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*Dutch adolescents' preferences for Nicotine Replacement Therapy: a DCE approach*

**Abstract**

Nicotine replacement therapy is a common way of trying to achieve smoking cessation by using nicotine replacement products that reduce the urge to smoke as well as cessation counselling. In order to promote cessation of smoking and subsequently public health, it is beneficial to further understand the proclivity of those who are addicted to nicotine with regards to cessation programs. The preferences for nicotine replacement therapy are thus far unexplored when it comes to the adolescent smoking population. In this study, I measured the preferences of Dutch adolescents that smoke on several characteristics of NRT as well as the impact and awareness of product reimbursement through health insurance. I used a discrete choice experiment consisting of two question blocks of six questions each where participants were tasked to choose the nicotine replacement program they most desired. Thereafter, I conducted a second choice experiment which had participants consider similar programs in a scenario of full reimbursement of all costs. Data of 88 Dutch adolescent smokers were used in the analysis. Based on conditional logit model estimates, adolescents prefer low nicotine replacement product costs, the use of one or two counselling sessions, a proclivity for a short duration of the program. Furthermore in terms of products, there is a preference for the nicotine patch over alternative products, with a heavy disdain towards nicotine spray. In terms of awareness of reimbursement, adolescents were mostly unaware of the potential reimbursement of products. Policy makers can use the findings to better tailor and target the smoking adolescent population and promote nicotine replacement therapy to reduce smoking rates amongst adolescents.

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## Introduction

Tobacco use and the habit of smoking cigarettes is becoming slightly less common in the past couple of decades (Bilano et al., 2015). Nevertheless, it still is one of the largest preventable causes of death in the world (Centre of Disease Control and Prevention, 2022). Smoking is considered a personal choice and, as described in Wadgave (2016), most people who smoke begin smoking in their early adulthood, between the ages of 18 and 25. In this impressionable period, social acceptance pressure are common reasons for adolescents to start smoking. Additionally, those who start smoking at a younger age are more likely to become addicted and keep smoking in their adulthood (American Cancer Society, 2022). Nicotine addiction, a major component of tobacco use and addiction, poses numerous risks to both physical and psychological well-being. Although nicotine is not the main contributor to the toxicity and harmful effects of tobacco, it has been proven that it is the active ingredient that reinforces tobacco's addictive behaviour (NIDA, 2021).

Smoking cessation and the likelihood of achieving cessation depend on the behaviour of the individual. Those who have a higher intake and therefore a higher dependency on nicotine find it more challenging to quit, amongst other factors such as effective coping mechanisms. Furthermore, the individual has to be willing to quit (Japuntich et al., 2011).

There are developed programs to combat smoking behaviour and achieve cessation. Nicotine replacement therapy (NRT) and nicotine replacement products have become a common substitution for nicotine to help individuals transition from tobacco use to abstinence (Wadgave & Nagesh, 2016). To elaborate, NRT is an umbrella term for the combination of two aspects pertaining to the cessation of smoking; The use of nicotine replacement products and a potential engagement of the individual in cessation counselling. Some popular alternative nicotine sources are nicotine gums, transdermal patches, nasal sprays or inhalers (Hartmann-Boyce et al., 2018; Tang et al., 1994). These products allow for the ingestion of nicotine without the harmful side effects of tobacco or cigarette use. They do not cause lung cancer or contribute to other lung diseases and drastically reduce the likelihood of heart diseases when compared to continued cigarettes usage (Center for Disease Control and Prevention, 2022). Even though they help the transition, it has been found by Molyneux (2004) & Wadgave (2016) that nicotine replacement products are most effective in achieving smoking cessation when combined with individual cessation counselling with a counsellor. As described by Park (2011), the development of cessation programs and related efforts help to protect societal health and reduce

unhealthy smoking behaviours. However, as most research on NRT has been conducted on a wider adult population, there is a lack of knowledge on the preferences of adolescents on nicotine replacement therapy.

Further research on adolescents smoking cessation strategies is obviously required given the high frequency of smoking among young adults (Garrison et al., 2003). NRT can be an effective mechanism to achieve smoking cessation for those looking to quit (Molyneux, 2004). Even though the effectiveness of these products and NRT have been proven (American Academy of Pediatrics, 2022; Wadgave & Nagesh, 2016), there is a lack of knowledge on the preferences of adolescents on NRT. As a susceptible group, it is of utmost importance to gather information on how NRT could be more effectively used to target the adolescent population. Additionally, smoking cessation programs that are tailored for a specific target group are found to be more cost-effective (Elixhauser, 1990) and are likely to have a higher efficacy (Garrison et al., 2003). Furthermore, as this group is young of age, any improvements of smoking cessation will have long lasting impacts and would reduce the amount of preventable deaths as well as lessen the burden on the health care sector.

From a societal perspective, it is of great importance for public health and policy makers to gather information on the adolescent's preferences for NRT. In order to effectively target the susceptible group and develop comprehensive intervention and control strategies for the adolescent population, there needs to be a more specifically tailored framework on preferences of smoking cessation programs (Elixhauser, 1990; Garrison et al., 2003). Furthermore, as health insurance coverage can impact the adolescent's preferences of NRT, it can inform policy makers regarding the accessibility, affordability and general knowledge on insurance and reimbursement (Ong & Glantz, 2005). Currently, the Dutch health insurance system allows for the total coverage of NRT costs. However, there is likely a lack of awareness on the reimbursement mechanics, which could withhold people from accessing these cessation programs. Due to the perceived lack of knowledge on the total reimbursement of NRT and nicotine replacement products, there are potential differences in NRT preferences and increases in the willingness to participate in NRT programs (Masako & Ohkusa, 2002). Policymakers need to recognize and shape policies that grant information and equitable access on these interventions, which would result in a more effective effort to reduce tobacco usage, promote cessation and reduce the public burden of tobacco-related diseases (Shami et al., 2019).

The aim of this research is to elicit the preferences of Dutch adolescents on Nicotine replacement therapy. It will encompass preferences with regards to nicotine replacement

products and other aspects such as cessation counselling, duration and product price. Therefore, the research question is: What are Dutch adolescents' preference of smoking cessation programs. Additionally, the Dutch healthcare system allows for the reimbursement of NRT programs and products. Even though these resources are available to the general population, there is likely an lack of awareness amongst adolescents who are willing to quit smoking. Therefore, this research aims to examine the awareness of the reimbursement pertaining to NRT and nicotine replacement products. Additionally, the willingness to participate in a NRT program after being made aware of the full reimbursement.

In order to gather information, this study will conduct a discrete choice experiment consisting of a choice experiment that was sent out to Dutch adolescents that smoke. The respondent population that will be approached will be in the Netherlands, therefore this study will take the perspective of the Dutch healthcare system, insurance and commonly available products sold in the Netherlands.

## Theoretical Framework

### *Eliciting preference for Nicotine Replacement Therapy in the Dutch adolescent population*

Efforts to reduce smoking behaviour and nicotine addiction is of great importance for public health and NRT is an effective tool to achieve this goal (American Academy of Pediatrics, 2022; Hartmann-Boyce et al., 2018; McNeill et al., 2001; Molyneux, 2004; Ong & Glantz, 2005; Tang et al., 1994; Wadgave & Nagesh, 2016). For this research I define NRT as effort from an individual to achieve smoking cessation through the means of usage of nicotine replacement products (MedlinePlus Medical Encyclopedia, 2023). Furthermore, as outlined by Molyneux (2004), Wadgave & Nagesh (2016), Lancaster & Stead (2017), the effectiveness of NRT is amplified by engaging in counselling in addition with the usage of nicotine replacement products for an extended period of time until cessation is achieved. However, it is as of yet unknown if counselling is desired by adolescents who are willing to quit.

Currently, there has been a lack of research conducted specifically towards the adolescent smoking population regarding NRT preferences and efficacy (Garrison et al., 2003). During this impressionable period, it is of paramount importance to promote smoking cessation in order to prevent future health complications burdening the individual as well as the health care system. The effectiveness of NRT is inherently difficult to measure due to complications with smoking cessation as an outcome variable (Mermelstein et al., 2002; Condiotte & Lichtenstein, 1981). Nonetheless, NRT is still a recommended tool, by the WHO amongst others, to combat smoking behaviour and promote cessation (McNeill et al., 2001). However, it has been thus far unknown what the specific efficacy is of NRT for adolescents. A potential relapse of smoking and self-reporting cast doubt on the true cessation rate which would be very costly to measure and would have a longer timeframe that goes beyond the scope of this research (Mermelstein et al., 2002; Condiotte & Lichtenstein, 1981). This research is therefore not designed to measure effectiveness due to a lack of resources. However, it is designed to measure preferences that could help policy makers to more effectively tailor NRT towards adolescents. Furthermore, it will attempt to measure the willingness to partake in NRT as a means of smoking cessation as well as the awareness of adolescents towards to potential reimbursement of NRT costs.

**Table 1**

## Design Characteristics

Characteristics	Relevant Literature
Products	(Molyneux, 2004; Salloum et al., 2014; Wadgave & Nagesh, 2016).
Counselling	(American Academy of Pediatrics, 2022; Katz et al., 2020)
Duration	(American Academy of Pediatrics, 2022; Centers for Disease Control and Prevention, 2022; Lancaster & Stead, 2017).
Price	(Heredia-Pi et al., 2012; Salloum et al., 2014).
Reimbursement	(Farrell & Gottlieb, 2020; Heredia-Pi et al., 2012; National Academies Press US, 2018)

The selected attributes and their respective levels were chosen on the basis on previous research conducted on smoking cessation programs as well as guidelines pertaining on NRT. Firstly, as seen in a study conducted in Lebanon (Salloum et al., 2014), participants were tasked to select their preferred cessation program. Included in the programs were nicotine patches and pills/tablets. The results indicated a slight preferences for nicotine patches (Salloum et al., 2014). Furthermore, I included additional products namely nicotine gum and nicotine spray, which are other common nicotine replacement products (Molyneux, 2004; Wadgave & Nagesh, 2016).

In a recent study conducted by Katz et al. (2020), a DCE was conducted to elicit the preferences of veterans on cessation counselling. Even though this research delved into the specific details of cessation counselling, for instance the type of counselling and communication skills, it did allow for inside on preference for counselling. The results indicated a preference for additional follow-up sessions. Therefore, this research included varying amounts of counselling sessions to gauge the desire of adolescents to engage in counselling, based guidelines for counselling (American Academy of Pediatrics, 2022).

NRT programs should last at least six to eight weeks and up to twelve weeks or more, according to recommendations. Typically, it is advised to extend the course of treatment as this will

improve effectiveness and lessen the likelihood of recurrence (American Academy of Pediatrics, 2022; Centers for Disease Control and Prevention, 2022). The research allows people to select from a period range between eight, ten, or twelve weeks. These values were chosen in order to lessen the complexity of the choice tasks and are in line with common guidelines for NRT (Centers for Disease Control and Prevention, 2022; Lancaster & Stead, 2017).

The pricing attributes and the respective levels were chosen based on the current average market prices for the nicotine products in the Netherlands. Intuitively, we expect that people exhibit price sensitive behaviour with regards to the product prices. This was also found in previous research conducted by Salloum et al. (2014). However, in a study conducted by Heredia-Pi et al. (2012), where respondents tested on the willingness to pay for smoking cessation, it was found that the willingness to pay for cessation programs exceeded the actual price of the programs. Hence, it will be intriguing to observe the price sensitivity of Dutch adolescents.

For the second scenario where product prices are reimbursed. In this scenario, I expect that the preferences for products and counselling remain roughly equal to the first scenario. Furthermore, as a result of the reimbursement, I expect people to be more willing to consider NRT as a cessation program NRT (Farrell & Gottlieb, 2020; National Academies Press US, 2018). Additionally, in a study conducted by Heredia-Pi et al. (2012), it was found that there was a lack of awareness of cessation programs. Therefore, I hypothesize (a) to find a the lack of awareness of the reimbursement of NRT products and (b) people are more willing to consider NRT after information about reimbursement is extended.



## Method

### *Discrete choice experiment*

This research will be conducted using a discrete choice experiment (henceforth referred to as a DCE). This technique is commonly used in eliciting preferences in the field of health economics (Haghani et al., 2021) as well as smoking behaviour and tobacco control studies (Czoli et al., 2015; Goto et al., 2007; Paterson et al., 2008; Regmi et al., 2017). This method presents the respondent with, in this case, two alternatives that consist of four attributes with varying levels. The individual is asked to carefully consider both alternatives and select the alternative that they would prefer. Based on this, it is possible to measure the relative importance of the attributes pertaining to NRT (Hensher et al., 2005).

There will be two DCE's conducted in this survey. Firstly, a DCE with the intent of eliciting preferences of NRT from Dutch adolescents. Secondly, a reduced DCE takes place after new information is presented to the respondent pertaining to the reimbursement of products. As smoking cessation is of great importance to society and policy makers, replacement strategies for nicotine to achieve cessation have become more common. Additionally, nicotine replacement products are sold over the counter in most supermarkets and drugstore chains such as Etos and Kruidvat. The Dutch government and healthcare system has existing mechanisms in place to incentivise smokers to engage in smoking cessation programs. Nicotine replacement products purchased at pharmacies are reimbursed by most Dutch health insurance, under the condition that the user combines this effort of cessation with counselling with a minimum requirement of three counselling sessions (Ministerie van Algemene Zaken, 2023). Therefore, the second DCE has the respondents consider the scenario where they will have full reimbursement for the products.

### *Attributes and attribute levels*

The attributes and attribute levels of the first DCE were chosen on several characteristics of which an NRT program exists (see Table 1), selected for relevance towards the Dutch setting. The characteristics of a NRT program are the relevant products that are available in the Netherlands, the duration of the program based on guidelines, the desired amount of counselling for the duration of the program and the weekly costs of the products. A detailed explanation will be given for each attribute and their respective levels.

**Table 2***Attributes and attribute levels of the DCE of NRT preferences*

Attribute	Level 1	Level 2	Level 3	Level 4
1. Nicotine Replacement products	Nicotine Patches	Nicotine Gum	Nicotine Tablets	Nicotine Spray
2. Duration of the program	8 Weeks	10 Weeks	12 Weeks	-
3. Counselling	No counselling	One session	Two sessions	Three sessions or more
4. Product price	€ 10	€ 15	€ 20	-

#### Nicotine replacement products

Nicotine replacement products are varying in method of nicotine ingestion and delivery (Hartmann-Boyce et al., 2018; Molyneux, 2004). This research will focus on four products that are commonly sold in Dutch supermarkets and drugstores. Firstly, transdermal patches. These are the most common and release nicotine through skin contact with a patch, which can be left on throughout the day. Secondly, nicotine gum, comparable to normal gum and used as such, administer nicotine slowly through chewing. Thirdly, nicotine tablets/lozenges are candy-like tablets that are meant to dissolve in the users mouth and release nicotine for roughly 30 minutes of use (Tang et al., 1994). Finally, nicotine spray is a relatively new method which allows the user to spray a small dose of vapor into their mouth which releases nicotine (American Academy of Pediatrics, 2022; MedlinePlus Medical Encyclopedia, 2023; Wadgave & Nagesh, 2016). There are very minor side effects related with the use of these products but are considered safe to use and do not carry any harmful chemicals that are found in tobacco products (Center for Disease Control and Prevention, 2022).

There has been much existing research conducted on the efficacy of these products. Even though efficacy of smoking cessation aids has been proven difficult to measure, especially for adolescents (Mermelstein et al., 2002) and capturing possible smoking relapse after cessation requires long term monitoring (Condiotte & Lichtenstein, 1981), there is a general scientific consensus that nicotine replacement products are able to increase the rate of smoking cessation

compared to the cessation rate without aid (Hartmann-Boyce et al., 2018; McNeill et al., 2001). The estimated cessation rate smokers with nicotine replacement products is roughly between 5% and 15% (Tang et al., 1994). This rate is a very rough estimate and will depend on the product, individual's characteristics amongst other factors (Tang et al., 1994). This estimate varies amongst different studies and thus far there is insufficient evidence to effectively compare different products and different population groups. The products are based on individuals preference and the cessation rate related with the use of these products is dependent on other factors such as willingness to quit or whether the individual partakes in counselling (Hartmann-Boyce et al., 2018; Tang et al., 1994). Hence, this design does not take efficacy of products into account.

### Counselling

The most important of these is whether the individuals combines the use of nicotine replacement products with counselling (Tang et al., 1994; Wadgave & Nagesh, 2016). Individual counselling as an aid to help facilitate the cessation of smoking behaviour has been proven to greatly increase the effectiveness of cessation attempts. As described in a systematic review by Lancaster & Stead (2017), the method of counselling can vary in frequency and intensity. Often, counselling sessions are conducted on a weekly basis and consist of a conversation with a counsellor in person or in group sessions. On the other hand, counselling can also be conducted online or via telephone. Counselling has been proven to aid in breaking down the roots of harmful habits and help the individual better understand their own behaviour in order to control their urges that arise from nicotine addiction. Cessation programs that have more intensive or frequent sessions generally have higher cessation rates (Lancaster & Stead, 2017; Molyneux, 2004; Towns et al., 2017).

In order to measure the desire to partake in counselling, the choice experiment will provide a several options that individuals can choose from. The levels are; No counselling, one session, two session or three sessions (American Academy of Pediatrics, 2022; Lancaster & Stead, 2017).

### Product Price

As previously explained, there are reimbursement mechanics in place that would make counselling completely free under Dutch health insurance. Therefore, this study will not consider counselling in the pricing of the cessation program. However, it is not commonly known that nicotine replacement products can be reimbursed when combined with counselling.

Additionally, these products are often sold as over the counter medicines in supermarket and retail stores. Therefore, this research will only consider the over the counter prices of the nicotine replacement products. Although there are different price ranges for different products and brands, the average price of these products ranges roughly between €10 and €20, based on the average between brands, nicotine dosage and average consumption as found on well-known Dutch pharmaceutical retailers such as Etos, De online drogist en Kruidvat. The choice experiment will therefore use this range of weekly prices; €10, €15 or €20.

Even though there is a price elasticity for over the counter medicine (Masako & Ohkusa, 2002), smokers take into account their own expenses for tobacco use. This could result in, depending on consumption, that the weekly price of NRT products is lower than the weekly consumption of tobacco. Furthermore, in a study on the willingness-to-pay for cessation in Mexican adults by Heredia-Pi et al. (2012), it was found that smokers have a higher willingness-to-pay than the cost of cessation program, but that there was a general lack of awareness pertaining to the information about and access to cessation programs.

#### Duration

NRT and smoking cessation programs differ in terms of duration. The actual duration of achieving cessation will vary from individual to individual with their willingness to quit and the extent of their addiction. Additionally, there is a difference in guidelines varying from product to product (American Academy of Pediatrics, 2022). The recommended duration of NRT plans are at least six to eight weeks and could reach up to twelve weeks or more. Usually it is recommended to extend the duration of the therapy as this will increase the efficacy and reduce chances for relapse (Center for Disease Control and Prevention, 2022). In order to reduce the complexity of the questionnaire, the design asks individuals to choose between a duration range between eight, ten or twelve weeks.

#### Insurance & product reimbursement

After the first DCE, the respondents are asked to consider a new scenario. They will be made aware of the total reimbursement of NRT products on the requirement that they will attend at least three counselling sessions. The logic behind this counselling requirement is rooted in the evidence that cessation through means of nicotine replacement products is amplified by attending counselling sessions (Lancaster & Stead, 2017; Molyneux, 2004; Towns et al., 2017). Hence, the reimbursement for nicotine replacement products are a great way to incentivise individuals to attend counselling sessions. If the individual attends these sessions, nicotine

replacement product (if gathered at a pharmacy on recipe), can be reimbursed if the individual has the basic Dutch insurance. It should be noted that most but not all health insurance companies reimburse these programs. These companies cover almost all Dutch health care providers and therefore most people who have Dutch health insurance are covered due to mandatory health insurances laws. All information on reimbursement of products and counselling can be found on the official Dutch web page of the national smoking cessation guidance <https://www.ikstopnu.nl/> (Ikstopnu.nl, 2023)

In order to replicate this scenario in the second DCE, the price attribute is excluded from the choice tasks as nicotine replacement products are reimbursed. As found by Heredia-Pi et al. (2012), price might not be a dominant factor driving the desire for cessation programs. Even though the reimbursement through reinsurance provides an easier access and would incentivise individuals to engage in the utilization of NRT (Farrell & Gottlieb, 2020; National Academies Press US, 2018) , it is unsure if there is a direct correlation an uptake in actual utilization of NRT.

Furthermore, for the second DCE the counselling attribute is reduced to three sessions or more than three sessions. Here we can observe whether individuals in this scenario would merely attend three sessions to pass the reimbursement requirement or desire more counselling.

**Table 3**

*Attributes and attribute levels of the DCE of NRT preferences for the reimbursement scenario*

Attribute	Level 1	Level 2	Level 3	Level4
Nicotine Replacement products	Nicotine Patches	Nicotine Gum	Nicotine Tablets	Nicotine Spray
Duration of the program	8 weeks	10 weeks	12 weeks	-
Counselling	Three sessions	More than three sessions	-	-

Even though the reimbursement mechanic exists, it is likely not commonly known. A question is added that asks the respondent whether they were aware of this potential reimbursement. I expect that most of the respondents are unaware. Additionally, there will be two questions that asks whether the individual would consider a NRT program, after the first DCE and the second

DCE. The difference between the two questions is that the second question is asked after the individual is made aware of the reimbursement. This allows for a comparison and the effect of the new information on the willingness to participate in a NRT cessation program.

### Experimental Design

I generated two Bayesian D-efficient designs using a groundbreaking new software program named Spotlight, developed by Marcel Jonkers of Erasmus University. This program automates randomization between the choice tasks' attribute levels for each respondent, allowing for a streamlined process of conducting a DCE. The two designs are NRT1 and NRT2, the latter being the reimbursed scenario. The first design contains two blocks of six choice tasks per block and the second design contained one block of eight choice tasks. The amount of choice tasks were chosen based on a minimum requirement of ten choice tasks per individual based on the amount of estimated parameters plus two extra questions in order to gather more information. NRT1 was split up in two blocks as to reduce potential drop-out rate (Johnson et al., 2013).

Both designs had individuals choosing one out of two alternatives per choice task. The choice is between two unlabelled NRT programs with varying attribute levels. In order to increase responder efficiency, I allowed for the overlap of one level meaning that during a given choice task one attribute could have the same attribute level in both options. This allows for extraction of more information in the case of an individual having a dominant attribute as individuals are encouraged to consider all attributes when completing a choice task (Jonker et al., 2018). Additionally, overlap helps in reducing respondent drop-out rate by reducing the complexity of choice tasks (Johnson et al., 2013).

#### Example choice task NRT 1

*If these were your options for Nicotine Replacement Programs, which one would you choose?*

	<b>Program A</b>	<b>Program B</b>
Nicotine Replacement Product	Nicotine Patches	Nicotine Gum
Duration	8 weeks	12 weeks
Counselling	Two sessions	No counselling
Weekly Product Price	€ 20	€ 10

The designs employed conservative priors for the pricing attribute and “zero priors” for the other attributes. After an initial pilot survey of 42 respondents, I was able to gather information which allowed for an update in priors (see Appendix) thus making the design more efficient in randomization of attribute levels. Informative priors are more statistically significant than

default priors (all parameters = 0), as stated by Johnson et al. (2013). The resulting D-score for the two designs were 1.064 for NRT1 and 1.349 for NRT2. The less efficient score for the NRT2 design is inherently due to it not being perfectly optimized for eliciting the preferences of individuals for NRT as a result of a reduction in parameters. In fact, NRT2 is designed to reflect on whether there are significant changes in preferences in the case of zero costs due to reimbursement.

### **Example choice task NRT 2 for the second DCE**

*If these were your options for Nicotine Replacement Programs, which one would you choose?*

	<b>Program A</b>	<b>Program B</b>
Nicotine Replacement Product	Nicotine Patches	Nicotine Gum
Duration	8 weeks	12 weeks
Counselling	Three sessions	Three sessions

### Questionnaire

As a perk of using this new and innovative program Spotlight, there was an easy way to send out the questionnaire to respondents. Spotlight allows for the easy and convenient distribution by sending out a link to the questionnaire that is optimized and accessible on mobile phone, laptops and other electronic devices. Special consideration was given for the visual design for mobile phones due to their smaller screens. After asking the respondents for consent for participation, use of their data and information on the purpose of the research, individuals were asked to disclose their age, gender and smoking behaviour. The latter was defined in five tiers; I have never smoked, I rarely smoke, I am a occasional/party smoker, I am a regular smoker (less than 10 cigarettes per day) and lastly, I am a heavy smoker (more than 10 cigarettes per day). These tiers were adapted from Pulvers et al. (2013) with the addition of the non-daily occasional or party smoker and those that rarely smoke (Evans et al., 1992) which were used in order to capture the smoking behaviour of the respondent. This was followed by an introduction of NRT and its characteristics with a brief explanation of the attributes and its accompanying levels. This was followed with two “warm-up” exercises. Subsequently, respondents started the first block of questions, where they were asked which program they would prefer to achieve cessation, even if they have no intention of quitting. After the first block ended they were asked if they would consider participating in NRT. After the second block, respondents were asked to carefully read the provided information pertaining to the full reimbursement of nicotine replacement products followed by the last set of eight choice questions. Finally, respondents

were asked if they would consider participating in NRT with counselling knowing that all costs would be reimbursed. Finally, an extension of gratitude was given as well as the message that they were able to close the questionnaire.

### Data collection

Before the distribution of the survey amongst the target population, a test survey was sent out to multiple students in the Health Economics faculty of the Erasmus school of Economics in order to provide feedback and further optimize the questionnaire. The data that was used during this research was collected during an extended period during June and July 2023. The respondents that were approached were Dutch adolescent individuals who smoke in the network and extended network of the researcher. The link through which the survey was accessible by was shared through WhatsApp. Additionally, adolescents were approached on campus and in the cities and were asked to participate. Due to limitations in time and resources, this was the most convenient and feasible method of data collection.

### Econometric model

The gathered data was extracted from Spotlight and imported into Stata/MP18.0 (Stata Statistical Software, 2023). The estimated conditional logit models are based on normal distribution for the random parameters. The first choice experiment of NRT1 that is estimated employs the following utility function;

$$U_{it} = \alpha + \beta_1 * NicotineGum + \beta_2 * NicotineSpray + \beta_3 * NicotineTablets + \beta_4 * Price15 + \beta_5 * Price20 + \beta_6 * onesession + \beta_7 * twosessions + \beta_8 * threesessions + \beta_9 * Duration10 + \beta_{10} * Duration12 + \varepsilon_{it}$$

The utility of an individual  $i$  in choice observation  $t$  is denoted as  $U_{it}$ . The constant is denoted as  $\alpha$ . The  $\beta_1 - \beta_{10}$  are the parameters of the characteristics of nicotine replacement therapy. The dummy variables of *NicotineGum*, *NicotineSpray* and *NicotineTablets* are dummy coded 1 if picked as the chosen product and coded 0 otherwise. The reference level or base level for products are nicotine patches. Furthermore, the parameters for *Price15* and *Price20* are coded 1 if the weekly product price for a certain program is 15 or 20 euros respectively otherwise they are coded as 0. The base level for this attribute is the weekly product price of 10 euros. The parameters for *onesession*, *twosessions* or *threesessions* or more are dummy coded 1 if the counselling for a certain program is one session, two sessions or three sessions or more respectively. Otherwise they would be coded as 0. The base level for this attribute is



no counselling. Furthermore, the last two estimated parameters are *Duration10* and *Duration12* and are dummy coded 1 if the duration of a NRT program is 10 or 12 weeks respectively. Otherwise they are coded 0, with a duration of 8 weeks being the base level. Finally,  $\varepsilon_{it}$  is the error term that captures the unobserved variation.

For the second design, the econometric model is reduced as the pricing parameters are excluded as well as only having one estimated parameter for counselling, with three sessions as the base level.

$$U_{it} = \alpha + \beta_1 * NicotineGum + \beta_2 * NicotineSpray + \beta_3 * NicotineTablets + \beta_4 * Duraiton10 + \beta_5 * Duration12 + \beta_6 * morethanthreesessions + \varepsilon_{it}$$

Similar to the first model, the outcome variable of  $U_{it}$  denotes the utility of individual  $i$  in choice task  $j$ . Furthermore, the parameter of  $\beta_1 - \beta_5$  remain unchanged and are dummy coded. The parameter  $\beta_6$  for *morethanthreesessions* is dummy coded 1, otherwise it would be coded as 0. The reference category for this attribute is three counselling sessions.

## Results

### Respondents

After the appending of the pilot and full dataset, 204 individuals started the survey from which 95 fully completed it. Due to our interest only being in finding the preferences of smoking individuals, I further filtered the data using the smoking behaviour characteristic and removed seven individuals that have never smoked. The data of the remaining 88 individuals were used for further analysis. As seen in Table 3, the research study encompassed 88 participants that were characterized by a mean age of 23.03 years with a standard deviation of 3.34 years with 18 as the lowest recorded age and 38 as the highest recoded age. The distribution of gender was as follows: out of the 88 individuals that participated, 49 (56.32%) identified as male, 35 (40.23%) identified as female, and 3 (3.45%) as other. This resulted in the sample distribution having a slightly higher fraction of males as compared to females. Furthermore, the smoking behaviour of the individuals were originally divided in five categories. After the exclusion of those that have never smoked, there is a roughly equal distribution over the remaining four categories. Individuals that rarely smoke make up 20.45% of the sample, occasional or party smokers comprise of 28.41% of the sample. Regular smokers were highest represented group with that group comprising 29.55%, and the heavy smokers making up the remaining 21.59%.

This indicated a diverse range and representation of smoking habits amongst the participants. Regarding the willingness of an individual to participate in NRT, we have to compare two instances. Firstly, in the first instance participants were asked whether they would consider NRT as a method of cessation. A sizable proportion of participants (36.36%), expressed their consideration of participating in NRT, signifying a positive attitude towards the method to achieve cessation. However, a substantial portion of participants indicated a lack of desire to participate in NRT (29.55%) or expressed that they were not sure (34.09%). Furthermore, after the first two question blocks, additional information was provided pertaining to the potential reimbursement of product cost when engaging in a minimum of three counselling sessions.

**Table 4**

Descriptive statistics of the sample

Characteristics	n	%	M (SD)
Age			23.07 (3.34)
Gender			
Male	49	56.32	
Female	35	40.23	
Other	3	3.45	
Smoking			
Rarely smokes	18	20.45	
Occasional smoker	25	28.41	
Regular smoker	26	29.55	
Heavy smoker	19	21.59	
Would you consider participating in NRT?			
Yes	32	36.36	
No	26	29.55	
I don't know	30	34.09	
Awareness of reimbursement of product costs			
Yes	20	22.73	
No	68	77.27	
Would you consider participating in NRT with counselling and reimbursed product costs?			
Yes	69	78.41	
No	19	21.59	

As hypothesized, the majority of participants, 68 (78.41%), were not aware of the potential reimbursement with the remaining 22.73% stating that they were aware. In contrast towards the first instance of expressing their desire to participate, after additional information was given there was a considerable change of attitudes towards NRT. After knowing there was a possibility of reimbursement, the overwhelming majority of individuals (78.41%) expressed that they would consider NRT and expressed a positive attitude towards.

the cessation program. This would indicate that there is a significantly higher level of willingness to engage in NRT if the cost of the products are reimbursed in addition to engaging in counselling. The increase in willingness to engage in NRT could indicate that individuals are somewhat price sensitive in their efforts to achieve smoking cessation. Additionally, it could indicate that participants see the additional value and potential beneficial effects of counselling.

### Model estimation results

The results of the first conditional logit model pertaining to the first design of NRT1, provides us with the estimated preferences of Dutch adolescents on the four characteristics of NRT. We observe that for the first attribute nicotine products all have a negative coefficient which would indicate that adolescents gain do not prefer these products over the reference category, nicotine patches, however the negative coefficient of gum and tablets are not statistically significant at the 5% level. Nicotine spray on the other hand is statistically significant at the 5% and even the 1% level. This could be attributed to nicotine patches being the most common and well known nicotine replacement product. Out of these product coefficients, nicotine spray is the least desired. Furthermore, the results indicate that adolescents prefer a NRT program with a short duration. Programs with 10 weeks reduce the utility by 0.73 compared to the base level, however this effect is not statistically significant at the 5% level. Programs with a duration of 12 weeks have a higher negative effect on utility of -0.412, which is statistically significant at the 5% level.

When observing the counselling attribute, all estimated parameters have a positive effect on utility when compared to the base level of no counselling. One session and two sessions increase utility by 0.618 and 0.65 respectively and are both statistically significant at the 5% level. Three sessions or more, although not significant at the 5% but statistically significant at the 10% level, also increases utility when compared to the base level, however to a lesser degree

**Table 5**

Conditional Logit results for NRT 1

Variables	Coefficients	
gum	-.235	(.152)
spray	-.626***	(.124)
tablets	-.259**	(.125)
10weeks	-.078	(.09)
12weeks	-.448***	(.12)
onesession	.618***	(.119)
twosessions	.65***	(.149)
threesessions	.532**	(.208)
price15	-.682***	(.124)
price20	-1.392***	(.174)
constant	-.055	(.066)
Number of Obs.	2112	
R-squared	0.095	
Chi-squared	84.736	
Prob > chi2	0.000	
AIC	1345.310	

*Note.* Standard errors between paratheses

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ , AIC: Akaike Information Criterion

compared to the other two estimated counselling attributes. Lastly, the pricing attribute shows

us that programs with a weekly product cost of 15 and 20 euros have quite a large negative effect on utility, as compared to the base level of 10 euros. These effects are statistically significant.

**Table 6**

Conditional Logit results for NRT 2 (reimbursement scenario)

Variables	Coefficients	
gum	.135	(.178)
spray	-.362***	(.14)
tablets	.081	(.165)
10weeks	-.174	(.115)
12weeks	-.63***	(.188)
morethanthree	-.336**	(.132)
constant	.02	(.079)
Number of Obs.	1408	
R-squared	0.045	
Chi-squared	29.790	
Prob > chi2	0.000	
AIC	945.911	

*Note.* Standard errors between paratheses

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ , AIC: Akaike Information Criterion

For the second scenario where product costs were reimbursed, the findings are as follows. Similar to the results in the first model, nicotine spray remained the only product parameter and has a statistically negative effect on utility as compared to the base level. The estimated

parameter for duration and counselling were quite intriguing. Firstly, individuals did not gravitate towards programs with longer durations and a preference remained for an 8 week program compared to 10 weeks or 12 weeks, although the estimated parameter for 10 weeks is not statistically significant.

Secondly, when having to choose between the minimum of three sessions or having more than three sessions of counselling, the results seem to indicate that more counselling sessions than the required minimum reduced the utility of the individual. This effect is statistically significant.

## Discussion

### *Finding and related Literature*

The results from the research allow us to firstly examine, what the preferences are for NRT for Dutch adolescent smokers and secondly, if these preferences differ in the scenario of total reimbursement. When looking at the nicotine replacement products, there is a strong disdain for nicotine spray amongst adolescents. A possible explanation for this is that it is relatively unknown and has only recently entered the market for nicotine replacement products (American Academy of Pediatrics, 2022; Wadgave & Nagesh, 2016). In the same line of reasoning, it is not surprising for individuals to have a preference for nicotine patches as they are likely the first product that comes to mind for most individuals when it comes to nicotine replacement products. This finding is in line with the findings of Salloum et al. (2014), where that was a slight preference for nicotine patches over nicotine pills.

Furthermore, when observing the preferences for weekly product price, the results displayed price sensitive preferences amongst adolescents with regards to product pricing. In line with Masako & Ohkusa (2002), adolescents appeared to gain the biggest disutility from highly priced programs when compared to lower priced programs. This is further exacerbated when we compare the willingness to participate in a NRT between the two scenarios. By comparing the willingness to consider NRT as a method to achieve cessation before and after additional information on reimbursement, after information was extended pertaining to the reimbursement of cost, there was a stark increase in individuals who were willing to consider a NRT program in order to stop smoking. This lends evidence to the hypothesis that adolescents are more willing to participate in NRT after given information about the reimbursement of products. This is in line with previous literature that states that information and access to intervention increases the utilization of health care (Farrell & Gottlieb, 2020; National Academies Press US, 2018).

When comparing the preferences of counselling between the two scenarios, we observe quite intriguing results. There is a clear preferences for counselling as compared to no counselling, which indicates that adolescents perceive that counselling would increase their changes to achieve cessation and add additional value to a cessation program. This is a pleasant discovery as cessation counselling is an important factor in a successful cessation attempt (Lancaster & Stead, 2017; Molyneux, 2004; Towns et al., 2017). From the results there is a preferences for either one or two counselling sessions, hence individuals do not seem to gain value from many more counselling sessions which is further confirmed when considering the second scenario.

Here, individuals have a preference for the minimum requirement for reimbursement of three counselling sessions as compared to more than three sessions. Hence, it would seem that adolescents are willing to engage in counselling even though they do not see additional value in very frequent counselling sessions.

Lastly, the duration of the program is preferred to be as short as possible. At first glance, this could be explained by the weekly costs of the program, however the preferences for shorter programs carries through to the second scenario as well where price is not a factor. Hence, it is likely that adolescents do not see longer programs as adding value to achieve cessation. This may indicate a slight overconfidence amongst adolescents that they are able to achieve cessation in a relatively shorter period. Even though longer programs generally increase the efficacy (Center for Disease Control and Prevention, 2022), adolescents prefer to have a program with a shorter duration.

### Limitations & future research

There are several limitations of this study. Firstly, due to a considerable lack in time, the sample size is limited, additionally the sample might not be entirely representable for the smoking adolescent population. This is further exacerbated by the fact that the sample likely suffers from a degree of selection bias as a result of the respondents being gathered mostly through the (extended) network of the researcher. Therefore, the sample is likely to have some unobserved characteristics that might differ from the population mean. Consequently, this further limits the predictive power of the models with regards to the true Dutch adolescent population.

Secondly, due to the research being conducted in the Netherlands with Dutch insurance, there is a lack of external validity. Even though the policy implications could carry over towards similar settings in other countries, programs of smoking cessation are treated differently across the globe as well as access to nicotine replacement products and cessation counselling.

Thirdly, in recent years there has been a trend amongst smokers where people would consider an alternative of smoking cigarettes, namely e-cigarettes and vapes. Just like cigarettes, these electronic devices allow for the ingestion of nicotine through smoke that releases nicotine in the blood vessels in the lungs. Even though, e-cigarettes and vapes have become more prevalent amongst young smokers, this research did not make a distinction between e-cigarette smokers and regular tobacco smokers, meaning it can be that some respondents might not smoke cigarettes but do smoke e-cigarettes. Future research can explore the potential differences in achieving cessation between e-cigarette smokers compared to tobacco consumers.



Last but not least, I want to underline that preferences discovered through a discrete choice experiment (i.e., stated preferences) attempt to but cannot perfectly reflect people's actual choices or actual preferences (Hensher et al., 1998). Additionally, the extent that people would consider NRT as a cessation program may be subject to similar issues. Nicotine addiction is a fickle matter. People can have the intention to quit and make several attempts to achieve cessation. However, the intention to quit is unquantifiable and can change from day to day.

Even though nicotine replacement therapy is not a new concept, future research can delve into the efficacy of NRT, the effects of nicotine replacement products and cessation counselling on adolescent cessation rate.

### Implication for policy makers

The results of the research offer several implications that could be useful for policy makers in order to more effectively target the smoking adolescent population and engage them in an smoking cessation program (Elixhauser, 1990; Garrison et al., 2003). This would help towards reducing the amount of smoking individuals which subsequently contributes to reducing the long term burden of smoking induced illnesses on the health care sector. I propose that if policy makers want to more effectively target the adolescent population, more awareness and information should be disclosed about the current reimbursement of products. Adolescents see the additional value of counselling to engage cessation, and the reward of reimbursed products can incentivise them to engage in counselling which can increase efficacy rates of achieving cessation. Policy makers could also consider reducing the minimum counselling requirement to two sessions as this seems to be a more preferred number of counselling sessions. However, as more frequent counselling increases efficacy, this option should be considered carefully. Currently, adolescents are quite unaware that reimbursement of products is a possibility which leads to advice to make a targeted promotion to spread awareness of this possibility. Additionally, the reimbursement would increase participation in NRT. Furthermore, policy makers should consider to reduce the prices of over the counter nicotine replacement products as adolescents are quite price sensitive.

Even though smoking rates have been seeing a decline over the years, adolescent smoking is still a problem that can be tackled by making strides in effectively promoting NRT towards the adolescent population and tailor it towards their preferences.

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## Appendix A

**Table 7**

*Pilot priors and post-pilot priors NRT1*

Attribute	Level	Pilot prior with s.d.	
		Pre-Pilot	Post-Pilot update
Nicotine Replacement Product	1) Nicotine Patches	ref	ref
	2) Nicotine Gum	0.0 (0.1)	0.0 (0.1)
	3) Nicotine Tablets	0.0 (0.1)	-0.7 (0.1)
	4) Nicotine Spray	0.0 (0.1)	-0.3 (0.1)
Duration	1) 8 weeks	ref	ref
	2) 10 weeks	0.0 (0.1)	0.0 (0.1)
	3) 12 weeks	0.0 (0.1)	0.0 (0.1)
Counselling	1) No counselling	ref	ref
	2) One session	0.0 (0.01)	0.9 (0.1)
	3) Two sessions	0.0 (0.1)	1.0 (0.1)
	4) Three sessions or more	0.0 (0.1)	1.2 (0.1)
Weekly Product Price	1) € 10	ref	ref
	2) € 15	0.1 (0.05)	-0.5 (0.05)
	3) € 20	0.2 (0.05)	-1.2 (0.05)

*Note; s.d in brackets ()*

**Table 8**

*Pilot priors and post-pilot priors NRT2*

Attribute	Level	Pilot prior with s.d.	
		Pre-Pilot	Post-Pilot update
Nicotine Replacement Product	1) Nicotine Patches	ref	ref
	2) Nicotine Gum	0.0 (0.1)	0.0 (0.1)
	3) Nicotine Tablets	0.0 (0.1)	.0 (0.1)
	4) Nicotine Spray	0.0 (0.1)	0.0 (0.1)
Duration	1) 8 weeks	ref	ref
	2) 10 weeks	0.0 (0.1)	0.0 (0.1)
	3) 12 weeks	0.0 (0.1)	-0.7 (0.1)
Counselling	1) Three sessions	ref	ref
	2) More than three sessions	0.0 (0.01)	0.0 (0.1)

*Note; s.d in brackets ()*

The questionnaire that was used can be accessed using the link below:

<https://spotlight-surveys.com/NICOTINE>