview.

Participant Selection

You are being invited to take part in the research because you are an adult living in Sint Maarten, who might be at risk of developing diabetes or maybe you have developed diabetes already. Therefore we think you can provide us information about your knowledge and experiences concerning this topic.

Voluntary Participation

The choice that you make will have no consequences in any way. You may change your mind later and stop participating even if you agreed earlier.

Procedures

A. We are asking you to help us learn more about factors that influence the choice you make concerning diet or physical activity. We are inviting you to take part in this research project. If you accept, you will be asked for example if you know how physical activity relates to developing diabetes.

B. The interview will be in a closed off room only together with the interviewer Mrs K. Andeweg.

The interview will start with a small introduction to make sure that you are comfortable. I can then also answer questions about the research that you might have. After that I will ask you questions about lifestyle and give you time to share your knowledge. The questions will be lifestyle knowledge, factors influencing choices you make in relation to lifestyle and knowledge on programs to improve lifestyle.

We will not ask you to share any knowledge that you are not comfortable sharing.

The discussion will take place in a closed room where no one else but the people who take part in the discussion and the facilitators can hear the conversations. The entire discussion will be tape-recorded, but you will not be identified by name on the tape. The tape will be kept at the Bushroad Clinic in a locked closet. The information recorded is confidential, and no one else except the research leader will have access to the tapes. The tapes will be destroyed after 4 weeks.

Duration

The research takes place over 3 weeks in total. The interview will take about one hour.

Risks

There is a risk that you may share some personal or confidential information by chance, or that you may feel uncomfortable talking about some of the topics. However, we do not wish for this to happen. You do not have to answer any question or take part in the discussion if you feel the question(s) are too personal or if talking about them makes you uncomfortable.

Benefits

There will not be a reward for any of the participants, however your participation is likely to help us find out more about what possible problems adults in your community face to be able to have a healthy diet and be physically active.

Confidentiality

The research being done in the community may draw attention and if you participate you may be asked questions by other people in the community. We will not be sharing information about you to anyone outside of the research team. The information that we collect from this research project will be kept private. Any information about you will have a number on it instead of your name. Only the researchers will know what your number is and we will lock that information up with a lock and key. It will not be shared with or given to anyone except for the principal investigator.

Sharing the Results

Nothing that you tell us today will be shared with anybody outside the research team, and nothing will be attributed to you by name. The knowledge that we get from this research will be shared with you and your community before it is made widely available to the public. Each participant will receive a summary of the results. After this a presentation will be given in the Bushroad Clinic to which you are invited to attend if you please. Following this presentation, we will publish the results so that other interested people may learn from the research.

Right to Refuse or Withdraw

You do not have to take part in this research if you do not wish to do so, and choosing to participate will not affect you in any way. You may stop participating in the discussion at any time that you wish without being affected. I will give you an opportunity at the end of the discussion to review your remarks, and you can ask to modify or remove portions of those.

Who to Contact

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact any of the following: K. Andeweg katja.andeweg@gmail.com or call the Bushroad Clinic +1721 5225800

This proposal has been reviewed and approved by Minister of PHSDL of Sint Maarten and the ethical committee of the KIT, which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find about more about the IRB, contact ????

You can ask me any more questions about any part of the research study, if you wish to. Do you have any questions?

Part II: Certificate of Consent

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant _____

Signature of Participant _____

Date _____

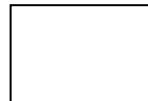
Day/month/year

If illiterate:

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness _____

Thumb print of participant



Signature of witness _____

Date _____

Day/month/year

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability.

I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Print Name of Researcher/person taking the consent _____

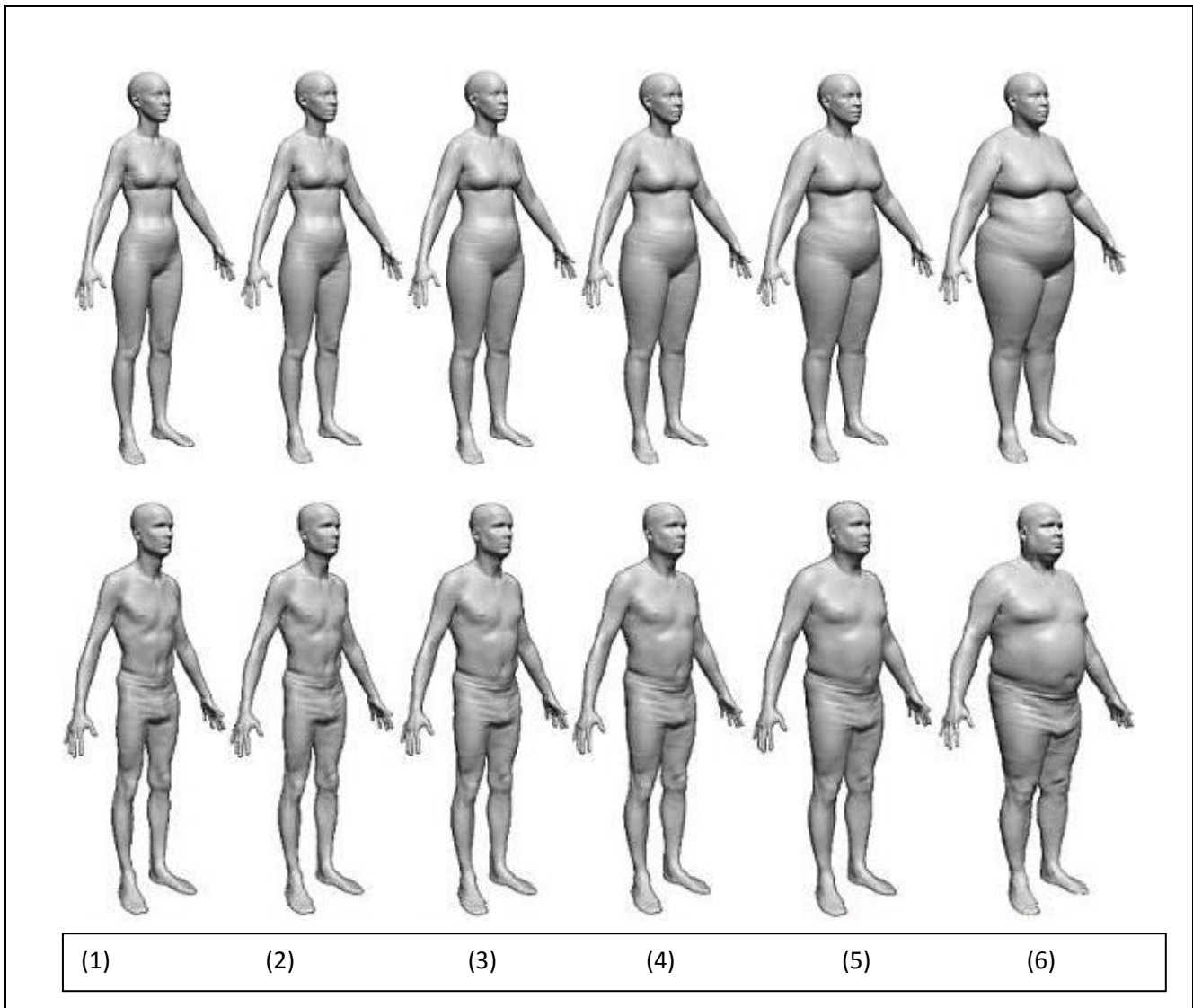
Signature of Researcher /person taking the consent _____

Date _____

Day/month/year

Annex 4: Topic list- qualitative study

Topic	Sub-issues
Knowledge lifestyle and DM2	<ul style="list-style-type: none"> • What do you think people should do to prevent developing sugar disease? <ul style="list-style-type: none"> - Physical activity/Sports => how often/what kind - Diet => what is good and what is not good? • What are the consequences for people when they get diagnosed with sugar disease?
Socio-cultural factors influencing lifestyle-choices	<ul style="list-style-type: none"> • Would you like to change your lifestyle? <ul style="list-style-type: none"> - Why yes or no? • Do other people tell you that you should change your lifestyle? <ul style="list-style-type: none"> - Why yes or no? • Do you believe people have difficulties to have a healthy lifestyle in Sint Maarten? Why yes or no? What are possible barriers? Availability/affordability/accessibility healthy food/sport possibilities? • What is for female/male (same sex as interviewee) to your opinion the most beautiful size? Why? (see pictures next page) • Which picture represents your shape?
Knowledge and perception services	<ul style="list-style-type: none"> • Where would you go/do you go for diet advice? Internet? <ul style="list-style-type: none"> - opinion of services in case being used • What would you do if you want to be (more) physically active? <ul style="list-style-type: none"> - Knowledge of any special programs? • Dietitian and sports activities available? Affordable? And acceptable?



Pictures above were shown, without showing the corresponding body mass index for each number. Corresponding body mass indices for females and males to the numbers are:

(1): 17.5 kg/m^2

(2): 18.5 kg/m^2

(3): 22 kg/m^2

(4): 24.9 kg/m^2

(5): 30 kg/m^2

(6): 40 kg/m^2

Annex 5: Topic list key actors-qualitative study

Topic	Sub-issues
<p>Knowledge lifestyle and DM2</p>	<ul style="list-style-type: none"> • How do most people on the island find out they are having diabetes? • What do you think of the level of knowledge diabetics have about their illness? • Do they know what the consequences are/might be when they get diagnosed? • What do you believe that people should change to prevent developing diabetes? - Physical activity/Sports => how often/what kind and how should people be encouraged to do so? - Diet => what is good and what is not good? How to change habits?
<p>Socio-cultural factors influencing lifestyle-choices</p>	<ul style="list-style-type: none"> • Do you think most diabetics are willing to change their lifestyle? - Why yes or no? • Do you think there are enough people encouraging diabetics to change their lifestyle? - Why yes or no? • Do you believe people have difficulties to have a healthy lifestyle in Sint Maarten? Why yes or no? What are possible barriers? Availability/affordability/accessibility healthy food/sport possibilities? • What is for the average female/male in St Maarten, the most beautiful size? Why? (see figure below)
<p>Knowledge and perception services</p>	<ul style="list-style-type: none"> • Where do you send your diabetes patients for diet advice? Do you recommend websites/apps? - opinion of services in case being used • Where would you send your diabetes patients when they want to be (more) physically active? Do you recommend YouTube videos/use of apps? - Knowledge of any special programs? • Do you believe the dietitian and sports activities are available? Affordable? And acceptable? Why yes or no.

Annex 6: Variety in demographics of participants-qualitative study

Number of participants interviewed per Age group, Residential Area, Country of Birth, Recruitment place, Education level and Income per month per household in US dollar.

Age group in yrs	Residential area	Country of birth	Recruitment	Education level	Income per month in USD per household
20-29	Betty's Estate	Aruba	Bushroad Clinic	Primary school	<1000
30-39	Cay Hill	Curacao	Dutch Quarter Clinic	Secondary vocational school	1000-2000
40-49	Cul de Sac	Dominica	St Martin's home	High school	2000-3000
50-59	Defiance	Dominican Republic	Philipsburg Medical Clinic	Bachelor	3000-4000
60-69	Dutch Quarter	Guyana	Union Road Clinic	Master	>4000
70-79	Lower Princes quarter	Haiti	Uwila Clinic		
	Oyster Pond	Hong Kong			
	Philipsburg	India			
	South Reward	Jamaica			
	St Johns	Netherlands			
	Sucker Garden	Nevis			
		St Eustasius			
		St Maarten			