Martine Stecher Nielsen

Latent class analysis of upbringing and mental health status among youth and young adults in Greenland

Master's thesis in Master of Global Health
Supervisor: Jon Øyvind Odland, Ulla Timlin, Ingebrigt Meisingset,
Christina V.L. Larsen

June 2020

NTNU
Norwegian University of
Science and Technology

ACKNOWLEDGEMENTS

ABSTRACT

Background

Profound socio-cultural changes in Grenland during the last 70 years have resulted in radical changes in the health and well-being of the population. Suicide rates and mental health problems have been rising, particularly among the young part of the Greenland Inuit. Previous research has found that protective factors for mental health in the Arctic often are linked to traditional activities and Inuit culture. Yet, most previous research has been assessing the youth in general, and more knowledge is needed, on how the youth and young adults in Greenland differ.

Design and Methods

This thesis was made as a cross-sectional study with data from the Greenland Health Survey 2018 and included 658 respondents between 15-34 years. The thesis sought to investigate how conditions in upbringing characterise Greenlandic youth and young adults with different negative and positive mental health outcomes. This was done by latent class analysis with distal variables.

Results

Four subgroups of youth and young adults were identified based on conditions in upbringing. Class 1 (*n*=178, 27%) and Class 2 (*n*=164, 25%) were both characterised by a relatively low probability of adverse childhood experiences (ACEs) during upbringing and a high probability of having grown up with strong ties to Inuit culture. These classes had the lowest probability of negative mental health outcomes. Class 3 (*n*= 224, 34 %) grew up with the highest probability of having experienced ACEs during upbringing and the highest probability of negative mental health. Class 4 (*n*= 92, 14 %) had the lowest probability of having grown up with strong ties to Inuit culture and the second-highest probability of an upbringing with ACEs.

Conclusion

Individuals growing up with the combination of an absence of ACEs and with strong ties to Inuit culture have the best mental health outcomes. This combination fosters good mental health independent of whether the individuals grew up in a settlement or town and independent of Danish language proficiency. Individuals growing up with ACEs have the poorest mental health outcomes. A significant proportion of the youth and young adults in Greenland have ACEs, and the ACEs investigated often co-occur.

Keywords: Mental Health; Well-being; Greenland; Youth; Adverse Childhood Experiences; Childhood conditions; Inuit culture; Traditional activities; Arctic; Arctic health; Latent class analysis

Contents

ABBREVIATIONS AND ACRONYMS

ACE = Adverse Childhood Experience

Adj. BIC = Adjusted Bayesian Information Criteria

AIC = Akaike Information Criteria

BIC = Bayesian Information Criteria

CI = Confidence interval

LCA = Latent Class Analysis

NCD = Non-communicable diseases

NIPH = National Institute of Public Health in Denmark

SDWG = Sustainable Development Working Group

WHO = World Health Organization

1 Introduction

Mental health problems present a great burden on the health of the global population. The World Health Organization (WHO) has declared that mental health should be seen as an integral part of health and well-being by stressing that: "There is no health, without mental health" [1]. In the Mental health Action plan, WHO describes that by 2020 their vision is a world in which mental health is prioritized worldwide by appropriate treatment, prevention and promotion. Moreover, one of the targets is to reduce global suicide mortality by 10% before 2020 [1]. Despite this, longitudinal data from 2016 showed that the total number of deaths from suicide had increased by 6,7 % since 1990 [2].

For decades the Arctic regions and Greenland, in particular, have had some of the highest suicide mortality rates in the world [2–4]. Due to the similar patterns between the Arctic regions, collaborative research has been assessing mental health among the indigenous groups in the Arctic. It has been found that protective factors for mental health often are connected to traditional practice, knowledge and having strong ties to the community [5]. Studies suggest that an upbringing with a strong connection to Inuit culture and traditions enhances mental health [6]. The Arctic regions have not always had a high prevalence of suicide mortality and mental health problems. In Greenland, the suicide rates started to increase in the decades after 1950, which were the year the Danish state initiated a program to turn Greenland into a *modern welfare society* [7]. The increase has therefore been linked to the colonial intrusion and rapid modernization of Greenland. The prevalence of mental health problems are especially seen among the youth and are at present a significant public health issue in Greenland [8, 9].

Considering the high burden of mental health problems in Greenland and incorporating the understanding of what is known about protective factors for mental health in the Arctic, the aim of this study is to investigate how youth and young adults in Greenland can be divided into meaningful subgroups based on conditions in upbringing. Moreover, to examine how mental health differs in these different subgroups. Until now, research on mental health among the youth and young adults in Greenland has mostly been focusing on the youth in general. However, this study should give insight into distinct differences among subgroups of youth and young adults. The results of this study should be useful for local health care workers and policymakers by equipping them with a better understanding of the characteristics of the youth and young adults in Greenland with poor mental health.

2 Background

2.1 Greenlands population: History and cultural transition

Greenland is a self-governing part of the Danish kingdom and is the worlds largest island. Despite the geographically large size, Greenland is only inhabited by around 56.000 inhabitants where around 90 % are Inuit [4, 10, 11].

There are 17 towns in Greenland and approximately 60 smaller villages almost all situated along the west coast [11]. However, due to the majority of the island being covered by ice only a very small part of the country is inhibited and 60 % of Greenland Inuit now live in one of the five largest towns [9, 10]. Around 17.000 of the inhabitants in Greenland lives in the capital Nuuk [11]. Despite the remote geographical location, the inhabitants of Greenland have been in contact with European explorers and whalers for centuries and even before their colonisation by Denmark/Norway in 1721 [12]. Nevertheless, Greenland was still a relatively isolated country until World War II. A country characterized by a traditional Inuit culture, a strong connection to the land and a livelihood centred around fishing and hunting [11, 12]. The Greenland Inuit were at that time, mostly living off and by the land as hunters and fishers living in small villages and settlements [12]. After World War II, the Danish state had increased

Figure 1: **Map of Greenland** Depicts an overview of municipalities and showing towns and larger settlements. Retrieved from Statistics Greenland [10]

incorporation and sedentarization of Greenland, which resulted in some severe disruptions of the traditional life-ways [7]. By multiple researchers, rapid cultural transitions have been described by acculturation, westernization, urbanization, migration and modernization [7, 12]. Terms that are also useful in understanding the transition occurring in Greenland.

Until 1979 the official policy of the Danish state was to assimilate Greenland, and the inhabitants of Greenland were commonly referred to as 'Northern Danes' [12]. This policy changed after the introduction of home rule in 1979 to officially being integrationist, yet the increased involvement by Denmark still resulted in radical societal changes in Greenland [12, 13]. Parallel with these changes, Greenland has likewise undergone an epidemiological transition in the last fifty years. Where communicable diseases are becoming less prevalent, non-communicable diseases (NCDs) as, e.g. chronic diseases and mental health problems are on the rise [12–14]. In the period after World War II, it was a political priority by Denmark to improve the physical health in Greenland

[15]. By contrast to most places in the Arctic, the Greenland Inuit were never sent abroad for treatment of, e.g. tuberculosis. Instead health personnel from outside, mostly from Denmark, came to Greenland, which led to some improvements as e.g. a decrease in tuberculosis. However, the sudden increase in migration to Greenland did also introduce a new lifestyle which among other things led to: "(...)alcohol misuse, sexually transmitted diseases and decreasing respect for the old ways" [16]. Surveys on the birth cohort of the Greenland Inuit born in post-colonial times clearly show an increase in sexual abuse and alcohol-related problems in the childhood homes. In the cohort from 1965-1995, more than 60 % reported having experienced alcohol-related problems in their childhood homes [17].

The changes in mortality pattern occurring in Greenland becomes clear in the figure below. This can be seen by the switch from a high prevalence of communicable-diseases to NCDs, mainly through the decrease in tuberculosis and acute diseases and the rise in cancer and suicide.

Figure 2: Age-adjusted mortality rate from major causes of death in Greenland; Men and women combined
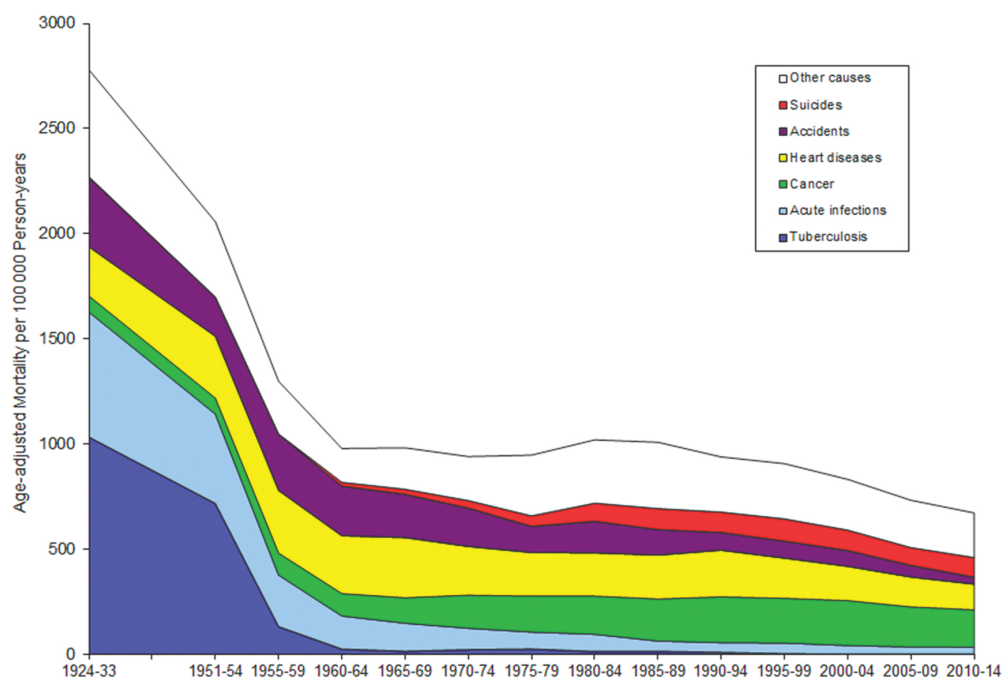
Retrieved from Bjerregaard & C.V. Larsen (2018) [11]

2.2   Mental health and suicide in Greenland and Inuit regions

WHO has defined mental health as "a state of well-being in which the individual realises his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" [18]. Until half a decade ago, the lifestyle and livelihood in Greenland were strongly connected to land-based activities and traditional Inuit culture. However, after the 1950s, rapid changes have turned Greenland into a modern country, the lifestyle and well-being of the Greenland Inuit have naturally been affected

[16]. The psychological impact of adapting to a new culture has been studied by Berry and Kim (1988), who describes that profound lifestyle changes can lead to acculturative stress. Berry has described that acculturative stress can give rise to different health consequences as, e.g. lowered mental health status, homicide, suicide, substance abuse, family violence, as well as changing patterns of physical health [12, 19]. In Greenland, the mental health problems have been rising in parallel with the shift towards a modern lifestyle and the disruption from the traditional Inuit culture [12, 16, 20]. Young generations are growing up in a context very different from the ones their closets ancestors grew up in. Having to balance and navigate between modernisation and a traditional Inuit way of doing has, in particular, affected the mental health of the young generation. Not only does the youth and young adults especially experience mental health problems, but Greenland also has the highest proportion of young people among the Nordic countries which further influence the magnitude of the mental health problems in Greenland [21, 22].

When assessing the rise in mental health problems in Greenland at a population level occurrence of suicide has served as an available and essential measure for mental health status [12]. The relatively recent rise in the suicide rate is not solely an issue in Greenland, but have occurred in almost all Arctic regions [23]. Even though the suicide rates exceed the national averages in most of the Arctic regions, distinct differences can be observed between sub-regions [7, 23]. In Greenland, a study on time trends in suicide from 1970-2011 clearly shows how the rates have become considerably higher in the Northern and Eastern part of Greenland and the lowest rates are seen in the capital Nuuk [8]. Along with the rise in the suicide rate among the youth, a rise can likewise be observed in suicidal thoughts and suicidal attempts. In an article about the health in post-colonial Greenland, Bjerregaard and Larsen have described how suicidal thoughts and attempts should "(...) not only be thought of as risk factors for suicide but as a general measure of poor mental health" [15].

In the Greenland Health Survey from 2014, it was found that almost every fifth young person between 18-29 years had attempted suicide within the last year. This number was 12,8 % in the first Greenland Health survey in 1993, and have been continually rising since the first survey [24]. With regard to committed suicides, the young men between 15-30, are having the highest rates in the Greenland Inuit population [8]. In a study by Breinholt Larsen [25] he explains that Greenlandic men, in general, find it more challenging to integrate into modern Greenlandic society than women do. The difficulties of adapting to modern culture for the Greenlandic men has been explained by, e.g. the "(...)loss of pride from the destruction of the hunting traditions(...)" [12, p. 46]. This is in line with studies on protective factors for mental health, showing that participating in land-based activities enhances mental health [6]. However, despite young men predominantly committing suicide, the rates for suicidal thoughts and suicide attempts are slightly higher for young women between 15-24 than for men in the same age-group. Almost

one-fourth of the young women answered that they had attempted suicide within the last year [17].

Regarding the underlying causes of suicide and suicidal thoughts and how those differ between sexes, the paper 'Health aspects of colonisation and the post-colonial period in Greenland 1721 to 2014' showed apparent differences between men and women [15]. Sexual abuse was the strongest determinant for suicidal thoughts among women, where it was being exposed to alcohol problems during childhood for men. Nevertheless, more research and knowledge is still needed on the gender differences regarding suicidal thoughts and suicide attempts. However, the statistics clearly indicate that noticeable differences exist between men and women when it comes to suicidal behaviour and mental health problems [15].

2.3 Measuring mental health among the Greenlandic youth and young adults

No official number of individuals with mental health problems exists in Greenland, yet, a range of studies have been trying to assess mental health in Greenland [12, 21, 22, 24, 26, 27]. In the study 'Well-being among youth' the researchers asked students from the senior classes about whether they had one or more mental health problems, and found that 78 % of adolescent men and 93 % of adolescent women reported at least one mental health problem [22]. However, in addition to direct questions on mental health problems, a range of different measures have been used to assess the mental health of the young Greenland Inuit. The Greenland Health Survey has included questionnaires about the mood and feelings of the respondents within the last 14 days as well as questions about suicidal thoughts and attempts [24]. By looking at time trends regarding the measurements of the feelings of the respondents: 'Trouble of sleeping', 'feeling fatigued' and 'Depression' have been decreasing between the surveys in 1999 and 2014. However, the proportion who answers that they have felt 'anxious' increased for both male and female [24].

During the last two decades, several studies on mental health have started to focus on the topic of resilience [28]. A study on Norwegian Sami and Greenlandic Inuit youth found that physical activity was fostering good self-rated health [26]. Another study on resilience used qualitative method to study mental health and resilience among the youth in Paamiut, Greenland, where the informants described how the following three factors were supporting their mental health: 1) to be proactive and actively seek help 2) to have concrete plans and wishes for the future 3) To receive and give social support by talking openly about things and trust other people [27]. The vast majority of the studies on resilience have used a qualitative method. A mapping review from 2017 found that 17 out of 25 studies on resilience had used qualitative method [28]. In spite of the qualitative studies on resilience, quantitative studies with an emphasis on standardised measurements have been dominating the research on mental health among youth and young adults in Greenland [28].

The General Health Questionnaire (GHQ) has been widely used to assess mental health status and has been used in all The Greenland Health Surveys in Greenland since 1993 with only one exception in the survey collected between 2005-2010 [24]. In the study by Bjerregaard, Curtis, *et al.* [12] they identified groups of robust (GHQ non-cases) and vulnerable (GHQ cases) and found that the highest proportion of vulnerable people were in the age-group of 18-24 with 42% GHQ-cases. The percentage of respondents who are characterised as GHQ-cases has been slowly decreasing from approximately 35 % in 1999 to 32 % in 2014 [24]. However, for the young part of the population between 18-34 years, the rates are still at a high level, especially among the young women between 18-24 where almost 56 % were categorized as GHQ-cases in 2014 [24].

Previous studies on Greenland have suggested mental health and well-being to be associated with demography and language proficiency [12, 17, 29]. In the study by Bjerregaard, Curtis, *et al.* [12] found a slightly higher percentage of GHQ-cases in respondents who grew up in a village/ hunter's family compared to those who grew up in Greenlandic towns. Bjerregaard, Curtis, *et al.* [12] described how the development had not yet reached the same level in the Northern and Eastern part of Greenland as it had in the Western and Southern part of Greenland. However, the study did not find a significant association between current residence and whether respondents were characterized as GHQ cases or GHQ non-cases [12]. Moreover, the study also found language proficiency to be associated with mental health status. 42 % of the respondents who only spoke Greenlandic were characterised as GHQ-cases; in contrast, it was only 26 % of those who were bilingual. That said, the researchers of the study believe that the relationship between language proficiency and GHQ-status operates through other socioeconomic factors [12]. However, in a study on common mental health disorders in Greenland, the researchers found that significantly higher prevalence of mental disorders among those who chose a Greenlandic questionnaire than among the ethnic Greenland Inuit who chose a Danish questionnaire [29]. Nevertheless, since Danish was introduced as the language of administration, higher education and technical matters, language proficiency naturally leads to some inequalities between monolingual and bilingual Greenland Inuit [12]. However, the researchers recommend that more socioeconomic factors should be included to obtain a thorough understanding of what is causing mental health problems. Especially experiences and conditions in childhood have been linked to mental health status during youth and adulthood.

2.4   Adverse childhood experiences

When assessing risk factors for mental health in Greenland and the Arctic in general, several studies are stressing the importance of adverse childhood experiences (ACEs) [11, 21, 30, 31]. It is well documented in the literature that ACEs have a substantial impact on the mental health status as an adult, including the risk for depression and suicide [32]. ACEs include, among other things: sexual abuse, emotional abuse, physical abuse, physical and emotional neglect, household mental illness and household substance use [32]. In a study on Native American adolescents, the

researchers linked depression and suicide attempts to ACEs such as abuse, neglect, witnessing violence against one's mother but also to historical loss associated symptoms [33].

The association between ACEs and mental health status have also been studied in a Greenlandic context. In the study by Curtis *et al.* [30] violence, sexual abuse and health were analysed with data from The Greenland Health Survey from 1993 and 1994. Here, Curtis et. al. found a significant association between being a victim of violence or sexual abuse and mental health problems. Furthermore, being a victim of violence or sexual abuse were associated with poor self-rated health, especially for women. These findings are in line with some of the findings from a more recent review on Child health in Greenland [31]. Among other things, this review assessed risk factors for mental illness in adulthood and showed that "(...)failing care, disharmony, and violence in the parental home" were significant risk factors [31, P.308]. This corresponds with the study "Well-being among Youth in Greenland" (2012), where young people who had attempted suicides were interviewed about their motives. 'Violence in the family','sexual abuse', 'violence in relationships', 'difficult teenage years', 'a general feeling of being unhappy' and 'family members who committed suicide' were some of the motives mentioned by the young people in the study [22].

Similarly, Bjerregaard & Larsen [15] demonstrated that exposure to sexual abuse, alcohol problems as well as poverty during childhood were associated with recent suicidal thoughts for both men and women. Furthermore, for women, current socioeconomic status was likewise associated with sexual abuse as a child [15].

The clear association between ACEs and mental health problems and suicide in adulthood is well-documented and not solely an issue in Greenland. Having said that, the major difference is that the proportion of people in Greenland who have experienced ACEs is at a very high level. In The Greenland Health Survey from 2014, they found that 66 % of the population had been exposed to ACEs such as alcohol, violence and sexual abuse during their upbringing. However, the numbers were highest in the birth cohorts from 1970, 1975 and 1980 [24]. In the Greenlandic families, ACEs often co-occur. An upbringing in a family with alcohol problems are often linked with, for instance, sexual abuse and violence, which further can lead to mental and physical health problems for both adults and children in the family. However, regarding co-occurring ACEs and child sexual abuse, the sexual abuses rarely happen between close relatives but are rather occurring as a result of the lack of parental control in a home characterised by alcohol problems [11]. Despite these high rates of ACEs in Greenland, the rates for both alcohol problems in the childhood home, sexual abuse during childhood and violence in the childhood home have all been declining after 1990 [17, 24]. However, despite the positive development, the latest Greenland Health Survey showed that more than one-third of the youngest in the survey had an upbringing with alcohol problems in their childhood home [17].

It is clear that the high occurrence of risk factors and ACEs in Greenland is having an extremely negative impact on mental health. That said, studies have also shown how an upbringing in an Inuit region such as Greenland can affect mental health positively. Especially, to have a strong connection to culture and traditions have been shown to act as a protective factor for the mental health in the Arctic populations [6, 34].

2.5 Protective factors

In a review on protective factors and causal mechanisms that enhance the mental health of the Indigenous Circumpolar youth, the authors identified more than 40 protective factors. A range of these identified factors were connected to traditional practice, knowledge and skills [34]. This corresponds with the findings from a study on Alaska Native students where they found that traditional ways and traditions were important for suicide prevention. Moreover, they found that it helped the youth to, e.g. facilitate meaningful relationships, communicate important cultural values and promote an overall healthy living [5]. Likewise, a study on protective factors for mental health among Canadian Inuit youth in Nunatsiavut found that, among other things, being on the land, connecting to the Inuit culture and having strong communities were enhancing mental health and well-being [35].

In a more recent review on well-being among the youth in the Arctic, the authors mapped protective factors from 27 articles about mental health in the Arctic [6]. In this review, the authors presented protective factors on three levels: community, family and individual. On a community level, they describe that, e.g. mentorship from older generations, strong relationships with community members, to have a sense of belonging in the community and to have positive role models were protecting for mental health problems. Also, one of the included studies in the review express that participating in land-based activities such as hunting, fishing, berry picking, preparing animals were potential socio-cultural protective factors [6]. On a family level, the review found that e.g. close relationships in the family, family history of having received treatment for psychiatric problems, competence in the native language and ethnic socialization at home were protective factors. On an individual level the importance of traditional knowledge, ethnic pride, cultural values and practice, to have a sense of purpose and being committed to the local community and culture were some of the factors that would protect the mental health [6].

Considering these protective factors on the three different levels, it becomes clear that growing up with knowledge about and a connection to traditions and culture is contributing positively to the mental health in the Arctic regions. The authors of the review do, therefore, recommend that this range of protective factors should be considered when planning interventions and actions. A range of the studies included in the review does also stress the importance of how cultural aspects of the traditional practices and cultural identity can contribute to research and interventions on

mental health and suicide [6]. In line with this recommendation, Arctic researchers have tried to include a more culturally appropriate way of obtaining and sharing knowledge. In 2018 a collaborative network of researchers from the Arctic regions were having a 'Sharing Circle' where they shared and gathered knowledge about Arctic thriving communities [36].

With regard to the youth sharing experiences, it is described in the review by MacDonald *et al.* [34] that incorporating stories of resilience and cultural histories have the potential to bring a shared context to the youth in the Indigenous cultures. A shared context that may help them to draw: "strength, resources and skills, in which they can situate themselves and their struggles in relation to others, to their history, and a collective sense of culture and identity" [34]. Furthermore, in order to create culturally relevant mental health resources, resilience strategies and programs, MacDonald *et al.* [34] call for involvement and perspectives from the youth and young adults in the different Arctic regions.

2.6   Youth mental health programs and political actions

Several initiatives and actions focused on mental health and suicide prevention are taking place in Greenland, where the majority is funded and carried out by municipalities and public agencies [21]. In 2005 a concerted countrywide strategy was initiated for the prevention of suicides, but this has not yet led to lower suicide rates [8]. However, more public initiatives are taking place, for example, the 'SAAFIK initiative' that aims to produce knowledge and to offer counselling for the youth who have experienced sexual abuse, 'The School Fairy system' for families who need social support and increased attention. An issue with the public agencies is that most of them are focusing primarily on the youth below the age of 18, and none of the initiatives are explicitly targeting the ones who are older than 18 years old. This specified age-span is leaving an essential part of the vulnerable youth and young adults without specialised expertise and support [21].

Several non-governmental organizations are also operating in Greenland. 'The Association of Greenlandic Children' (FGB), 'Nanu Children' and 'Better Life for Children' (MIBB) are organizations working to improve conditions for children and ensuring that the children's rights comply with UN's convention. Likewise, NGO's such as 'Timi Asimi' and 'Sapiik' has initiatives targeting the older children [21]. Moreover, the mental health of the youth and young adults is getting increased focus in current research on Greenland, for instance, does the latest Greenland Health Survey from 2018, have a particular focus on the mental health and well-being among youth and young adults between 15-34 [17]. Furthermore, a rising number of political actions and strategies concerning well-being, mental health and suicide prevention are taking place in Greenland. The Ministry of Family, Gender Equality and Social Affairs developed an action plan called 'Break the silence, stop the violence' which was implemented between 2014-2017. This action plan was facilitated through information campaigns, educational material, focus on closer interdisciplinary collaborations between professionals, direct contact with victims of violence in

public institutions and municipalities and a national web-page about violence [21]

Due to the similar suicide and mental health patterns across the Arctic regions the Arctic Council, under chairmanship by the US, created the initiative 'Rising Sun' to collaborate on solving the mental health problems in the Arctic together by a circumpolar comparative framework [37]. Before 'Rising sun' collaborative network was taken place under the initiative 'Promising practices' where innovative approaches for mental well-being in the Arctic were shared under the Canadian chairmanship [3]. Already at the time of 'Promising practices' there was a focus on creating strong networks between the indigenous communities and the local and regional governments, researchers and health service providers [38]. With the establishment of 'Rising Sun' in 2015, the aim was to establish a shared toolkit to access suicide prevention efforts in the different arctic regions [23]. Moreover, to have follow-up activities across the Arctic regions as well as to have shared data and common metrics in order to share measurements and evaluations of suicide prevention interventions [39]. In a report by 'Rising Sun', they describe that the Arctic communities prefer strategies with an emphasis on the indigenous ways of knowing as well as community- and family-driven efforts for the youth and young adults. In line with this, the Arctic Council, under the Finnish chairmanship, initiated the project 'CREATeS' where youth across the Arctic States were invited to share their ideas and experiences. This was done to include youth perspectives in the development and leadership of projects for youth and community wellness [40].

Collaborative cross-border initiatives and political actions on improving the mental health in the Arctic does not only take place between researchers and policymakers in the Arctic, but also at a global level. In 2015 the UN sustainable development goals were formulated with target number 3.4 stressing the importance of mental health problems and suicide worldwide by aimiing to: "By 2030, reduce by one-third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being". However, despite the emergence of national, non-governmental and global initiatives for the last decades the suicide rates and prevalence of mental health have continued to be at a high level, especially for the young part of the population.

3 Rationale

3.1 Rationale for the study

Given the high prevalence of mental health problems among Greenlandic youth and young adults, it is of great importance to gain a better understanding of the mental health among youth and young adults in Greenland. Several studies have been done on risk factors and protective factors for the mental health of the youth as a whole in Greenland [17, 22, 24, 41]. However, more knowledge is needed on how different conditions in upbringing characterises the youth and young adults in Greenland and how these are associated with different mental health outcomes. Such knowledge should help policymakers and professionals to establish appropriate services, interventions, and promotions to prevent mental health problems in Greenland.

3.2 Objectives

To investigate how conditions in upbringing characterise Greenlandic youth and young adults with different negative and positive mental health outcomes.

3.3 Research questions

1. How do indicators for conditions in upbringing determine subgroups of youth and young adults in Greenland?

2. How do mental health outcomes differ between these subgroups?

4 Materials and methods

4.1 Study design

This study was performed as a cross-sectional study using data from The Greenland Health Survey from 2018. The data was retrieved from the National Institute of Public Health (NIPH) in Denmark. NIPH has performed five Greenland Health Surveys; in 1993-1994, 1999-2001, 2005-2010, 2014 and 2018 [17]. However, this thesis will solely be using the latest data from The Greenland Health Survey 2018.

4.2 Study population

The age-span for youth and young adults in this study has been defined as individuals between 15-34 years of age. This specific age-span was chosen since this group has shown to be especially vulnerable to mental health problems and suicidal behaviour [8, 9]. Furthermore, since the researchers in charge of The Greenland Health Survey 2018 have used the same age-span to define youth and young adults and made an additional questionnaire focused on mental health and well-being for this specific age-span [17]. The Greenland Health Survey 2018 included answers from 2539 participants between 15 and 94 years of age. However, when excluding participants older than 34 years of age, a sample of 658 participants was used for this master thesis.

4.3 Data collection

The data for the Greenland Health Survey 2018 was collected between August 2016 and January 2019 by NIPH. The participants were interviewed by an interviewer, had a clinical examination and were given a self-administered-questionnaire. For the youth and young adults between 15-34 years of age, an additional questionnaire was given. Apart from the questions on mental health and well-being, the additional questionnaire included questions about 'the transition from school and education to working life', 'place of residence and plans for residence later', 'use of social media', 'relations to older generations in the community' and 'whether participants were doing traditional activities during their upbringing' [17]. The interviews could be completed in Danish or Greenlandic. 98 % of the participants chose to have the interview in Greenlandic [17].

The team of researchers and health personnel in charge of the data-collection travelled by both plane and ship to 12 towns and eight settlements to collect data from Nanortalik in the south to Qaanaaq in the north as well as Tasiilaq in the east [17]. The distinct landscape and climate in Greenland naturally influenced the planning and performing of the data-collection and made it difficult to, e.g. return to towns or settlement with low response rates. Some geographical disparities in response rates, can therefore, be observed between the municipalities [17]. The overall response rate has been relatively constant on around 60 % since The Greenland Health Survey was initiated. However, the response rate dropped to 52 % in the study from 2018 with a

rate of around 60 % for female and 40 % for male participants [17]. With regard to the response rate, the researchers were mapping the reasons for the loss of participants and found that the primary reasons were: 'Individuals not wanting to participate' and 'Not possible to get contact to the individuals'. Moreover, 2,8 % of the loss of participants was due to 'individuals having a disease at the time of the survey' [17].

4.4 Measures for statistical analysis

Figure 3 shows the variables included in the statistical analysis; Latent Class Analysis (LCA). LCA was used to identify subgroups (classes) of youth and young adults in Greenland based on certain conditions in upbringing. Moreover, the mental health status among these classes was compared through six distal variables for mental health.

A detailed description of the statistical analysis will be given in sections 4.5 - 4.5.2. Furthermore, a description of the included variables will follow in the sections below.

Figure 3: Overview of the variables included in the latent class analysis
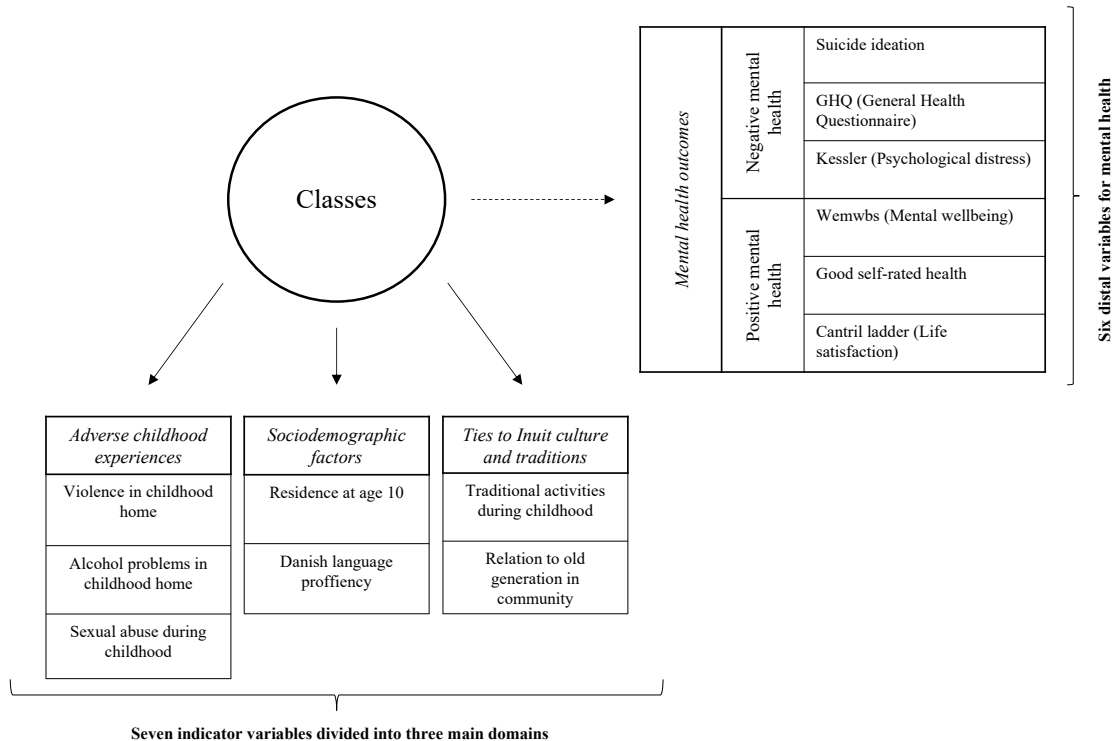
4.4.1 Conditions in upbringing

The measures for upbringing were chosen after a thorough literature search on how conditions in upbringing, ACEs and protective factors related to tradition and culture affect mental health in Greenland. Seven measures for upbringing were included and will be presented in the following section.

Adverse Childhood experiences (ACEs)

Measures of ACEs were included since it is well-documented that it affects mental health status later in life to experience adversities during childhood [32]. Moreover, since several studies also have stressed the association between ACEs and mental health status in the Greenlandic population [11, 21, 30, 31]. ACEs include a range of experiences, but in this thesis, the following three measures were included: 1) 'Violence in childhood home' 2) 'Alcohol problems in childhood home' and 3) 'sexual abuse or attempt on sexual abuse before the age of 13'. The variables concerning alcohol problems and violence were initially coded as categorical variables at a three-point scale but recoded to a binary variable covering the following options: (0) "No" and (1) "Yes, often and sometimes". The measure of sexual abuse before the age of 13 was already formulated with the binary response options (0) "No" and (1) "Yes", and were not recoded.

Ties to Inuit culture and traditions

The two indicators for ties to Inuit culture and traditions were included since reviews have shown these to be protective factors for mental health in the Arctic regions [6, 34]. The following two variables were included: 1) 'Traditional activities during childhood' and 2) 'Relation to older generations'. The question about traditional activities was formulated: "Have you had the opportunity to see and learn traditional Greenlandic activities during your upbringing? (This could, for example, be to go hunting, fishing, picking berries, being in nature or doing leather stitching, craft or similar activities". The second measurement concerning relations to older generations was formulated: "Do you feel close to people from the old part of the generation where you live? (This could be grandparents but also other people in the town/settlement that means something to you)". In both of these variables, the possible answers were originally coded at a categorical 4-point scale, but were recoded into binary variables measuring: (0) "To a small extent or no" and (1) "Yes to a great extent or some extent"

Sociodemographic factors

Place of residence during upbringing was included as an indicator for upbringing since an earlier study found a higher prevalence of mental health problems in participants who grew up in settlements than in those who grew up in Greenlandic towns [12]. Place of residence during childhood was formulated as: "Where did you live when you were ten years old?" and initially, had an open answer category; however, the answers have been sorted and recoded into a binary category of (0) "Town" and (1) "Settlement". Twenty participants answered a place

outside of Greenland which was treated as missing values, however, the participants were still included in the statistical analysis due to the small number of missing values and the fact that they presumably still had some of their upbringing in Greenland.

Danish language proficiency was included as a measure for upbringing since studies have shown that the bilingual Greenland Inuit (those also speaking Danish) were less likely to be GHQ-cases than the monolingual [12]. Furthermore, the variable was included since Danish was introduced as the language of, e.g. higher education, wherefore, fluency in Danish should presumably be advantageous [12]. The question was formulated as: "How well do you speak Danish?". This measure originally had response options at a categorical 4-point scale, but was recoded into a binary variable consisting of: (0) "No, not at all or find it difficult" and (1) "Yes, without trouble or speaks some Danish".

4.4.2 Mental health

Six different measures were used to assess mental health status among youth and young adults in Greenland. Three measures were targeting negative mental health, and three measures were targeting positive mental health.

Negative mental health

Suicide ideation

Suicide ideation was included as a measure due to the high prevalence of suicide and suicidal thoughts in Greenland and since this measure has been used in previous studies as an indicator for poor mental health [7, 8, 17]. Suicide ideation was coded as a binary variable with the following categories: (0) "No" and (1) "Yes."

General Health Questionnaire (GHQ)

The 12-unit GHQ was used since this is a standardised measurement that has been widely used to assess mental health and likewise has been found to be a useful screening instrument to detect depression [16]. It was developed by Goldberg as a screening tool to detect current mental disturbances [42]. GHQ has likewise been used to assess the mental health among the Greenland Inuit in the previous Health Surveys in Greenland [17]. In the 12 questions participants were asked how often they had felt: 'unhappiness', 'worthlessness', 'loss of confidence', 'depressed', 'able to overcome difficulties', 'capable of making decisions', 'able to face up problems', 'able to concentrate, able to enjoy normal activities', 'useful', 'under strain' and 'sleepless' during the last couple of weeks.

Initially, the 12 questions in GHQ were all coded at 4-point scales. The 12 items were firstly, combined into a scale. Secondly, GHQ was recoded to a binary variable according to the 'GHQ

method' with scores in the range 0-12. In general populations, a cut-off point of 3 has been commonly used to identify individuals with poor mental health [42, 43]. However, previous studies of Greenland Inuit have instead used a cut-off point of 2 [12, 44]. Therefore, this thesis used a cut-off point of 2 with individuals scoring '0' and '1' indicating that they are potential GHQ non-cases, coded as (0), and individuals scoring '2' and above indicates that they are potential GHQ-cases, coded as (1).

Kessler Psychological Distress Scale (K-6)

K-6 was developed for substance abuse and mental health service administration in the United States, but the scale has also been shown to be attractive to estimate the prevalence of serious mental illness [45]. However, K-6 has also previously been used to screen mental health and well-being in the general population [45, 46]. The questions in K-6 concern negative feelings and asks respondents on a 5-point scale whether they have felt: 'nervous', 'hopeless', 'restless or fidgety', 'so depressed that nothing could cheer you up', 'that everything was an effort' and 'worthless' during the last 30 days. These questions were combined into a scale and recoded into a binary variable with a cut-off point between 12 and 13 based on results from a methodological evaluation of Kessler K-6 finding this to be the optimal cut-off point [45]. Hence, scores between 0 and 12 indicate 'participants probably not having serious mental illness' (SMI) and scores between 13-24 as 'participants with probable SMI'.

Positive mental health

The Warwick-Edinburg Mental Health well-being Scale (WEMWBS)

WEMWBS is a tool to measure mental well-being at a population level and was developed by experts in the field and tested on both a sample of students and a representative population sample [47]. In contrast to the other measurements of mental health, WEMWBS focuses solely on the positive aspects of mental health and is comprised of positively worded items [47]. WEMWBS originally consisted of 14 questions, but a shorter versions of seven questions were later introduced and used in research and clinical settings [48]. The short seven questions version will be used in this thesis. Having said that, the researchers at The Greenland Health Survey did only include six out of seven of the validated WEMWBS questions in their questionnaire. Hence, a version with six questions will be used and included the following feelings: 'optimistic', 'useful', 'relaxed', 'dealing with problems well', 'thinking clearly' and 'been able to make up my own mind about things'.

Initially, the six questions had response options at a 5-point scale, but after combing the six questions into a scale, it was recoded to a binary variable. Previous research using the short-version instrument of WEMWBS have had cut-off points with three categories for 1) Bottom 15ht percentile: 'high mental well-being' 2) Top 15th percentile: 'low mental well-being' 3) Values in-between: 'participants with neither high or low mental well-being' [49]. In order

to use WEMWBS to capture positive aspects of mental health among the youth and young adults in Greenland, it was decided to use the lowest 15th percentile as a cut-off point to capture participants with highest mental well-being. However, since 18,43 percent of the participants answered the best possible answer '1' in each question, giving them a mean value of 6, the cut-off point was between 6 and 7. Hence, values above 7 were used to measure (0) "Participants with low mental well-being and participants with neither high or low mental well-being and" and values between 1-6 to measure: (1) "Participants with high mental well-being".

The Cantril Ladder self-anchoring scale

The Cantril ladder self-anchoring scale or just the Cantril Ladder is a standardised scale measure that asks participants to place themselves on an 11-step (from 0 to 10) visual analogue scale to measure their life satisfaction [50]. Some previous studies have used a cut-off point between 5 and 6; however, data from HBSC found that the mean value for life satisfaction were 7,58 [51]. In line with this finding and the fact that the cut-off used in measurements of adolescents in the Nordic countries, a cut-off point of 9 was used for this thesis [52]. The Cantril ladder was recoded into a binary scale with scores below 9 coded as (0) indicating "Medium or low life satisfaction" and scores of 9 and 10 coded as (1) and indicating "High life satisfaction".

Self-rated health (SRH)

SRH was likewise included to assess mental health status since self-rated health have been found useful to measure psychological distress and mental health status [53, 54]. In the SRH question participants are asked to give a graded assessment of own health status as 'excellent', 'good', 'fair', 'poor' or 'very poor'. These categories were recoded into a binary scale of (0) "Fair, poor or very poor" and (1) "Excellent or good".

4.5   Statistical analysis

In the present study, distinct subgroups of young Greenland Inuit with differing conditions in upbringing will be identified through Latent Class Analysis (LCA). LCA was proposed by Lazarsfeld and Henry and is a cross-sectional latent variable mixture modelling approach [55]. LCA seeks to find heterogeneity within the population by identifying so-called latent classes based on the response patterns in a set of categorical indicators. This process results in classes with individuals, who are most similar to each other and most distinct from those in other classes [56]. Each subject is therefore modelled with its own probability of belonging to each class, known as posterior probability [55]. A posterior probability of close to 1 indicates that the individual has a low degree of classification uncertainty and hence, a high probability of belonging to the class of assignment and no other class. Contrary, a value close to 0 indicates a high classification uncertainty and that no class emerge as the most likely [56]. A commonly used cut-off point for posterior probabilities is 0,7, indicating a sufficiently high probability of belonging to the exact class of assignment [57–59]. The LCA model assumes that the class membership is determined

by an underlying categorical latent variable that groups individuals into these specific classes [55]. The analyzes were run in the software program STATA/IC 15.1. To run the analysis in STATA, the LCA Stata Plugin Version 1.2.1 from The Methodology Center at Pennsylvania State University were used [60].

When fitting a latent class model, it is necessary to estimate the model parameters based on the data which is done through an assessment of the maximum number of iterations and the maximum absolute deviation (MAD). The analysis was run with several different values in the initial stage of the analysis, until a satisfactory balance of precision and computational time was found at a maximum number of iterations of 5000 [56]. MAD works as a stopping rule for the iterations and stops iterating when the successive iterations estimation of the estimation procedure is sufficiently close to the maximum likelihood solution [56]. MAD was through an iterative process found to yield good results at 0.00001. Hence, the iterations are stopped after the successive iteration where the difference between any parameters are less than 0.00001.

In LCA, missing values are permitted in the analysis when fitting an LCA model. All indicator variables were recoded into binary indicators as this is the most commonly used in LCA [61]. After the preparation of the variables, a Spearman correlation test was run with the included variables to check the strength and direction of the association (Appendix B). Almost all of the correlation coefficients were low with one exception of 'alcohol problems in childhood home' and 'violence in childhood home' which had a value of 0.55. However, ACEs have been shown to co-occur in a Greenlandic context, and the two measures were still included [11]. The other indicator variables showed a low correlation (Spearman <0.4), indicating low multicollinearity. The seven indicator variables were therefore included in the LCA.

4.5.1 Class enumeration

A class enumeration was made to decide on the number of classes that would give the best fit for the latent class analysis. The first step of the class enumeration was to fit a model with one class that could serve as a comparative baseline for the following models where the number of classes was increasing. This was done until no convergent results appeared or until the new class appearing did no longer contribute with additional insight [61]. A comparison of a set of specific fit indices decided how many classes that should be included [61]. To compare the models and decide which best fit the data, three different indices were used: The Akaike Information Criteria (AIC), the Bayesian Information Criteria (BIC) and the adjusted BIC (Adj. BIC). Adj. BIC have been shown to be very accurate in predicting the best number of classes with samples of more than 300 respondents [62]. These three fit indices were compared since it is recommended to use several indices to obtain a better basis for choosing the most optimal model [61]. An examination of the values of these fit indices and the final number of included classes will be given in section 5.2.

To ensure robustness against differences between sex and age groups, separate LCA models were run and compared. Firstly, a comparison between an LCA model only including the youngest part of the sample between 15-27 years of age and a model only including the oldest part of the sample between 28-34 years of age was performed. Secondly, LCA models were performed respectively for male and female. The results of the separate LCA models will be described in section 5.1.

In the description of the latent classes, the terms 'classes' and 'subgroups' will be used interchangeably throughout the thesis. However, each of the classes will be assigned a number which will be used when referring to that specific class.

4.5.2 Latent Class Analysis with distal variables

After the latent classes were discovered through indicators of terms in upbringing and the best fit (number of classes) was found through a class-enumeration, the following step was to assess the association between these classes and their mental health outcomes. When interested in a relationship between a latent class variable, C, and a distal variable, Z, a specific LCA approach with a distal variable can be applied [63]. In this case, for example to assess the probability of a certain mental health outcome (Z) in a specific class (C). This was done in STATA with the LCA Distal BCH plugin version 1.1 from The Methodology Center at Pennsylvania State University [63]. This approach makes it possible to compare class-specific expected values, which is the same as mean values in each of the classes. Since the variables used in this study are entirely binary, the expected value will be the probability of the value '1' rather than the value '0' for a randomly selected member of that specific class [63]. LCA with distal variables is done through the following three steps: 1) The LCA model is estimated with only the indicator variables as described in section 4.5. 2) After the latent classes are estimated, posterior probabilities of class membership are being used to compute a weighting variable. 3) Based on the weighting variable, the weighted average of Z (mental health outcomes) is calculated for each class. The weighted distal outcomes were calculated with modal BCH adjustment since this is recommended in all cases where it does not produce an uninterpretable value [63].

Since this thesis examines six measures of mental health, the third step was done for each of the six distal variables. Moreover, the six measures were, similarly to the indicator variables, also recoded into binary variables. An advantage with latent class analysis is the ability to include missing values; however, this is not the case when including the distal variables. Hence, missing values in the distal variables are not included in the third step [63]. Due to the sensitive matter of the mental health variables, some missing values appeared, which were excluded. However, with between 0-90 missing values, the number of missing values were significantly lower than in the indicator variables concerning ACEs (Appendix A).

4.6 Ethical approval

The data material is being accessed from the NIPH, and the specific theme of the master thesis is agreed upon with the institute. NIPH has been monitoring the health of the population in Greenland since 1993 with ethical approvals in Greenland for each of The Greenland Health Surveys. Therefore, The Greenland Health Survey 2018 already have a valid ethical approval which also covers this specific master thesis (Appendix D). A data processing agreement was likewise developed for this master thesis (Appendix E). In collaboration with NIPH, the results of this master thesis will be translated to Danish and handed to Greenland's home-rule government.

Since the master thesis is conducted under the auspices of a Norwegian University, ethical approval has been obtained from the Regional Committee for Medical research Ethics - REK (85118/2020 REK), using de-identifiable anonymized data.

5 Results

5.1 Sample characteristics

The study sample consists of 658 participants between 15 and 34 years of age, where 50,5 % are between 15-24 years and 49,5 % are between 25-34. The mean age of the sample is 24,7 (SD= 5.5). Moreover, there is an almost equal proportion of male and female in the sample with 49,5 % male and 50,5 % female. Table 1 shows the percentage and number of the whole population who answered that each of the indicators of conditions in upbringing was present.

Table 1: Values for the whole population concerning conditions in upbringing. Percentage of participants where each variable was present and total no. of responses in each variable

Upbringing variables	%	n
Violence in childhood home	43	218
Alcohol problems in childhood home	53	312
Sexual abuse during childhood	25	114
Residence in settlement at 10 years of age	31	199
Speak Danish	62	408
Traditional activities during upbringing	74	458
Relation to old generations in community	66	411

Approximately one-third of the participants were living in a settlement when they were ten years old, and 61 % speaks Danish. Moreover, 43 % experienced violence and 53 % experienced alcohol problems in their childhood home. One-fourth of all participants experienced sexual abuse. Finally, the majority of the participants grew up with traditional activities and with a relation to old generations in the community.

Table 2: Values for the whole population concerning mental health. Percentage of participants where the condition was present and total no. of responses in each variable

Measures for mental health	%	n
Suicide ideation	25	141
GHQ-case	38	228
Probable serious mental illness (Kessler)	10	62
Good mental well-being (WEMWBS)	18	113
Good self-rated health	59	391
High life satisfaction (Cantril Ladder)	35	216

Table 2 displays the values for the whole population of youth and young adults in the six measures for mental health, which will be included as the distal variables in the LCA. One out of four participants has considered suicide and almost 40 % of the participants can be considered GHQ-cases. Furthermore, the table illustrates that 10 % of participants are likely to have a serious mental illness (Kessler). Regarding positive mental health, table 2 shows that 18 % have good mental well-being according to WEMWBS and that 59 % of participants rate their health as good or excellent. Finally, more than one-third of participants have a high life-satisfaction (Cantril Ladder).

In the initial stage of the LCA, separate analyses were made adjusted for sex and age. The LCA adjusted for age showed, in line with findings from Dahl-Petersen *et al.* [24], that the generation born before 1990 were more likely to experience ACEs. The separate analysis for sex showed classes with a higher probability of sexual abuse for females and a higher probability of having experienced alcohol problems and violence during childhood for males. However, despite small differences, the age- and sex-adjusted LCA models showed a very similar pattern of classes and response rates, and it was decided to keep the latent class analysis for the whole sample. Hence, the following sections will include classes made based on the entire sample of participants between 15-34 years of age.

The values from table 1 and table 2 will serve as a comparison to the following part of the results where the participants will be divided into subgroups through LCA.

5.2 Class enumeration

Table 3 shows a class enumeration run with the following variables: 'Violence in childhood home', 'Alcohol problems in childhood home', 'Sexual abuse during childhood', 'Residence at age 10', 'Danish language proficiency', 'Traditional activities during childhood' and 'Relations to older generations'. One class were included at a time while the changes in fit indices were compared amongst the LCA models.

Table 3: Class enumeration for the LCA model with AIC, BIC and Adj. BIC as fit indices

Number of classes	AIC	BIC	Adj. BIC
LCA: 1 classes	240	264,6	242,5
LCA: 2 classes	258	325,4	277,8
LCA: 3 classes	193,5	296,8	223,7
LCA: 4 classes	171,3	310,5	212,1
LCA: 5 classes	161	336	212,1
LCA: 6 classes	166	377	228

As seen in the table above the AIC values are smallest in the five and six class. However, previous research has found that AIC does not work as a good indicator for categorical variables and has a tendency to decrease in value while the number of classes increase [61]. Contrary, BIC and Adj. BIC, have shown to be more successful fit indices for binary and categorical data. The smallest BIC value can be observed for the three-class model followed by the four-class model, however the Adj. BIC values are smallest for the four and five class models. Since the BIC is smallest for the four-class model and the Adj. BIC is similar in the four- and five-class models, the model with four classes were favoured. Moreover, a visual representation showed more distinct differences between the classes in the 4 four class models, wherefore, it was assumed to be the most parsimonious model.

5.3 Posterior probabilities of latent class membership

All classes have a mean posterior probability of at least 0.7, indicating a high probability of belonging to the exact class of assignment [57–59]. Table 4 shows similar values in Class 1, Class 2 and Class 3, with Class 4 having a slightly lower probability of 0.70. Hence, all four classes had sufficient mean posterior probabilities to get included in the LCA model.

Table 4: Posterior probabilities for belonging to each class

Class	Posterior probability	Range
Class 1	0.82	0-1
Class 2	0.79	0-1
Class 3	0.83	0-1
Class 4	0.70	0-1

5.4 Identification of four latent classes

Four distinctive classes were identified through inspection of the fit indices. These four classes included respectively 27 % (*n*= 178), 25 % (*n*= 164), 34 % (*n*= 224) and 14 % (*n*= 92) of the participants in the sample. All measures for conditions in upbringing were binary with a value of 1 indicating that the condition was present and 0 indicating that the condition was not present.

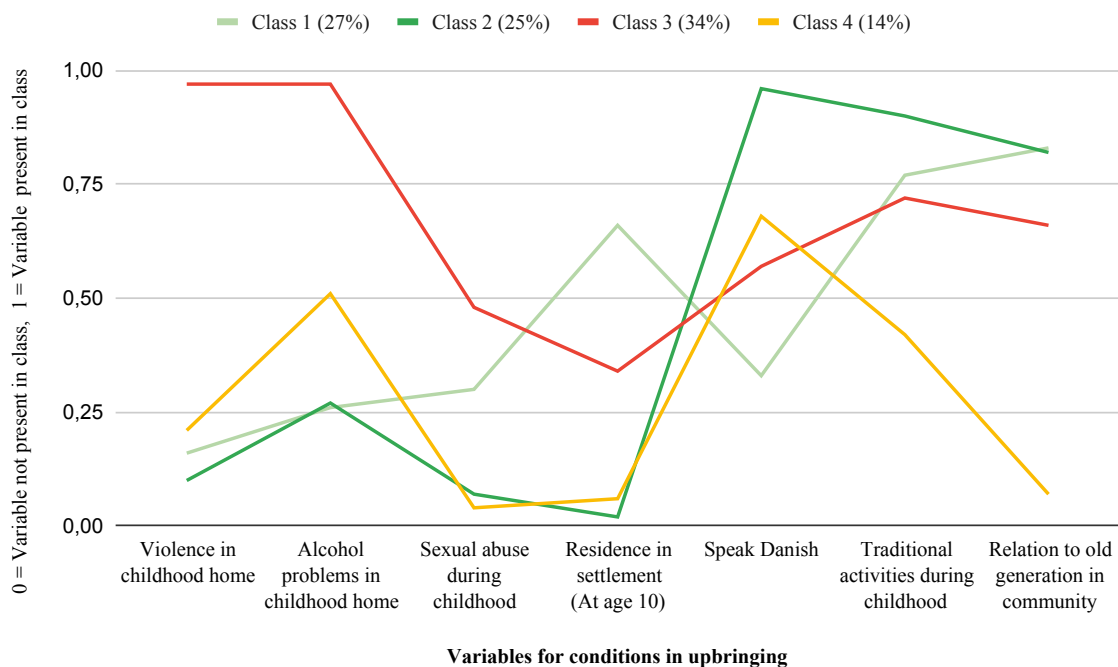Figure 4: Latent class analysis with values for conditions in upbringing

Figure 4 illustrates the characteristics of each of the four classes, where some important differences appear between the four classes.

Class 1 has the highest probability of residence in a settlement during childhood and the lowest probability of speaking Danish. They have the second-lowest ACEs; however, with a slightly higher probability of having experienced sexual abuse during childhood where almost one-third of the group have experienced sexual abuse. Moreover, this class has a high probability of an upbringing with traditional activities as well as having relations to older people in the community.

Class 2 is characterised by individuals who had an urban upbringing with only 0,02 probability of growing up in a settlement. Also, it consists of individuals who have the highest probability of speaking Danish. This class has the lowest overall probability of ACEs, with only a small peak in alcohol problems during childhood. Moreover, this class has the highest probability of having had traditional activities during childhood as well as a high probability of having had relations with the older generations in the community.

Class 3 consists of individuals who mostly grew up in a town and where approximately 50 % is speaking Danish. Class 3 is also characterised by having the highest probability of having been exposed to ACEs. Individuals in this class have almost 100 % probability of having experienced violence and alcohol problems in their childhood home and a probability of around 50 % of having experienced sexual abuse before the age of 13. The rates for traditional activities and relations to older generations in class 3 are second-lowest; however, the probabilities in this class were markedly higher than in class 4.

Class 4 consists of participants who grew up in a town and with a probability of almost 70% of speaking Danish. This class has a probability of having experienced violence in childhood of 21%. Moreover, with a probability of 51% this class has the second-highest probability of having experienced alcohol problems in their childhood home. However, sexual abuse is almost not present in class 4. Individuals in this class have the lowest probability of traditional activities during upbringing and by a probability of 0,07, also the lowest probability of having relations to the old generation in the community.

5.5 Association between terms in upbringing and mental health

After characterising the four classes, the six distal variables concerning mental health were added to the latent class analysis in order to compare the different outcomes for mental health in each class.

Table 5: LCA with distal variables showing probabilities, confidence intervals and whether the class is significantly different from the other classes in each distal variable

Distal variables concerning mental health	Probability [0-1]	95 % CI	Significant differences between classes
Class 1			
Suicide ideation	0.17	0.09 - 0.24	Class 3*
GHQ-case	0.32	0.22 - 0.41	Class 3*
Kessler	0.04	0 - 0.08	Class 3*
WEMWBS (Mental well-being)	0.22	0.15 - 0.31	No
Good self-rated health	0.57	0.47 - 0.66	No
Cantrill ladder (Life satisfaction)	0.44	0.35 - 0.54	Class 3*, Class 4*
Class 2			
Suicide ideation	0.15	0.74 - 0.23	Class 3*
GHQ-case	0.35	0.26 - 0.45	No
Kessler	0.03	-0.01 - 0.06	Class 3*
WEMWBS (Mental well-being)	0.19	0.11 - 0.26	No
Good self-rated health	0.71	0.62 - 0.80	Class 3*
Cantrill ladder (Life satisfaction)	0.42	0.33 - 0.52	Class 3*, Class 4*
Class 3			
Suicide ideation	0.43	0.34 - 0.51	Class 1*, Class 2*, Class 4*
GHQ-case	0.45	0.37 - 0.53	Class 1*
Kessler	0.21	0.14 - 0.28	Class 1*, Class 2*
WEMWBS (Mental well-being)	0.20	0.13 - 0.27	No
Good self-rated health	0.52	0.44 - 0.60	Class 2*
Cantrill ladder (Life satisfaction)	0.27	0.19 - 0.35	Class 1*, Class 2*
Class 4			
Suicide ideation	0.16	0.03 - 0.29	Class 3*
GHQ-case	0.42	0.26 - 0.59	No
Kessler	0.10	0.01 - 0.20	No
WEMWBS (Mental well-being)	0.06	0.00 - 0.15	No
Good self-rated health	0.62	0.46 - 0.77	No
Cantrill ladder (Life satisfaction)	0.20	0.06 - 0.34	Class 1*, Class 2*

*Statistical significant ($p < .05$)

Fewest significant differences appeared between Class 4 and the other classes. Class 3 had most values that were significantly different from the other classes. The following two figures will show the mental health outcomes divided into measures for negative and positive mental health.

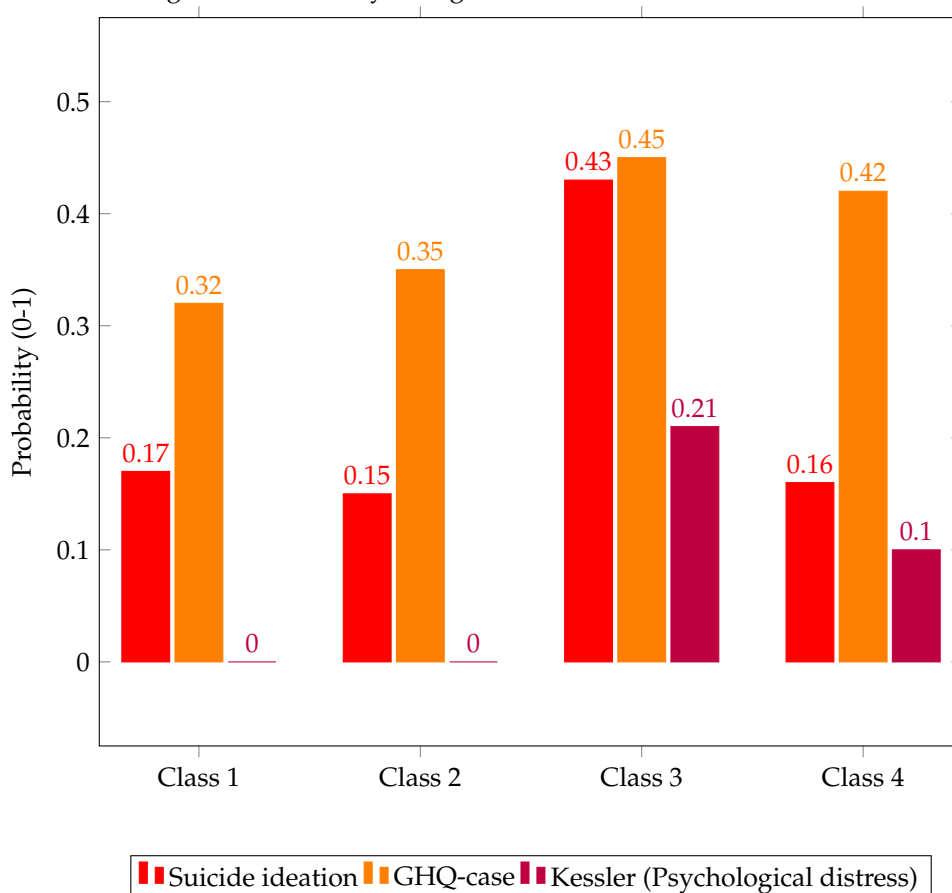Figure 5: Probability of negative mental health in each of the four classes

Figure 5 shows the probabilities of negative mental health measured through 'Suicide ideation', 'GHQ-case' and 'Kessler' in the four subgroups. Variations appeared between the subgroups, especially regarding the negative mental health indicators: 'Suicide ideation' and 'Kessler'. Overall, Class 3 is having a higher probability of poor mental health in all of the three measures. Individuals in this class had a 43 % probability of having considered suicide and a 45 % probability of being categorized as a GHQ-case.

Class 1 and Class 2 have similar low values in the measures of poor mental health with almost no probability of having psychological distress (Kessler) and a probability of respectively 17 % and 15 % of having considered suicide. Besides, table 5 showed that the values in suicide ideation and psychological distress (Kessler) in both Class 1 and Class 2 were significantly different from Class 3. Nevertheless, with regard to the probability of being a GHQ-case, the values between the four classes were more similar with the biggest difference between Class 1 and Class 3 and likewise, only a significant difference between these classes. Overall, most distinct differences exist between Class 1, Class 2 and Class 3 regarding the probability of negative mental health.

The values concerning negative mental health in Class 4 are not significantly different from the other classes, despite one significant difference appearing between this class and Class 3 in

suicide ideation. These values differ from respectively 0.16 in Class 4 to 0.43 in Class 3, where the probability of suicide ideation in Class 4 is almost identical to Class 1 and Class 2.

Figure 6: Probability of positive mental health in each of the four classes
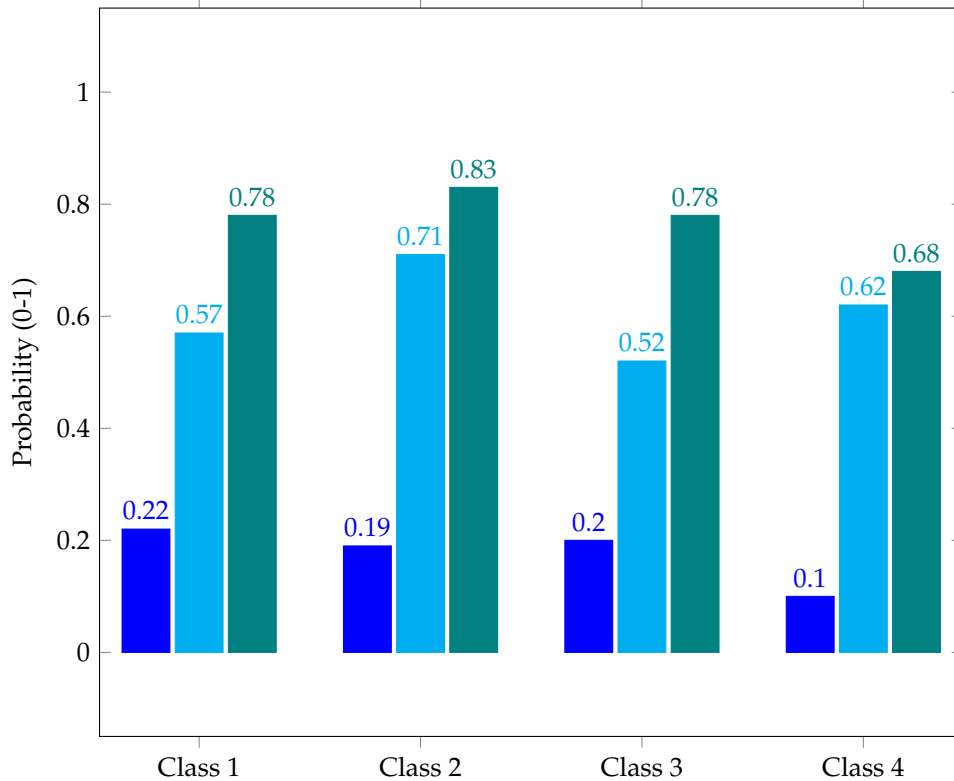
Positive mental health status is shown in figure 6 measured through: 'Good mental well-being (WEMWBS)', 'Good self-rated health' as well as 'Life-satisfaction (Cantril ladder)'. All classes have the lowest probability of positive mental health in WEMWBS. However, it was shown in table 5 that there are no significant differences between any of the classes' score in WEMWBS. Regarding good self-rated health, the biggest difference could be observed between Class 3 and Class 2, which were also the only classes with significant differences.

All of the classes showed relatively high values in life-satisfaction in the range from 0,68 to 0,83. Class 2 had the highest probability of excellent or good health where 83 % in this group indicated this; however, this was followed closely by the probability of 78 % in both Class 1 and Class 3. Moreover, table 5 indicated that all classes had significant differences in life-satisfaction except for Class 3 and Class 4, which did not show to be significantly different. In comparison to figure 5 smaller variances and fewer significant differences could be observed between the four classes in the measures of positive mental health.

6   Discussion

6.1   Overview of the results

This thesis sought to investigate how conditions in upbringing determine subgroups of youth and young adults in Greenland with different negative and positive mental health outcomes. The results obtained showed four subgroups of youth and young adults in Greenland with distinct differences in conditions in upbringing and mental health outcomes. Class 3, which had the highest probability of an upbringing with ACEs also had the highest probability of negative mental health outcomes. Class 1 and Class 2, which both grew up with relatively low probabilities of ACEs and strong ties to Inuit culture, had the lowest probability of negative mental health outcomes. This combination was shown to foster good mental health independent of language proficiency and whether the upbringing was in a town or settlement. Fewer significant differences appeared between the subgroups regarding the measures for positive mental health than negative mental health. Also, fewest significant differences appeared between Class 4, characterised by disruption from the Inuit culture, and the other subgroups. However, the measure for life-satisfaction (Cantril Ladder) in Class 4 was significantly different from and lower than in Class 1 and Class 2.

6.2   Discussion of main results

Several previous studies on risk factors for mental health in Greenland have stressed the association between an upbringing with ACEs and poor mental health status [11, 21, 30, 31]. In line with this, this thesis found that Class 3, the class with the highest probability of ACEs during childhood, likewise, had the highest probability of negative mental health in all of the three indicators. That the probability of having considered suicide was almost three times higher in Class 3 than in the other three classes coincides with results from a previous study. Bjerregaard & Larsen [11] describe that exposure to alcohol problems and sexual abuse during childhood were significantly associated with suicidal thoughts in adulthood. Class 3 were least likely to report good self-rated health which is, moreover, conforming to how a study showed that exposure to violence during childhood was closely linked to poor self-rated health [31]. In line with this, the results showed that Class 2, which had the lowest probability of having experienced violence in their childhood home, had a 71 % probability of reporting good self-rated health. How an upbringing with ACEs often leads to poor mental health is not solely an issue in Greenland. However, there is a high proportion of youth in Greenland, growing up with ACEs [17]. This became visible by the size of Class 3 (34 % of participants, n = 224) as well as in the rates for the whole sample showing that between 25-53 % had an upbringing with one or more ACEs (Table 1, Figure 4). Merrick *et al.* [32] found a dose-response relationship between the number of ACEs and risk of mental health problems where the risk for a poor mental health outcome increases for each additional adverse childhood experience. This is conforming with the high rates of both

violence and alcohol problems in childhood home - where both conditions were reported by almost 100 % of the individuals in Class 3. The pattern observed in Class 3 is in line with the findings from a study by Bjerregaard & Larsen [11] where they found that individuals who are growing up in a home with alcohol problems often also grow up with other common ACEs.

This thesis found that the two subgroups who were most likely to have an upbringing with traditional activities and relations to older people in the community had the lowest probability of negative mental health. This is consistent with how other studies have found that protective factors for mental health in the Arctic often are connected to traditional activities, strong relationships with community members and traditional knowledge [6, 34, 35]. The results of this thesis support the growing evidence among the Arctic communities - that protective factors for mental health often are connected to indigenous culture and traditions [34, 35]. This is, however, a relatively new field and resilience and protective factors for mental health have only been included in the research for the last two decades [28]. The majority of the studies on how protective factors for mental health are related to culture and community have been done in Alaska and Canada [6]. In Greenland, this association have been studied more sparsely. Moreover, the vast majority of the studies that have been done on resilience and protective factors for mental health in Greenland have been using qualitative methods, and only a few have been using quantitative methods [28]. A recently published study on Indigenous interventions recommends researchers to develop measures, evaluation tools, terms and theories based on the Indigenous culture and knowledge [64]. In line with this recommendation, it could perhaps benefit the research on how Inuit culture can protect mental health if the findings from qualitative studies were used further when developing measures and evaluation tools for further research. Having said that, measures for Inuit culture and traditions were included in the questionnaire for the youth in the latest Greenland Health Survey [17]. That this thesis, with data from the Greenland Health Survey 2018, found that the two subgroups with the most substantial ties to tradition and culture had the best mental health outcomes contributes to the understanding of culture as a protective factor for mental health in Greenland. Hence, it seems that in order to strengthen the mental health among youth and young adults in Greenland, researchers, policy-makers and professionals should not only search outside of Greenland for the content of interventions and programs. Part of the potential for decreasing suicide rates seems to be linked to their own Inuit culture and traditions. Community-based participatory research (CBPR) is an example of a culture-centred approach where community members are invited to participate in the research and share their ways of knowing throughout the research process [65, 66]. For the last two decades, CBPR has been gaining popularity in Indigenous research in, e.g. Northern Canada and Alaska, moreover, a toolkit for CBPR in Greenland have recently been developed [66–69]. This indicates an acknowledgement of the importance of including the community and Inuit culture when aiming to strengthen the health and well-being in Greenland, and this approach is, moreover, particularly in accordance with the results of this thesis.

The association between Inuit culture and mental health outcomes could have been investigated further if more significant values had appeared in Class 4 since individuals in this class had a much lower probability of traditional activities and relations to older generations than the other subgroups. With this in mind, it could have been interesting to compare this class further with Class 3 in order to investigate further how disruptions from Inuit culture affects mental health. Despite the shortage of significant differences, the probability of a high life-satisfaction (Cantrill ladder) was lowest in Class 4 and significantly different from Class 1 and Class 2. In line with how Berry & Kim [19] describes how acculturative stress from adapting to a new culture can lead to psychological distress and lowered mental health status, the seeming disruption from the traditional Inuit culture in Class 4 could perhaps be lowering the life satisfaction in this class.

This thesis found interesting results regarding the link between language and demography and mental health outcomes. Bjerregaard, Curtis, *et al.* [12] found that the individuals who grew up in a village/hunter's family were more likely to be considered as GHQ-cases than respondents who grew up in a town. Similarly, the researchers found considerably more GHQ-cases among monolingual Greenland Inuit than among the ones speaking Greenlandic and Danish [12]. Contrary, the results in this thesis showed that Class 1 with the highest probability of growing up in a settlement and the lowest probability of speaking Danish had the overall lowest probability of being a GHQ-case. That the class with the lowest probability of speaking Danish still had one of the best mental health outcomes can perhaps be explained by the importance of speaking the native language and having a connection to the culture. Ingemann & Larsen [6] reported that a range of studies found that speaking the native language was protecting the individuals' well-being. Also, a study in Arctic Canada found that health outcomes were positively improved by the inclusion of traditional practices and the use of native language in health practices [70]. Hence, it seems apparent that health outcomes in a Greenland will be supported if health care services, initiatives and interventions have communication in the native language. This is in accordance with results from a recently published report on the users' experience with the health care system in Greenland [71]. They found several challenges connected to health care in another language than Greenlandic leading to misunderstandings and insecurity among the Greenlandic users of the health care systems [71]. Based on previous studies and the results in this thesis it seems that perhaps proficiency in the native language is an indicator of the individual's connection to Inuit culture since a language holds cultural values, traditions, rules and ways of communications. However, it can be difficult to completely isolate the association between language and mental health outcomes and hence, language could presumably also be explained by demographic differences.

An important contribution of this thesis is how the results showed almost similar mental health outcomes in Class 1 and Class 2. This result strongly indicates how low ACEs and strong

ties to Inuit culture are essential factors for good mental health independent of residency during childhood and language proficiency. How this thesis found good mental health to be connected with traditional activities and relations to older people in the generation is in line with findings and recommendations from Alaska and Northern Canada [64, 70, 72–74]. In a study about "Why Culture Matters in Health Interventions", the researchers describes that: "to change negative health behaviours, one must first identify and promote positive health behaviours within the cultural logic of its context" [73]. Barnhardt & Oscar Kawagley [72] describes the importance of indigenous knowledge (IK) and how indigenous people have retained unique worldviews and own knowledge systems based on core values, belief and practices. Hence, more research should be done with a focus on mapping the positive health behaviours within the specific cultural logic in order to create meaningful interventions for mental health in Greenland. Rasmus *et al.* [64] have examined ways culture is translated into health interventions. Among other things, the researchers stress the importance of collaboration among participating parties in interventions with an emphasis on IK and the importance of building a trusting relationship over time and showing respect for the culture. However, the researchers also found that the intended "cultural" inclusion in interventions often is at a superficial level, yet, they describe that the focus is shifting towards an acknowledgement of the Indigenous frameworks, paradigms and theories [64].

The Qasgiq model is an example of an indigenous intervention in Alaska that was guided by cultural logic and protective factors identified by community members [64]. Rasmus *et al.* [64] describe that the key factor of success in this intervention was the degree of control and involvement by the indigenous community. Hence, in order to apply the results of this thesis and be inspired by interventions and results from other Arctic regions, it seems apparent that the already existing initiatives presented in section 2.6 such as, e.g. 'The School Fairy System', 'Sapiik', 'Timi Asimi' and the 'SAFIIK Initiative' can benefit from a strong emphasis on Inuit culture and traditions [21]. Likewise, it seems that this focus should be applied independent of whether the initiative is focused on rural or urban areas. Moreover, it seems apparent that the design and planning of interventions to enhance mental health among youth in Greenland can benefit from a strong collaboration between, e.g. the researchers, health care workers, policymakers and the community members [64].

6.3 Discussion of reliability and validity

Important differences could be observed with regard to the six measures of mental health outcome. In the three measures for negative mental health, the four subgroups had higher probabilities of being a GHQ-case than having psychological distress (Kessler scale). Since the Kessler scale was developed to capture serious mental illness, this scale does not capture as many cases as GHQ. A strength of GHQ is that it has been validated in the Greenlandic population with a cut-off point of 2, which was the same as it was used in this thesis [44]. Despite this, in other settings, a cut-off point of 3 has been more commonly used [43, 44]. Since more than 30 %

of respondents in all of the four subgroups were characterised as GHQ-cases, there might be a risk of misclassification bias. This will most likely be non-differential misclassification bias since it can be assumed that all respondents have an equally high probability of misclassification [75]. This could perhaps have been reduced by having a higher cut-off point as for example 3, which have been validated in other populations [43, 76]. Having said that, due to the high suicide rates and the burden of mental health problems in Greenland the proportion of GHQ cases found in this thesis could, unfortunately, be representative for the population, wherefore, the cut-off point of 2 was kept in the analysis [2, 3, 8, 11].

The three measures for positive mental health did not vary as much between the subgroups as the measures for negative mental health, which made it difficult to draw overall conclusions between the subgroups with regard to the measures for positive mental health. In addition, the fact that one question was left out in the WEMWBS scale possibly affected the predictive validity of the scale, the reliability of the results as well as if the specific results on WEMWBS can be generalized to populations outside of this study [75]. However, since WEMWBS is a highly used and validated scale, including it in the version with only six questions were perceived as contributing more than if the scale had been excluded [47, 48]. Another potential bias could have appeared when the variables were recoded into binary variables. E.g. in Cantrill ladder (life-satisfaction) the negative outcome did also include the participants who answered 'Medium life-satisfaction', similarly, in Self-rated health the answer 'Fair' was categorized as a negative outcome. This can lead to misclassification and have potentially resulted in an overestimation of the results [75]. Despite some weaknesses related to the measures for mental health, the use of a total of six measures for mental health outcome was perceived to strengthen the validity of the study, by offering more nuances to the comparison of mental health in the four subgroups [75]. Additionally, the fact that all of the six measures have been widely used in previous studies of mental health of youth and young adults made the results more comparable to other studies [8, 17, 24, 46, 52–54]. Similarly, the majority of the indicators for mental health were standardised scales which improved the reliability [75].

The results of this study suggest that suicide ideation and Kessler (Psychological distress) were best suited to distinguish between the negative mental health among the subgroups. Similarly, that Cantrill Ladder (Life-satisfaction), which was the only variable that showed significant differences between the subgroups, perhaps was best at measuring positive mental health. That the researchers had a focus on mental health among youth and young adults in the latest Greenland Health Survey contributed positively to the internal validity of this thesis by offering an increased number of relevant variables [17, 75].

Since the age-span of 15-34 is relatively broad and male and female are combined in the latent class analysis, it can be questioned if separate age- and sex-adjusted analyzes would have

strengthened the validity of the results. Possible differences in age-group were relevant since there have been found significant differences between Greenland Inuit born after 1990 [17]. However, one of the major limitations of LCA is that it requires a relatively large sample size in order to ensure that the distributional assumptions of the test statistics are met [61, 77]. It has been suggested that the fit indices used in LCA can be expected to function adequately with sample sizes of roughly 500 respondents, hence, when including the full sample of 658 participants the sample size in this study would be sufficiently large [61]. Despite this recommendation, LCA models adjusted for sex and age were made in the initial stage of the analysis, to also visually inspect the potential differences in the results. Since the results from the age- and sex-adjusted models were very similar to the results from the LCA with all participants included, and due to the requirements of LCA, the model with all participants included was considered to be the best option.

6.4   Strenghts and limitations

In light of current literature, this study is the first study where youth and young adults in Greenland are identified in subgroups based on terms in upbringing to compare their mental health outcomes. How the LCA in this thesis builds upon existing knowledge of which conditions in upbringing that have shown to be important for mental health is the greatest strength of this study since previous studies have merely focused on the youth in general. This thesis showed meaningful differences in mental health outcome between subgroups with different conditions in upbringing, moreover, that strong ties to Inuit culture enhances mental health independent of Danish language proficiency and residency at ten years of age. Hence, this thesis contributed with knowledge on Greenland to an area that has been studied more extensively in Northern Canada and Alaska [6]. Another major strength of the study is that the thesis is done in collaboration with NIPH who have been monitoring the health of the Greenland Inuit since 1993 and have increased the focus on the mental health of the youth and young adults in their latest Health Survey in Greenland [24]. The access to such extensive data material was also a strength of the collaboration. Due to the logistics in Greenland data collection is timely and expensive [78]; hence it would not have been possible to obtain a sample with such size and representativeness if data-collection was made within the period of this 1-year master thesis [75]. In addition, the use of LCA with distal variables can be perceived as a strength of the study since this method has shown to outperform other classify-analyze practices [79].

There were several limitations related to this thesis. One thing that can be perceived as a limitation was the fact that the response rate decreased slightly from the previous surveys, resulting in a response rate of 52 %. This can cause the type of selection bias called non-response bias, where, even in a random sample, certain people omit to participate [17, 75, 80]. How this non-response bias influence the results can, however, be difficult to predict. However, the relatively low response rate naturally affected the external validity and makes it more difficult

to draw conclusions on the population as a whole [75]. Furthermore, it can be assumed that the people who omit to participate represent a more vulnerable part of the population, which is perhaps making the results underestimated.

This thesis included twenty respondents who answered that they lived outside of Greenland when they were ten years, which could potentially affect the internal and external validity [75]. Yet, due to the low number and since they were part of a stratified random sample, it was considered to strengthen the representativeness of the study if these respondents were included [17]. Moreover, it is a part of latent class analysis that participants with missing values are included, which was the case for all included variables where, e.g. some of the variables on ACEs had more than 100 missing values [60]. The relatively high number of missing values in ACEs can be seen as a weakness of the study that can affect the conclusions that can be drawn. It is a well-known phenomenon in survey methodology that some people, to a greater extent, fail to answer parts of the questionnaire leading to missing data bias [80]. Then again, the bias caused by the missing values were possibly reduced by their inclusion in the LCA model [60]. Additionally, the posterior probabilities for class membership were sufficiently high in each class despite the missing values.

The decision to include Class 4 in the analysis, despite this class was having the lowest posterior probability of 0.70, and likewise included the smallest percentage of the population (14 %) can also be perceived as a weakness. With few significant differences in mental health outcome, this class could not be compared with the other classes to the extent that was expected. However, this class was kept in the analysis since it showed to be very distinct from the other classes. This was mainly with regard to their low values in traditional activities and relations to older generations, which was seen as an essential contribution to this study. Finally, if a new study were made with a sample size sufficiently large for divided LCA models, it would perhaps strengthen the study if models were made respectively for the whole sample and adjusted for sex and age. Despite these weaknesses, this thesis contributed with more knowledge to the understanding of how conditions in upbringing affect the mental health of the youth and young adults in Greenland.

7 Conclusion

The use of LCA with distal variables has allowed this study to explore and present a more segmented and detailed view of the Greenlandic youth and young adults concerning mental health, than what has previously been described in the literature. Through an assessment of relevant fit indices and posterior probabilities, the results show that four distinct subgroups exist among youth and young adults in Greenland when considering conditions in upbringing. Moreover, these subgroups have diverse mental health outcomes.

Individuals growing up with the combination of an absence of ACEs and with strong ties to Inuit culture have the best mental health outcomes. This combination fosters good mental health independent of whether the individuals grew up in a settlement or town and independent of Danish language proficiency. Nevertheless, the thesis also shows, in line with previous research, that individuals growing up with ACEs have the poorest mental health outcomes. Furthermore, this thesis shows that a significant proportion of the youth and young adults have ACEs and that the ACEs investigated in this thesis often co-occur. Another interesting finding of this thesis, although not statistically significant, suggests that disruption from Inuit culture negatively affects mental health. However, this association needs to be investigated further with a larger sample size. Regarding the measures for mental health outcome, this thesis suggests that the three indicators for positive mental health were not successful in distinguishing between the youth and young adults in Greenland when considering disparities in mental health.

7.1 Public health implications & future research

Since the increase in suicide rates and mental health problems after 1970, mental health among youth and young adults have been a public health concern in Greenland and have been studied widely. Based on the findings in this thesis, future research, initiatives and interventions for mental health should consider the Greenlandic youth through a more segmented approach, while having a strong emphasis on ACEs as well as an incorporation of Inuit culture and traditions. Furthermore, it seems apparent that initiatives and intervention with a focus on Inuit culture and traditions should be introduced or strengthened not only in settlements but also in larger towns since the measures for Inuit culture and traditions showed to be protective for the mental health independent of childhood residency. Moreover, in light of the results of this thesis and the national suicide rates, initiatives and interventions on mental health can perhaps benefit from expanding the age-span of their target groups.

Since the results show that a substantial part of the youth and young adults is differentiated through better mental health outcomes relative to the rest of the sample, this should be set in context to populations outside of Greenland. This will allow future research to further assess the degree of thrivingness in the subgroups with the best mental health outcomes.

The majority of studies on protective factors for mental health have used a qualitative method. Hence, it would enhance the knowledge on the association between protective factors related to Inuit culture and mental health if this was also included in more quantitative studies. This will require that the topics emerging from the qualitative research will be implemented and investigated further in surveys.

In light of the results of this thesis, it is necessary to continue the focus on prevention of alcohol problems, violence and sexual abuse. Future research and interventions can, moreover, benefit from a focus on how culturally appropriate efforts with an emphasis on including the community can help to shed light on the issues concerning ACEs. Since the cultural disruption, ACEs, suicide rates and mental health problems are closely concatenated, research on each of these topics can benefit from a holistic approach with an emphasis on Inuit culture and traditions as protective factors for mental health. As protective factors for mental health have been studied more extensively in Canada and Alaska, the consistency of the results of this thesis advocate for continued collaboration on mental health in the Arctic regions. Collaboration on research as well as on how to create successful interventions and eventually to improve the mental health of the youth and lower the suicide rates. Finally, it seems that in order to lower the suicide rates and enhance the mental health in Greenland, these results highlighted the importance of a continued focus on ACEs as well as incorporating traditionally relevant approaches.

References

1. WHO. *Mental health action plan 2013-2020* 2013. `https://www.who.int/mental_health/action_plan_2013/en/`.

2. Naghavi, M. Global, regional, and national burden of suicide mortality 1990 to 2016: systematic analysis for the Global Burden of Disease Study 2016. *bmj* **364** (2019).

3. Sustainable Development Working Group. Sharing Hope. Circumpolar Perspectives on Promising Practices for Promoting Mental Wellness and Resilience. (2015).

4. Björkstén, K. S., Bjerregaard, P. & Kripke, D. F. Suicides in the midnight sun—a study of seasonality in suicides in West Greenland. *Psychiatry research* **133,** 205–213 (2005).

5. DeCou, C. R., Skewes, M. C. & López, E. D. Traditional living and cultural ways as protective factors against suicide: perceptions of Alaska Native university students. *International journal of circumpolar health* **72** (2013).

6. Ingemann, C. & Larsen, C. V. L. A scoping review: Well-being among indigenous children and youth in the Arctic–with a focus on Sami and Greenland Inuit (2018).

7. Hicks, J. Suicide by Greenlandic youth, in historical and circumpolar perspective. *Children and Youth in Greenland: An Anthology, MIPI, Ilisimatusarfik and MILIK Publishing* (2007).

8. Bjerregaard, P. & Larsen, C. V. L. Time trend by region of suicides and suicidal thoughts among Greenland Inuit. *International journal of circumpolar health* **74,** 26053 (2015).

9. Leineweber, M. & Arensman, E. Culture change and mental health: The epidemiology of suicide in Greenland. *Archives of Suicide Research* **7,** 41–50 (2003).

10. Groenlands Statistik. *Greenland in figures 2019. Statistics Greenland* 2019. `http://www.stat.gl/dialog/topmain.asp?lang=da&subject=Befolkning&sc=BE`.

11. Bjerregaard, P. & Larsen, C. V. Three lifestyle-related issues of major significance for public health among the Inuit in contemporary Greenland: A review of adverse childhood conditions, obesity, and smoking in a period of social transition. *Public health reviews* **39,** 5 (2018).

12. Bjerregaard, P., Curtis, T., *et al.* Cultural change and mental health in Greenland: the association of childhood conditions, language, and urbanization with mental health and suicidal thoughts among the Inuit of Greenland. *Social Science & Medicine* **54,** 33–48 (2002).

13. Riva, M., Larsen, C. V. L. & Bjerregaard, P. Household crowding and psychosocial health among Inuit in Greenland. *International journal of public health* **59,** 739–748 (2014).

14. Mulvad, G., Petersen, H. S. & Olsen, J. in *Arctic Alpine ecosystems and people in a changing environment* 413–427 (Springer, 2007).

15. Bjerregaard, P. & Larsen, C. V. L. Health aspects of colonization and the post-colonial period in Greenland 1721 to 2014. *Journal of Northern Studies* **10,** 85–106 (2016).

16. Young, T. K. & Bjerregaard, P. *The circumpolar Inuit: Health of a population in transition* **1,** 149–185 (Munksgaard, 1999).

17. Larsen, C., Hansen, C., Ingemann, C., *et al.* Befolkningsundersøgelsen i Grønland 2018. *Levevilkår, livsstil og helbred–oversigt over indikatorer for folkesundheden.(Population health survey in Greenland 2018).[In Danish]. SIF's Grønlandsskrift. Statens Institut for Folkesundhed, SDU* (2019).

18. WHO. *Atlas: child and adolescent mental health resources: global concerns, implications for the future* 2005. `https://www.who.int/mental_health/publications/atlas_child_ado/en/`.

19. Berry, J. W. & Kim, U. Acculturation and mental health. *Cross-cultural research and methodology series* (1988).

20. Bjerregaard, P. & Lynge, I. Suicide—a challenge in modern Greenland. *Archives of Suicide Research* **10,** 209–220 (2006).

21. Karsberg, S. *Mental health among youth in Greenland: Who is responsible? What is being done?* 2016.

22. Pedersen, C. P. & Bjerregaard, P. *Well-being among Greenlandic Youth in 2004: Kalaallit Nunaanni inuusuttut akornanni atugarissaarneq pillugu meeqqat atuarfianni atuartut angajulliit akornanni 2011-mi misissuisitsineq* (Statens Institut for Folkesundhed, 2012).

23. Collins, P. Y. *et al.* RISING SUN: prioritized outcomes for suicide prevention in the Arctic. *Psychiatric services* **70,** 152–155 (2018).

24. Dahl-Petersen, I. K., Larsen, C. V. L., Nielsen, N. O., Jørgensen, M. E. & Bjerregaard, P. Befolkningsundersøgelsen i Grønland 2014 (2016).

25. Larsen, F. B. Interpersonal violence among Greenlandic Inuit. *Crime, law and justice in Greenland,* 47–69 (1996).

26. Spein, A. R. *et al.* Self-rated health among Greenlandic Inuit and Norwegian Sami adolescents: associated risk and protective correlates. *International journal of circumpolar health* **72,** 19793 (2013).

27. Berliner, P. & Hagedorn, K. Unges fortællinger om resiliens. *Psyke & Logos* **34,** 21 (2013).

28. Glendøs, M. & Berliner, P. Forty years of research concerning children and youth in Greenland: a mapping review. *International journal of circumpolar health* **76,** 1323526 (2017).

29. Lynge, I., Munk-Jørgensen, P., Pedersen, A. L., Mulvad, G. & Bjerregaard, P. Common mental disorders among patients in primary health care in Greenland. *International Journal of Circumpolar Health* **63,** 377–383 (2004).

30. Curtis, T., Larsen, F. B., Helweg-Larsen, K. & Bjerregaard, P. Violence, sexual abuse and health in Greenland. *International Journal of Circumpolar Health* **61,** 110–122 (2002).

31. Niclasen, B. V. & Bjerregaard, P. Child health in Greenland. *Scandinavian journal of public health* **35,** 313–322 (2007).

32. Merrick, M. T. *et al.* Unpacking the impact of adverse childhood experiences on adult mental health. *Child abuse & neglect* **69,** 10–19 (2017).

33. Brockie, T. N., Dana-Sacco, G., Wallen, G. R., Wilcox, H. C. & Campbell, J. C. The relationship of adverse childhood experiences to PTSD, depression, poly-drug use and suicide attempt in reservation-based Native American adolescents and young adults. *American journal of community psychology* **55,** 411–421 (2015).

34. MacDonald, J. P., Ford, J. D., Willox, A. C. & Ross, N. A. A review of protective factors and causal mechanisms that enhance the mental health of Indigenous Circumpolar youth. *International journal of circumpolar health* **72,** 21775 (2013).

35. MacDonald, J. P. *et al.* Protective factors for mental health and well-being in a changing climate: Perspectives from Inuit youth in Nunatsiavut, Labrador. *Social Science & Medicine* **141,** 133–141 (2015).

36. Healey Akearok, G. *et al.* Exploring the Term "Resilience" in Arctic Health and Well-Being Using a Sharing Circle as a Community-Centered Approach: Insights from a Conference Workshop. *Social Sciences* **8,** 45 (2019).

37. Collins, P. Y. & Saxena, S. Action on mental health needs global cooperation. *Nature* **532,** 25–27 (2016).

38. Group, S. D. W. *et al.* Reducing the Incidence of Suicide in Indigenous Groups-Strengths United through Networks 2015-2017 (2017).

39. SDWG *et al.* Sustainable Development Working Group Work Plan for 2015-2017. (2015).

40. Group, S. D. W. *et al.* Project CREATeS Circumpolar Resilience, Engagement, and Action Through Story (2019).

41. Christensen, E. *Ung i det grønlandske samfund: unges viden om og holdning til sociale problemer og muligheder* (SFI-Det Nationale Forskningscenter for Velfærd, 2013).

42. Goldberg, D. P. & Blackwell, B. Psychiatric illness in general practice: a detailed study using a new method of case identification. *Br med J* **2,** 439–443 (1970).

43. Goldberg, D. & Williams, P. *General health questionnaire* 1988.

44. Lynge, I. *Psykiske lidelser i det grønlandske samfund* (Afdeling for psykiatrisk demografi, Institut for psykiatrisk grundforskning ..., 2000).

45. Kessler, R. C. *et al.* Screening for serious mental illness in the general population. *Archives of general psychiatry* **60,** 184–189 (2003).

46. Furukawa, T. A., Kessler, R. C., Slade, T. & Andrews, G. The performance of the K6 and K10 screening scales for psychological distress in the Australian National Survey of Mental Health and Well-Being. *Psychological medicine* **33,** 357–362 (2003).

47. Tennant, R. *et al.* The Warwick-Edinburgh mental well-being scale (WEMWBS): development and UK validation. *Health and Quality of life Outcomes* **5,** 63 (2007).

48. Shah, N., Cader, M., Andrews, W. P., Wijesekera, D. & Stewart-Brown, S. L. Responsiveness of the Short Warwick Edinburgh Mental Well-Being Scale (SWEMWBS): evaluation a clinical sample. *Health and quality of life outcomes* **16,** 1–7 (2018).

49. Stewart-Brown, S., Samaraweera, P. C., Taggart, F., Kandala, N.-B. & Stranges, S. Socioeconomic gradients and mental health: implications for public health. *The British Journal of Psychiatry* **206,** 461–465 (2015).

50. Levin, K. A. & Currie, C. Reliability and validity of an adapted version of the Cantril Ladder for use with adolescent samples. *Social Indicators Research* **119,** 1047–1063 (2014).

51. De Looze, M. E., Huijts, T., Stevens, G., Torsheim, T. & Vollebergh, W. A. The happiest kids on earth. Gender equality and adolescent life satisfaction in Europe and North America. *Journal of youth and adolescence* **47,** 1073–1085 (2018).

52. Due, P. *et al.* Trends in high life satisfaction among adolescents in five Nordic countries 2002–2014. *Nordisk välfärdsforskning | Nordic Welfare Research* **4,** 54–66 (2019).

53. Kosloski, K., Stull, D. E., Kercher, K. & Van Dussen, D. J. Longitudinal analysis of the reciprocal effects of self-assessed global health and depressive symptoms. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* **60,** P296–P303 (2005).

54. Andrew, D. & Dulin, P. The relationship between self-reported health and mental health problems among older adults in New Zealand: Experiential avoidance as a moderator. *Aging and Mental Health* **11,** 596–603 (2007).

55. Dean, N. & Raftery, A. E. Latent class analysis variable selection. *Annals of the Institute of Statistical Mathematics* **62,** 11 (2010).

56. Collins, L. M. & Lanza, S. T. *Latent class and latent transition analysis: With applications in the social, behavioral, and health sciences* (John Wiley & Sons, 2010).

57. Mueller, M. P. *et al.* Ordering patterns following the implementation of a healthier children's restaurant menu: A latent class analysis. *Obesity* **25,** 192–199 (2017).

58. Meisingset, I. *et al.* Novel approach towards musculoskeletal phenotypes. *European Journal of Pain* (2020).

59. Wang, J. & Wang, X. *Structural equation modeling: Applications using Mplus* (John Wiley & Sons, 2019).

60. Lanza, S. T., Dziak, J. J., Huang, L., Wagner, A. T. & Collins, L. M. LCA Stata plugin users' guide (Version 1.2). *University Park: The Methodology Center, Penn State* (2015).

61. Nylund-Gibson, K. & Choi, A. Y. Ten frequently asked questions about latent class analysis. *Translational Issues in Psychological Science* **4,** 440 (2018).

62. Swanson, S. A., Lindenberg, K., Bauer, S. & Crosby, R. D. A Monte Carlo investigation of factors influencing latent class analysis: An application to eating disorder research. *International Journal of Eating Disorders* **45,** 677–684 (2012).

63. Huang, L., Dziak, J. J., Bray, B. C. & Wagner, A. T. LCA_Distal_BCH Stata function Users' Guide (Version 1.1) (2017).

64. Rasmus, S. M., Trickett, E., Charles, B., John, S. & Allen, J. The qasgiq model as an indigenous intervention: Using the cultural logic of contexts to build protective factors for Alaska Native suicide and alcohol misuse prevention. *Cultural diversity and ethnic minority psychology* **25,** 44 (2019).

65. Chen, E., Leos, C., Kowitt, S. D. & Moracco, K. E. Enhancing Community-Based Participatory Research Through Human-Centered Design Strategies. *Health promotion practice* **21,** 37–48 (2020).

66. Wallerstein, N. *et al.* Engage for equity: A long-term study of community-based participatory research and community-engaged research practices and outcomes. *Health Education & Behavior* **47,** 380–390 (2020).

67. Khan, R. K. & Misra, R. Community-based participatory research in diabetes prevention programs. *Social Determinants of Health* **5** (2020).

68. Hudson, B. W., Spence, J. C. & McHugh, T.-L. F. An exploration of the physical activity experiences of Northern Aboriginal youth: a community-based participatory research project. *Qualitative Research in Sport, Exercise and Health* **12,** 108–124 (2020).

69. Rink, E. & Reimer, G. A. A toolkit for Community Based Participatory Research in Greenland (2020).

70. Newell, S. L., Dion, M. L. & Doubleday, N. C. Cultural continuity and Inuit health in Arctic Canada. *J Epidemiol Community Health* **74,** 64–70 (2020).

71. Olesen, I., Hansen, N. L., Ingemann, C. & Larsen, C. V. L. *En pilotinterviewundersøgelse om brugeres perspektiv på og oplevelse af det grønlandske sundhedsvæsen* in *NUNAMED 2019-en grønlandsmedicinsk konference: Bevægelse i Sundhed* (2020).

72. Barnhardt, R. & Oscar Kawagley, A. Indigenous knowledge systems and Alaska Native ways of knowing. *Anthropology & education quarterly* **36,** 8–23 (2005).

73. Airhihenbuwa, C. O., Ford, C. L. & Iwelunmor, J. I. Why culture matters in health interventions: lessons from HIV/AIDS stigma and NCDs. *Health Education & Behavior* **41,** 78–84 (2014).

74. Dickerson, D. *et al.* Encompassing cultural contexts within scientific research methodologies in the development of health promotion interventions. *Prevention Science* **21,** 33–42 (2020).

75. Hulley, S. *et al. Designing clinical research. Philadelphia* (USA: Lippincott Williams & Wilkins, 2007).

76. Malt, U., Mogstad, T. & Refnin, I. Goldberg's general health questionnaire. *Tidsskrift for den Norske laegeforening: tidsskrift for praktisk medicin, ny raekke* **109,** 1391–1394 (1989).

77. Eid, M., Langeheine, R. & Diener, E. Comparing typological structures across cultures by multigroup latent class analysis: A primer. *Journal of Cross-Cultural Psychology* **34,** 195–210 (2003).

78. Bjerregaard, P., Mulvad, G. & Olsen, J. *Studying health in Greenland: obligations and challenges* 2003.

79. Lanza, S. T., Tan, X. & Bray, B. C. Latent class analysis with distal outcomes: A flexible model-based approach. *Structural equation modeling: a multidisciplinary journal* **20,** 1–26 (2013).

80. De Vaus, D. *Surveys in Social Research, Abingdon* 2014.

Appendix

A. Missing values

Figure 7: Missing values
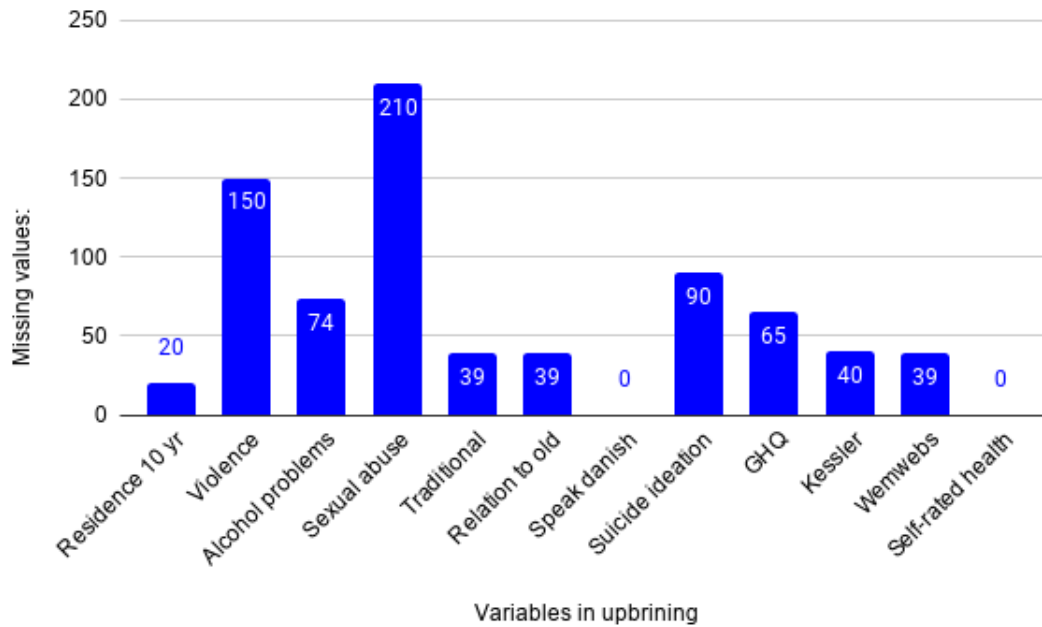
B. Correlation matrix for upbringing variables

Measures	Residence	Violence	Alc. prob.	Sex. abuse	Trad. act.	Rel. to old gen.	Speak danish
Residence	1						
Violence	00.10	1					
Alc. prob.	00.01	00.55	1				
Sex. abuse	00.19	00.29	00.20	1			
Trad. act.	00.02	00.07	00.09	00.08	1		
Rel. to old gen	00.26	00.08	00.08	00.06	00.20	1	
Speak danish	00.39	00.03	00.03	00.18	00.07	00.06	1

C. Correlation matrix for distal variables

Measures	Self-rated health	Suicide ideation	GHQ	Kessler	WEMWBS	Cantril ladder
Self-rated health	1					
Suicide ideation	00.07	1				
GHQ	00.31	00.14	1			
Kessler	00.15	00.26	00.26	1		
WEMWBS	00.12	00.10	00.10	00.11	1	
Cantril Ladder	00.26	00.13	00.25	00.20	00.27	1

D. Ethical Approval Greenland

Nunatsinni Nakorsaaneqarfik
Landslægeembedet

NAALAKKERSUISUT

GOVERNMENT OF GREENLAND

Christina VL Larsen
Statens Institut for Folkesundhed
Øster Farimagsgade 5A
1353 København K

Vedrørende godkendelse af projektet KVUG 2017-05

Det Videnskabsetiske Udvalg for Grønland har godkendt projektet: *Befolkningsundersøgelsen i Grønland 2018* med følgende kommentarer:

Projektets hovedformål: At fortsætte monitoreringen af folkesundheden i Grønland ved regelmæssigt gentagne befolkningsundersøgelser

Der er tale om et interview og spørgeskema undersøgelse, samt en mindre objektiv undersøgelse.

Der vil komme til at ligge en lang række meget personfølsomme oplysninger, hvor der ikke i protokollen ligger en klar beskrivelse af opbevaringen og tilgængeligheden af disse data.
Der er i Grønland vedtaget en ny datalovgivning omkring persondata, og før opstarten af denne undersøgelse skal der indsendes en beskrivelse omkring dataopbevaringen og hvem der har adgang til data
Det skal ved beskrivelsen sikres at de nye grønlandske data lovgivning overholdes, dette gælder også for data opbevaring af tidligere befolkningsundersøgelser.

Vi er enige i de etiske overvejelser i projekt protokollen. Forskergruppen har stor erfaring omkring håndtering at meget personfølsomme oplysninger både i interview fasen og ved afrapportering. De etiske overvejelse omkring interview af en lang række af disse meget personfølsomme oplysninger og den påvirkning det medføre skal hver gang nøje vurderes.

Projektbeskrivelsen sammen med denne videnskabs etiske godkendelse skal tilsendes Sundhedsledelsen i Grønland til orientering samt til Departementet for Sundhed, sundhedsledelsen@peqqik.gl + pN

Brevdato: 29-03-2017
Sags nr. 2017 - 5582
Dok. nr. 4854329

Postboks 120
3900 Nuuk
Tlf. (+299) 34 51 92
Fax (+299) 32 51 30
E-mail: nun@nanoq.gl
www.nanoq.gl

På vegne af Udvalget
Med venlig hilsen

Tania Broberg

1

E. Data processing agreement

SDU🍏

Databehandleraftale

mellem

Syddansk Universitet
Campusvej 55
5230 Odense M
(i det følgende også SDU eller den dataansvarlige)

og

Martine Stecher Nielsen
Nedre Ila 9b
7018 Trondheim
Norge
Privatperson

(i det følgende også MSN eller databehandleren)

1. Formål med databehandleraftalen
Denne aftale fastsætter de rettigheder og forpligtelser, som finder anvendelse, når databehandleren foretager behandling af personoplysninger på vegne af den dataansvarlige.

I henhold til Databeskyttelsesforordningen – ***Europa-Parlamentets og Rådets forordning (EU) 2016/679 af 27. april 2016 om beskyttelse af fysiske personer i forbindelse med behandling af personoplysninger og om fri udveksling af sådanne oplysninger og om ophævelse af direktiv 95/46/EF (Databeskyttelsesforordningen) -*** indgås efter art. 28, stk. 3 denne databehandleraftale. Databehandleraftalen har til formål at sikre, at behandling af personoplysninger sker i overensstemmelse med Databeskyttelsesforordningen samt Databeskyttelsesloven.

2. Anvendelsesområde
SDU er dataansvarlig for de personoplysninger som MSN behandler på vegne af SDU i henhold til denne databehandleraftale mellem SDU og MSN (herefter Kontrakten). MSN er databehandler for SDU. SDU overlader det til MSN at behandle personoplysninger på SDU's vegne i overensstemmelse med denne databehandleraftale.