MASTER THESIS

Adolescents' Perception of the MenACWY Vaccination

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Abstract

Introduction: With the rise of the number of infections caused by the infectious meningococcal disease (IMD) strain W at the end of 2015, an infectious and dangerous disease rose to the attention of the Dutch government. In addition to adding a vaccine in the NIP, a boost campaign was initialized to vaccinate all children aged 14 to 18. This group was chosen, due to containing a relatively high percentage of asymptomatic carriers and the highly social behaviour of this group, which increases the chance of spreading the meningococcal bacteria. The vaccination efforts started in the winter of 2018. However, the initial vaccination rates were lower than the rates of the previous boost campaign in 2002. This might be related to the target audience being studied too little concerning vaccine hesitancy in adolescents. Thus the question that was answered during this study was: *How do adolescents, who have been or are to be vaccinated, perceive the MenACWY-boost vaccination program?* This study aimed at identifying potential facilitators and barriers and asked the adolescents the question how they would improve upon the current boost vaccination campaign.

Method: 36 students aged 14-18 from a single school were interviewed in 6 separate focus groups. The information gained was analysed using the World Health Organisations' Global Vaccine Action Plan's 3-C's model.

Results: The most important facilitators were the parental opinion and health. Other facilitators such as peer-pressure and process had less impact, but were still important. Important barriers were possible side effects and fear for of the vaccine. Students often noted that there was a real fear for side effects. However, students often thought that the side effects were high impact side effects. Concerning information, most students exhibited very limited knowledge of the vaccination, IMD and the information campaign of the Dutch government concerning the vaccination efforts. The main source of information was the invitation letter and the enclosed leaflet. Information spread using social media was overlooked, except for those attending VWO. Concerning the improvements that students would like, there were about changing the ads on social media to increase awareness and changing vaccination locations to lessen the barrier of effort.

Conclusion: The general opinion concerning vaccinations was positive. However, in both the group that received the invitation and the group who had yet to receive the invitation vaccine hesitant behaviour was noticed. This often stemmed from not fully understanding either

vaccinations or IMD and was mostly seen in the MAVO and HAVO students. These students also seemed more prone to believing rumours and misinformation. This study has three recommendations. First, to increase the awareness of the vaccination efforts and IMD; the use of social media influencers might be a useful tool in spreading knowledge and awareness. Secondly, giving the vaccinations to adolescents in the school they attend, in a class by class basis. This would reduce the potential barrier of effort for a minority of adolescents, whilst having no negative impact on other adolescents. Additionally, this could increase the role of peer pressure, which students stated had a mostly positive effect. The third recommendation concerns the information included in the invitation and the leaflet. Adding a subsection on how the vaccine works and what substances are in the vaccine and how this influences the body might prove beneficial for adolescents who fear vaccines.

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List of abbreviations

HAVO – Hoger Algemeen Voortgezet Onderwijs (Senior general secondary education)

HPV – Humane papillomavirus

hSBA - The Serum Bactericidal Antibody assay with human complement

IMD – Invasive Meningococcal Disease

MAVO - Middelbaar Algemeen Voortgezet Onderwijs (Junior general secondary education)

MenA – Neisseria meningitides Serogroup A

MenB - Neisseria meningitides Serogroup B

MenC - Neisseria meningitides Serogroup C

MenW - Neisseria meningitides Serogroup W

MenY - Neisseria meningitides Serogroup Y

MenACWY vaccine- Vaccine against Neisseria meningitidis serogroups A, C, W and Y

NIP – Dutch National Immunization Program

UK – United Kingdom

VWO - Voorbereidend Wetenschappelijk Onderwijs (Pre-university secondary education)

WHO – World Health Organisation

1. Introduction

This study focuses on how adolescents perceive and would improve the MenACWY boost vaccination campaign. This is important, as the number of vaccines aimed at adolescents is increasing and the vaccination rates are decreasing whilst opinions, perception and how to inform adolescents has been investigated little. The introduction starts with a description of the MenW outburst in the Netherlands and a number of disease specific issues and will subsequently describe the importance of high vaccination rates.

1.1 Meningococcal outburst

The Invasive Meningococcal disease (IMD) is quite rare in the Netherlands, with only 73 to 111 infections per year between 2005 and 2011. However, since 2015 a steady increase in the number of infections caused by MenW serotype was noted. This increase was on par with the recent increase in MenW infections in Spain. (Abad & Vázquez, 2016) The MenW serotype is thought to have originated from the UK, where an increase in MenW infections was seen in 2013. (Knol, et al., 2017) The MenW serotype, a hyper-virulent type, caused 30% of all infections with IMD in the UK in 2015. (Knol, et al., 2017) Initially, the increase in infections was

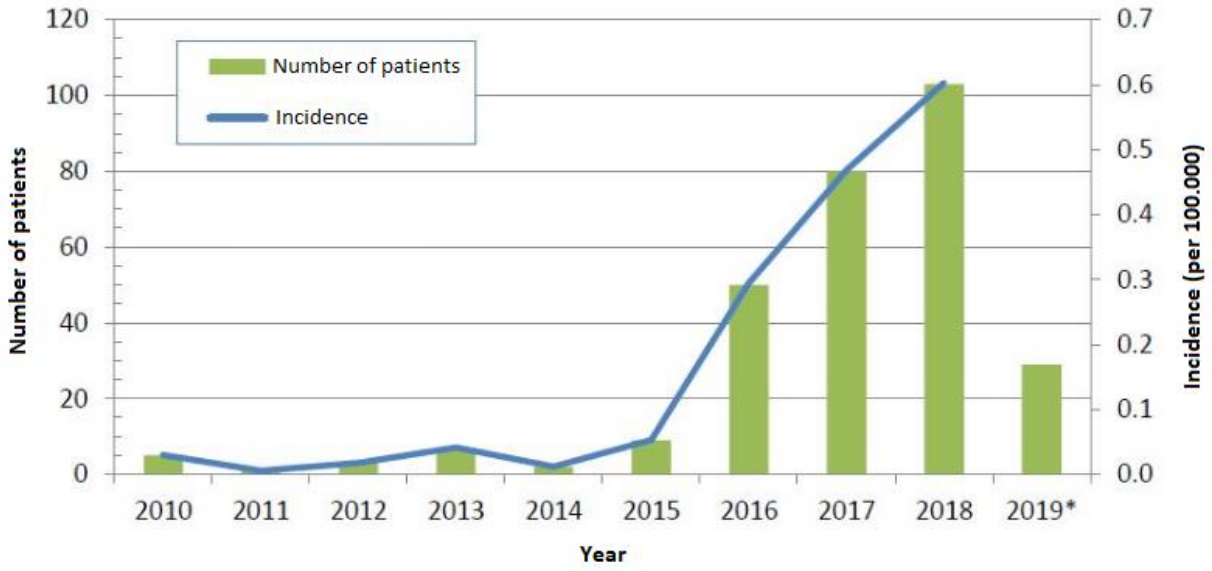

Figure 1. Increase in MenW cases in the Netherlands per 100,000 people. *2019 contains only cases from January until April. (RIVM, 2019)

noticed in patients aged 65 and up. Many of these patients presented with atypical symptoms, such as pneumonia, gastrointestinal complaints and septic arthritis, with a relatively high fatality rate of 12%. (Broad & Snape, 2017) To speed at which the MenW strain spread can be seen in the number of infections in the Netherlands in January 2019, which was already on par with the whole of 2015. (RIVM, 2019) This outbreak is very alike the MenC outbreak from 2002 and the MenW outbreak in the UK, as stated by Knol et al.

In the years before the MenW outburst in the Netherlands, the average number of patients was 4 per year, an incidence rate of 0.01 per 100,000 citizens per year. In the past few years, the number of patients increased steeply; in 2015, 9 patients presented with IMD, 7 of which were seen in the last three months of that year. (Knol, et al., 2017) In 2016 there were 50 patients, 80 in 2017 and 103 in 2018. Until April of 2019, 29 patients have been diagnosed with the MenW serotype of IMD. This increase can also be seen in figure 1**.** Most patients are children under the age of 5 and adolescents aged between 14 and 18. Additionally, for those over the age of 50, the incidence increases with age. Since 2015, 17% of patients who were infected have died from the disease. Mortality is highest in those aged 14-24 years, but occurs in all age groups. (RIVM, 2019)

1.2 Invasive meningococcal disease

IMD is an infectious disease which can cause meningitis and sepsis. The infection is caused by the Neisseria meningitides bacteria, which is classified into different serotypes. Almost all infections are due to one of six serotypes (A, B, C, W, X and Y), but other serotypes do exist. Humans are the only known carrier of these bacteria, which is found in the nasopharynx of 5 to 25% of the population. (Stephens, Greenwood, & Brandtzaeg, 2007) These human carriers are often asymptomatic; thus they will not necessarily fall ill, but will be at risk of infecting others. Infections of the bloodstream and/or the meninges will lead to a quick and serious sickbed. Estimated is that up to 25% of all adolescents are asymptomatic carriers, and only 5-8% of children and elderly are asymptomatic carriers. (Stephens, Greenwood, & Brandtzaeg, 2007) Due to the highly social behaviour of adolescents and high percentage of asymptomatic carriers, adolescents are seen as the most important source as the disease is easily spread in crowded environments. (Bilukha, Rosenstein, & NCID, 2005)

Initial symptoms of IMD are non-specific and will occur between 4 and 6 hours after infection. (Bosis, Mayer, & Esposito, 2015) Patients will subsequently show rapidly declining health, due to the increased severity of meningitis or sepsis or a combination. Typical meningitis signs are a stiff neck and neck cramps. In children under the age of 2 these symptoms are not always visible; this group can have more typical symptoms such as convulsions, drowsiness and decreased appetite. For sepsis, symptoms are mostly equal, with hypotension, fever and drowsiness as the most important initial symptoms. (Gillmore, Stuart, & Andrews, 2000)

In the case of IMD caused by MenW, non-specific symptoms are more common, decreasing the chance of a quick diagnosis, slowing the treatment process. This causes the MenW serotype to have a higher fatality rate than other serotypes. Due to the non-specific nature of the symptoms, treatment is often delayed. Diagnosis is made via liquor and blood cultures, combined with a gram-stain. (Nadel, 2016) The disease can be treated very effectively with antibiotics. Successful treatment is followed by supportive treatment, especially when the infection is combined with sepsis and the bacterium undergoes lysis, thereby releasing endotoxins into the bloodstream. This can increase the chance and severity of a septic shock increasing the chance of multiple organ failure. (Nadel, 2016)

When left untreated, IMD will almost always lead to death. When treated properly, fatality rates are 5-10%, however many patients suffer from residual injuries. (Stoof, et al., 2015) Residual injuries are caused by the meningitis and sepsis. The meningitis and infected brain tissue can lead to swelling and cerebral oedema, which can cause residual damage in case of survival. Residual symptoms can be hearing and vision impairments and neurological and physical disabilities. (Stephens, Greenwood, & Brandtzaeg, 2007) In addition to causing neurological disabilities, sepsis can also lead to amputation, chronic pain and other physical disabilities. Patients who suffered from meningococcal infection induced sepsis often have a decreased quality of life. (Strifler, et al., 2016) Stoof et al. found that residual injuries due to IMD may result in lifelong physical and motor issues in 29% of survivors and severe issues such as amputation and kidney insufficiency in 6%. (Strifler, et al., 2016)

1.3 MenACWY vaccine

The high mortality rate and high chance of residual injuries has led to the Dutch government starting their vaccination efforts against IMD. This occurred in 2002 to combat the

rising number of IMD infections caused by the MenC serotype. The Dutch government added the MenC vaccine to the Dutch National Immunization Program (NIP) for children aged 14 months. Additionally, a boost campaign was started, vaccinating all children between 1 and 18 years of age. This campaign proved effective, as the number of IMD infections decreased steeply in the years that followed. The average number of IMD infections decreased to only 10 per year, whilst this was 300 in 2001. Current incidence rates are less than 0.1 per 100,000, at the peak this was 2.1 per 100,000. (van Lier, et al., 2018) The campaign resulted in high vaccination rates, which led to a quick reduction in transmission and also protected unvaccinated groups (either due to age or choice) due to most people in there surrounding being vaccinated. This is called herd immunity and it refers to protection from infectious diseases due to the prevalence of people within a population who are immune to a disease, either due to vaccination or due to natural immunity. Herd immunity decreases the chance of those being susceptible coming into contact with disease carriers. MenC numbers have remained low ever since the vaccination campaign and the MenC vaccine was integrated into the NIP that same year. Due to the current increase in MenW infections, the Dutch government decided in 2017 to start a boost campaign to vaccinate those most likely to be infected and most likely to spread the bacterium. (van Lier, et al., 2018) Additionally, the MenC vaccination was replaced by the MenACWY vaccine for children aged 14 months. (Gezondheidsraad, 2018)

The current boost campaign focuses on children and adolescents born between January 2001 and May 2018 who have not yet had a MenC or MenACWY vaccination after turning 1. (RIVM, 2019) The boost campaign aims to vaccinate 860.000 recipients. (Knol, et al., 2018) In the autumn of 2018, those born between 1 July 2004 and 31 December 2004 were invited; which accounted for 132.000 possible recipients, of whom 114.000 were vaccinated; a vaccination rate of 86.5%. Vaccination rates did differ across the country; the lowest vaccination rates were seen in the city of Amsterdam, in which only 77% received a vaccination, whilst the highest rates were seen in the province of Drenthe, where 92% received a vaccination. (RIVM, 2019) The average vaccination rate of 86.5% is too low, as it can compromise herd immunity and fail in protecting those at risk who are not eligible, unable or unwilling to be vaccinated. The World Health Organisations' (WHO) Global Vaccine Action Plan states that a 90% vaccination rate should be reached, with a minimum of 80% per administrative district. (WHO, 2013) The rest of the cohort, those born between 1 January 2001 and 1 May 2004, will receive an invitation over the course of 2019.

The new meningococcal vaccine includes the A, C, W and Y serotypes of the meningococcal bacteria. MenB, even though having the highest incidence, is not included in the new MenACWY vaccination. This decision was based on a report of the Health Council, which stated that the MenB vaccine had an uncertain long-term protection and effectiveness and was not cost effective. (Gezondheidsraad, 2018) The UK also utilizes the MenACWY vaccine. They included it in the national vaccination program in 2015, following the MenW outbreak. They too used a boost campaign to directly decrease infections and to achieve herd immunity. The boost campaign has had differing levels of success. In 2015/16 it was 77.2%, in 2016/17 it was at 82.5% and up to August 2018 the uptake was 84.6%. (NHS, 2019)

1.3.1 Safety and effectiveness

Like with many vaccines there is a possibility of side effects, most of which are of little impact. In the case of the MenACWY vaccine, often noted side effects are tenderness and/or pain at the injection site. A study from 2015 with 180 subjects found that 28.3% of adolescents who received a MenACWY vaccine dose presented with these side effects. Other possible side effects are headaches, malaises, chills, fevers and sometimes nausea, which occurred in approximately 2.8% of recipients. (Lalwani, et al., 2015) Another study, that measured side effects in 705 children up to the age of 1, found that approximately 9% of recipients had vaccine related adverse effects within an 86 day timespan. From day 87 until day 422, only 1% showed adverse events related to the vaccine. Side-effects were most common. The most common events were seen within the initial 86 days timespan and were headaches, vomiting and fever. (Johnston, et al., 2016)

According to Johnston et al., recipients are immune when they have “an increase from pre-vaccination hSBA titers <4 to post vaccination hSBA titers ≥8 or at least a 4-fold increase in hSBA titers for subjects with pre-vaccination titers ≥4.” Other studies also use this level of hSBA titers as a measure for immunity. (Lalwani, et al., 2015) (Klein, et al., 2016). There is a difference between receiving a single shot (ACWY1) and receiving two shots (ACWY2), in which ACWY2 seems to offer longer protection. This study also looked at immunization via a booster shot. For the booster shot, 100% of the recipients had an hSBA titers ≥8 1 month post injection, showing its direct effectiveness. Table 1 gives an overview of hSBA titer values, adapted from Klein et al., which gives information on how long the vaccine is deemed protective and in what percentage of the population. (Johnston, et al., 2016)

Table 1. Percentage of MenACWY vaccination recipients with hSBA titer ≥8. ACWY1 is for single shot recipients and ACWY2 is for dual shot recipients(28)

Serotype	Time after injection	ACWY1	ACWY2
MenA	1 month	79.5%	63.3%
	2 months	-	88.4%
	1 year	20.6%	25.9%
	3 years	17.1%	16.7%
MenC	1 month	94.6%	90.6%
	2 months	-	100%
	1 year	87.5%	91.2%
	3 years	70.4%	72.3%
MenW	1 month	50.8%	18.8%
	2 months	-	99.3%
	1 year	89.4%	99.1%
	3 years	62.8%	84.5%
MenY	1 month	56.1%	37.4%
	2 months	-	99.3%
	1 year	80.0%	92.5%
	3 years	62.4%	62.1%

1.4 3C model

As a part of the WHO's Global Vaccine Action Plan, the 3C model was created to increase the understanding about vaccine hesitancy and what factors influence it. The 3C model is used to cluster facilitators and barriers that participants might experience whilst deciding on whether or not to be vaccinated and to better understand vaccine hesitancy. The model was created to better understand and to conceptualize vaccine hesitancy. Vaccine hesitancy is a behavioural term that describes the decision making process and factors that influence individual's decisions concerning acceptance of vaccines. (MacDonald & SAGE, 2015) The 3-C's are Confidence, Complacency and Convenience.

Confidence includes safety and efficacy of vaccines, motivation of the policy makers and reliability and competence of the healthcare services responsible for vaccinating. This means that side effects and how long the vaccine stays protective is of importance. Perception of the motivation of the policy maker is of importance, as trust in the government is not a given. Competence of the healthcare services responsible among others refers to the system that handles and delivers the vaccines. (MacDonald & SAGE, 2015)

Complacency exists when the perceived risks of the preventable disease is low, leading to vaccines being deemed an unnecessary preventive action. A disease which is deemed not serious enough by the target population will lead to lower vaccination rates. This might be of influence if teenagers would be actively vaccinated against the common flue, which is not seen as life threatening for this age group. Other life and health responsibilities can be seen as more important at the time, which can be of influence as well. The impact of not seeing the disease as a threatening occurrence can also stem from individuals weighing the risks of a disease that they are not familiar with versus the perceived risks of the vaccine. Complacency also refers to the influence of possible side effects on vaccine hesitancy, often in the shape of self-perceived risks. (MacDonald & SAGE, 2015)

Convenience concerns factors such as the quality of the service (both real and perceived), timeliness of the vaccination process, a time and place which are deemed convenient and comfortable in the cultural context and concerns availability and accessibility, for the location where the vaccinations are given. Convenience can also be a barrier as some might be unable to understand the appeal of the vaccination, due to low (medical) literacy or the language used to explain the importance of the vaccination. Convenience also includes willingness-to-pay and affordability; however these factors will be of little influence as the MenACWY boost vaccine is free of costs if received during the boost campaign. (MacDonald & SAGE, 2015)

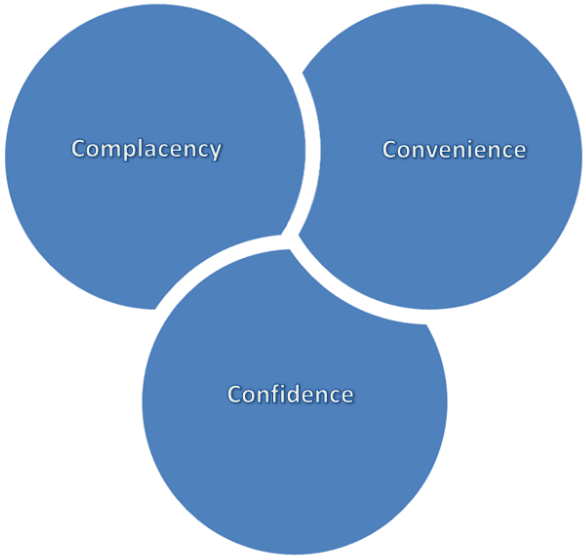

Figure 2. The 3-c model

1.5 Knowledge Gap

The effects of aspects of vaccine hesitancy such as parental opinion and importance of current health state in adolescents are not well established, exposing a knowledge gap. The opinions of adolescents have been analysed, however this has been done mainly for the Humane Papilloma virus (HPV)-vaccine as this is the first vaccine to mainly focus on

adolescents. (Allen, et al., 2010) Other vaccines that are aimed at adolescents and that aim at non-sexual disease have been barely investigated. Studies have been done concerning vaccinations against the common flu; however aspects such as possible side effects and importance of current health state are less important for such a vaccine. (Bhat-Schelbert, et al., 2012) This is important, as a decrease in vaccination rates have been detected, whilst the group that is now being vaccinated has been of little interest. This study aims at closing the knowledge gap and looking at the opinions of adolescents concerning the MenACWY vaccination and MenACWY boost campaign initiated by the Dutch government. The increase in vaccine hesitancy in prior years requires action, because it might be part of a larger trend (Kennedy, 2019) (Gezondheidsraad, 2018) and because the group that is to be vaccinated has historically been of little interest to the scientific community. There have been studies about the HPV vaccine; however, the non-sexual nature of IMD makes it different from the HPV vaccine.

1.6 Research questions

The paper at hand has the goal to compose recommendations as to how the government could improve vaccination rates for the current MenACWY vaccination. In order to give recommendations the following research question will be studied: *How do adolescents, who have been or are to be vaccinated, perceive the MenACWY-boost vaccination program?*

To help answer this question, four sub-questions were drafted. The first sub-question was drafted to get insight into current understanding of adolescents' opinions concerning vaccines a mini review was utilized. With this, the researcher expects to answer the question: *What is known from the scientific literature about the opinion of adolescents concerning vaccinations against non-sexually transmittable diseases?* This should additionally give insight into what the scientific community currently wants to know of this group, not only what their current understanding is.

The second question to be answered is: *Which factors of the 3-C's model do adolescents currently perceive as facilitators and which as barriers in receiving the MenACWY vaccination?* This should help policy makers, as it could create a basis on which the vaccination process could be improved and would reduce the chance of policy makers undermining aspects of the vaccination process that are currently perceived as positive. Decreasing or removing barriers

should be a sure-fire way of improving vaccination rates and improving the opinions of adolescents and increase vaccination rates.

The third question to be answered is: *How do adolescents perceive the information campaign surrounding the MenACWY vaccination?* This question is for all adolescents applicable for the vaccination. This should help policy makers in reaching more adolescents and help in making these adolescents weary of the disease and the risks.

The fourth and final question is: *how would adolescents change the vaccination process and organisation of the MenACWY vaccination boost campaign to increase the vaccination rate of the MenACWY vaccination?* The aim is to find explicit improvements of the vaccination process and the information that the government is spreading as to improve awareness of the MenACWY infection and vaccination.

1.7 Scientific and societal relevance

A reason for the vaccination rate of adolescents being lower than vaccination rates of other populations might lie in a lack of understanding of adolescents' motives and being unable to successfully reach them. Vaccines aimed at adolescents are often part of a boost-campaign, upholding high vaccination rates for a long time was never really a necessity. These vaccines are often influence by media coverage (both positive and negative) and anxiety. (Vandermeulen, et al., 2008)

The main reason to immunize adolescents is, due to the sudden outbreak of a disease, the exception being the HPV virus. (CDC, 2017) However, large parts of these studies focus on the sexually transmittable nature of the HPV virus or are studies that focus solely on either males or females. (Allen, et al., 2010) (Fu, Bonhomme, Cooper, Joseph, & Zimet, 2014) Many studies advice that the adolescent age group should be studied more concerning vaccine hesitancy. (NHS, 2019) (Hilton, Patterson, Smith, Bedford, & Hunt, 2013) (Fu, Bonhomme, Cooper, Joseph, & Zimet, 2014) The aim of this study is to give more insight, not only into the opinions of adolescents concerning the MenACWY boost campaign. It should provide health care professionals and policy makers with extra information and support on how to improve upon the vaccination process and providing information. This goal has a scientific relevance, as it could improve upon the current knowledge surrounding the opinions of adolescents for the MenACWY

vaccine and IMD. More prove is needed to directly connect certain facilitators and barriers to vaccine hesitancy in adolescents, not only for the MenACWY vaccine but vaccine wide. (Maisonneuve, Witteman, Brehaut, Dubé, & Wilson, 2018) (Allen, et al., 2010)

Society would benefit from an increase in vaccination rates in adolescents, as it would be beneficial for herd immunity and public health. Thus, an increase would protect not only those immunized but the general public. In addition to this, the information gained from this research should be suitable for different vaccinations for the same age-group, as the amount of studies that focus on teenagers' understanding of vaccines and vaccine-preventable disease are scarce and mostly focused on HPV. (Hilton, Patterson, Smith, Bedford, & Hunt, 2013) This study should be one of the first studies that focus on the attitude of adolescents towards a number of vaccines and the process of vaccination related topics. The importance of high vaccination rates in the adolescent age group is important due to two main factors. First off is the fact that there are a high number of asymptomatic carriers. This means that adolescents can easily spread the disease, without becoming sick themselves. Approximately 25% of all adolescents are possibly asymptomatic carriers. (Stephens, Greenwood, & Brandtzaeg, 2007) The second factor is that the adolescents group tends to be highly social, increasing the chance of spreading the disease. These factors, when combined with low vaccination rates, can endanger herd immunity.

The next chapter is dedicated to creating a theoretical framework to help analyse the results. This will be done by looking at existing literature in the shape of a mini-review and placing these results into the 3-C model. The chapter after that, the method, will be used to explain how data collection was done, how data was analysed and what the study population and setting are. This will be followed by the chapter results, in which the transcript are analysed and useful quotes are organized, interpreted and used for conclusions. The final chapter will be the discussion and conclusion, which will be used to answer the, then four, remaining sub-questions and the main question. This chapter will also be used to discuss the thesis's weaknesses, strengths, a recommendation for follow-up research and recommendations to increase vaccination rates in the Netherlands for the MenACWY boost vaccine.

2. Theoretical framework

This chapter starts with an exploration of current knowledge concerning the opinion of adolescents with a mini-review. This will be used to answer the first sub question; *what is known from the scientific literature about the opinion of adolescents concerning vaccinations against non-sexually transmittable diseases?* The outcomes of the mini-review will be placed in the 3-C's framework categories. These 3-C's consist of confidence, complacency and convenience. Each of these terms will be elaborated upon to derive a hypothesis of what are expected to be barriers or facilitators for the decision adolescents make concerning the MenACWY vaccination.

2.1 Mini review

To find out what questions are important to be asked during the focus groups, it is first important to find information concerning questions that are already answered, questions that need to be expanded on and questions that are not yet answered. This is to further investigate the knowledge gap. The question to be answered from the mini-review is: *What is known from the scientific literature about the opinion of adolescents concerning vaccinations against non-sexual transmittable diseases?* To answer this, a mini-review as described by Griffiths was performed. (Griffiths, 2002) The search for literature was done using PubMed, Scopus and Web of Science.

2.1.1 Inclusion criteria

The inclusion criteria were set up so articles were of relevance and to give more insight into the current knowledge of the opinion of adolescents and vaccinations. Three inclusion criteria were maintained. First off, articles should not be older than 12 years. This was chosen to increase relevance and to uphold with the changing believes and accessibility of adolescents (i.e. increased social media usage). Secondly, the subjects should be about the combination of vaccinations and adolescents. This was chosen, due to the low number of studies focussing solely on adolescents; many studies combine studying opinions of adolescents and (their) parents. Thirdly, the outcomes of these studies must explain what facilitators or barriers were found that influence the vaccination uptake or reasons that could influence the uptake, acceptance or intentions.

2.1.2 Exclusion criteria

The exclusion criteria were set-up so only relevant studies were used. Firstly, all studies that did not focus on adolescents were excluded. Secondly, studies that focussed on the HPV vaccine were excluded. This was decided, due to the high focus these articles put on the sexual transferability of the HPV infection, which is a strong influencer of opinions around HPV vaccines. (Fu, Bonhomme, Cooper, Joseph, & Zimet, 2014) Thirdly, studies in non-western countries were excluded, due to cultural differences and due to distance and costs are of importance in non-western countries. Finally, articles of which the main text was not available were excluded.

2.1.3 Search Strategies

The main objective of the search strategy was to identify useful published articles. Databases used were PubMed, Scopus and Web of Science. Databases all gave differing number of results; Scopus 92 results, Pubmed 85 and Web of Science 38, adding up to a total of 215 titles that were screened. Of these articles, 38 were selected on title of which 12 were double. After reading abstracts and applying inclusion and exclusion criteria, 3 articles were selected for the review. The process can be found in Figure 3. The aim of each study and determinants on vaccine hesitancy in adolescents can be seen in table 2

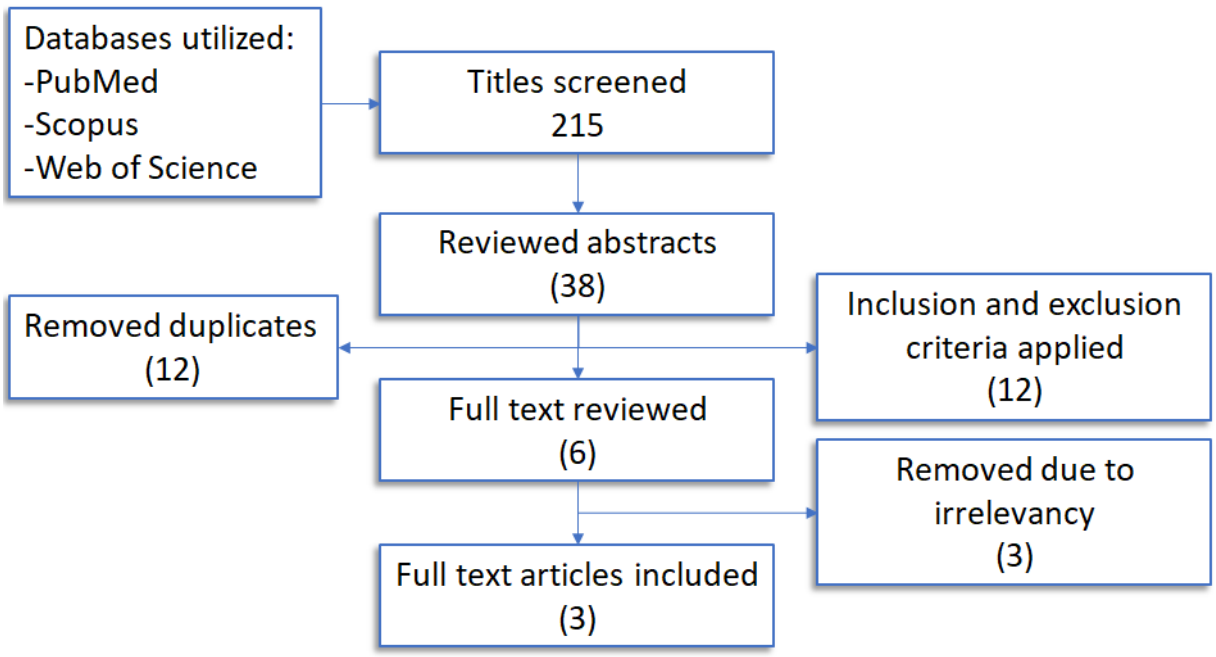

Figure 3. Flowchart of the selected articles

Table 2. Overview of the selected studies

Title (author, year)	Study design	Aim of the study	Determinants on vaccine hesitancy in adolescents
Community, parental and adolescent awareness and knowledge of meningococcal disease. (Wang, Clarke, & Marshall, 2014)	Survey 3055 participants 15.9% between 15-24	To assess knowledge of invasive IMD and concern about the disease in the South Australian Community including adolescents, adults, parents and non-parents.	-Adolescents had lower knowledge of IMD in comparison with non-adolescents -Information should be relevant to what adolescents want to and need to know -Information about IMD should be provided in a variety of languages to assist migrants who may originate from countries with lower incidence of IMD.
Immunizing adolescents: a selected review of recent literature and US recommendations. (Schneyer, Yang, & Bocchini, 2015)	Review of current literature	To provide a clinically relevant synopsis of the latest research and recommendations regarding adolescent immunizations	-Using recall or reminder systems can be an effective strategy in decreasing vaccine hesitancy -Receiving mailed or telephoned reminders had greater immunization rates -Adding educational text to reminders improved immunization rates
Vaccination coverage in 14-year old adolescents: documentation, timeliness, and socio-demographic determinants. (Vandermeulen, et al., 2008)	Survey 1500 individuals HBV, MMR and MenC	To report on vaccination coverage, timeliness of recommended vaccinations and socio-demographic factors which were associated with non-immunization or partial immunization. To give under-standing of adolescent for vaccinations intended for this age group	-General/technical students had higher uptake than those in vocational training -Normal students showed higher uptakes than those who repeated 1 year or followed special education - School based immunization: Higher attendance compared to primary care vaccination - Compliance is enhanced through peer pressure at school

2.1.4 Articles quality and setting

The study by Vandermeulen et al. was a quantitative study set in Belgium. Adolescents aged 14 completed questionnaires on sociodemographic and related factors. The aim of the study was to measure coverage and factors that influence the coverage, which was clearly defined in both the abstract and the introduction. The study population was specific and was selected using a WHO clustering sampling design. Of the 1500 adolescents invited to participate, 1344 agreed to participate. This includes 210 adolescents who were invited as replacements, of which the selection method is not mentioned. Inclusion and exclusion criteria were mentioned for neither the initial nor the replacement group.

All interviewees and their parents were aware of the aims of the study, and as such may have checked what the vaccination status of their children at the time was. This may have influenced the main measure used, to assess vaccination rates; ability to show written proof of vaccination data. In this case, exposure to the study might have influenced the outcome. As the vaccinations measured are given at ages 10, 12 and 14 most variables are timely, one of these variables is civil status of the parents which can change quite quickly. All variables were initially assessed separately and were later used to create a logistic regression model. Distinct conclusions are given for the determinants which had a significant impact on vaccination rates, together with an overall conclusion that follows the general trend of the article.

The study by Schneyer et al. was a review with the goal to provide a clinically relevant synopsis of the latest research and recommendations regarding adolescent immunizations. This study was not as much as a review of articles, as it was of a review of the adolescent immunization for a number of different vaccines. It does not follow a specific design, and as such is difficult to assess using standard assessment tools.

The study is structured in such a way that multiple aspects are discussed. The study covers new information on Tdap MenB, HPV and strategies to improve adolescent vaccination rates. Sources are sometimes marked as being of special interest or of outstanding interest. Conclusions from different articles are used to strengthen conclusions and outcomes of other articles, with which this article shows that multiple researchers found the same results or support the outcomes of a different paper.

The final study, by Wang et al. was a quantitative study set in Australia. In this study both adolescents and adults were asked to complete a questionnaire on IMD. The objective of this

study was to assess knowledge of the IMD. Of the total of 5200 randomly selected households, 3055 participants filled in the survey, of which 487 were adolescents (15.9%). A reason for the size of the cohort was not given.

A number of socioeconomic variables were explored, many had a number of possible outcomes (such as people per household) whilst for others it was a simple yes or no (parental status). Both exposure and outcome variables were clearly defined. Each of the predictors were stratified in into separate tables in which all possible exposure variables were shown. Univariate and multiple logistic regression analyses were utilized to test association between predictors and outcome measures and were, when $p \leq 0.20$, included in a multivariate logistic model.

The studies by Wang et al. and by Vandermeulen et al. were assessed using a quality assessment tool of the national Heart Long and Blood institute. (National Heart, Lung, and Blood Institute) The articles were found to be of acceptable quality to be used in the mini-review and the assessment tool used can be found in Appendix A

2.1.5 Mini review conclusion

The number of studies that focus solely on adolescents and what they see as facilitators and barriers for vaccinations is quite limited and articles that write about the subject often conclude that the amount of knowledge on the subject is lacking. (NHS, 2019) (Hilton, Patterson, Smith, Bedford, & Hunt, 2013) (Holman, et al., 2014) This led to the articles by Wang et al. also being included, even though the majority of participants were adults. The article was published in Vaccine in 2014. A significant portion of the participants was in the adolescents age group (n=487), and was analysed as a subgroup. The article found that there were adolescents that had a much lower understanding of IMD compared to adults, which the researchers linked to a lower vaccination rate for adolescent focussed vaccines. To give extra information to adolescents, relevant information is required with which they can connect. In addition to this, Wang et al. found that those not born in Australia had an even lower understanding of the disease compared to natives. Concern of a meningococcal infection, although not statistically significant, was lowest for the adolescents age group.

The article by Schneyer et al. was a review of recent literature focussing on adolescents. The article was published in Current Opinions in Pediatrics in 2015. The article gave a few recommendations on improving vaccination rates in adolescents. For process improvements, they concluded that using a recall/reminder system, for patients who missed a vaccination

improved vaccination rates. Best system for reminders was by email, which increased uptake by 21% and telephonic reminders trough text messages increased vaccination rates by 17%. In addition to this, Schneyer et al. showed that adding information about the time and date of the vaccine, information on the clinic and information on the need of a second dose had a higher vaccination rate for the second dose (72.7% vs. 66.7%). In addition to this, they found that addressing missed opportunities or skipped vaccinations during visits to general practitioners increased vaccination rates from 73% to 80% in adolescents. The use of social media to spread information as a way to improve vaccination rates was also investigated. It was found that utilizing Public service announcements, a webinar and a website with links to credible resources increased vaccination rates significantly.

The final article was by Vandermeulen et al. and measured determinants that influenced vaccination rates through a survey. The article was published in Pediatrics in 2008, which. A number of socio-demographic factors were found. The parents and adolescents having a lower socioeconomic status showed correlation with lower vaccination rates. They found that this was likely due to a lack of knowledge of both the disease and the vaccine, lower language skills leading to not understanding the information provided by healthcare services and schools, and missing the time to review the given information. From the results of the survey they also found that families who had more urgent priorities than vaccinations, such as financial, relational, and educational, showed lower vaccination rates. Vandermeulen et al. stated that additional support for those families should have a positive impact on vaccination rates. They also found having the vaccinations take place at schools boosted vaccination rates. They allocated this to higher convenience of the vaccination and due to peer pressure.

The articles had a different approach, but in every article it became clear that there are many factors that influence vaccination rates. All articles found that information was a limiting factor that could be improved upon. All articles had something in the line of: adolescents that have a lower understanding or less knowledge of a vaccine preventable disease were generally less up to date with their vaccines. A shared conclusion is that knowledge of the opinions of adolescents concerning vaccines is still lacking.

The sub-question to be answered is *what is known from the scientific literature about the opinion of adolescents concerning vaccinations against non-sexual transmittable diseases.* The literature study showed that the current knowledge about the opinions of adolescents concerning vaccinations against non-sexual transmittable diseases is available but it would be

wise to expand upon the currently known barriers and facilitators. There was literature available on a number of the factors from the 3-C's model; the study from Vandermeulen et al. showed that vaccine hesitancy due to convenience could be decreased through school based immunization. This study also found that higher educated students had higher vaccination rates, which might be linked to a better ability to understand, which is a factor integrated in the complacency component. The study by Schneyer et al. also stated that information should be relevant to what adolescents would like to know. These facilitators and barriers will be further expanded upon and sorted into the 3-C's model in the next section.

2.2 Theoretical determinants

Not accepting or having a delayed reaction to vaccinations is considered to be vaccine hesitancy. The official definition of vaccine hesitancy is: "to delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as complacency, convenience and confidence." (MacDonald & SAGE, 2015) These last factors are combined in the 3-C's model, from the WHO EURO vaccine Communicates Working Group.

2.2.1 Confidence

The perceived risks come from short term side effects, such as fevers and pain at injection site. (Lalwani, et al., 2015) However, some see the possibility that the vaccination causes long term harm such as autism or the disease itself. The perception of these risks can influence recipients into declining a vaccination. This irrational approach can be influenced by triggers from media or friends and family. This increased risk perception is often based on uncertainty and ambiguities, which are difficult to undermine with a rational approach based on empirical evidence. (Vandermeulen, et al., 2008) (Wang, Clarke, & Marshall, 2014) Risk perception is also usable, as the disease in question is severe. Those who are prone to making more rational decisions, were more likely to see the benefits of vaccinating against a disease. However, this group often have found differing results from non-peer reviewed sources.

2.2.2 Complacency

The increase in complacency likely stems from vaccine preventable diseases often being of very little danger to individuals and from the unfamiliarity of the disease. Many were eager to

vaccinate against these diseases due to the high number of cases and seriousness of the disease. Due to the success of vaccines, for many individuals being vaccinated against such an (now) uncommon disease is now of less importance. (GGD Hart voor Brabant, 2019) This is truer for adolescents, who already seem to have less knowledge about vaccine preventable diseases. (Hilton, Patterson, Smith, Bedford, & Hunt, 2013) (Wang, Clarke, & Marshall, 2014) This might be different for meningococcal infections, as this disease was already quite rare, making the perceived risk of being infected with the disease is seen as lower. And the seriousness of a meningococcal infection is often underestimated by adolescents. (Hilton, Patterson, Smith, Bedford, & Hunt, 2013) (Wang, Clarke, & Marshall, 2014)

2.2.3 Convenience

The facilitating factors in the Dutch context are affordability and quality of the healthcare service. The affordability is due to these vaccines being free during the boost campaign, which lowers the threshold for being vaccinated. This factor would, however, not influence adolescents as much as it would parents, seeing how they are the ones paying for the vaccine. Quality of the Dutch healthcare system would be a facilitating factor as well, as it is perceived as one of the best systems in the world. (GBD 2016 Healthcare Access and Quality Collaborators, 2018)

Factors that will possibly be seen as barriers are ability to understand and the vaccine being delivered in a convenient and comfortable manner. Ability to understand will more often be a barrier for both parents and adolescents with a lower level of education than for those with a higher level of education. (Vandermeulen, et al., 2008) (Holman, et al., 2014) This will mean that those with a lower education will have more difficulty to understand what the disease is and why it should be vaccinated against, leading to disinterested behaviour. (Holman, et al., 2014)

The other barrier of convenient and comfortable delivery is likely negative due to the setting. (Vandermeulen, et al., 2008) These boost campaign vaccinations are often given in locations which are able to handle large numbers of people such as gymnasiums or exhibition halls. (GGD Hart voor Brabant, 2019) (GGD West-Brabant, 2019) (GGD Utrecht, 2018) This requires adolescents to go to a different location to receive a vaccination, thus having to go through more trouble to receive the vaccination. However, these adolescents are often already clustered in location that can handle high numbers of people: schools. There is also a group which would rather receive the vaccination in a GP's office, due to anxiety or the want for more information. (Pelullo, Napolitano, & Di Giuseppe, 2018)

3. Method

This chapter will describe the method used in this study. The study design, population sample and sample size and data collection will be explained. Additionally, information about ethical considerations and data analysis will be discussed

3.1 Study Design

A qualitative research design was used, as it gives participants the chance to explain and expand upon certain statements and the study was observational with a prospective nature. This was seen as optimal as it gives better understanding of the decision-making process of adolescents and gives them a platform were they can pitch ideas to improve, and find additional facilitators and barriers. The focus group design used should make it easier to discuss ideas. The goal of the focus group interviews was to get an answer to the residual sub-questions. These sub-questions were the questions about what are seen as facilitators and barriers by adolescents concerning the factors of the 3-C's model, how adolescents perceive the information campaign and how would adolescents change the vaccination process and thereby increase vaccination rates.

3.2 Study Population

The study focusses on students from the three different types of high school education the Netherlands has. This being VWO[1], HAVO[2] and MAVO[3]. The three levels of education are important to the study, as it can be a predictive value (Vandermeulen, et al., 2008). VWO is the highest level of secondary education and gives access to research universities, HAVO is the second level of secondary education and gives access to universities of applied science, and VMBO/MAVO gives access to vocational education. Each type of education had separate focus

[1] Pre-university secondary education

[2] Senior general secondary edcuation

[3] Junior general secondary education

groups, as each level of education might have different opinions concerning the questions. (Kennedy, 2019)

Two focus group sessions were held per education level, with each group containing 6 students. All 36 students were selected on a voluntary basis by the teachers of the classes. Age of students was between 14 and 18 years. All students attended the same high school in the province of Gelderland. The school contained all levels from MAVO to VWO and from years 1 to 6 and schooled about 1400 children. Students, who during the interview had objections or had other issues with the group or the subject, were asked if they would like to continue or stop. If one (or more) student(s) preferred to opt out, the focus group would continue with fewer members.

3.3 Study Setting

The interviews took place in classrooms of the selected school. This was chosen as it provided students with a familiar environment. To improve motivation of the students, data collection took place during school hours, as before school would be too early and after school might be seen as bothersome by students. Students were asked at the start of the interview to write down their first names and age. The pens used for this, were given to the students. A voice recorder was used to record the interviews. The interviews took place in a small conference room in the middle of the schools. Students sat in a circle at a table, and the researcher sat with them. The interview started with the researcher giving some general information about the disease and the vaccination program. This information was mainly to give students a grip on what the focus group was about as few had actually heard of either the disease or the vaccination program. Some questions from students that would not directly influence opinions were answered directly, whilst questions that might influence opinions were answered at the end of the interview. The questions, as can be seen in appendix B and C were asked directly afterwards. The order in which these questions were asked were not set in stone, only the first questions, *"Are you familiar with the information campaign of the government concerning the Meningococcal infection?"* followed by the question "*What information did you find or search for",* if the first question was answered with yes, and *"Why would you start looking for information?"* The rest of the questions were asked to follow the flow of the conversation; if students started talking about barriers or improvements questions surrounding these topics

were asked. During the questions about the information campaign, printed versions of the homepages of deelditnietmetjevrienden.nl and RIVM.nl were handed out. These prints can be found in appendix D and E.

3.4 Data Collection

The data was collected using semi structured focus group interviews. A focus group is seen as a technique which uses in-depth group interviews to focus a group on a given topic. (Rabiee, 2004) A distinct feature of the focus-group interview is the involvement of group dynamics, giving deeper and richer information than that obtained in a one-on-one interview. Participants are not necessarily representative of a specific population. (Thomas, MacMillan, McColl, Hale, & Bond, 1995) Important is that the subjects had opinions that were applicable to their peers, for that reason multiple levels of education were chosen. This is the only variable seen as being a possible confounding factor within the research.

With focus groups, large amounts of information can be generated in relative short periods of time. And, like in one-on-one interviews, results can be presented in uncomplicated ways, by using direct quotes and lay terms used by participants should. The data generated will also be based on group interactions. Students from these groups are all acquainted with one another, which increases the possibility of participants challenging the views of one another and can relate more to the views of other participants. (Rabiee, 2004) It does have some limitations, as it is stated to decrease the chance of more spontaneous and honest answers and answers have to be supported by the majority of the group. (Kreuger & Casey, 2000) In addition to this, answers are based on consensus from the group, if 5 out of 6 students say yes than the consensus is yes; the opinion of the person who said no will be weighted less as the average opinion is yes. If one or two students have a differing opinion than is the trend, these opinions will likely not be used.

The groups of six were chosen, as many articles state that the optimal number of participants is between six and ten. (Kreuger & Casey, 2000) The lower of the two was chosen, due to the lack of experience from the researcher. The relatively low number of participants makes them more manageable, better to keep track of and better to observe participants. The lower number of participants also means that those with lower self-esteem and a lack of confidence plays a smaller role for those who coping with these issues. (Rabiee, 2004) The

number of focus groups used should help with finding clear patterns, for this purpose and for the purpose of this study the number of focus groups might be overstated. The article by Kreuger & Casey suggested that for a simple research question only three or four focus groups are necessary. However, this study includes three different groups of people whose opinions (and especially different opinions) have been discussed very little, and thus the possibility arises that each group might have vastly different opinions and solutions concerning the same subject.

3.5 Data Analysis

Focus group interviews were all transcribed using Atlas.ti 8.1 build in transcribing tool. Atlas.ti was chosen as it is an easy to use program which helps with organizing and analysing the transcriptions. A transcribing and analysing tool helps with systematically, sequentially and verifiably analysing the transcripts, and gives the ability to use the same coding across multiple transcripts.

The transcripts were analysed in a line by line manner. Every line was analysed firstly as an independent statement and then to see how it would fit in with the surrounding text. All statements were then placed into one or more of the corresponding groups. As the 3-C's model contains aspects which can be seen as both facilitators and barriers, corresponding groups were created to support this. These groups were: Barriers and Facilitators. Additionally another group was created to support the questions surrounding information; this group was called Information. Finally for quotes that did not fit in either category, the "Other" group was created. These groups were then split up into a number of codes. This led to the Barriers group being split into 6 different codes, Facilitators into 6, Information into 3 and Others into 3. This led to a total of 18 codes being used throughout the transcripts. Due to the broad nature of the 3-C's model 21 different codes were used to examine quotes. The codes, code-groups can be found in appendix F. The 3-C's model was chosen as it is suitable model to structure information gained via the focus group interviews.

Each quote was divided into a group in which it fit best, some quotes fit multiple possible uses and were assigned multiple codes. The Barriers group consisted out of everything which was seen as a barrier or which was seen as a possible barrier. Answers and discussions that were about reasons for not participating in the vaccination program or that could be seen as reasons to not be vaccinated were put into this group.

The Facilitators group consisted out of everything which was seen as a facilitator or a possible facilitator. These codes were subsequently divided into different codes as to order them. Additionally, answers and discussions that were about reasons for participating in the vaccination program or that could be seen as reasons to be vaccinated were put into this group.

In both Barriers and Facilitators, the codes Parental, Peer pressure, Fear and Side effects occur. These came from both the questions and from the discussions within the focus groups. The Information group consisted out of everything which related to information. This contained the want for information, the sources of information and if information was seen as sufficient.

There were many different quotes concerning information, which were subsequently divided into 3 code-groups. The first code-group was about the information students would want, and was named “Information want”. These statements were about what are the possible side effects, the disease, the vaccine and the timeliness of the vaccine. The second code was about the information source. In this code, quotes concerning where students found their information, where they would find their information and how they would look for this information. The third code was Sufficient. This was used when students found information in the invitation letter or information that they found sufficient enough to stop or not search further. The codes used in each of the code-groups do not necessarily link to specific factor of the 3’c-model; the codes were created to increase consistency in how each quote was specified. In the results section, quotes will be identifiable from there quote ID, which will be behind the quotes.

3.6 Ethical Approval

The study was approved by the ethical committee, affiliated with the faculty of Behavioural, Management and Social sciences of the University of Twente. The application can be found under application number 190240.

Informed consent was asked for and given by each participant at the start of the focus group interviews. Parental informed consent was asked per e-mail. In this e-mail, consent was also asked for a questionnaire that targeted a similar population. Information was given about the interview, for what sort of study it would be used and that it would be recorded.

4. Results

In this chapter, quotes will be analysed, interpreted and used to answer the sub-questions. The codes will be used to analyse each of the different aspects of the 3-C's model and how these fit in the results. The results will be used to interpret aspects that are facilitators or barriers of the 3-C's model. The goal of this is to answer the second sub-question *what factors of the 3c model do adolescents currently perceive as facilitators and which do they currently perceive as barriers in receiving the MenACWY vaccination?"* Following this, the third sub-question; "*how do adolescents perceive the information campaign surrounding the MenACWY vaccination?"* will be answered. Finally the fourth sub-question "*how would adolescents change the vaccination process to increase the vaccination rate of the MenACWY vaccination?*" will be answered. The number of quotes per focus group and code are shown in tables 3 and appendix G, H and I. Table 3 shows the average age, education, number of quotes and number of times a certain code was used. The total number of quotes is often lower than the total number of codes, due to some quotes fitting into multiple codes.

Table 3. Group demographics and number of quotes per code group and per focus group.

Group	Age	Level	Quotes	Facilitators	Barriers	Info	Other
Group 1	16.2	MAVO 4	60	11	13	30	14
Group 2	15.3	VWO 4	67	14	13	19	24
Group 3	14.5	MAVO 3	42	12	11	21	5
Group 4	16.2	HAVO 4	67	19	17	29	17
Group 5	15.7	HAVO 4	47	7	13	22	14
Group 6	16.8	VWO 5	79	25	20	38	22
Average	15.8	-	56.8	14.7	14.5	26.5	16

4.1 Facilitators and Barriers in receiving the MenACWY vaccination

In this chapter, the second sub-question "*what factors of the 3c model do adolescents currently perceive as facilitators and which do they currently perceive as barriers in receiving the MenACWY vaccination?"* will be answered. Each of the 3-C components, confidence, complacency and convenience, will be analysed separately by looking at the students' opinions which are subsequently interpreted. This will be finished with a conclusion as to what components of the 3-C's models are seen as facilitators and which are seen as barriers.

4.1.1 Students' perception on Confidence

Confidence as a factor that increased vaccine hesitancy was often directed onto the vaccine itself, the substances within the vaccine and possible side effects. Three quotes, from three different focus groups were directed towards the substances within the vaccines. A student from MAVO-3 stated that "*not knowing what was inside the vaccine*" (3:31) was a barrier, which was directly supported by 2 other students from that same group. A Student Havo-4 stated that "*The fact that part of the disease is injected, (…), would be a reason for me to not take the vaccine.*" (5:24) From that same group, another student noted that a friend of her stopped believing that vaccines are effective, when she was diagnosed with cervical cancer, even though she received the HPV-vaccine. From the MAVO-4 group, one student stated that "*Some might refuse the vaccine because of certain substances they do not want in their body.*" (1:23)

Reasons were also stated in which effectiveness and safety was seen as a facilitator instead of as a barrier, thus decreasing vaccine hesitancy. This was often the case due to low chance of side effects or the seriousness of the disease. Looking at side effects, both the seriousness of the disease and the side effects were important for them to count as a barrier. With one of the students MAVO-4 stating that "*If the side effects were extreme I wouldn't take the vaccine."(1:14)* and a student from MAVO-3 stating that: "*As long as the side effects aren't worse than the disease.*"(3:16) A student from VWO-4 said that "*even if the side effects are bad, it's better that 1 in 5000 have issues with side effects than everyone dying due to not being vaccinated.*"(2:28) And possible side effects were even seen as a positive thing by a few students, with another student from VWO-4 saying that "*I'd rather have a small flue, so I don't have to go to school.*"(2.18) The effectiveness of the vaccine, which made it subsequently more difficult to spread the disease, was also seen as a reason for being vaccinated. A number of

students said that this was an important reason for them; with a student from HAVO-4 saying "*That some might not be vaccinated due to medical reasons, and you'd be protecting them by vaccinating yourself*"(2.17), and a different student from HAVO-4 saying "*that if you're not vaccinated you'll be a danger to others, because even those who were vaccinated might still fall ill.*"(2.16) Another reason that decreased vaccine hesitancy was trust in the government and policy makers, which was only expressed by the HAVO-4 and both the VWO groups. A Student from Havo-4 said "*The fact that the government says it is necessary, is a reason for me to be vaccinated. I don't think they would do it if it wouldn't be necessary.*"(5.22) In VWO-5 one student said "*They inject something into your arm, which is probably good for you and the society, (…). So I have trust in it.*"(6.9) This was supported by multiple students in that group.

In conclusion, side effects have the largest negative influence on vaccine hesitancy, especially if not conveyed properly. The severity of side effects seem mostly unknown to the students, leading them to think of worst case scenarios as being plausible. The only students who had an idea of what side effects could occur were those in the VWO-5 group. Other students stated that any knowledge they had surrounding the side effects came from the information which came with the invitation. Another issue that was often heard and which contributed to vaccine hesitancy was fear for the substances within the vaccine. This was heard in 4 different groups as being something students who had no real knowledge about vaccines had difficulty with. This was both fear of chemicals in the vaccine and due to the fact that the disease is injected. Students who conveyed these ideas often sparked something of a discussion, giving them the time and place to convey these thoughts. The only groups that had no issues with these were the MAVO-3 and the VWO-5 groups.

The least barriers were mentioned by VWO-5 and the MAVO-3 groups. However, this was due to largely different reasons. The VWO-5 group seemed to have more trust in the vaccine and acceptance of the government, whilst the MAVO-3 group had no grasp of how and what vaccines really were, which is supported by the literature (Vandermeulen, et al., 2008) (Wang, Clarke, & Marshall, 2014). The effectiveness and safety as a factor for vaccine hesitancy seem to spring from a lack of understanding and/or ignorance, and was seen most prominently in the younger and lower educated groups. Important is the quote from student VWO5:3 who noted that "*ignorance of what it is*" (6.37), with it being the vaccine, could be a barrier for some. Especially in the VWO-5 group there was a lot of trust in the government and their decision.

This was also noticeable in the other VWO group and one HAVO group, but this degree of trust was not present in any other group.

4.1.2 Students' perception on Complacency

Complacency as a factor for increasing vaccine hesitancy was often due to seeing other health and life responsibilities as more important. Some students noted that the vaccine preventable disease was seen as low impact and in very few cases were vaccines not deemed necessary preventive action. Other health responsibilities were a possible issue for a number of students, however these came mostly from scenario's in which students would see them be influenced by certain believes or pieces of information. A student from MAVO-4 noted that some "*may refuse a vaccine because of certain substances within the vaccine, which are against their religious believes.*"(1.23) A student from VWO-5 noted this as well, however did state that this would only be an issue with "extremist groups". Concerning other vaccine hesitancy increasing statements, a student from VWO-4 noted that "*there are groups who believe diseases are a part of life.*"(2.26) Fear was not seen as a real issue, with student VWO-5:1 saying that "*People will overcome their fear of needles when their and others health is at stake.* (6.43) Student 4 from that same group did note that, on the subject of your parents being against vaccines "*that you'd have to go alone, which can be quite difficult.*"(6.46) Vaccine hesitancy coming from the perceived low impact of the disease was also mentioned a number of times. A student from HAVO-4 said that "*if there is a large fear for needles, whilst the disease isn't that bad, people might not take the vaccine*"(5.34) and a student from VWO-5 said that "*if the chance of getting the disease might be low, some might not see the vaccine as beneficial.*"(6.36) One student from MAVO-4 even went as far as to say "*I wouldn't directly take the vaccine, the chance of getting the disease has to be at least something like 20%.*"(1.44) When asked if this student would be vaccinated if the chance of getting ill would be 2 or 3%, this student answered with no. Concerning possible side effects, another student in this same group stated that "*when there are a number of side effects possible and if the vaccine is only effective against one type of bacteria I wouldn't take the vaccine.*"(1.16) Other students in this group also said that "*If the side effects from the vaccine would make me ill in some other way, I'd might ruin something which I wasn't even at risk for."(1.15)*

There were also a number of statements which had a positive impact on the level of vaccine hesitancy. A number of students stated that fear of the disease was a direct influencer for getting vaccinated. Health was also an important factor for every group. There were different

manners in which this was expressed, ranging from not wanting to spread the disease to fearing the complications that arose from being infected with the MenACWY disease and just not wanting to fall ill. Especially the statement not wanting to fall ill was heard often, with at least 1 person per group stating this. Also important was peer pressure. This was especially important if vaccines were to be given at school, which will be discussed in chapter 4.6. For instance one student from HAVO-4 stated "*If everyone opts to take the vaccine, it becomes standard. Then it's a no doubt situation."*(6.26) And some of the VWO-5 group were in the process of actively encouraging a friend of theirs to take the vaccine.

Summarizing, health is a very important factor in lowering vaccine hesitancy, as it was stated in every focus group to be of importance. These students often said that not wanting to get ill is very important to them. When seeing that some students noted that the chance of falling ill should be quite high for them to be vaccinated, the possible impact of the disease should be conveyed clearer. Fear for the vaccine might be of influence as well, especially in how the vaccine works and what is in it. This topic was of more importance for lower educated groups, than in the higher educated groups. Fear for needles was an issue for many; however no-one stated that this would be their main reason for declining a vaccine. Vaccine hesitancy due to complacency factors are present, however the extent to which these factors play a role in increasing vaccine hesitancy seem to increase depending on the level of education. The complacency related factors that decrease vaccine hesitancy are generally the same across the groups, with health and peer pressure being of importance.

4.1.3 Students' perception on Convenience

Many barriers concerning convenience were about the ability to understand the appeal of the vaccination. A student from HAVO-4 stated that "*I didn't receive the 9 years vaccination, and still I'm sitting here*"(4.39), showing that this student did not fully understand why this vaccination was given. Whilst a student VWO-5 showed insight into this behaviour by stating: "*Ignorance on what it (the disease) is. If someone were to state that it is about a certain bacteria, it won't say much about the disease. And if people don't know about the disease then they won't know what the disease is.*"(6.37) A student who looked up information stated that the information about side effects only concerned children "*and that those side effects have not presented themselves yet in adults*."(4.22) Other barriers that were seen concerning convenience were about the location

and distance. Many students noted that they had to travel, mostly by bike, to the location of the vaccination. Students noted that, with other vaccinations, "*that it was super busy. But it is sometimes done here at school, which would be much easier.*"(2.38) Another student stated that "*If you live in some far away village and your parents don't want you to go, it makes it that more difficult to go.*"(6.45) When asking for peer pressure as a barrier if vaccines were given at school, students disagreed with the statement that they would be negatively influenced by decisions of their peers.

Whilst many barriers for convenience were about the ability to understand the appeal of the vaccination, there were also many vaccine hesitancy decreasing factors about the same subject. These were very often attributed to the parents. Many students stated that their parents had a large influence on their decision, if the decision of the parents was pro vaccine. A student from HAVO-4 stated that "*my mother wanted me to take the vaccine, your home environment is very important if they say that you have to take the vaccine*."(4.16) Which was also mentioned in other groups, with a student from VWO-5 stating: "*your parents can give advice, but can't force you. It would be unwise to (not taking the vaccine), but you can't force your children.*"(6.55) This sentence was the trend which was seen in the VWO group with student 6 stating that "*it is very dependent on the home situation."*(6.53) Peer pressure, which was not seen as a barrier, was seen as a facilitator in many cases. Students noted that, especially if the vaccines would be given at school "*and the whole school would take the vaccine, then it has to be good*" (MAVO-4 student 4, 1.28), "*you'll have to, because else everybody will know you are not vaccinated*" (HAVO-4 student 1, 4.48) and finally in the VWO-5 group they said: Student 2: "*you will be with friends, so you won't be alone*" Student 1: "*It can even be sociable*" Student 2: "*And if you're afraid, than you'll have someone to support you*", Student 6:"*Someone to hold your hand*." (6.52) A number of students stated that they were happy with the speed with which the vaccine was given." And a student from HAVO-4 said that "*getting the vaccine is little effort; you'll go to a gymnasium get the vaccine and leave after a few seconds.*"(4.25)

In short; the barriers concerning convenience were less great than the facilitators. Especially the influence of parental opinion differed quite a lot between the barrier and facilitator. The students all noted that, if the parental opinion was positive concerning vaccines, they were much more likely to follow. If the parental opinion was negative, they would be much more hesitant to follow their parents. There was also a general acceptance with the current vaccination process and speed, this being said a number of students pitched the idea of giving

the vaccination in school, which was also a generally accepted improvement. In short, convenience might increase vaccine hesitancy in some areas, but decrease in others.

4.1.4 Conclusions from the 3c model

The information from the previous three sections can be used to answer the second sub-question *what factors of the 3c model do adolescents currently perceive as facilitators and which do they currently perceive as barriers in receiving the MenACWY vaccination?"* The first aspect of this question, concerning the facilitators, will first be answered. The most important facilitators were parental opinion and health. Other facilitators such as peer-pressure and process are impactful, but much less so. A number of facilitators were found during this study. The first factor is the parents; these play a large role in the behaviour of the child and showed a lot of positive influence. The adolescents seemed to be more easily swayed towards the vaccine, if their parents had a positive view. Students noted that their home-situation was a large influence and even went as far as to state that they would just listen to what was told. Another large facilitator was health. This was important for personal reasons, so as to not get sick, but also in different way. Not wanting to spread the disease was also often heard as a facilitator. Peer-pressure was often seen as a reason to be vaccinated, with students noting that if other students were to get the vaccine and they would be singled out, it would be a good reason for them to be vaccinated. This was not true for everyone, as some stated that they would continue doing what they thought was good. The efficiency of the vaccination process was mentioned a few times.

The second part of the question concerns the barriers. The most important barriers were possible side effects and fear for the vaccine. Students often noted that there was a real fear for side effects. Students often thought that the side effects were high impact side effects, whilst the side effects are limited to headaches, fevers and a few other minor symptoms. (Johnston, et al., 2016) (Lalwani, et al., 2015) A fear for the severe side effects, such as autism or effects from substances within the vaccine, seemed to have a large impact on vaccine hesitancy. Fear for the vaccine was stated; however this was often stated by a few students who were quite convinced of possible harmful substances in the vaccines. These students proclaimed that there where harmful chemicals in these vaccines, with nothing to back these claims up, except for quoting those close to them. A negative parental opinion was of much less importance than a positive opinion. The students noted that parents would need substantial evidence to withhold them from being vaccinated. The right for self-determination was of importance, although

students were not aware of at what age this right takes effect. For adolescents who do not know that this is their decision, whilst in a negative environment, this might be of importance to know.

4.2 Students perception on Information

The results from this section will be used to answer the third sub-question: *"How do adolescents perceive the information campaign surrounding the MenACWY vaccination?"* The need for more info was often expressed by students and very few students had the feeling that they had adequate information. There was the need for information about side effects, how the vaccine works and what substances are in the vaccine. In many groups, one of the first answers to what information they would want was about possible side effects of the vaccine. These were questions such as what side effects are there and how often do they occur. A few students wanted more information about what substances vaccines contain. Important to note is that there is a fear of the chemicals and fear of the Meningococcal bacteria which are injected. These fears bottle down to having too little knowledge about vaccines, and were expressed by students. Other students noted that would like more information on the disease. Information was wanted about what the disease was, what the impact was and what the outcome was. These questions were asked in all groups.

However, the students who had received the invitation did often state that the information concerning the IMD in the letter and folder was sufficient. Except for a few quotes, many of the students who stated that the information they had was sufficient, had found the information they needed within the invitation. Very few students found or searched for additional information. There was, however, a large difference between students from VWO-5 and the other students. The VWO-5 group was the only group in which the majority of the students stated that they had sufficient information. These students had seen commercials on television and social media, a poster about the vaccination in school and in the newspapers. This group was, overall, very happy with the information and vaccination process, more so than the other groups.

The VWO-5 students had sufficient information and found this through different channels and student 6 said *"I had the feeling that, like with the HPV vaccination, information was very widely available.*"(6.58), which was supported by other students. Students from other groups did state that they saw some information on Social media or the news, but other than the invitation they saw little or nothing about the subject. Many of these students seem to have fully missed

the commercials on social media, with a student even suggesting that the government should show commercials via Instagram and Snapchat. The perceived absence of commercials on social media was seen as a big miss by most students who found no too little information on the vaccination, leading to the need for an improvement in commercials in social media aimed at this age group. One student even suggested the possible use of clickbait to draw in more people.

On the subject of the website deelditnietmetjevrienden.nl, there were differing opinions. A Student from MAVO-4 stated "*The people are laughing and sitting together. The pictures are too happy for vaccinations.*"(1.49) Students noted that the website lacked something shocking, such as "*a person missing limbs"*(1.47), showing the need for a trigger to search or look further. The picture of a child in a wheelchair who suffered from a meningococcal infection was not triggering enough. The website did seem easy to understand *and* nicely divided into subsections. It must be noted that only one student had some knowledge of the existence of this website, even though it is the slogan of the campaign and is on the front of the invitation letter.

Of Importance to many the students, was that the information surrounding the possible side effects was clear. A Student from HAVO-4 used the issues with the HPV-vaccine and stated that "*Information is key here, as with the HPV-vaccine, there was a large news item that a number of people were sterile after they were administered the vaccine*."(4.67) There was also a student who had an acquaintance that received the HPV vaccine and still fell ill, leading this acquaintance to lose faith in vaccines and not take them anymore. Distrust is also a possibility when peer pressure is of importance, with multiple students saying that if their peers would decline the vaccine then there must be a good reason. These students express a need for clear information on possible side effects and why they might occur.

With these results, it becomes possible to answer the third sub-question; *"How do adolescents perceive the information campaign surrounding the MenACWY vaccination?"* Very few teens had a notion of the existence of the deelditnietmetjevrienden.nl website and ads from the government on social media platforms such as Instagram and Snapchat were hardly noticed. Students even suggested that the government should use ads in social media to spread information, consolidating the notion that these ads were completely missed by students. Only students in VWO-5, who were the oldest and highest educated, had seen the information and found the governmental campaign to be successful. The deelditnietmetjevrienden.nl website was new to all students, even though it was the slogan of the campaign and the website

was printed on the invitation letters. These letters were, however, the main source of information for many students. This information was adequate for many of the students, however for the students that had yet to receive the letter information was scarce. These students had very little notice of what the disease was and information surrounding the vaccination often came from peers who had already received the invitation/vaccination. These students also noted insecurity surrounding their own invitation and often doubted whether or not they would receive it or missed it. Information on possible side effects should also be disclosed better and easier to understand.

4.3 Student's recommendations

The results from this section will be used to answer the fourth sub-question: "*how would adolescents change the vaccination process to increase the vaccination rate for the MenACWY vaccination?"* Most of the ideas students could think of were either about the location and the process or about spreading information. In two cases, student themselves came up with the idea of giving the vaccines in their own school, during school hours. A Student from MAVO-4 stated "*Like I said, school is the best option. You're done quickly and your done in one go, you can more easily get it over with. You know the location and you don't have to take the effort to go somewhere else. School is the best location.*"(1.58) Another student from that group stated "*if you do it per school, I think that more people are inclined to just do it."*(1.27) In HAVO-4, a student stated "*it would be smart to do it per school and then call in one class at a time. It might take some more effort, but it would also increase speed.*"(4.46) Students often responded with at school, when asked what other locations they could think of. A student from VWO-5 suggested to "*Do it during school hours, in the same manner it is done now as with the school pictures.*"(6.48) This would mean that every class would be called to a central location in school that can house the flow of students.

There were a number of suggestions to improve the spread of information. From MAVO-4 came the suggestion of "*More information via school. Like showing a short clip during mentor-class about vaccines, so everybody knows about it and it might get talked about more during school.*" This was also suggested by student VWO-4:4, who added "*to also inform how and when I'll be vaccinated.*"(2.11) And student VWO-5:1 also suggested doing it during a class. To improve credibility the VWO-5 group suggested "*having someone from the local health*

department give a short talk during these classes."(6.69) Concerning information spread via social media, the general trend was to make commercials more visible. Students suggested to make the government adds more shocking, Student HAVO-4:1 said "*People need to be scared, just like with packs of cigarettes, just scare them: this can happen if you don't get vaccinated*."(4.59)

This leads to the final sub-question to be answered; "*how would adolescents change the vaccination process to increase the vaccination rate for the MenACWY vaccination?"* In short these are more information on when they are to be vaccinated, different ads on social media and changing vaccination locations. A number of students stated that more information on when they could expect the invitation would be a welcome improvement. This would give the government a second timeslot to create awareness surrounding the vaccine and the disease. Another important notice is that many students missed the ads on social media. This might be due to the ads not being noticeable or memorable enough for students to be aware of them. Some students noted that a shocking image would be a trigger for them to seek more information, thus using more shocking images in the advertisement might increase the noticeability of the ads. However, some students already noted that they don't click on ads or ignore them. In addition to this, there are various forms of software that block advertisements. The last improvement given was to change vaccination locations. This would not only increase awareness through school, but would also give students a specific timeslot as to when to be vaccinated. It decreases effort, would make the vaccination quicker for the adolescents and doing it during school hours was also seen as a positive thing as it decreases time in class.

5. Conclusion and Discussion

The main question of this paper was "*How do adolescents, who have been or are to be vaccinated, perceive the MenACWY-boost vaccination program?"* The answer is that many of the interviewed adolescents who had not yet received the invitation for the MenACWY vaccination had very little to no knowledge of the vaccination campaign, and thus had a very basic perception of the MenACWY-boost vaccination campaign. However, most students did see a direct benefit in being protected against a potentially lethal disease. There was a discrepancy noticeable concerning knowledge about the vaccination program between students who had received the invitation versus those who had not yet received the invitation. The students who had received the invitation had a basic perception of the MenACWY-boost vaccination campaign, but wanted to expand with as little effort as possible in obtaining new information. The general opinion concerning vaccinations was positive. However, in both the group that received the invitation and those who had yet to receive the invitation vaccine hesitant behaviour was noticed, this often stemmed from not fully understanding either vaccinations or the meningococcal infection. This was solely seen in the MAVO and HAVO students. These students also seemed more prone in believing rumours and misinformation, such as there being harmful chemicals in the vaccine or being able to fall severely ill due to the vaccination. Additionally, these students showed little interest in the vaccination campaign, making it so that the amount of information that reached these adolescents was minor. The students attending VWO were different in both knowledge of the vaccination program and showed much less vaccine hesitance, this was especially true for the VWO 5 students. Whilst the students from the VWO-4 focus group showed little vaccine hesitancy and seemed eager to be vaccinated, due to their general perception of vaccinations being positive, the students from VWO-5 were actually well-informed and had noticed information spread by the Dutch government, other than the invitations. These students based their opinions on actual information, showing they had sufficient knowledge of and grasped the basics of the MenACWY-boost vaccination program. The students' overall perception of vaccinations and the MenACWY-boost vaccination program was positive.

Especially for students attending MAVO and HAVO, the ability to understand the appeal of the vaccine and the vaccination was a barrier. This factor, which relates to convenience of the 3-C's model, is in line with literature. (SAGE Working group, 2014) (Johnston, et al., 2016) (Wang, Clarke, & Marshall, 2014) These studies all found that those who did not fully

understand the appeal of vaccinations or how vaccinations work showed higher vaccine hesitancy compared to those who did. This means that a different approach is necessary to educate these students about vaccinations. The ability to understand was also an issue for the meningococcal infection itself; with those who had not yet received the invitation having almost no knowledge of the disease.

Another barrier that was seen in both this study and found in literature is side effects. Short term side effects such as pain at the injection site and fever were of little interest to students. Long term side effects, predominantly falling severely ill, were of interest to those who did not understand the basics of vaccines. This is not fully in line with literature, as short and long term side effects are often bundled. (Domachowske & Suryadevara, 2013) (Maisonneuve, Witteman, Brehaut, Dubé, & Wilson, 2018) (Vandermeulen, et al., 2008) This means that it is important to differentiate between these two side effects; this study showed that the students had no issue with the short term side effects but showed some concern of non-existing long term side effects.

Parental opinion, which can be both a facilitator and a barrier, was mostly seen as a facilitator by students. Students stated that parental opinion was of more influence if their opinion was positive concerning vaccines, the students trusted in their parental opinion. If parental opinion was negative concerning vaccines, students stated they might be influenced if the arguments used by their parents were acceptable. Students did state they were less likely to blindly adopt the parental opinion; they stated that they would likely look for information themselves if what their parents said was right or wrong. The importance of parental opinion was mentioned in multiple articles and was seen in this study as well. (Rosenthal, Jittenhahn, Brio, & Succop, 1995) (Kilic, Seven, Guvenenc, Akyuz, & Ciftci, 2012) In this study, it seemed that students were more acceptive of parental opinion, if the parental opinion was a facilitator, whilst questioning parental opinion if it was a barrier.

The importance of peer pressure, which is supported by literature, was also seen in this study. (Vandermeulen, et al., 2008) (Swartz, et al., 2005) (Rambout, Tashkandi, Hopkins, & Tricco, 2014) Students saw the opinion of their peers as a factor that could lower vaccine hesitancy. Students even showed that they were actively influencing a fellow student who showed vaccine hesitant behaviour. This anti vaccine hesitant behaviour is likely because vaccinations are the social norm, thus students are more likely to follow their peers in this behaviour. Having vaccinations taking place at school, as was suggested by students and which is supported by Vandermeulen et al, might have an increased positive influence.

The importance of maintaining their current state of health was also important to many students. Not wanting to contract a meningococcal infection was important for students, which became an even larger facilitator when students learned of the seriousness of the disease. The associated health consequences with contracting a meningococcal infection was a facilitators, is supported by literature concerning other vaccine preventable diseases. (Bhat-Schelbert, et al., 2012) (Rambout, Tashkandi, Hopkins, & Tricco, 2014)

5.1 Strengths and limitations

The main limitation was due to a time constraint, which leads to data saturation not being reached. Focus group interviews should have carried on after the last focus group interview with the VWO-5 group. This group showed differing opinions from the previous groups. According to the article by Rabiee this meant that more focus group interviews should have been carried out, to find out if these opinions were a one off occurrence or the trend for VWO-5 groups. For the study, this means that the results from the VWO-5 group are as reliable as the results from the other focus groups. For follow-up research, the interviews should continue until the results from the last group add no or very little new information.

Another limitation lies in the quality of the focus groups. These were done solely by the researcher, who had very limited experience with interviews in general. The limited experience was especially visible with the first focus group, in which the conversation was more rigid and the interviewer took a more leading approach instead of a more passive demeanour as advised by Rabiee. This means that the interviews and answers might have been steered towards what the researcher wanted to hear, decreasing reliability. For follow-up research the focus groups should be carried out by sufficiently experienced researchers.

The final limitation was that the data analysis was done solely by the researcher, who had limited experience in coding interviews. This issue has two sides, the first one being that the lack of experience might have decreased reliability and consistency of the coding process. To counteract this as good as possible, all codes were revised for accuracy if so needed and all quotes were double checked. However, wrongly coded quotes might have slipped through in the process. To avoid this, follow-up research should be carried out by sufficiently experienced researchers.

This all being said, the usage of focus groups instead of one-on-one interviews was a major strength of this study. Much more information was extracted from the focus groups compared to interviews what interviews would have yielded. When students were asked what they thought of this type of interview, reactions were all positive. Students stated that it gave them more time to think of answers, that they found themselves less intimidated by the interviewer and that they were capable to use answers of other students to formulate their own answer. The utilization of focus group interviews instead of standard one-on-one interviews seems a superior method for interviewing adolescents.

5.2 Recommendations

The goal of this study was to give recommendations on how the government could improve vaccination rates for the current MenACWY boost vaccination program. From this study come three recommendations. The first and most important is about the spread of information and that there might be gap between what is aimed to reach adolescents and what actually reaches them. The amount of information that reached the interviewed adolescents was very little, considering how many of them use social media and the high chance they have of running into ads aimed at informing these students about the vaccination program. The possibility of using one specific group on social media might have a large impact; social media influencers. These influencers are often used for marketing and give hands on experiences and explain why and how they use certain products. They might be useful as a tool to spread knowledge and awareness about both the IMD and the MenACWY vaccine. Using different influencers to reach different audiences might prove beneficial. This can be done using micro-influencers, who have at least 10.000 followers, macro-influencers who are often national celebrities, or nano-influencers who often have a niche group of followers. (Lieber, 2018) (Maheshwari, 2018) A feasibility study on the effects of using influencers in information campaigns is recommended, followed by an intervention study to measure the potential difference in information spread, and if these studies show an improvement in information provision a cost-effectiveness study.

The second recommendation is about the location where the vaccinations are given. Even though the interviewed students were currently satisfied with the used locations, some did suggest using their own school. Using the school which the adolescents attend would possibly reduce a potential barrier for a minority of adolescents, whilst not negatively impacting other

adolescents. Using the same format that is used for the school photography would see students being vaccinated in a more orderly fashion and might decrease the chance of students not being vaccinated due to forgetfulness or effort. The students noted that the added peer-pressure might play a larger part compared to the current situation; with the general trend being positive towards the vaccine. It was also stated that they could use their peers for support when scared or hesitant. This outcome was in line with the results from Vandermeulen et al., who also found that the compliance increased due to peer pressure at school. A cost-effectiveness study and a feasibility study would be the best course of action in looking for possible issues with this method. One that comes to mind directly are dropouts and home-schooled adolescents, as these groups would then be missed and overlooked.

The third recommendation is about vaccine hesitancy due to limited knowledge on vaccinations and the fear of side effects. These students were afraid of some of the substances that were in these vaccines and what the impact of these substances could be on their body. These adolescents responded that the chemicals might be dangerous. Adding a subsection in the invitation letter or in the included folder, as that is the most important source of information for most students, describing the used substances and how they impact the body might prove beneficial. It would educate these vaccine hesitant adolescents, leading to less fear of the unknown.

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Appendix

Appendix A. Outcome of the article quality check

Criteria	Vander-meulen et al.	Wang et al.
1. Was the research question or objective in this paper clearly stated?	Yes	Yes
2. Was the study population clearly specified and defined?	Yes	Yes
3. Was the participation rate of eligible persons at least 50%?	Yes	Yes
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	N/A	N/A
5. Was a sample size justification, power description, or variance and effect estimates provided?	Yes	No
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	N/A	N/A
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	Yes	Yes
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	Yes	Yes
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes	Yes
10. Was the exposure(s) assessed more than once over time?	N/A	N/A
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes	Yes
12. Were the outcome assessors blinded to the exposure status of participants?	N/A	N/A
13. Was loss to follow-up after baseline 20% or less?	N/A	N/A
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	Yes	Yes

Appendix B. Script for the focus-group interview

Vraag	Deelvragen	Informatie
Wie van jullie is bekend met de informatiecampagne van de overheid over de meningokokken infectie en de vaccinatie hiertegen?	Hebben jullie naar informatie gezocht over deze vaccinatie en de vaccinatie campagne? Hebben jullie naar informatie gezocht over IMD? Vond je de informatie die je vond nuttig en was het de info je om zocht? Zouden jullie deze websites aanraden aan vrienden?	De webpagina van het RIVM over de MenACWY vaccinatie De webpagina deelditnietmetje-vrienden.nl over de MenACWY vaccinatie
Kunnen jullie redenen bedenken waarom sommigen van jullie leeftijd de vaccinatie wel zouden halen?	In hoeverre zien jullie je gezondheid als een reden om de vaccinatie te halen? Zou groepsdruk van leeftijdsgenoten van invloed kunnen zijn om de vaccinatie te halen? Zou de mening van je ouders belangrijk zijn als ze zouden willen dat je de vaccinatie wel ging halen?	
Kunnen jullie redenen bedenken waarom sommigen van jullie leeftijd de vaccinatie niet zouden halen?	In hoeverre zien jullie mogelijke bijwerkingen als een reden om niet te gaan? Zou pijn of angst voor naalden een reden kunnen zijn om niet te gaan? Zou de moeite en tijd die het kost om de vaccinatie te halen een reden kunnen zijn om niet te gaan? Zou de mening van je ouders belangrijk zijn als ze zouden willen dat je de vaccinatie niet ging halen? Zou de mening van je leeftijdsgenoten belangrijk zijn als ze zouden willen dat je de vaccinatie niet ging halen?	
Hoe zou het vaccinatie proces verbeterd kunnen worden?	Zien jullie iets in een verandering van de locatie? Zouden jullie de informatie en hoe deze wordt gegeven veranderen?	

Main question	Sub questions	Information
Are you familiar with the information campaign of the government concerning the Meningococcal infection?	Have you looked for information on the vaccination and the vaccination campaign? Have you searched for information on IMD? Did you find the information you found useful and/or what you were looking for Would you recommend these sites to your friends?	Show pages of the RIVM website concerning MenACWY Show a page of the deeldit-nietmetjevrienden.nl website
What do you see as facilitators to be vaccinated with the MenACWY vaccine?	To what extent is maintaining your health an important factor for being vaccinated? Would you succumb to peer pressure if students around you would get vaccinated whilst you doubted about getting the vaccination? Of how much importance is the opinion of your parents if you doubted about getting the vaccination?	
What do you see as barriers to be vaccinated with the MenACWY vaccine?	Do you see risks of possible side effects as a barrier? Does the pain of the injection and the injection itself play a part in your decision? Of how much importance is the opinion of your parents if they would be against you taking the vaccine? Of how much importance is the opinion of your peers if they would be against you taking the vaccine? Do you see the effort and time it takes to be vaccinated as a barrier?	
How would you improve upon the MenACWY vaccination process, with the goal to improve the vaccination rate?	Would you change the location? How would you improve what and how information is given?	

Appendix D. Front page of the Meningococcal disease infopage from the RIVM via https://www.rivm.nl/meningokokken

Meningokokken

In dit onderwerp

Wijzigingsdatum 08-02-2019 | 10:55

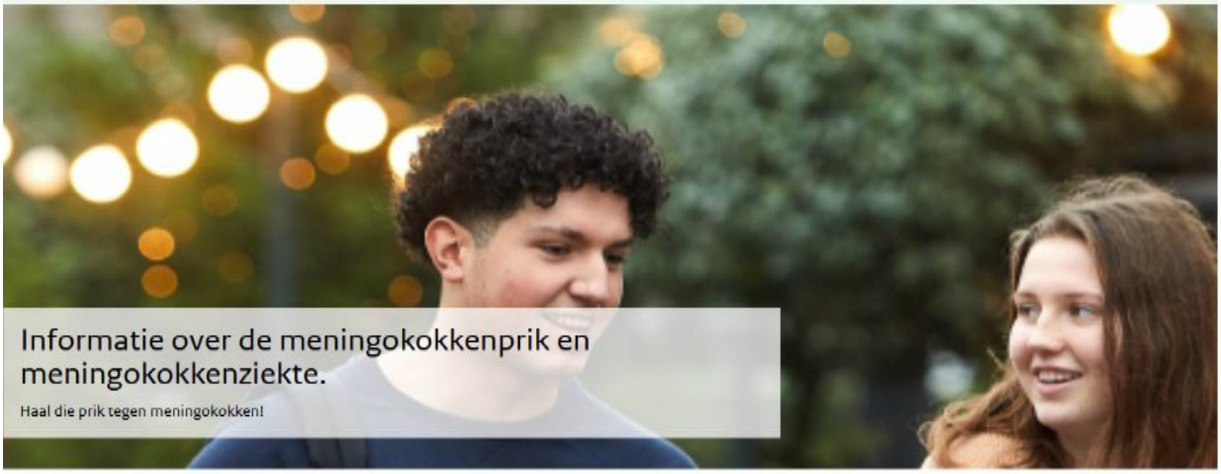
Meningokokkenziekte is een zeer ernstige infectieziekte die veroorzaakt wordt door een bacterie, de meningokok. De infectie geeft een ernstig ziektebeeld zoals hersenvliesontsteking of een bloedvergiftiging, die zich snel kan ontwikkelen tot een shock waar veel mensen aan overlijden. Er zijn verschillende typen meningokokken. In Nederland worden mensen vooral ziek van de typen B, C, W en Y.

Vaccinatie tieners

In het voorjaar van 2019 krijgen tieners een uitnodiging voor een prik tegen meningokokkenziekte type A, C, W en Y. Jongeren geboren in 2001, 2002 of tussen 1 januari en 1 mei 2004 krijgen een uitnodiging voor een prik in maart of april dit voorjaar. Jongeren die in 2003 of 2005 zijn geboren, krijgen een uitnodiging voor een vaccinatie in mei of juni. In 2018 heeft een deel van de 14-jarigen deze uitnodiging al gehad. Eind 2019 hebben alle jongeren van 14 t/m 18 een uitnodiging voor vaccinatie ontvangen. Kijk voor meer informatie hierover op de website www.deelditnietmetjevrienden.nl. In 2020 zal de prik tegen meningokokkenziekte type A,C, W en Y worden opgenomen in het Rijksvaccinatieprogramma.

Appendix E. Front page of the deelditnietmetjevrienden website via https://www.deelditnietmetjevrienden.nl/

Home



DEEL DIT NIET MET JE VRIENDEN.NL

Meningokokkenziekte

Wat is meningokokkenziekte?

Meningokokkenziekte krijg je van een bacterie: de meningokok. Via hoesten, niezen en zoenen kun je elkaar besmetten.

Hoe werkt de prik?

Met 1 prik in je bovenarm ben je voor minimaal 5 jaar beschermd. Je kunt dan niet ziek worden van de meningokokbacterie en je kunt anderen niet besmetten.

Geen uitnodiging?

Ontvang je geen uitnodiging voor een prik tegen meningokokkenziekte? Hier lees je wie er wel en wie er geen uitnodiging ontvangt, en waarom dit zo is.

Het verhaal van Terry

Terry was tot voor kort minstens vier keer per week op het voetbalveld in Castricum te vinden. Maar nu zit hij in een rolstoel. Door een hersenvliesontsteking zal hij misschien nooit meer kunnen lopen. Lees het verhaal van Terry en dat van andere jongeren en ouders.

Lees de verhalen →

JOUWGGD.nl
Alles over gezondheid voor jongeren

JouwGGD.nl

Op JouwGGD.nl vind je informatie over meningokokkenziekte. Je kunt hier ook chatten met een verpleegkundige of een vraag stellen via mail.

Ga naar JouwGGD.nl →

Aflevering Brugklas

Deze aflevering van Brugklas gaat over de prik tegen meningokokkenziekte. Bekijk hoe de leerlingen over de prik denken en of ze uiteindelijk de prik halen.

Foto: Elvin Boer

Bekijk hier de aflevering van Brugklas →

Deel deze pagina

Facebook Twitter LinkedIn Google+ E-mail

HAAL DIE PRIK TEGEN MENINGOKOKKEN! Service

Appendix F. Used code-groups and code in Atlas.ti

Code-group	Code
Barriers	Barriers-belief
Barriers	Barriers-effort
Barriers	Barriers-fear
Barriers	Barriers-parents
Barriers	Barriers-peer.pressure
Barriers	Barriers-side.effects
Facilitators	Facilitators-familliarity
Facilitators	Facilitators-fear
Facilitators	Facilitators-health
Facilitators	Facilitators-parents
Facilitators	Facilitators-peer.pressure
Facilitators	Facilitators-process
Information	Information-source
Information	Information-sufficient
Information	Information-want
Other	Improvements
Other	Process

Appendix G. Number of quotes per focus group, number of quotes per code in the Facilitator code group, and total number of quotes per code in the Facilitator code group

Group	Nr. quotes	Belief	Effort	Fear	Parents	Peer pressure	Side effects
Group 1	13	2	0	2	6	1	3
Group 2	13	1	2	5	3	0	2
Group 3	11	1	1	2	4	1	3
Group 4	17	1	2	4	1	4	5
Group 5	13	3	1	4	5	1	2
Group 6	20	4	1	6	7	0	4
Total	87	12	7	23	26	7	19

Appendix H. Number of quotes per focus group, number of quotes per code in the Barriers code group, and total number of quotes per code in the Barriers code group

Group	Nr. quotes	Familiarity	Fear	Health	Parents	Peer pressure	Process
Group 1	11	1	1	2	2	1	2
Group 2	14	1	0	5	5	3	0
Group 3	12	0	2	6	6	1	0
Group 4	19	0	1	5	5	2	1
Group 5	7	0	0	4	4	0	1
Group 6	25	1	0	5	5	7	7
total	88	3	4	27	27	14	11

Appendix I. Number of quotes per focus group, number of quotes per code in the Others code group, and total number of quotes per code in the Others code group

Group	total	Source	Sufficient	Want
Group 1	30	13	4	13
Group 2	19	10	1	9
Group 3	21	9	2	11
Group 4	29	17	6	10
Group 5	22	9	3	12
Group 6	38	17	18	12
total	159	75	34	67