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Explaining Socioeconomic Oral Checkup Inequalities

Material and psychosocial factors in the explanation of socioeconomic

inequalities in oral checkup behavior

Master thesis

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Abstract

Background: As with many behavioral health aspects, there are clear socioeconomic inequalities in oral health and oral checkup regularity. This study aimed to assess the influence of material and psychosocial factors as mediators in the explanation of socioeconomic inequalities in relation to oral checkup regularity among Dutch adults. **Methods:** Survey data from subjects (25 – 75 years) that participated in the fifth wave follow up of the GLOBE study (N = 2577) was used for this study. Binary logistic regression models were created to demonstrate the association between socioeconomic status (educational level) and oral checkup regularity. It was studied whether material factors (financial difficulties) and psychosocial factors (psychological distress, social support, and social network size) functioned as mediating factors in this association. Odds ratios (OR) were obtained and compared to draw conclusions. **Results:** Lower socioeconomic status is associated with lower oral checkup regularity. This relationship functions as a gradient: people with lower educational backgrounds were less likely to perform regular oral checkups. Furthermore, financial difficulties, psychological distress, social network size and number of close family members functioned as mediators. **Conclusions:** The results indicate that financial difficulties, psychological distress, social support, and number of close family members play a role in the explanation of socioeconomic differences in oral checkup behavior. However, there are notable differences in the degree of influence and the effect of the mediators on different educational groups. This study calls on professionals to be aware of risk-factors for non-regular oral checkups and provides a solution for reform of the Dutch healthcare system. We suggest a removal of the financial barrier for oral checkups to reduce the socioeconomic inequalities in oral checkup regularity and oral health. **Keywords:** oral checkup behavior, SES, dental behavior, socioeconomic inequalities.

Introduction

More than half of the world's population, roughly 3.5 billion people, are affected by oral diseases (Marcenes et al., 2013) Oral diseases are the most prevalent noncommunicable diseases and can have big influences on people, affecting personal and professional life, as well as perceived life quality in general. Often, the mouth is referred to as ''*the mirror of general health''*, as oral health is linked to several diseases, among which diabetes, cardiovascular disease, rheumatoid arthritis, obesity, pregnancy complications, kidney failure and pulmonary diseases (KNMT, 2019). The World Health Organization (2003) defines oral health as *''a state of being free from chronic mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing''*.

Preventing oral health problems

Adequate oral health is vital for living a long, healthy life. Many general health problems, including oral health problems like dental caries, losing teeth and periodontal diseases can be prevented with adequate oral self-care. Regular tooth brushing and the use of fluoride (embedded in toothpaste or as sealants) are measures proven to be effective in preventing oral problems (Featherstone, 1999; Chestnutt et al., 1998). Next to oral self-care, regular oral checkups are effective in preventing oral problems and disease by checking the overall oral health and performing preventive cleaning (Thomson et al., 2010).

Socioeconomic inequalities in oral checkup behavior

As with many behavioral health aspects, there are socioeconomic inequalities in oral checkup regularity (Hjern et al., 2001): higher income and higher achieved education are predictors for a higher prevalence of oral checkups. To decrease the number of oral health problems, it is important to explain these socioeconomic inequalities in oral checkup regularity and understand why they exist.

This study

This study aims to explain socioeconomic inequalities in oral checkup regularity by looking at material and psychosocial barriers and enabling factors that influence people in attending regular preventive oral checkups. Recent international studies have successfully linked

material and psychosocial factors individually to oral checkup behavior. In many western countries, access to dentists is inadequate due to the high cost of treatments (Sisson, 2007). Furthermore, studies on depression in relation to dental visits show that people who experience higher levels of depressive symptoms have lower oral checkup frequencies (Antilla et al., 2006; Okoro et al., 2011). However, no research has combined these factors to look at oral checkup behavior from an integral point of view. An integral perspective provides clarification on the interplay of material and psychosocial factors. Furthermore, no (inter)national empirical studies linked the notion of health-related social support to oral checkup behavior. However, the fact that the beneficial effect of social support on health is proven in many empirical studies (Berkman et al., 2000), raises the expectation of the positive effect on oral checkup behavior. The outcomes of this study are useful for public health professionals, social workers and dental professionals in understanding these barriers and enabling factors. It calls on professionals to be aware of risk-factors for non-regular oral checkups and takes a critical look at the Dutch healthcare system.

Existing research

Socioeconomic inequalities in oral health

Socioeconomic status is defined as *''the social standing or class of an individual or group. It is often measured as a combination of education, income, and occupation''* (American Psychosocial Association, 2020). The population with the lowest education and worst financial situation carries the burden of having the worst oral health status (Timiş & Dănilă, 2005). Many studies prove the significant link between socioeconomic status (SES) and oral health (Locker, 1993; Locker, 2000). As with many inequalities in health, this relationship functions as a social gradient, with oral health deteriorating as one's SES decreases. Furthermore, recent studies show that educational level and income are related to the number of natural teeth a person has (Duijster et al., 2018).

Socioeconomic inequalities in oral checkup behavior

As mentioned earlier, regular oral checkups are effective in preventing oral problems and disease by checking the overall oral health and performing preventive cleaning (Thomson et al., 2010). The Royal Dutch Society for the Promotion of Dentistry (2020), strongly advises performing regular oral checkups at least once a year. However, depending on dental status, this advice can be altered to two times per year. As discussed before, higher income and higher achieved education are predictors of a higher prevalence of dental visits. 71 percent of Dutch people in the low-end income group visit the dentist at least once a year (CBS, 2019). In the high-end income group, this percentage is much higher: 85 percent. This trend is also present in different educational groups (CBS, 2019). In the low-end educational group, 57 percent make at least one dental visit per year, while in the high-end educational group, this percentage is 86.

Explaining inequalities in health behavior

For years, social scientists have attempted to provide explanations for socioeconomic inequalities in health and related preventive behavior. The complexity of human behavior makes this a rather difficult challenge. Two commonly interpreted leading explanations are the *material explanation* and the *psychosocial explanation*, based on the work of Sisson (2007).

(Neo)material explanation

The material explanation, often referred to as the *neo-material* explanation, entails that ''*health inequalities result from the differential accumulation exposures and experiences that have their sources in the material world*'' (Lynch et al., 2000). Simply put, the material explanation states that individuals with lower SES may not be able to afford services and facilities that are vital to maintaining a healthy life. According to this explanation, inequalities in health are a result of material disadvantage. It reaches as far as including negative life experiences, lack of (financial) capital and structural underinvestment in social, physical and health infrastructure. In many western countries, access to dentists is inadequate due to the high cost of treatments, partially explaining the differences in oral checkups among socioeconomic groups (Sisson, 2007). Preventive dental checkups and treatments for adults are not covered by basic obliged health insurance in The Netherlands (Rijksoverheid, 2019). However, individuals do have the possibility to take out additional dental insurance. In sum, not being able to cover the dental costs (or take out insurance) due to low income or financial difficulties possibly remains one of the biggest barriers to regular oral checkups.

Psychosocial explanation

The psychosocial explanation entails that inequalities in health are a result of alterations in psychological distress (anxiety, depression) between different socioeconomic groups (Sisson, 2007). Psychological distress can negatively influence health in direct and indirect ways. The direct path, referred to as the *aetiological* explanation, assumes that distress increases one's susceptibility for disease. For example, when one experiences high levels of psychosocial stress, their immune system weakens and gets more susceptible to disease. The indirect path, focusing on behavior, argues that people who experience psychological distress make less healthy choices. This is expressed in (un)conscious acts of self-destruction, such as smoking and drinking, which sometimes functions as a mechanism to alleviate stress. People with lower SES are to experience higher rates of psychological distress, possibly caused by a higher number of detrimental events (ea. unemployment, loss of a family member) in life (White, 2002). Also, poverty is linked to depressive symptoms (Jin et al., 2020). Studies on depression in relation to dental visits show that people who experience higher levels of depressive symptoms have lower oral checkup frequencies (Antilla et al., 2006; Okoro et al., 2011).

Social environments have a large influence on individual behavior too (Sanders et al., 2006). Supportive social networks are beneficial for individual health status and enable healthy behavior (McKenzie et al., 2017). Research shows that the odds of timely dentist visits increase when the number of close friends and family members increases (Gironda et al., 2013). People from lower socioeconomic groups more often have smaller social networks (Weyers et al., 2008), and thus are expected to make less regular oral checkups. Closely related to the concept of social networks is the notion of social support, which is defined as '*'support that people receive from others''* (Elstad, 1998). The beneficial effect of social support on health is proven in many empirical studies (Berkman et al., 2000). Being able to gather health-related advice and information from people close to you has positive effects on health. Furthermore, health-related social norms put pressure on performing healthy behavior.

Social network size and psychological distress are likely to be individually linked to oral checkup behavior. However, thus far, no empirical studies linked the notion of health-related social support to oral checkup behavior. Experiencing less social support, having a smaller social network and higher levels of psychological distress presumably may weaken the alertness and capacity to care for oral health and cause a person to visit a dentist less regularly, even when the need is high (Berkman & Glass, 2000).

Psychosocial and material factors combined
Material and psychosocial drawbacks do not always occur completely independent of each other. They can occur simultaneously and sometimes have the same cause. Research shows that certain psychosocial factors, like mental state, are often linked to a persons' financial situation (Jin et al., 2020). Furthermore, negative life experiences like unemployment can be the cause of both psychological distress as well as financial problems. These situations are often complex and causality differs from case to case. A systematic review of Moor et al. (2017) on socioeconomic differences in self-reported health showed that material factors contribute most when combined with psychosocial factors, due to the large main effect and extra shared effect of material factors through psychosocial factors. It is not clear whether this is also true for self-reported health behavior. So far, no study compared the effects of both material and psychosocial factors when they occur simultaneously in regard to oral checkup regularity.

Other explanations

Cultural factors such as language barriers can lead to confusion about dental treatments and cause anxiety in people from ethnic minority groups (Freeman, 1999). Norms and attitudes on (dental) health services use may also differ from Dutch natives, both resulting in less regular dentist attendance. Given the fact that, in The Netherlands, ethnic minority groups are on average lower educated (CBS, 2018), cultural factors undoubtedly play a role in the explanation of the lower prevalence of dental visits. Another barrier to regular dental visits is overall dentist anxiety (Sisson, 2007). Cultural factors and dentist anxiety will not be taken into account in this study. However, they are important factors to highlight as they can be of significant influence on oral checkup behavior.

Theoretical approach

Healthcare Utilization Model

Over the past decades, various studies have conceptualized factors that predict healthy behavior and usesage of healthcare services. In 1974, Anderson introduced the *Healthcare Utilization Model* (Aday & Andersen, 1974). Despite it has been revised numerous times, the original model is still valuable in understanding oral checkup behavior (Baker, 2009). This theory argues that the use of dental services can be determined by predisposing, enabling and needs related factors. Predisposing factors that predict the use of dental services are age, sex, education and health beliefs. Regarding these factors, it is known that younger adults, women, and people with higher educational backgrounds are more likely to regularly perform oral checkups (Roberts-Thomson et al., 1995). The most important enabling factors are social support and financing (ea. one's income and insurance status). Experiencing high levels of social support, having high income and access to dental insurance are all factors that enable people to regularly visit dentists (Sisson, 2007; Gironda et al., 2013). When these material and psychosocial factors are low or even absent, the intention to visit the dentist is likely to be low or absent too.

Health Belief Model

Another relevant theory is the *Health Belief Model*, adjusted to preventive dental behavior by Heafner (1974). This value-expectancy theory was developed by psychologists in the 1950's and aims to explain why people do or do not use health services. This theory states that the expected consequences of health behavior determine the intention to perform the behavior. The simultaneous occurring of perceived benefits, perceived barriers, perceived self-efficacy and perceived threat, strengthened by cues to action, determine the action to see a dentist. Furthermore, modifying factors are of influence. Starting with these modifying factors, people with higher socioeconomic levels more often possess health beliefs (that is: knowledge) that are preventive oriented (Haefner, 1974). Age and gender are also relevant modifying factors. Commonly studied barriers to preventive dental visits are dentist anxiety, financial difficulties regarding paying for the costs of treatment (Sisson, 2007) and lack of self-efficacy (the belief in capacity to perform healthy behavior). The last factor to mention is perceived threat, that is, the belief of a person that he or she is vulnerable to dental disease. To complete the explanation, former factors in combination with cues to action (for instance in the form of a dental practice reminder card) shape an individuals' oral checkup behavior.

Social Network Theory

The *Social Network Theory* (Heaney & Isreal, 2008) entails that there is a difference in health outcomes between people who are, and people who are not part of social networks. Social networks are defined by the same authors as *''a web of social relationships that surround people''*. Being part of social networks has positive effects on regular dentist attendance: the odds of timely dentist visits increase when the number of close friends and family members increases (Gironda et al., 2013). Closely related to the concept of social networks is the notion of social support. Individuals with a lower SES more often experience lower levels of social support (Elstad, 1998). Heaney & Isreal (2008) argue that the *Social Network Theory* describes the processes, structures and functions of personal relationships. There is no suitable evidence to make statements about the perfect size and concrete beneficial characteristics of social networks (McKenzie et al., 2017). However, the fact that social networks and social support play a big role in preventive health behavior, cannot be denied.

This current study is based on a combination of the three former discussed theoretical approaches, comprising predisposing and enabling factors as well as barriers in explaining dental visit regularity. Specifically translated into the notions of material and psychosocial factors. Furthermore, several sociodemographic factors are of influence. The first factor to distinguish is age. Younger adults are more likely to regularly visit a dentist as compared to older adults (Freeman, 1999; Robert-Thomson et al., 1995). The second factor is sex, with women making more use of dental services than men. These sociodemographic factors often function as confounders in existing research. *Figure 1* provides a schematic overview of the overall theoretical approach.
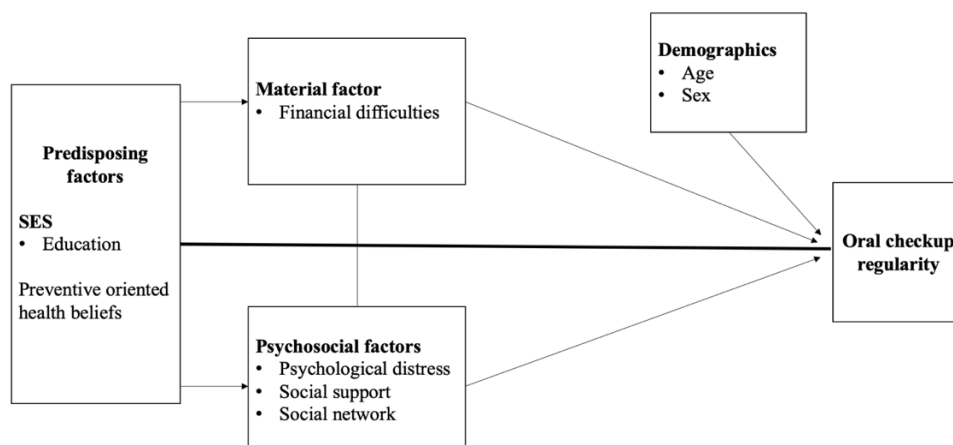

Figure 1. Schematic overview of the overall theoretical approach

Research question and hypotheses

This study aimed to assess the influence of material and psychosocial factors as mediators in the explanation of socioeconomic inequalities in relation to oral checkup regularity among Dutch adults. The main research question reads '*is the relation between socioeconomic status and oral checkup regularity mediated by material and psychosocial factors*?'. Based on previous research and expectations, several hypotheses have been formulated:

1. We expected that lower SES leads to lower oral checkup regularity (Hjern et al., 2001);
2. We expected that lower SES leads to more financial difficulties, which leads to lower oral checkup regularity (Sisson, 2007);
3. We expected that lower SES leads to higher psychological distress, which leads to lower oral checkup regularity (White, 2002; Antilla et al., 2006; Okoro et al., 2011);
4. We expected that lower SES leads to lower health-related social support, which leads to lower oral checkup regularity (Elstad, 1998);
5. We expected that lower SES leads to a smaller social network size, which leads to lower oral checkup regularity (Gironda et al., 2013; Weyers et al., 2008);
6. We expected that the effect of all psychosocial mediators declined, but remained significant when all mediators were put in an integrated model (Moor et al., 2017).

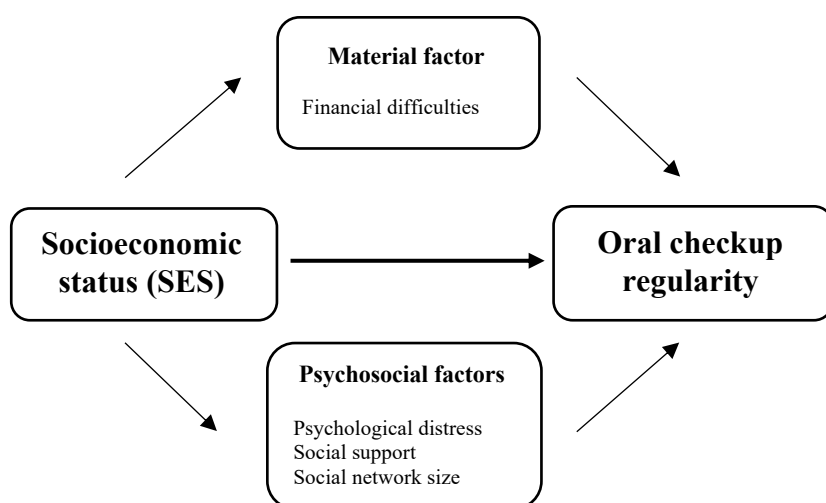*Figure 2* shows the overall hypothesized model.

Figure 2. The relationship between SES and oral checkup regularity as mediated by material and psychosocial factors

Methods

Research design

This study has a quantitative fundamental exploratory research design. It can be classified as a within-group research design, as it analyzes multiple variables in the same group of participants. Secondary data, collected by a large-scale survey, was used for the study.

Participants and sampling

Participants of this study were subjects that participated in the 2014 fifth wave follow up of the GLOBE study (Globe Study, 2015). This follow up consists of a total of 4851 respondents (response: 45.5%). GLOBE is a self-report longitudinal study that started in 1991 and aims to research the effects of living conditions on health. The study tries to find explanations for socioeconomic differences in health in The Netherlands. The GLOBE study is registered at the Dutch Data Protection Authority (#1248943). All subjects provided informed consent. Only participants who are between 25 and 75 years of age were included in the analyses. 2039 participants were excluded because they did not fall in the age range. Furthermore, 235 participants were excluded due to missing data. The final sample included 2577 participants.

Data collection instruments

The fifth wave questionnaire consists of 100 questions. Information on the reliability and validity of the questions is to be found elsewhere (Van Lenthe et al., 2014). The answers are coded partially following the coding scheme of an earlier study that included these variables (Duijster et al., 2018). Some adjustments were made to fit the coding scheme to this study.

Oral checkup regularity is the dependent variable, measured on a nominal (binary) level. *Socioeconomic status* is the independent variable, measured on an ordinal level. *Material and psychosocial factors* function as mediating variables, these are measured on ordinal, nominal and binary levels. For the measurement of every variable, a separate question has been asked in the questionnaire.

Dependent variable

Firstly, we are interested in the regularity of oral checkups. In the questionnaire, this is measured by the question '*what is usually the reason for you to visit the dentist?*', and is

answered by *regularly for checkup, incidentally for checkup, regularly for treatment, only when there are problems with mouth, teeth or prothesis* and *I never visit the dentist.* When a respondent answered *incidentally for checkup, regularly for treatment, only when there are problems with mouth, teeth or prothesis* and *I never visit the dentist,* the respondent is classified as to not make regular oral checkups (coded binary: regular checkup, non-regular checkup).

Independent variable

Socioeconomic status (SES) was determined using the International Standard Classification of Education (Matsui, et al., 2016). Three educational categories were distinguished: ISCED 0-2 (primary, lower vocational and lower secondary education), ISCED 3-4 (intermediate vocational education and higher secondary education) and ISCED 5-7 (higher vocational education and university), (coded: low/medium/high).

Mediators

Regarding mediating factors, we were interested in material factors and psychosocial factors. The material factor is financial difficulties, which was measured by the question: '*in the past year, have you had difficulties paying for food, rent, repayments, electricity bills, etc.?*' Which could be answered by *no difficulties*, *some difficulties* and *big difficulties* (coded: no, small, big). Regarding psychosocial factors, the first factor to distinguish is health-related social support. The question '*do you have someone to support you if you want to quit smoking, lose weight, eat healthier, become more physically active or receive medical advice?*' could be answered *no, family/partner, friend, colleague and acquaintance* for each aspect. Subjects who answered '*no*' to a minimum of two aspects are interpreted as having little health-related social support (coded: little/more). The second psychosocial factor to distinguish is social network size, which was measured by two questions. The first one being '*how many family members do you have good contact with?*'. This question could be answered by *0, 1-2, 3-5, 6-10, 11-20 and >20.* (coded: 0, 1-2, >3). The second question '*how many good friends do you have?*' could be answered by *0, 1-2, 3-5, 6-10, 11-20 and >20.* (coded: 0, 1-2, >3). The third and last psychosocial factor is psychological distress. This was measured using the MHI-5 method, which consists of five statements on emotional control, depression, positive affect and anxiety that could be answered on a 6-point Likert scale. An individual that scores >60 on a scale of 0-100 is perceived to be mentally healthy and not experience psychological distress (CBS, 2011), (coded: yes/no).

Confounders

As described in the literature review, age and sex influence oral checkup behavior (Freeman, 1999; Robert-Thomson et al., 1995). These variables can unintendedly interfere with other variables in our statistical models. To eliminate this interference, age, and sex were added to the models of this study and function as confounders. Age was measured on a continuous scale (25-75). Sex was measured on a categorical scale (coded: male/female). *Table 1* lists all the variables used in the analysis, including their measurement in the questionnaire and their coding for statistical tests.

Table 1. Measurement and coding of variables

Variable	Measurement in the questionnaire	Variable coding
Regularity of dental visits	*What is usually the reason for you to visit the dentist?*	Regular / not regular
Socioeconomic status	*International standard classification of Education distinguishing three categories*	Low / intermediate / high
Financial difficulties	*In the past year, have you had difficulties paying for food, rent, repayments, electricity bills, etc.?*	No / small / big
Health-related social support	*Do you have someone to support you if you want to quit smoking, lose weight, eat healthier, become more physically active or receive medical advice?*	Yes / no
Social network size	*How many family members do you have good contact with? And how many good friends do you have?*	0 / 1-2 / >3
Psychological distress	*Emotional control, depression, positive affect and anxiety measured by MHI-5*	Yes / no
Age	*What is your age?*	25-75 years
Sex	*Are you male or female?*	Male / female

Statistical analyses

Statistical software SPSS V.25 was used to perform analyses on the data. The dataset was cleaned and cases with missing values were eliminated using listwise deletion. Dummy variables were created using a coding system to make them suitable for analyses. All analyses were performed with a weighing factor enabled. Descriptive statistics of the sample population, as well as the variables, were obtained and reported using (cross)tables. Binary logistic regression was performed to analyze the data. Regarding assumptions, the absence of multicollinearity was tested by a linear regression model and interpreting the VIF, and by

looking at correlations between the variables. Linearity of independent variables with outcome variable log odds was assumed since there were no continuous independent variables. A total of four regression models were created. Sex and age were added as confounding variables. Model 1 includes the main relation, that is, the effect of SES on dental visit regularity. Model 2 includes the main relation as well as the material factor. Model 3 includes the main relation as well as psychosocial factors. And model 4, the final model, includes all variables. Odds ratios were obtained and reported. Odds ratios of models 1, 2, 3 and 4 were compared to draw conclusions: a significant odds ratio on a variable while the independent variable odds ratio (partially) lost its significance, meant that that particular factor functioned as mediator. A significance level of .05 and 95% CI's were used for all analyses. All data has been stored safely on a secured server and deleted once the research was conducted.

Results

The mean age of the sample was 48.5 years (SD 14.8). 54.5% was female (*table 2*). Of the total sample, 72.7% went for regular oral checkups, while 27.3% did not. 75.9% of the higher educated participants went for regular oral checkups. In medium and lower educated participants, these percentages were respectively 72.3 and 66.3. Furthermore, 60.7% was employed, 23.3% was retired, 1.6% was a student and 13.2% was unemployed.

Hypothesis 1: main effect

The odds of people in the medium educational group who went for non-regular oral checkups were 1.26 times as high in comparison to people in the highest educational group (95% CI 1.03-1.56) (*table 3*). For people in the lowest educational group, these odds were 1.91 times as high in comparison to people in the highest educational group (95% CI 1.52-2.39).

Hypothesis 2: material factor

When experiencing small and big financial difficulties, the odds of going for non-regular oral checkups respectively were respectively 1.66 (95% CI 1.35-2.04) and 2.62 (95% CI 1.83-3.75) times as high in comparison to experiencing no financial difficulties. The socioeconomic gradient is still partly significant: the odds of people in the lowest educational group going for non-regular oral checkups decreased somewhat compared to the base model, but remained significantly higher in comparison to people in the highest educational group (1.61 95% CI 1.28-2.04). The odds for people in the medium educational group going for non-regular oral checkups remained higher, however, lost its significance (1.10 95% CI 0.89-1.37).

Hypothesis 3, 4 and 5: psychosocial factors

The odds of non-regular oral checkups were 1.63 (95% CI 1.13-2.34) times as high when a person experienced psychological distress in comparison to when a person did not experience psychological distress. The odds of non-regular oral checkups were 1.54 (95% CI 1.14-2.08) times as high when a person experienced little health-related social support in comparison to experiencing high social support. The odds of non-regular oral checkups were 1.53 times as high when good contact with zero family members was reported (95% CI 1.07-2.20), in comparison to to good contact with more than three family members. When people reported good contact with 1-2 family members, the increase in odds was smaller and not significant.

The odds of non-regular oral checkups did not increase significantly when good contact with zero friends was reported, in comparison to good contact with more than three friends. When people reported good contact with 1-2 friends, the increase in odds was smaller and also not significant. When psychosocial factors were added to the base model, the socioeconomic gradient is still partly significant: the odds of people in the lowest educational group going for non-regular oral checkups remained significantly higher in comparison to people in the highest educational group (1.74 95% CI 1.38-2.19). The odds for people in the medium educational group going for non-regular oral checkups remained higher, however, lost its significance (1.22 95% CI 0.99-1.51).

Hypothesis 6: full model

When all mediating factors were added to establish a final model, the odds of people in the lowest educational group going for non-regular oral checkups declined, but remained significantly higher in comparison to people in the highest educational group (1.52 95% CI 1.20-1.93). The odds for people in the medium educational group going for non-regular oral checkups were not significantly higher. Experiencing small or big financial difficulties did explain a significant part of the increase in odds (1.63 95% CI 1.33-2.00), (2.28 95% CI 1.58-3.30). The odds of non-regular oral checkups were 1.46 (95% CI 1.08-1.99) times as high when a person experienced little health-related social support in comparison to experiencing high social support. The odds of non-regular oral checkups were 1.48 (95% CI 1.02-2.15) times as high when a person experienced psychological distress in comparison to when a person did not experience psychological distress. Social network size did not significantly affect the odds of non-regular oral checkups.

Table 2. Sample descriptives

	Regular oral checkup		Total sample	Educational level High	Educational level Medium	Educational level Low	P-value
	OR	(95% CI)	n=2577 %	(n=1261) %	(n=647) %	(n=669) %	
Sex							<.001
Male	0.72**	(0.61-0.85)	45.5	49.2	44.5	38.6	
Female	1.00		54.5	50.8	55.5	61.4	
Age (m= 48.5)							<.001
25-34	1.00		25.8	36.0	23.3	7.2	
35-44	1.63**	(1.25-2.11)	17.4	19.7	21.2	8.7	
45-54	2.18**	(1.65-2.87)	17.6	15.3	24.6	15.3	
55-64	1.56**	(1.21-2.00)	19.0	16.6	16.2	26.9	
65-75	1.01	(0.79-1.27)	20.1	12.4	14.6	41.8	
Work status							<.001
Paid work	1.00		60.7	64.7	62.3	50.8	
Unemployed	1.43**	(1.09-1.89)	13.2	13.3	14.4	11.8	
Retired	0.79**	(0.65-0.97)	23.3	18.8	21.0	35.2	
Student	1.59	(0.73-3.43)	1.6	2.1	1.2	0.9	
Other	1.75	(0.71-4.31)	1.2	1.2	1.2	1.4	
Oral checkup							<.001
Regular	1.00		72.7	75.9	72.3	66.3	
Non-regular	1.00		27.3	24.1	27.7	33.7	
Material factor							
Financial difficulties							<.001
No difficulties	1.00		73.5	83.4	63.0	63.8	
Small difficulties	0.57**	(0.47-0.70)	21.5	14.3	30.6	27.1	
Big difficulties	0.36**	(0.26-0.51)	5.0	2.4	6.4	9.2	
Psychosocial factors							
Social support							<.001
More support	1.00		92.0	94.7	91.9	86.8	
Little support	0.55**	(0.41-0.73)	8.0	5.3	8.1	13.2	
Social Network size							
Close friends							<.001
0	0.50**	(0.36-0.70)	5.5	3.0	4.3	11.9	
1-2	0.93	(0.77-1.13)	24.9	18.6	31.1	31.7	
>3	1.00		69.6	78.4	64.5	56.4	

Close family members						<.001
0	0.52** (0.37-0.73)	5.6	3.2	7.4	8.7	
1-2	0.83* (0.69-1.02)	23.6	20.9	26.1	26.5	
>3	1.00	70.8	75.9	66.5	64.8	
Psychological distress						.001
Yes	0.51** (0.36-0.72)	5.0	3.8	4.8	7.5	
No	1.00	95.0	96.2	95.2	92.5	

Notes: frequencies (n) in table 2 are not weighted and represent the numbers of participants in the dataset. The percentages (%) are weighted to reflect the population of Eindhoven in 2014, based on a random sample of the municipal registry of Eindhoven. P-values in the right column indicate whether there are significant differences between educational groups on variable. '1.00' refers to the category of reference. ** = p<0.05, * = p<0.10.

Table 3. Odds Ratios of non-regular oral checkups by SES

Odds ratios of non-regular oral checkups

	Model 1 Main effect		Model 2 Material model		Model 3 Psychosocial model		Model 4 Full model	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Education								
Low (ISCED 0-2)	1.91**	(1.52-2.39)	1.61**	(1.28-2.04)	1.74**	(1.38-2.19)	1.52**	(1.20-1.93)
Medium (ISCED 3-4)	1.26**	(1.03-1.56)	1.10	(0.89-1.37)	1.22*	(0.99-1.51)	1.09	(0.88-1.35)
High (ISCED 5-8)	1.00		1.00		1.00		1.00	
Material factor								
Financial difficulties								
No difficulties			1.00				1.00	
Small difficulties			1.66**	(1.35-2.04)			1.63**	(1.33-2.00)
Big difficulties			2.62**	(1.83-3.75)			2.28**	(1.58-3.30)
Psychosocial factors								
Social support								
More support					1.00		1.00	
Little support					1.54**	(1.14-2.08)	1.46**	(1.08-1.99)
Social Network size								
Close friends								
0					1.38*	(0.95-1.99)	1.35	(0.93-1.96)
1-2					0.91	(0.74-1.12)	0.88	(0.71-1.08)
>3					1.00		1.00	
Close family members								
0					1.53**	(1.07-2.20)	1.43*	(0.99-2.07)
1-2					1.14	(0.93-1.41)	1.11	(0.90-1.37)
>3					1.00		1.00	
Psychological distress								
Yes					1.63**	(1.13-2.34)	1.48**	(1.02-2.15)
No					1.00		1.00	

Notes: all models are adjusted for age and sex. '1.00' refers to the category of reference. ** = $p<0.05$, * = $p<0.10$.

Discussion

This study aimed to assess the influence of material and psychosocial factors as mediators in the explanation of socioeconomic inequalities in oral checkup regularity among Dutch adults. The results indicate that financial difficulties, number of close family members, psychological distress and social support do indeed function as mediators. However, there are notable differences in the degree of influence and the effect of the mediators on different educational groups.

Hypothesis 1: main effect

In line with the hypothesis and the findings of Hjern et al. (2011) and Roberts-Thomson et al. (1995), the analysis shows that there is an association between lower SES and lower oral checkup regularity. This relationship functions as a gradient: people with lower educational backgrounds are less likely to perform regular oral checkups. These findings confirm commonly used knowledge and models on preventive health behavior, including the *Healthcare Utilization Model* (Aday & Andersen, 1974) and the *Health Belief Model* (Heafner, 1974), in which educational level is seen as an important predictor for healthy behavior. Furthermore, these findings align with the findings of Duijster et al. (2018), that educational level is related to the number of natural teeth a person has left. Logically, less frequent oral checkups (including preventive cleaning) could lead to a decline in the number of natural teeth one possesses and a decline in overall oral health.

Hypothesis 2: material factor

The analysis shows that financial difficulties functions as a mediator in the relation between SES and oral checkup regularity. These findings are in line with the hypothesis and the findings of Sisson (2007). This relationship functions as a gradient: experiencing larger financial difficulties is associated with lower oral checkup regularity. For people in the medium educational group, experiencing financial difficulties is a complete mediating factor. Hence, it can be concluded that experiencing financial difficulties explains the differences in oral checkup regularity between medium and higher educated people. For people in the lowest educational group, financial difficulties functions as a partial mediating factor. A previous study in The Netherlands showed that health inequalities between people with debt are larger in low-SES groups compared to high-SES groups (Van Rijnsoever et al., 2012). This indicates that having debt is a disproportionately large burden for health in lower

educated people. The precise causal relationship between financial difficulties and negative health outcomes remains unclear (Münster et al., 2013). In some cases, health problems lead to financial difficulties and therefore, unhealthy behavior. While in other cases, financial difficulties lead to unhealthy behavior and therefore, health problems. Unfortunately, research on this complex causality is scarce and often provides inconsistent results.

Hypothesis 3, 4 and 5: psychosocial factors

The analysis shows that all psychosocial factors, except for number of close friends, function as mediators in the relation between SES and oral checkup regularity. In line with the hypothesis and the findings of White (2002) and Antilla et al. (2006), there is an association between experiencing psychological distress and lower oral checkup regularity. Previous research underlined that symptoms of psychological distress (anxiety, depression) are associated with a lack of preventive health behaviors on many aspects, like using sunscreen, eating healthy and using a seatbelt in young people (Allgöwer et al., 2001). The findings of this current study specify psychological distress as an explanation for the socioeconomic gradient in regular oral checkups.

The claim of Elstad (1988), that experiencing little health-related support is associated with lower oral checkup regularity, was hypothesized and is supported as well. Not being able to ask health-related questions, gain health advice or get help changing into healthy behavior understandably results in worse preventive oral checkup behavior. Previous studies showed the link between social isolation and health behavior: being socially isolated is, among other health behavior, related to smoking and the risk of being physically inactive (Shankar et al., 2011). The findings of this current study show that there is an association between not having good contact with family members and lower oral checkup regularity. These findings support the claims of Gironda et al. (2013) and Weyers et al. (2008), that a smaller social network size is associated with lower oral checkup regularity. However, the findings also show that this is not the case when the number of close family members declines from more than three to one or two close family members.

For people in the medium educational group, all psychosocial factors, except for number of close friends, function as complete mediating factors. Hence, it should be concluded that these factors explain the differences in oral checkup behavior in comparison to higher

educated people. For people in the lowest educational group, all psychosocial factors function as partial mediating factors.

Hypothesis 6: full model

We expected that the effect of all psychosocial mediators would decline, but remained significant, when all mediators are put in an integrated model. The findings partially support this hypothesis. When all mediators were taken into account, social network size (number of close friends and number of close family members) lost their significance. Social support and psychological distress did remain significant mediating factors, while their effect declined. Furthermore, the only material factor, financial difficulties, remained a mediating factor as well. Financial difficulties showed the strongest increase in odds for non-regular oral checkups in comparison with the psychosocial mediators. These findings indicate that financial difficulties are of largest influence on the relation between SES and oral checkup regularity. These findings build on the systematic review of Moor et al. (2017) on socioeconomic differences in self-reported health. They conclude that material factors contribute most when combined with psychosocial factors, due to the large main effect and extra shared effect of material factors through psychosocial factors.

The socioeconomic gradient partially stayed significant in the full model. These findings suggest that, besides material and psychosocial factors, other factors may play a role in the explanation as well. Sisson (2007) stated overall dentist anxiety as a clear barrier to regular oral checkups. This anxiety could come from negative past experiences, stories from others or lack of knowledge. Some studies have found lower SES to be associated with higher levels of dental anxiety (Moore et al., 1993; Wisløff et al., 1995), making it a plausible mediating factor. People with dental anxiety are more hesitant to make dental appointments and are more likely to cancel them. Furthermore, cultural factors could be other mediating factors that are of influence on people from the lowest educational group. In these lower educational groups, ethnic minorities are overrepresented compared to higher educational groups (CBS, 2018). Hence, lower educated people from ethnic minority groups may experience language barriers in understanding the Dutch healthcare system or dental practice, preventing them from attending regular oral checkups and explaining the inequalities in socioeconomic status. Also, culture-based norms and values on health and related preventive behavior may play a prominent role. Lastly, Berkman et al. (2000) stated that health-related social norms put pressure on performing healthy behavior. According to the *Health Belief Model* (Heafner,

1974), these social norms are often based on health beliefs (that is: knowledge), which is less often preventive oriented in people from lower socioeconomic groups.

Strengths & limitations

This study does not come without potential limitations. All data were collected through a self-reported questionnaire. As a result, answers could be unconsciously biased or influenced by social desirability (Devaux & Sassi, 2016). However, as anonymity was guaranteed and questionnaires were filled in at home, this bias was minimized. Furthermore, to use the method of logistic regression, all variables were coded and analyzed categorically. Using distinct categories causes partial (unavoidable) information loss. The second drawback of quantitative analyses is that it is impossible to include all 'life variables' in a model. Factors that were not measured in the questionnaire (ea. motives, knowledge, past experiences) have not been taken into account.

Despite potential limitations, this study gained valid scientific insights. The use of this particular extensive, long-term dataset makes the data valid and reliable. The quantitative nature of this study provided an opportunity to analyze multiple possible explanations in a limited period of time. Furthermore, the large size and characteristics of the sample make the results generalizable to the population of Eindhoven in 2014. We presume this population to be reasonably generalizable to the population of Dutch adults. Most importantly, no previous study combined material and psychosocial factors in the explanation of SES in relation to oral checkup regularity.

Implications

Three implications arise from the results. The first implication is a suggestion for professionals, including dentists and social workers. With the results of this study in mind, dentists and social workers should be aware of the risk factors for non-regular oral checkups. People who are socially isolated from their families, experience psychological distress or experience financial difficulties should be given particular attention and stimulated to change their oral checkup behavior. This can, for instance, be done by personal conversations at the practice or via personal checkup invitations. When a patient or client mentions any of these psychosocial or financial aspects, red flags should be noticed and stimulating measures (ea. starting a conversation about their oral checkups and inviting for oral checkups) can be taken.

The second implication relates to the Dutch healthcare system, in particular regarding the financing and regulations of oral checkups. As this study shows, experiencing financial difficulties is still the biggest barrier to attending regular oral checkups. This implies that the choice to go for regular oral checkups is still largely determined by one's financial situation. This was not always the case. In 1941, the Dutch Health Insurance Fund was introduced (Kenniscentrum Historie Zorgverzekeraars, 2020). This moment was the start of a major improvement for the Dutch healthcare system: everyone with low-income was obliged to insure themselves for healthcare. Several conditions applied to everyone making use of this insurance scheme. The most important condition in the field of oral health was the obligation to remediate your teeth (go for oral checkups) twice a year at a dentist, to be able to claim the insurance's compensation. The effect of this obligation was that all people had the opportunity to go for regular oral checkups, despite their socioeconomic status or financial situation. This enabled dentists to perform regular cleaning and prevent serious oral consequences for a large portion of the population. Unfortunately, this Health Insurance Fund stopped in 2006.

Present-day, preventive dental checkups and treatments for adults are not covered by basic obliged health insurance in The Netherlands (Rijksoverheid, 2019). Meaning that people have to pay extra for additional insurance or pay dentist bills in cash. This current policy scheme is irreconcilable with the principles of fairness and justice, as it enlarges the socioeconomic gap in health and health behavior. A possible solution could be to include a minimum of one oral checkup per year in the basic insurance package. Initially, this would increase insurance costs and premiums. However, the neglectance of oral health can lead to serious health issues, costing insurance companies (and society as a whole) presumably much more on the long term. We should be aware that it is impossible to change the entire health care system based on a single study. However, this study should set the pace for Dutch health system reforms focusing on removing the financial barrier when making regular oral checkups.

The third implication focusses on future research opportunities. Because situations differ from person to person, qualitative data (ea. interviews) can be of great added value in understanding the relation between SES and oral checkup behavior in future studies. Valuable insights can be acquired when case-specific data is combined with generalized quantitative findings. This way, complex forms of causality regarding material and psychosocial factors can become clearer. We know that, for instance, depression can lead to

poverty, while poverty can also lead to depression (Jin et al., 2020). Understanding these mechanisms is vital for understanding why people do not attend regular oral checkups. By combining qualitative and quantitative research methods, valuable results can be obtained that will help explain socioeconomic oral checkup inequalities in the future.

Conclusions

The relationship between socioeconomic status and oral checkup regularity is mediated by financial difficulties, psychological distress, social support, and social network size. When all mediators were taken into account, social network size (number of close friends and number of close family members) lost its significance. Social support and psychological distress did remain mediating factors. Furthermore, the only material factor, financial difficulties, remained a mediating factor too. The findings indicate that experiencing financial difficulties is of largest influence on the relation between SES and oral checkup regularity. This study provided an explanation for socioeconomic differences in oral checkup regularity and functions as a fundament for policy changes and future research. It calls on professionals to be aware of risk-factors for non-regular oral checkups and provides a solution for reform of the Dutch healthcare system. We suggest a removal of the financial barrier for oral checkups to reduce the socioeconomic inequalities in oral checkup regularity and oral health.

References

Aday, L., & Andersen, R. (1974). A framework for the study of access to medical care. *Health Services Research, 9*, 208-220.

Allgöwer, A., Wardle, J., & Steptoe, A. (2001). Depressive symptoms, social support, and personal health behaviors in young men and women. *Health Psychology, 20*, 223-227. https://doi.org/10.1037/0278-6133.20.3.223

American Psychosocial Association. (2020, March 1). *Socioeconomic status*. Retrieved from Psychology Topics: https://www-apa-org.proxy.library.uu.nl/topics/socioeconomic-status/

Anderson, R. (1995). Revisiting the behavioral model and access to medical care: does it matter. *Journal of Health and Social Behavior, 36*, 1-10.

Anttila, S., Knuuttila, M., Ylöstalo, P., & Joukamaa, M. (2006, March 27). Symptoms of depression and anxiety in relation to dental health behavior and self-perceived dental treatment need. *European Journal of Oral Sciences, 114*, 109-114. https://doi.org/10.1111/j.1600-0722.2006.00334.x

Baker, S. (2009, December). Applying Andersen's behavioural model to oral health: what are the contextual factors shaping perceived oral health outcomes? *Community Dentistry and Oral Epidemiology, 37*, 485-494. https://doi.org/10.1111/j.1600-0528.2009.00495.x

Berkman, L., & Glass, T. (2000). Social Integration, Social Networks, Social Support, and Health. In L. Berkman, & I. Kawachi, *Social Epidemiology* (137-173). New York: Oxford University Press.

Berkman, L., Glass, T., Brisette, I., & Seeman, T. (2000, September). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine, 51*, 843-857. https://doi.org/10.1016/s0277-9536(00)00065-4

CBS. (2011). *Geestelijke ongezondheid in Nederland in kaart gebracht.* Centraal Bureau voor de Statistiek, Den Haag.

CBS. (2018, September 11). *Onderwijs*. Retrieved from De Sociale Staat van Nederland: https://digitaal.scp.nl/ssn2018/onderwijs/

CBS. (2019, March 3). *Bezoek aan tandarts, orthodontist en mondhygiënist 2018*. Retrieved from Maatwerk: https://www.cbs.nl/nl-nl/maatwerk/2019/10/bezoek-aan-tandarts-orthodontist-en-mondhygienist-2018

CBS. (2019, March 7). *Gezondheid en zorggebruik; persoonskenmerken*. Retrieved from

    CBS StatLine:

    https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83005NED/table?ts=1578999531997

Chestnutt, I., Schafer, F., Jacobson, A., & Stephen, K. (1998). The influence of tooth

    brushing frequency and post-brushing rinsing on caries experience in a caries clinical

    trial. *Community Dentistry and Oral Epidemiology, 26*, 406-411.

Devaux, M., & Sassi, F. (2016). Social disparities in hazardous alcohol use: self-report bias

    may lead to incorrect estimates. *European Journal of Public Health, 26*, 129-134.

    https://doi.org/10.1093/eurpub/ckv190

Duijster, D., Oude Groeniger, J., Van der Heijden, G., & Van Lenthe, F. (2018, August).

    Material, behavioural, cultural and psychosocial factors in the explanation of

    socioeconomic inequalities in oral health. *European Journal of Public Health, 28*,

    590-597. https://doi.org/10.1093/eurpub/ckx209

Elstad, J. (1998). The psycho-social perspective on social inequalities in health. *Sociology of*

    Health and Illness, 20, 598-618. https://doi.org/10.1111/1467-9566.00121

Featherstone, J. (1999). Prevention and reversal of dental caries: role of low level fluoride.

    Community Dentistry and Oral Epidemiology, 27, 31-40.

    https://doi.org/10.1111/j.1600-0528.1999.tb01989.x

Freeman, R. (1999). The psychology of dental patient care: Barriers to accessing dental care:

    patient factor. *British Dental Journal, 187*, 141-144.

    https://doi.org/10.1038/sj.bdj.4800224

Gironda, M., Maida, C., Marcus, M., Wang, Y., & Liu, H. (2013, February). Social support

    and dental visits. *The Journal of the American Dental Association, 144*, 188-194.

    https://doi.org/10.1371/journal.pone.0218678

Globe Study. (2015). *Opzet van de Globe Studie*. Summoned on December 2019, from

    Globe-Study: http://www.globe-study.nl/opzet-van-de-globe-studie/?lang=nl

Haefner, D. (1974). The Health Belief Model and Preventive Dental Behavior. *American*

    Journal of Public Health and the Nations Health, 2, 420-432.

Heaney, C., & Isreal, B. (2008). Social networks and social support. In B. K. K. Glanz,

    Health behavior and health education: Theory, research, and practice (189-210). San

    Francisco: Jossey-Bass. https://doi.org/10.1371/journal.pone.0085327

Hjern, A., Grindefjord, M., Sundberg, H., & Rosén, M. (2001). Social inequality in oral health and use of dental care in Sweden. *Community Dentistry and Oral Epidemiology, 29*, 167-174. https://doi.org/10.1034/j.1600-0528.2001.290302.x

Jin, Y., Zhu, D., & He, P. (2020). Social causation or social selection? The longitudinal interrelationship between poverty and depressive symptoms in China. *Social Science & Medicine, 249*. https://doi.org/10.1016/j.socscimed.2020.112848

Kenniscentrum Historie Zorgverzekeraars. (2020). *De ziekenfondsverzekering vanaf 1941*. Retrieved from http://www.kenniscentrumhistoriezorgverzekeraars.nl/bronarchief/geschiedenis/geschiedenis3.html

KNMT. (2019). *Uit: Gezonde mond, gezond lichaam! Literatuuronderzoek naar de relatie tussen mondziekten en andere ziekten.* KNMT, Onderzoek & Informatie. Nieuwegein: KNMT.

KNMT. (2020, April 30). *Controle.* Retrieved from AllesOverHetGebit: https://www.allesoverhetgebit.nl/alles-over-mondgezondheid/behandelingen/controle/

Locker, D. (1993). Measuring social inequality in dental health services research: individual, household and area-based measures. *Community Dental Health, 10*, 139-150.

Locker, D. (2000, June). Deprivation and oral health: a review. *Community Dentistry and Oral Epidemiology, 28*, 161-169. https://doi.org/10.1034/j.1600-0528.2000.280301.x

Lynch, J., Smith, G., Kaplan, G., & House, J. (2000). Income inequality and mortality: importance to health of individual income, psychosocial environment, or material conditions. *BMJ, 320*, 1200-1204. https://doi.org/10.1136/bmj.320.7243.1200

Marcenes, W., Kassebaum, N., Bernabé, E., Flaxman, A., Naghavi, M., Lopez, A., et al. (2013, July). Global burden of oral conditions in 1990-2010: a systematic analysis. *Journal of Dental Research, 92*, 592. https://doi.org/10.1177/0022034513490168

Matsui, D., Yamamoto, T., Nishigaki, M., Miyatani, F., Watanabe, I., Koyama, T., et al. (2016). Validity of self-reported number of teeth and oral health variables. *BMC Oral Health, 17*, 17. https://doi.org/10.1186/s12903-016-0248-2

McKenzie, Neiger, & Thackeray. (2017). *Planning, implementing & evaluating health promotion programs: A primer.* United States: Pearson.

Moor, I., Spallek, J., & Richter, M. (2017). Explaining socioeconomic inequalities in self-rated health: a systematic review of the relative contribution of material, psychosocial and behavioural factors. *J Epidemiol Community Health, 71*, 565-575. https://doi.org/10.1136/jech-2016-20758910.1136

Moore, R., Birn, H., Kirkegaard, E., Brødsgaard, I., & Scheutz, F. (1993, October). Prevalence and characteristics of dental anxiety in Danish adults. *Community Dentistry and Oral Epidemiology, 21*, 292-296. https://doi.org/10.1111/j.16000528.1993.tb00777.x

Münster, E., Zier, Y., Rüger, H., & Letzel, S. (2013). Over-indebtedness, health and social network. In W. Backert, S. Block-Lieb, & J. Niemi, *Contemporary Issues in Consumer Bankruptcy* (163–180). Frankfurt am Main.

Okoro, C., Strine, T., Eke, P., Dhingra, S., & Balluz, L. (2011, August 25). The association between depression and anxiety and use of oral health services and tooth loss. *Community Dentistry and Oral Epidemiology, 40*, 134-144. https://doi.org/10.1111/j.1600-0528.2011.00637.x

Rijksoverheid. (2019, December 29). *Krijg ik tandartskosten vergoed?* Retrieved from Zorgverzekering: https://www.rijksoverheid.nl/onderwerpen/zorgverzekering/vraag-en-antwoord/krijg-ik-tandartskosten-vergoed

Roberts-Thomson, K., Brennan, D., & Spencer, A. (1995). Social inequality in the use and comprehensiveness of dental services. *Australian Journal of Public Health, 19*, 80-85. https://doi.org/10.1111/j.1753-6405.1995.tb00302.x

Sanders, A., Spencer, A., & Slade, G. (2006). Evaluating the role of dental behaviour in oral health inequalities. *Community Dentistry and Oral Epidemiology, 34*, 71-79. https://doi.org/10.1111/j.1600-0528.2006.00261.x

Shankar, A., McMunn, A., Banks, J., & Steptoe, A. (2011). Loneliness, social isolation, and behavioral and biological health indicators in older adults. *Health Psychology, 30*, 377-385. https://doi.org/10.1037/a0022826.

Sisson, K. (2007). Theoretical explanations for social inequalities in oral health. *Community Dentistry and Oral Epidemiology, 35*, 81-88. https://doi.org/10.1111/j.1600-0528.2007.00354.x

Thomson, W., Williams, S., Broadbent, J., Poulton, R., & Locker, D. (2010). Long-term Dental Visiting Patterns and Adult Oral Health. *Journal of Dental Research, 89*, 307-311. https://doi.org/10.1177/0022034509356779

Timiş, T., & Dănilă. (2005). Socioeconomic status and oral health. *The Journal of Preventive Medicine, 13*, 116-121.

Van Lenthe, F.J. et al., (2014). Cohort profile: understanding socioeconomic inequalities in health and health behaviors: the GLOBE study. *Int. J. Epidemiol, 42,* 721-730. https://doi.org/10.1093/ije/dyt040

Van Rijnsoever, M., Tromp, E., Waterlander, W., Schütz, F., & Steenhuis, I. (2012). Verschillen in leefstijl en gezondheid tussen mensen met en zonder schulden. *Tijdschrift voor gezondheidswetenschappen, 89*(1), 43. https://doi.org/10.1007/s12508-011-0017-1

Weyers, S., Dragano, N., Möbus, S., Beck, E., Stang, A., Möhlenkamp, S., et al. (2008). Low socio-economic position is associated with poor social networks and social support: results from the Heinz Nixdorf Recall Study. *International Journal for Equity in Health, 7*(13). https://doi.org/10.1186/1475-9276-7-13

White, K. (2002). *An introduction to the sociology of health and illness.* London: Sage Publications.

Wisløff, T., Vassend, O., & Asmyhr, O. (1995). Dental anxiety, utilisation of dental services, and DMFS status in Norwegian military recruits. *Community Dental Health, 12*(2), 100-103.

World Health Organization. (2003). *World Oral Health Report 2003 - continuous improvement of oral health in the 21st century - the approach of the WHO Global Oral Health Programme.* Geneva, Switzerland: World Health Organization.

World Health Organization. (2018, September 24). *Oral Health*. Summoned on January 2020, from Oral Health - Key Facts: https://www.who.int/news-room/fact-sheets/detail/oral-health

Appendices

Appendix A) Survey questions

The answers to the following questions from the 2014 GLOBE survey were used for this study.

1. Bent u:
- ☐ vrouw
- ☐ man

2. Wat is uw leeftijd ☐☐☐ jaar

5. Wat is uw burgerlijke staat?
- ☐ gehuwd of geregistreerd partnerschap
- ☐ ongehuwd (en nooit gehuwd geweest)
- ☐ gescheiden
- ☐ weduwe/weduwnaar

8. Wilt u voor de genoemde personen aankruisen wat de <u>hoogste</u> opleiding is die hij/zij met een <u>diploma</u> heeft afgerond?

	a. u zelf ⬇	b. uw partner ⬇	c. uw vader ⬇	d. uw moeder ⬇
geen opleiding	☐	☐	☐	☐
lager onderwijs/basisonderwijs	☐	☐	☐	☐
lager beroepsonderwijs (bijv. VMBO, LTS, LHNO, huishoudschool, LEAO)	☐	☐	☐	☐
middelbaar algemeen onderwijs (bijv. LAVO, MULO/MAVO, 3-jaar HBS)	☐	☐	☐	☐
middelbaar beroepsonderwijs, MBO (bijv. MTS, MEAO)	☐	☐	☐	☐
voortgezet algemeen onderwijs (bijv. HAVO, VWO, HBS, MMS)	☐	☐	☐	☐
hoger beroepsonderwijs, HBO (bijv. HTS, HEAO, MO)	☐	☐	☐	☐
wetenschappelijk onderwijs, WO (bijv. universiteit)	☐	☐	☐	☐
anders, namelijk	☐	☐	☐	☐
Niet van toepassing/weet ik niet	☐	☐	☐	☐

12. Welke werksituatie is voor u het meest van toepassing?
- ☐ betaald werk, fulltime (36 uur of meer)
- ☐ betaald werk, parttime
- ☐ betaald werk, op oproepbasis
- ☐ werkloos, werkzoekend
- ☐ anders, namelijk
- ☐ gepensioneerd (AOW, VUT, vroegpensioen)
- ☐ arbeidsongeschikt (WAO, WIA)
- ☐ huisvrouw, huisman
- ☐ scholier, student

15. Deze vragen gaan over hoe u zich in de **afgelopen 4 weken** voelde. Wilt u bij elke vraag aankruisen welk antwoord het best aansluit bij hoe u zich voelde?

	Voortdurend ↓	Meestal ↓	Vaak ↓	Soms ↓	Zelden ↓	Nooit ↓
a. Voelde u zich erg zenuwachtig?	☐	☐	☐	☐	☐	☐
b. Zat u zo in de put dat niets u kon opvrolijken?	☐	☐	☐	☐	☐	☐
c. Voelde u zich kalm en rustig?	☐	☐	☐	☐	☐	☐
d. Voelde u zich erg energiek?	☐	☐	☐	☐	☐	☐
e. Voelde u zich neerslachtig en somber?	☐	☐	☐	☐	☐	☐

18. Wat is voor u meestal de reden om naar de tandarts te gaan?

☐ Regelmatig voor controle
☐ Incidenteel voor controle
☐ Regelmatig voor behandeling
☐ Alleen als er problemen zijn met uw mond, uw gebit en/of uw prothese
☐ U gaat nooit naar de tandarts

36. Met hoeveel familieleden heeft u goed contact, dat wil zeggen familieleden bij wie u zich op uw gemak voelt, met wie u over persoonlijke dingen kan praten, en kan bellen voor hulp? *(uw partner of thuiswonende kinderen niet meerekenen)*

☐ Geen → **gaat u door naar vraag 42**
☐ 1 of 2
☐ 3 tot 5
☐ 6 tot 10
☐ 11 tot 20
☐ Meer dan 20

42. Hoeveel goede vrienden heeft u ongeveer, dat wil zeggen: vrienden bij wie u zich op uw gemak voelt, met wie u over persoonlijke dingen kan praten, en kan bellen voor hulp?

☐ Geen → **gaat u door naar vraag 54**
☐ 1 of 2
☐ 3 tot 5
☐ 6 tot 10
☐ 11 tot 20
☐ Meer dan 20

58. Stel dat u advies of hulp nodig heeft bij één van de volgende onderwerpen, kunt u dan gemakkelijk bij iemand aankloppen?
→ *U mag meerdere antwoorden aankruisen.*

	a. nee ↓	b. familie/ partner ↓	c. vriend ↓	d. collega ↓	e. kennis ↓	f. n.v.t. ↓
a. als u gewicht zou willen verliezen?	☐	☐	☐	☐	☐	☐
b. als u meer zou willen bewegen?	☐	☐	☐	☐	☐	☐
c. als u zou willen stoppen met roken?	☐	☐	☐	☐	☐	☐
d. als u minder alcohol zou willen drinken?	☐	☐	☐	☐	☐	☐
e. als u gezonder zou willen eten?	☐	☐	☐	☐	☐	☐
f. als u medisch advies nodig hebt als u niet tevreden bent met uw dokter?	☐	☐	☐	☐	☐	☐

95. Hebt u in het afgelopen jaar moeite gehad om met het inkomen van uw huishouden uw eten, huur, aflossing, elektriciteitsrekening en dergelijke te betalen?

☐ nee, geen enkele moeite
☐ soms met enige moeite
☐ ja, grote moeite

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Appendix B) SPSS Syntax

* Encoding: UTF-8.

Educationsklassen obv ISCED categorieen maken met: 1 = High; 2 = Middle; 3 = High

RECODE G14v8_opl1 (1 thru 4=3) (5 thru 6=2) (7 thru 8=1) (ELSE=SYSMIS) INTO
Education_ISCED.
VARIABLE LABELS Education_ISCED 'Education ISCED categories'.
value labels Education_ISCED 3 'Low' 2 'Middle' 1 'High'.
EXECUTE.

** Geslacht**

recode G14v1 (1=1) (2=0) (else=sysmis) into Sex.
variable labels Sex 'Sex: reference=men'.
value labels Sex 0 'Men' 1 'Women'.
execute.

Leeftijd

RECODE
  G14v2
  (ELSE=Copy) INTO Age .
VARIABLE LABELS Age 'Age'.
EXECUTE .

** 10-jaars leeftijdscategorieen**

recode G14v2 (25 thru 34=1) (35 thru 44=2) (45 thru 54=3) (55 thru 64=4) (65 thru 75=5)
into Age_groups.
variable labels Age_groups '10 year age groups'.
value labels Age_groups 1 '25-34' 2 '35-44' 3 '45-54' 4 '55-64' 5 '65-75'.
execute.

** Extra dummy variables

recode Education_ISCED (1=1) (2 thru 3=0) into High.
value labels High 0 'Other' 1 'High'.
recode Education_ISCED (1=0) (2=1) (3=0) into Middle.
value labels Middle 0 'Other' 1 'Middle'.
recode Education_ISCED (1 thru 2=0) (3=1) into Low.
value labels Low 0 'Other' 1 'Low'.

** creeren no health support variabele

DATASET ACTIVATE DataSet1.
IF (((G14v58a_a = 1) AND (G14v58b_a = 1) AND (G14v58c_a = 1) AND (G14v58d_a = 1)
AND (G14v58e_a =
    1) AND (G14v58f_a = 1))) NoSupport=1.

EXECUTE.

Inkomen*

recode G14v93 (1 thru 2=4) (3=3) (4=2) (5=1) (ELSE=SYSMIS) into income.
variable labels income 'household income, 4=0-1800, 3=1800-2600, 2=2600-4000, 1=>4000)'.
value labels income 1 'Highest' 2 'midhigh' 3 'midlow' 4'Lowest'.
execute.

recode G14v93 (1 thru 2=4) (3=3) (4=2) (5=1) (ELSE=99) into income9.
variable labels income9 'household income, 4=0-1800, 3=1800-2600, 2=2600-4000, 1=>4000; 99=missing)'.
value labels income9 1 'Highest' 2 'midhigh' 3 'midlow' 4'Lowest' 99 'missing'.
execute.
fre income income9.

ompolen regular checkups

RECODE G14v18 (1=0) (2=1) (3=1) (4=1) (5=1) INTO RegularDentist.
EXECUTE.

ompolen aantal familieleden

RECODE G14v36 (1=1) (2=2) (3=3) (4=3) (5=3) (6=3) INTO FamilyMembers.
EXECUTE.

ompolen aantal vrienden

RECODE G14v42 (1=1) (2=2) (3=3) (4=3) (5=3) (6=3) INTO Friends.
EXECUTE.

Items MI5 ompolen

DATASET ACTIVATE DataSet1.
RECODE G14v15_c (6=0) (5=1) (4=2) (3=3) (2=4) (1=5).
EXECUTE.

RECODE G14v15_d (6=0) (5=1) (4=2) (3=3) (2=4) (1=5).
EXECUTE.

RECODE G14v15_a G14v15_b G14v15_e (6=5) (5=4) (4=3) (3=2) (2=1) (1=0).
EXECUTE.

Score MHI5 berekenen

COMPUTE ScoreMIH5=((G14v15_a) + (G14v15_b) + (G14v15_c) + (G14v15_d) + (G14v15_e)).
EXECUTE.

```
COMPUTE ScoreMIH5x4=(ScoreMIH5 * 4).
EXECUTE.

IF  ((ScoreMIH5x4 < 60)) PsychDistress=1.
EXECUTE.

*82 Cases verwijderd op basis van MIH5*

*crosstabs gemaakt*

DATASET ACTIVATE DataSet1.
CROSSTABS
  /TABLES=G14v1 Age_groups FinDificulties NoSupport Friends FamilyMembers
PsychDistress BY
   Education_ISCED
 /FORMAT=AVALUE TABLES
 /CELLS=COUNT COLUMN
 /COUNT ROUND CELL.

*delete missing cases by sorting descending*

*Weight*

WEIGHT BY Weegfactor.

WEIGHT OFF.

*Somscore social support berekenen*

DATASET ACTIVATE DataSet1.
COMPUTE SomSocialSup=(G14v58a_a + G14v58b_a + G14v58c_a + G14v58d_a +
G14v58e_a + G14v58f_a).
EXECUTE.

*Somscore social support dichotoom maken*

IF  ((SomSocialSup > 1)) SocialSupport1=1.
EXECUTE.

*Ompolen huwelijks status*

RECODE G14v5 (1=1) (2=0) (3=0) (4=0).
EXECUTE.

*ompolen werksituatie*

RECODE G14v12 (1=1) (2=1) (3=1) (10=1) (7=2) (6=2) (4=2) (5=3) (8=4).
EXECUTE.

*Crosstabs maken*
```

```
CROSSTABS
  /TABLES=Sex AgeGroups MaritalStatus WorkStatus RegularCheckup FinDificulties
SocialSupport1
    Friends FamilyMembers PsychDistress BY Education_ISCED
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT COLUMN TOTAL
  /COUNT ROUND CELL.

* Dummy for regular checkup*

RECODE RegularCheckup (1=0) (0=1) INTO RegularCheckup1.
VARIABLE LABELS  RegularCheckup1 'Dummy waar regular is 1'.
EXECUTE.

* stappen voor mediatie berekenen*

LOGISTIC REGRESSION VARIABLES RegularCheckup1
  /METHOD=ENTER Sex
  /CONTRAST (Sex)=Indicator
  /PRINT=CI(95)
  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

LOGISTIC REGRESSION VARIABLES RegularCheckup1
  /METHOD=ENTER MaritalStatus
  /CONTRAST (MaritalStatus)=Indicator(1)
  /PRINT=CI(95)
  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

LOGISTIC REGRESSION VARIABLES RegularCheckup1
  /METHOD=ENTER WorkStatus
  /CONTRAST (WorkStatus)=Indicator(1)
  /PRINT=CI(95)
  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

LOGISTIC REGRESSION VARIABLES RegularCheckup1
  /METHOD=ENTER AgeGroups
  /PRINT=CI(95)
  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

LOGISTIC REGRESSION VARIABLES RegularCheckup1
  /METHOD=ENTER FinDificulties
  /CONTRAST (FinDificulties)=Indicator(1)
  /PRINT=CI(95)
  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

LOGISTIC REGRESSION VARIABLES RegularCheckup1
  /METHOD=ENTER SocialSupport1
  /CONTRAST (SocialSupport1)=Indicator(1)
```

```
/PRINT=CI(95)
/CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

LOGISTIC REGRESSION VARIABLES RegularCheckup1
 /METHOD=ENTER Friends
 /CONTRAST (Friends)=Indicator
 /PRINT=CI(95)
 /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

LOGISTIC REGRESSION VARIABLES RegularCheckup1
 /METHOD=ENTER FamilyMembers
 /CONTRAST (FamilyMembers)=Indicator
 /PRINT=CI(95)
 /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

LOGISTIC REGRESSION VARIABLES RegularCheckup1
 /METHOD=ENTER PsychDistress
 /CONTRAST (PsychDistress)=Indicator(1)
 /PRINT=CI(95)
 /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).
```

Model 1

```
LOGISTIC REGRESSION VARIABLES RegularCheckup
 /METHOD=ENTER Sex Age Education_ISCED
 /CONTRAST (Sex)=Indicator
 /CONTRAST (Education_ISCED)=Indicator(1)
 /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).
```

Model 2

```
LOGISTIC REGRESSION VARIABLES RegularCheckup
 /METHOD=ENTER Sex Age Education_ISCED FinDificulties
 /CONTRAST (Sex)=Indicator
 /CONTRAST (Education_ISCED)=Indicator(1)
 /CONTRAST (FinDificulties)=Indicator(1)
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

Model 3

```
LOGISTIC REGRESSION VARIABLES RegularCheckup
 /METHOD=ENTER Sex Age Education_ISCED SocialSupport1 PsychDistress
   FamilyMembers Friends
 /CONTRAST (Sex)=Indicator
 /CONTRAST (Education_ISCED)=Indicator(1)
 /CONTRAST (SocialSupport1)=Indicator(1)
 /CONTRAST (FamilyMembers)=Indicator
 /CONTRAST (Friends)=Indicator
 /CONTRAST (PsychDistress)=Indicator(1)
```

```
/PRINT=CI(95)
/CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

Model 4

```
DATASET ACTIVATE DataSet1.
LOGISTIC REGRESSION VARIABLES RegularCheckup
 /METHOD=ENTER Sex Age Education_ISCED FinDificulties SocialSupport1
   PsychDistress FamilyMembers Friends
 /CONTRAST (Sex)=Indicator
 /CONTRAST (Education_ISCED)=Indicator(1)
 /CONTRAST (FinDificulties)=Indicator(1)
 /CONTRAST (PsychDistress)=Indicator(1)
 /CONTRAST (FamilyMembers)=Indicator
 /CONTRAST (Friends)=Indicator
 /CONTRAST (SocialSupport1)=Indicator(1)
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```