Hardcore Smokers:

Developing and evaluating an online intervention

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Hardcore Smokers:

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Hardcore rokers:

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Jeroen Bommelé

chapter 1

General introduction

General introduction

Smoking: a major public health problem

Tobacco has been used as a natural stimulant for centuries. Shortly after the discovery of the Americas in 1492, consuming tobacco use became common among the European settlers in the New World. The native people believed tobacco had healing properties and they mainly used it during ceremonies.[1] The Europeans however, having discovered its stimulant properties, used it on a more regular basis. Because of its pleasure-enhancing characteristics, tobacco was one of the first commodities brought back to the Old World.[2] Shortly after its first introduction in Europe and its first cultivation in Turkey, tobacco became widespread among Europeans.[1,3]

At the time, little was known about the health effects of tobacco use. Many people in the 1500s and 1600s died at early age. As tobacco-related diseases take years to develop, few deaths were attributed to tobacco use. During the first half of the 20th century, life expectancy increased rapidly and doctors became more interested in long-term effects of addictions such as smoking. Although some studies in the 1950s described negative health effects of tobacco use,[4–6] one of the first studies to identify smoking as a major health concern was the American Surgeon General report in 1964.[7] It linked smoking to cancer and mortality, and it called for action to decrease smoking prevalence. The Surgeon General report was controversial at the time and the political climate of the 1960s did not allow for large governmental public health interventions in the US. The report did, however, spark new research on tobacco. Over the next decades, this new research revealed a whole spectrum of damaging health consequences of smoking. Today, we know that smoking causes lung cancer, ischemic heart diseases, colorectal cancer, chronic bronchitis and many other diseases.[8,9] We also know that different types of tobacco use cause different types of health problems. While smoking tobacco is known to affect the lungs, chewing tobacco is known to cause mouth and throat cancer. Globally, tobacco kills about 6 million people each year.[10] About 600.000 of these people have not smoked themselves but die though exposure to second-hand smoke.[11] This makes smoking one of the largest causes of preventable death and disease globally.

In the Netherlands, about 20.000 people die of smoking each year. This is about 1 of every 7 deaths in the Netherlands. It is one of the major contributors to all cancers and heart diseases. Despite this, about 23% of the Dutch population continues to smoke and this prevalence has remained stable over the past decade.[12,13] As smoking continues to kill both smokers and non-smokers, smoking remains a major public health concern, both globally and in the Netherlands.

In the current thesis, I will describe one group of smokers who have little to no intention to quit smoking in particular. These 'hardcore smokers' are hard to reach by current tobacco control measures, but are particularly vulnerable to death and disease.[14] Together with others, I therefore developed and evaluated an online intervention that motivates these hardcore smokers to quit smoking.

Smoking: the big picture

Despite the fact that smoking is detrimental for one's health, many people continue to smoke. Smoking initiation, continuation, addiction and cessation are influenced by a number of factors, which all could be viewed at different levels, such as the cultural level, the family level and the individual level.

One model that describes most of these levels is the Social Determinants of Health Framework (SDHF).[15] This model states that one's health is determined by factors at four different levels. The first level is the individual level and includes factors such as one's physical fitness, personality characteristics and personal beliefs. The second level describes social networks by factors such as perceived social support from family or friends. The third level includes working and living conditions, such as access to health care and the level of stress at home or work. The fourth and final level describes social, cultural and socioeconomic factors, such as socioeconomic status.

The SDHF shows similarities to other models, such as Bronfenbrenner's ecological systems theory,[16,17] and it has recently been used by Twyman et al. to describe smoking and smoking cessation.[18] Twyman et al. systemically reviewed perceived barriers to smoking cessation among vulnerable groups of smokers. They categorized the factors that cause these barriers into the four levels of the SDHF. In the current thesis, most of the factors I focus on influence smoking at the individual level. Therefore, below, I first describe these individual factors. Then, I shortly reflect on factors at higher levels in the SDHF.

Individual level

The individual level include biological factors, such as genetics[19] and gender,[20] stable psychological factors, such as nicotine dependence[21,22] and personality,[23] and unstable psychological factors, such as beliefs about smoking and quitting.[24–26] Unstable psychological factors could be influenced by interventions and altering such factors could stimulate smokers to quit smoking.[27–30] In the current thesis, I therefore focus on these less stable psychological factors to influence smoker's smoking-related beliefs and behaviour.

Other levels

While the main focus in this thesis lies at factors at the individual level, some of the factors I focus on are influenced at both the individual level and at other levels.

Social and community level. As tobacco control intensified over the past decades, smoking prevalence gradually declined in the Netherlands. Whereas about 52% of the Dutch population smoked in 1980, only 23% smoked in 2014.[13] As this smoking continues to decline, smoking seems to have become less accepted by society.[12,31] Social norms influence smoking cessation at both the societal level as well as the individual level.[32] At the societal level, low acceptance of smoking may evoke more tobacco control

measures. At the individual level, societal norms influence the way people look at smokers[32] and influence the quality of support smokers feel they receive if they attempt to quit.[33] In the current thesis, I will not study actual societal norms about smoking, but I do investigate how smokers' perception of these societal norms influence smoking behaviour.

Living and working conditions level. Working and living conditions also predict smoking and smoking cessation. Previous research has shown, for example, that smokers are more likely than non-smokers to be unemployed[34] and have lower income jobs.[35] They therefore have limited financial resources, which limits their access to effective smoking cessation therapies. In the current thesis, I do not investigate how these living and working conditions could be changed in order to alter smoking behaviour.

Cultural, socioeconomic and environmental level. According to the SDHF, one of the distal factors that predict smoking behaviour is socioeconomic status (SES). People with low SES are more likely to smoke than people with high SES and this difference is increasing.[12] Because of these widening inequalities between socioeconomic groups, smoking has become a problem of low SES groups in particular.[35] People with low SES generally have less financial resources and less social support.[35] They are therefore also less likely to quit smoking. To investigate how these health inequalities could be reduced, I therefore focus on differences between SES groups throughout this thesis.

Current thesis

As said, in the current thesis, I focus on psychological factors at the individual level. Although I also include factors at other levels, such as socioeconomic status, the main focus will be on factors that could be changed through interventions. In the next section, I describe several theories about ways to change these psychological factors.

From smoking to cessation

Theories about behaviour change could help us understand smoking and smoking cessation. Such theories identify components of effective smoking cessation, help to understand barriers of successful smoking cessation and provide directions for developing effective interventions. In this section, I will discuss a selection of theories and models used within tobacco research. Some behavioural and neurobiological theories, such as the Incentive Sensitization Theory of Addiction[36] and Dual Process Theories,[37] offer useful frameworks for studying and understanding addiction, but have not been well-tested with regard to smoking *cessation* specifically. I therefore focus on theories that have been well investigated with regard smoking cessation and that have yielded effective behavioural interventions before.

Models of smoking cessation

Several social cognition models have been developed to explain why people smoke and how they quit. Social cognition models generally consist of a parsimonious set of modifiable beliefs that determine people's intentions to change behaviour.[38]

Stage models, such as the Transtheoretical Model,[39,40] state that smokers go through separate phases before attempting to quit. The Transtheoretical Model postulates that, at first, smokers do not consider smoking cessation at all (pre-contemplation stage). As they experience, for example, more cost of smoking and more benefits of quitting, they start to consider smoking cessation (contemplation stage).

Next, they gain more confidence in their ability to quit smoking. When this quitting self-efficacy has increased sufficiently, they plan to quit smoking (preparation stage) and attempt to quit (action stage). After this attempt, they either remain abstinent (maintenance phase) or return to one of the previous stages (relapse).

The Transtheoretical Model helped to distinguish one group of smokers that is particularly unmotivated to quit smoking (i.e., pre-contemplators).[41,42] Research using this model also identified important predictors of smoking cessation, such as self-efficacy[43] and perceived pros and cons of smoking.[44,45] The model itself, however, focuses strongly on conscious decision-making and it assumes that individuals make rational and coherent plans only. It therefore neglects both social processes, such as perceived social support, and processes outside the individual, such as environmental restrictions. As a result, the Transtheoretical Model might not be an optimal theoretical framework for predicting smoking cessation.[46] Other models integrated both the important predictors form the Transtheoretical Model, and other factors, such as social support and environmental restrictions. Such models may be better in predicting smoking cessation. Two such models are the Theory of Planned Behaviour[27] and its successor, the Reasoned Action Approach.[47] Both models state that intention to quit predicts quitting behaviour and that three factors influence this intention to quit. The first factor to predict intention to quit is attitude towards quitting. Attitude is defined as the personal favour or disfavour towards quitting and can be seen as the result of an evaluation of the perceived pros and cons of smoking and quitting. Concepts similar to attitude towards quitting have been emphasised by other theories, such as the Health Belief Model[29] and the previously described Transtheoretical Model.[30,39] The second factor to predict intention to quit is quitting self-efficacy. Self-efficacy is the perceived ability to successfully perform an action. Its importance in behaviour change has also been emphasised in the Social Cognitive Theory.[28] A third and final factor is the perception of social norms. These include perceived societal norms and perceived social support from family and friends. The role of social norms in smoking cessation has been emphasized by others before,[16,32] including the Social Norms Approach.[48]

Both intention to quit and its underlying factors have been incorporated in interventions that aim to change smoking behaviour. In the next section, I describe such interventions, together with other effective interventions available for smokers.

Behavioural interventions

There is a range of interventions available for smokers to quit smoking. Some interventions aim to change societal norms (e.g., mass media campaigns), while others target the environment (e.g., indoor smoking bans). Such population-wide interventions target factors at the cultural or social network level (see section 1.2). They usually stimulate current smokers to quit smoking and aim to prevent non-smokers from future smoking. In the current thesis, I focus on interventions that aim to stimulate current smokers to quit smoking, targeting factors at the individual level.

Individual level smoking cessation interventions range from pharmacological interventions to psychological interventions. Pharmacotherapies, such as Varenicline and Bupropion, reduce nicotine cravings by influencing chemical processes in the brain. They may help to reduce withdrawal effects or decrease the amount of pleasure gained by smoking. Other pharmacological therapies, such as nicotine patches and nicotine nasal spray, help smokers quit smoking by gradually reducing their nicotine

consumption. Pharmacotherapies and nicotine replacement therapies are both effective ways to quit smoking,[49,50] but may not be suitable for certain groups of smokers (e.g., pregnant women and people who use drugs that could interact with pharmacotherapies).

Psychological interventions are often based on theories similar to the ones described above. They aim to change psychological factors, such as intention to quit, self-efficacy and attitude towards quitting. Such interventions used to be delivered by telephone, by postal mail or through mass media mediums such as TV or radio. Nowadays, many psychological interventions are delivered through the internet. Online interventions are easier to deliver and allow for more elaborate materials. Over the past decade, online psychological interventions have increasingly been used and they have proven an effective aid in smoking cessation.[51-53]

Psychological interventions for smoking cessation tend to incorporate additional techniques to stimulate smokers to quit smoking. One such technique is the use of tailored messages. Tailored messages are messages based on previous responses from participants. For example, if an intervention aims to increase quitting self-efficacy, it may give different advice to different participants, based on their different responses. Tailoring messages makes interventions more interactive and has proven to increase their effectiveness.[52,54,55] Another technique to increase the effectiveness of interventions is the use of motivational interviewing.[56] Motivational interviewing is a conversation technique, in which a health professional elicits arguments for behaviour change from the client himself or herself, instead of providing them himself.[57] Motivational interviewing techniques have also been applied to online health interventions with aims ranging from increasing physical activity,[58] reducing sexual risks,[59] increasing weight loss[60] and smoking cessation.[61]

The role of intention to quit
Many interventions use theoretical frameworks similar to the Theory of Planned Behaviour and the Reasoned Action Approach. They tend to focus on increasing intention to quit by changing its underlying factors. The paradox here is, however, that most interventions require some minimum level of intention to quit.[52] Few interventions target smokers with very low intention to quit. Therefore, knowledge about how to involve such smokers is lacking. As there is growing evidence of specific subgroups of smokers with particularly low intention to quit[14] (i.e., so-called hardcore smokers), we need to find ways to involve such smokers in tobacco control.

Those who continue to smoke: hardcore smokers
One group of smokers is particularly resistant to smoking cessation. These 'hardcore' smokers have generally reached a stable smoking consumption and do not intend to quit smoking.[14] They seem to be unaffected by tobacco control interventions and may increasingly become a target group for health professionals.[62] There is, however, little known about the smoking-related motivations and beliefs of these hardcore smokers. The current thesis focuses on this gap in the literature.

Defining 'hardcore' smokers
There is little agreement in the literature on what defines a hardcore smokers.[63] Most studies include criteria about smoking consumption, smoking and quitting history, and intention to quit. On consumption, most studies agree that hardcore smokers smoke daily.[20,62,64-75] Some, however, also include a minimum

consumption of 15 cigarettes per day[20,65,71,75] and a minimum of 100 cigarettes in life.[64,66,70] Others use criteria of nicotine dependence[69,70,72,76] or no consumption criteria at all.[77,78] On smoking and quitting history, many studies only include smokers who have been smoking in the past 12 months[62,64,66,68-73,75] or who have smoked at least 5 years in their life.[20,65,67,77] While in some studies hardcore smokers have not attempted to quit in the past 12 months,[62,64,66,68-73,75,77] in other studies they have never attempted to quit.[20,65,67] Studies also differ in the way they define low intention to quit. While some studies only include smokers who do not plan to quit within the next four weeks,[62] the next six months[20,65,67,68,70] or the next year[69,71,72] other studies include only those who have 'no intention to quit',[73,75-77] 'no desire to quit'[62] or who will 'never' quit.[64,66] Finally, most studies aimed to included smokers who have reached a stable smoking consumption only. They therefore limited the group of hardcore smokers to those older than 25 years.[20,64-68,70,71,75,76]

Although there is wide variety of definitions, most studies agree that hardcore smokers have a substantial daily consumption, have been smoking for a number of years and have little intention to quit. In the current thesis, the definition of hardcore smokers varies per chapter due study design restrictions. In the current thesis, smokers were defined as hardcore if they a) were older than 35 years (Chapter 2 and 6: 25 years), b) smoked daily, c) smoked on average 15 cigarettes per day, d) had not attempted to quit in the past 12 months, e) had no intention to quit within 6 months and f) had smoked at least 15 years in life (Chapter 2: no minimum; Chapter 6: 5 years). A comprehensive overview of the different definitions of hardcore smokers could be found in **Appendix A**.

Characteristics of hardcore smokers
Compared to non-hardcore smokers, hardcore smokers tend to be older, lower educated, have lower income, started smoking at earlier age and are more likely to be male.[20,64,65,68,76] They are also less aware of the dangers of smoking[77] and are less receptive to tobacco control measures.[14,64] Among low SES there are more hardcore smokers than among higher SES groups and this difference is widening.[79]

According to the hardening hypothesis,[80,81] the prevalence of hardcore smoking will increase over time. It assumes that tobacco control policies are more likely to reach light smokers than heavier smokers (including hardcore smokers). As a result, more light smokers than heavier smokers quit smoking, leaving a group of heavy smokers. Hardcore smokers will therefore make up an increasingly larger portion of the smoking population. As a result, the remaining group of smokers becomes more difficult to reach by tobacco control policies.[14,82]

Rose's model,[83] in contrast, predicts that the population of smokers becomes easier to reach by tobacco control over time. Whereas the hardening hypothesis states that tobacco control policies reach light smokers in particular, Rose's model assumes that tobacco control policies influence a society as a whole. As a result, norms within society change and the entire group of smokers become 'softer'.[82] While some found evidence for the hardening hypothesis,[76,84] most recent studies found no support for this hypothesis. Instead, many found that the prevalence of hardcore smoking has decreased over time, suggesting that the population of smokers is softening.[70,78,85] Chapter 2 describes a study on the prevalence of hardcore smoking in the Netherlands. It tests whether the hardening hypothesis is supported or whether Rose's model better describes the developments in the Dutch smoking population. Whether the prevalence of hardcore smokers is increasing or decreasing, a group of hardcore smokers

still remain. Conventional psychological interventions that use the theories and techniques described in section 1.3 may not be able to reach these hardcore smokers.[14] As hardcore smokers have a low intention to quit[64] and a low quitting self-efficacy,[66] they are not likely to participate in such conventional psychological interventions. We therefore need to develop interventions that target hardcore smokers in particular. Such interventions should not only focus on psychological predictors to smoking cessation, but should also tackle defensive responses to such interventions.

Dealing with resistance: message processing

According to the self-affirmation theory,[86] people are strongly motivated to perceive themselves as competent and moral people, who always act according to social norms or in line with their own personal values. In order words, people are motivated to maintain their *self-integrity*. Health messages, such as anti-smoking ads or interventions, show people that they are not acting according to social norms or in line with their own personal values. Anti-smoking messages therefore threaten smokers self-integrity.[87,88] As a result, smokers tend to avoid or discard such messages or rationalise their own behaviour. Needless to say, this makes anti-smoking messages less effective.

Self-affirmations could prevent anti-smoking messages from threatening people's self-integrity in the health domain. They do this by strengthening one's global self-integrity first, before an anti-smoking message threatens the domain-specific self-integrity. An example of a self-affirmation manipulation is the kindness questionnaire.[89,90] This small questionnaire reminds people of past events in which they had been kind to others. People who complete this questionnaire feel more social and less threatened by anti-smoking messages afterwards. Self-affirmations have proven helpful in changing a wide range health behaviours,[91] such as smoking.[92] They may therefore be helpful in interventions targeting hardcore smokers.

Another way to tackle resistance is by using motivational interviewing techniques.[56] As said before, motivational interviewing is a technique in which a health professional elicits reasons for behaviour change in the patient, without explicitly providing these arguments himself.[57]

In motivational interviewing, a health professional establishes a cooperative relationship with the patient by emphasising his or her respect for the patient's autonomy. Then, the health professional aims to evoke reasons for behaviour change in the patient. This is in contrast to a traditional, hierarchical doctor-patient relationship, in which the patients ask for help and the doctor decides what treatment is appropriate.[56] The health professional and the patient together investigate the ambivalence the patient may have towards behaviours change. The patient expresses his or her perceived pros, cons and barriers for behaviour change. Together, they then find way to tackle these barriers, reducing the initial resistance towards behaviour change. Motivational interviewing techniques have been used in a wide variety of online health interventions.[58–61]

Outline of this thesis

This thesis aims to investigate the characteristics of hardcore smokers and to test ways to motivate hardcore smokers to quit smoking.

The following chapters describe the development of an online intervention for hardcore smokers. The first chapters discuss characteristics of hardcore smokers and the final chapters describe the development of the online intervention.

First, to determine the size of the population of hardcore smokers, **Chapter 2** describes a study on the prevalence of hardcore smoking in the Netherlands. We used a series of cross-sectional survey data to determine whether the prevalence of hardcore smoking has changed over time. The study focused on trends in hardcore smoking between 2001 and 2012, and on differences in these trends between socioeconomic groups.

Having determined the size of our population, we continued to investigate the smoking-related beliefs of this specific subgroup of smokers. **Chapter 3** reports a focus groups study among hardcore smokers, in which we investigated what pros and cons of smoking and quitting both current and former hardcore smokers have. These pros and cons were then categorizes in themes.

In **Chapter 4**, we used the themes found in Chapter 3 to further examine smoking-related beliefs among hardcore smokers. Through an online survey, we used the pros and cons of smoking and quitting to identify subgroups among hardcore smokers. Such subgroups may need different approaches in tobacco control interventions.

In **Chapter 5**, we examined whether we could change smoking-related beliefs among hardcore smokers. One barrier to behaviour change may be defensive responses to anti-smoking messages. In this study we aimed to reduce defensive responses to anti-smoking messages through self-affirmations. We tested a self-affirmation manipulation for hardcore smokes that could be used in an online intervention.

In **Chapter 6**, we tested an online intervention that aims to change smoking consumption and smoking-related beliefs among hardcore smokers. In this intervention, we incorporated knowledge about the smoking-related beliefs and use the self-affirmation manipulation from Chapter 5. Details of the intervention are outlined in **Appendix B**.

Finally, **Chapter 7** summarizes the main findings of this thesis and discuss directions for future research and future policy. A summary of this thesis could be found in **Chapter 8** and a Dutch version of this summary is presented in **Chapter 9**. Below are the main research questions of each chapter:

Chapter 2:   What is the prevalence of hardcore smoking in the Netherlands and has this prevalence been increasing between 2001 and 2012?

Chapter 3:   What pros and cons of smoking and quitting do hardcore smokers perceive?

Chapter 4:   Based on these perceived pros and cons of smoking and quitting, what subgroups exist among hardcore smokers?

Chapter 5:   Could self-affirmations tackle defensive responses to anti-smoking messages among hardcore smokers?

Chapter 6:   Could we change hardcore smokers' smoking consumption and their beliefs about smoking through an online intervention?

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Prevalence of hardcore smoking in the Netherlands between 2001 and 2012: a test of the hardening hypothesis

Prevalence of hardcore smoking in the Netherlands between 2001 and 2012: a test of the hardening hypothesis

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Abstract

Background: Hardcore smokers are smokers who have smoked for many years and who do not intend to quit smoking. The "hardening hypothesis" states that light smokers are more likely to quit smoking than heavy smokers (such as hardcore smokers). Therefore, the prevalence of hardcore smoking among smokers would increase over time. If this is true, the smoking population would become harder to reach with tobacco control measures. In this study we tested the hardening hypothesis.

Methods: We calculated the prevalence of hardcore smoking in the Netherlands from 2001 to 2012. Smokers were 'hardcore' if they a) smoked every day, b) smoked on average 15 cigarettes per day or more, c) had not attempted to quit in the past 12 months, and d) had no intention to quit within 6 months. We used logistic regression models to test whether the prevalence changed over time. We also investigated whether trends differed between educational levels.

Results: Among smokers, the prevalence of hardcore smoking decreased from 40.8% in 2001 to 32.2% in 2012. In the general population, it decreased from 12.2% to 8.2%. Hardcore smokers were significantly lower educated than non-hardcore smokers. Among the general population, the prevalence of hardcore smoking decreased more among higher educated people than among lower educated people.

Conclusions: We found no support for the hardening hypothesis in the Netherlands between 2001 and 2012. Instead, the decrease of hardcore smoking among smokers suggests a 'softening' of the smoking population.

Background

In the past decades, smoking prevalence has declined globally,[1] and in Western countries in particular.[2] As fewer people smoke, the remaining group of smokers may have changed over time.[3] According to the *hardening hypothesis,*[3] light smokers are more receptive to tobacco control measures than heavy smokers, and they are therefore more likely to quit smoking. As the number of light smokers in the population of smokers decreases, the remaining group of smokers contains an increasingly larger portion of heavier smokers. Over time, the population of smokers would therefore become harder to reach and more difficult to change.[4,5] In the Netherlands, for example, the prevalence of smoking decreased from 29.9% (3.9 million people) in 2001 to 25.5% (3.5 million people) in 2012. However, the portion of heavy smokers among those 3.9 million people in 2012, may be higher than the portion among those 3.5 million in 2001.

If the hardening hypothesis is supported, the portion of so-called 'hardcore smokers' in the population of smokers would have increased over the last years. Generally, hardcore smokers are smokers who have smoked for many years and do not intent to quit.[4] Compared to other smokers, such hardcore smokers are more likely to be male, to live alone and to have a lower socioeconomic status.[6] There are different definitions of hardcore smokers,[7] but they generally share certain characteristics: smoking consumption, quitting history and intention to quit.[6,8-17]

On consumption, most studies agree that smokers can be classified as hardcore smokers if they smoke daily[6,8-16] and have a minimum consumption of 15 cigarettes per day.[6,8-10,12,15,16] On quitting history and intention to quit, many of the studies on hardcore smoking only include smokers who have been smoking in the past 12 months[6,9,11-16] and who have no intention to quit within the next six months.[8-11,15,16] Finally, most studies aim to included smokers who have reached a stable smoking consumption only. They therefore limit the group of hardcore smokers to those older than 25 years.[6,8-12,15,16]

In this study, we chose a definition that was most similar to most of the wide variety of definitions that exist in the field. This way, the results from our study could be compared the findings of others. In addition, our criteria have been shown to be related to a lower likelihood of quitting.[17] As a result, we defined smokers as 'hardcore' if they were older than 25 years, smoked every day, smoked on average 15 cigarettes per day or more, had not attempted to quit in the past 12 months, and had no intention to quit within 6 months. Previous studies suggest that smokers have hardened in some countries or within subgroups. Some found hardening among English adults from 2000 to 2010[18] and Norwegian adolescents from 2002 to 2010,[19] Others, however, found no support for the hardening hypothesis among Norwegian adults from 1996 to 2009,[11] among Australian adults from 1997 to 2007,[20] among US adults from 1992 to 2011[21] and among European adults from 2006 to 2012.[21]

Educational inequalities

Educational inequalities in smoking are widening in both the Netherlands and other European countries.[2,22] Also, not only are lower educated people more likely to be a smoker than higher educated people, they are more likely to be a *hardcore* smoker as well.[6,11] Previous studies suggest that hardcore smoking is increasing at a higher rate among lower educated people than among higher educated people.[13] As a result, the portion of lower educated people among hardcore smokers would rise. As lower educated people are, in general, harder to reach by tobacco control messages than higher educated people,[23] it would become even more difficult to affect hardcore smokers through tobacco control measures.

Current study

The current study is performed with data from 2001 to 2012 from the Netherlands. In the current study, we investigated whether the smoking population hardened in the Netherlands during the period 2001-2012. We also investigated whether differences in hardcore smoking existed between educational levels and whether these differences have changed over time. To identify such population trends, we used repeated cross-sectional survey data from a large nationally representative sample of the general population in the Netherlands.

As smoking is predicted by education,[24] the distribution of smoking across educational levels differs between the smoking population and the general population (i.e., which also includes non-smokers). The influence of education on trends in hardcore smoking among smokers may be different from that among the general population. We therefore analysed both trends in hardcore smoking among smokers and among the general population.

Methods

Participants

We used data from the Dutch Continuous Survey of Smoking Habits: a cross-sectional web survey that monitors the smoking habits of the Dutch population.[22] Respondents were 15 years and older, had been recruited via a market research company (TNS NIPO). They were invited to complete the questionnaire by email and all respondents have given informed consent. From 2001 until 2008, data were collected per household web interviewing, but from 2009 until 2012, data were collected per personal-level web interviewing. Between 2009 and 2012, response rates ranged from 67.5 % to 70.3 % (no data is available about the response rates from before 2009). These rates are similar to those of other studies.[9,11] After applying weights for sex, age, educational level, working hours, geographic region, urbanisation, and household size, the sample was representative for the Dutch population of 15 years and older. A more detailed description of the recruitment process and the sample characteristics can be found elsewhere.[22] The Central Committee on Research Involving Human Subjects in the Netherlands required no ethical approval for this non-medical survey research.

Variables

Hardcore smoking. We categorized respondents as non-smoker, non-hardcore smoker or hardcore smoker. We determined smoking status by asking: 'Do you ever smoke or do you not smoke at all?' Smokers were 'hardcore' if they a) smoked every day,[11,14] b) smoked on average 15 cigarettes or more per day,[6,10] c) had not attempted to quit in the past 12 months,[15,16] and d) did not intend to quit within 6 months.[8,9] All other smokers, who did not meet the criteria for being a hardcore smoker, were considered non-hardcore smokers. Comparable to previous studies, we only included participants of at least 25 years old in our analyses.[8,10] These smokers may not have reached a stable level of average daily consumption.[6] We were unable to identify hardcore smokers in the first three months of 2001 and the last three months of 2004, due to missing values on our criterion variables. We therefore excluded participants from these periods from the analyses.

Table 1. Sex and educational levels among the general population and among hardcore smokers from 2001 until 2012 (weighted data).

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
General population													
Total N		11369	15536	16280	11626	16490	15370	12562	15879	16815	15992	15861	15590
Sex (%)	Male	48.8%	48.8%	48.8%	48.8%	48.8%	48.8%	48.8%	48.8%	49.5%	49.7%	49.2%	49.4%
	Female	51.2%	51.2%	51.2%	51.2%	51.2%	51.2%	51.2%	51.2%	50.5%	50.3%	50.8%	50.6%
Education (%)	Low	47.3%	47.1%	47.1%	47.6%	47.5%	47.1%	47.0%	47.2%	30.4%	28.1%	28.4%	26.5%
	Medium	31.9%	31.9%	31.7%	31.2%	31.6%	32.1%	32.5%	32.4%	40.6%	41.0%	39.7%	40.0%
	High	20.8%	21.0%	21.2%	21.2%	20.9%	20.8%	20.5%	20.4%	29.0%	30.9%	31.9%	33.5%
Hardcore smokers													
Total N		1386	1980	1926	1243	1737	1652	1335	1619	1678	1417	1219	1281
Sex (%)	Male	51.5%	52.2%	51.2%	52.3%	54.2%	53.0%	53.6%	52.4%	51.1%	49.9%	50.5%	48.2%
	Female	48.5%	47.8%	48.8%	47.7%	45.8%	47.0%	46.4%	47.6%	48.9%	50.1%	49.5%	51.8%
Education (%)	Low	57.9%	58.0%	58.1%	61.2%	62.6%	61.0%	60.9%	58.9%	45.6%	40.2%	41.5%	39.9%
	Intermediate	30.3%	30.0%	30.1%	28.8%	27.2%	29.6%	28.3%	31.1%	41.4%	44.5%	43.5%	43.6%
	High	11.8%	12.0%	11.8%	10.0%	10.2%	9.4%	10.8%	10.1%	13.0%	15.2%	15.0%	16.5%

Note: Due to missing values on criterion variables we were unable to identify hardcore smokers in the first three months of 2001 and the last three months of 2004. We therefore excluded participants from these six months from the analyses.

Respondents' characteristics. We assessed age, sex, employment, number of cigarettes per day and whether participants used roll-your-own cigarettes or factory-made cigarettes. We assessed highest attained education and categorized participants in three groups (Dutch names in brackets). Lower educated people either received primary education, lower secondary education (MAVO) or lower vocational education (LBO). Intermediate educated people received intermediate vocational education (MBO) or higher secondary education (HAVO, VWO). Higher educated people had attained tertiary education (HBO, University).

Analyses
First, we tested for groups differences between hardcore smokers and non-hardcore smokers on age (t-test) or any other characteristics (χ^2-tests).

Next, we calculated the prevalence of hardcore smoking within both the smoking population and the general population. We did this for each year from 2001 until 2012. We also calculated this prevalence for each educational level separately.

Finally, we used a logistic regression model to test whether the prevalence of hardcore smoking among smokers had increased over time. This model had hardcore smoking as outcome and consisted of three steps. In the first step, we entered a dichotomous trend variable (0 for 2001, 1 for 2012). In the second step, we added a three-level ordinal variable for education. In the final step, we added interaction variables to test whether the prevalence of hardcore smoking had developed differently between educational levels. We controlled for age and sex, because age and sex are known predictors of hardcore smoking.[6] As the distribution of educational levels of the smoking population is different from that of the general population, we calculated a separate model for the prevalence of hardcore smoking among the general population.

Secondary analysis

In a secondary analysis, we investigated whether the trend in hardcore smoking would have been different if we had used another definition of hardcore smoking. Some studies did not use consumption to define hardcore smokers.[14,25] Therefore, in this secondary analysis we used the same regression models as described above to investigate the trend in hardcore smoking, but this time we removed our consumption criterion from our definition. As a result, in this secondary analysis, hardcore smokers were defined as those who a) smoked every day, b) had not attempted to quit in the past 12 months, and c) did not intend to quit within 6 months. Again, we only included participants of at least 25 years old in these sensitivity analyses.

Results

Sample characteristics

Table 1 shows the weighted distribution of sex and education in the general population from 2001 until 2012. Over the years, the weighted dataset included more males χ^2 (1, N = 179371) = 4.50, p = .034, ϕ = .007, and higher educated participants, χ^2 (1, N = 178601) = 4011.91, p < .001, ϕ = .189. Our weighted dataset of hardcore smokers, also included more women, χ^2 (1, N = 18474) = 4.48, p < .034, ϕ = .031, and higher educated participants over time, χ^2 (1, N = 18399) = 219.20, p < .001, ϕ = .169

Hardcore smokers vs. non-hardcore smokers

Table 2 shows the sample characteristics of both hardcore smokers and non-hardcore smokers in 2012. Compared to non-hardcore smokers, hardcore smokers were older, t(2873.61) = 3.23, p = .002, d = .104, and more likely to be lower or intermediate educated, χ^2 (2, N = 3972) = 108.50, p < .001, ϕ = .165. They were also less likely to be student and more likely to be unemployed or unable to work, χ^2 (5, N = 3953) = 78.23, p < .001, ϕ = .141. Finally, hardcore smokers were more likely than non-hardcore smokers to smoke roll-your-own cigarettes, χ^2 (1, N = 3972) = 333.53, p < .001, ϕ = .290. We found no significant differences in sex in 2012, χ^2 (1, N = 3973) = 3.78, p = .053, ϕ = .031.

Prevalence

Among smokers, the prevalence decreased from 40.8 % in 2001 to 32.2 % in 2012. Among the general population, the prevalence decreased from 12.2 % in 2001 to 8.2 % in 2012. Both drops were significant, p < .001 (see Table 3, step 1 in both models).

Educational inequalities

Step 2 in Table 3 shows the odds ratios for being a hardcore smoker for each educational level. In both populations, lower educated people were more likely to be hardcore smoker than intermediate and higher educated people. Step 3 shows the odds ratios for the interaction terms between trend and education. Among smokers, we found no trend differences between educational levels. Among the general population, however, the prevalence of hardcore smoking decreased more among higher educated people than among lower educated people, p < .001. The trends between lower and intermediate educated people did not differ significantly, p = .081. Figure 1 shows the prevalence of hardcore smoking among the general population from 2001 to 2012 for each educational level.

Table 2. Sample characteristics of hardcore smokers and non-hardcore smokers in 2012.

	Hardcore smokers (n = 1414)	Non-hardcore smokers (n = 2957)	Significance
Age (SD) [a]	49.2 (12.4)	47.9 (14.4)	p = .002
Sex (%)			
Male	48.2	51.5	p = .053
Female	51.8	48.5	
Education (%)			
Low	39.3	27.3	p < .001
Medium	43.6	42.4	
High	16.5	30.3	
Employment (%)			
Employed	56.7	67.3	p < .001
Unemployed	9.7	5.3	
Unable to work	14.0	9.0	
Retired	9.9	13.5	
Student	0.5	1.9	
Other	9.3	7.0	
Smokes RYO (%) [b]			
Yes	67.8	36.8	p < .001
No	32.2	63.2	

[a] For this analysis, we only included participants aged 25 years or older because hardcore smokers are by definition 25 years or older.
[b] RYO: Roll-your-own cigarettes.

Table 3. Logistic regressions for the prevalence of hardcore smoking.

	Smokers (N = 7,456)		General population (N = 27,804)	
	Adj. OR [a]	CI (95%)	Adj. OR [a]	CI (95%)
Step 1 [a]				
Trend				
2001	1		1	
2012	.665***	(.603, .733)	.658***	(.606, .713)
Step 2 [a]				
Trend				
2001	1		1	
2012	.738***	(.667, .816)	.803***	(.738, .874)
Education				
Low	1		1	
Intermediate	.752***	(.673, .841)	.629***	(.573, .691)
High	.424***	(.369, .489)	.305***	(.269, .346)
Step 3 [b]				
*Trend * Education*				
Low vs. Intermediate	.903	(.725, 1.125)	.850	(.709, 1.020)
Low vs. High	.907	(.686, 1.200)	.656**	(.514, .837)

[a] Adjusted for age and sex. [b] Adjusted for age, sex and main effects of trend and education. Significance: ** *p* < .01 *** *p* < .001

Smoking consumption
The sensitivity analysis showed that removing the consumption criterion did not affect the results of any of the regression models. Among both smokers and the general population, we found a decrease in hardcore smoking over time. In both populations the trend remained significant after including education and the interaction between trend and education to the regression models.
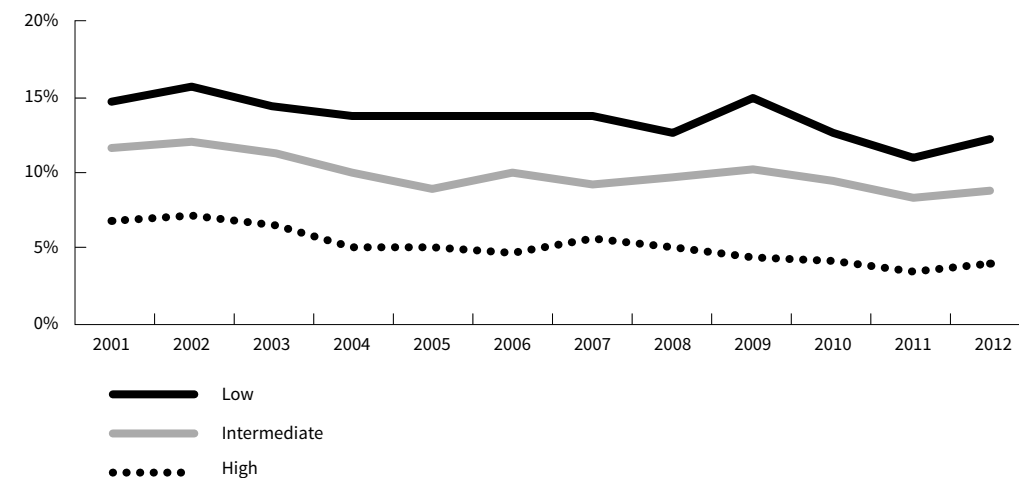
Figure 1. Prevalence of hardcore smoking among the general population from 2001 to 2012 by educational level (weighted data).

Discussion

Hardening hypothesis
The hardening hypothesis predicts that the portion of hardcore smokers among smokers would increase over time. In contrast to this hypothesis, we found that among smokers the prevalence of hardcore smoking decreased from 40.8 % in 2001 to 32.2 % in 2012. In the general population, this prevalence decreased from 12.2 % in 2001 to 8.2 % in 2012. These findings suggest that, between 2001 and 2012, the Dutch smoking population has gradually softened, instead of hardened. This is in line with previous studies in Norway,[11] Australia,[20] and the United States.[21]

The softening of the population may also be explained by a gradual decrease in the number of cigarettes smoked among smokers. As in previous studies,[6,8–10,12,15,16] one criteria for hardcore smoking was smoking at least 15 cigarettes per day. As the average number of cigarettes per day smoked decreased, some hardcore smokers started smoking less than 15 cigarettes per day and may have become non-hardcore smokers over the past years. However, removing the consumption criterion from our definition of hardcore smokers, did not affect the results of our study. The softening of the population may therefore have occurred independently from the reduction in cigarette consumption.

Two other factors may also explain this softening of the smoking population. First, tobacco control policy measures, such as smoking bans and tax policies, may not only have stimulated light smokers to quit smoking, but may have influenced heavy smokers (i.e., hardcore smokers) as well. Second, the softening may be a result of changing social norms. Societal norms about smoking may have changed over time and this process might have increased quitting throughout the whole smoking population.

Both explanations are in line with Rose's theory, which states that tobacco control measures and social norms do not only influence light smokers, but the population as a whole.[26] Therefore, the remaining group of smokers would become softer instead of harder. While tobacco control policies and changing social norms are likely causes, the decrease of hardcore smoking in the Netherlands might also have been caused by other factors, such as a higher rate of mortality among hardcore smokers than among other smokers. Following Rose's argument, however, we expect that the prevalence of hardcore smoking continues to decline in the next years in the Netherlands. As others have found evidence of hardening in other countries,[18,19] future research may focus on the causes for hardening and softening of the smoking population to investigate why some studies found evidence for hardening, while others did not.

Educational inequalities
In line with previous research,[6,11,13] we found that hardcore smoking was more prevalent among lower educated people than among intermediate or higher educated people. Hardcore smoking decreased in all three groups, but we found no trend differences between educational levels among smokers. Among the general population, however, we did find such trend differences. The prevalence of hardcore smoking decreased more among higher educated people than among lower educated people. This corroborates literature on widening educational inequalities in smoking behaviour in the Netherlands.[22] The different findings between the smoking population and the general population could be explained by other trends in the Dutch general population. While the portion of higher educated people has increased in the Dutch general population,[27] these higher educated people are less likely to smoke than lower educated people.[22] The general population therefore contains an increasing portion of non-smoking higher educated people over time. The smoking population, however, remains relatively unaffected by this growing group of non-smoking higher educated people. This may explain why we found trend differences between educational levels among the general population, but not among smokers.
In line with other studies,[6,12] we found that hardcore smokers were lower educated than non-hardcore smokers and that they were more likely to be unemployed. In addition, we found that hardcore smokers are much more likely to smoke roll-your-own cigarettes than non-hardcore smokers in the Netherlands. This difference may further indicate socio-economic differences, because roll-your-own cigarette smokers tend to have a lower income and to be lower educated than those who smoke factory-made cigarettes.[28] Lower costs are one of the main reasons for smoking roll-your-own cigarettes.[28] Therefore, tax policies may help to further decrease educational inequalities in hardcore smoking. Increasing tax on roll-your-own tobacco, for example, would decrease the difference in price between roll-your-own cigarettes and factory-made cigarettes.

Strengths and limitations
A strength of our study is that we used repeated cross-sectional data from a large representative sample of the general population. This allowed us to examine trends in hardcore smoking among both smokers and among the general population. Because we had a large sample, we were also able to identify differences in trends between educational levels.
A potential concern is the definition of hardcore smokers. Although several studies investigated the prevalence of hardcore smoking before, no clear definition of hardcore smokers currently exist. In our

study, we therefore used a definition that is most comparable to other studies. As many studies have used different definitions, it is difficult to compare the prevalence of hardcore smoking between studies.[7] By using a definition that is similar to others, however, we are able to compare *trends* in hardcore smoking. These trends may be more informative about future characteristics of the smoking populations than prevalence rates.

Suggestions for future research
Future research may focus on the use of e-cigarettes among hardcore smokers. A recent study showed that Dutch tobacco smokers are increasingly aware of e-cigarettes and that many have started to use them.[29] If future population surveys do not effectively take into account e-cigarette use, this may bias future estimates of hardcore smoking. Many e-cigarette smokers have smoked traditional cigarettes before taking up e-cigarettes and remain to do so after starting to use e-cigarettes.[30] In the current study, we have assessed traditional cigarette consumption, but some smokers would be classified as hardcore nicotine users if we had assessed their e-cigarette consumption as well. Also, as e-cigarettes allow smokers to use nicotine in places where smoking traditional cigarettes is banned, smokers may be more likely to increase their total nicotine consumption and become hardcore nicotine users eventually.

Practical implications
Despite the softening of the smoking population, about 8.2 % of the Dutch population is still a hardcore smoker. This group remains particularly vulnerable to death, disease, and lower quality of life. Therefore, interventions targeting hardcore smokers are still needed to further decrease the prevalence of hardcore smoking in the Netherlands.[4] Previous literature suggested that such interventions may incorporate motivational interviewing techniques[31] and contain targeted and tailored information.[32] Motivational interviewing aims to decrease resistance to anti-smoking messages and encourages participants to come up with arguments for behavioural change themselves. Tailored information is information that has been individualized to participants, based on, for example, their personal beliefs about smoking.[32] It has shown to increase effectiveness of web-based smoking cessation interventions.[33]
In line with previous studies,[6] our study showed that hardcore smoking is more prevalent among lower educated people. Interventions targeting hardcore smokers may therefore decrease educational inequalities. One such intervention encourages smoking cessation among pregnant women.[34,35] In the Netherlands, smoking during pregnancy is particularly prevalent among lower educated people.[36] Improving interventions that encourage these hardcore smoking, pregnant women to quit smoking, may therefore not only reduce hardcore smoking, but may reduce educational inequalities in smoking as well.

Conclusions
The prevalence of hardcore smoking among smokers *decreased* between 2001 and 2012. This suggests that the population of smokers has softened, instead of hardened. There was no support for the hardening hypothesis in the Netherlands. Among the general population, hardcore smoking decreased at a higher rate among higher educated people than among lower educated people. This may be explained by increasing educational differences in smoking among the general population.

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chapter 3
focus group

Perceived pros and cons of smoking and quitting in hard-core smokers: a focus group study.

Perceived pros and cons of smoking and quitting in hard-core smokers: a focus group study.

Jeroen Bommelé, Tim M. Schoenmakers, Marloes Kleinjan, Barbara van Straaten, Elske Wits, Michelle Snelleman and Dike van de Mheen (2014). *BMC Public Health*, 14 (175). doi:10.1186/1471-2458-14-175.

Abstract

Background: In the last decade, so-called hard-core smokers have received increasing interest in research literature. For smokers in general, the study of perceived costs and benefits (or 'pros and cons') of smoking and quitting is of particular importance in predicting motivation to quit and actual quitting attempts. Therefore, this study aims to gain insight into the perceived pros and cons of smoking and quitting in hard-core smokers.

Methods: We conducted 11 focus group interviews among current hard-core smokers (n = 32) and former hard-core smokers (n = 31) in the Netherlands. Subsequently, each participant listed his or her main pros and cons in a questionnaire. We used a structural procedure to analyse the data obtained from the group interviews and from the questionnaires.

Results: Using the qualitative data of both the questionnaires and the transcripts, the perceived pros and cons of smoking and smoking cessation were grouped into 6 main categories: Finance, Health, Intrapersonal Processes, Social Environment, Physical Environment and Food and Weight.

Conclusions: Although the perceived pros and cons of smoking in hard-core smokers largely mirror the perceived pros and cons of quitting, there are some major differences with respect to weight, social integration, health of children and stress reduction, that should be taken into account in clinical settings and when developing interventions. Based on these findings we propose the 'Distorted Mirror Hypothesis'.

Background

In the last decade, so-called hard-core smokers have received increasing interest in research literature. According to some, their significance within the population of smokers will increase over the coming years.[1] Although many different definitions exist, most agree that smokers are considered 'hard-core', when they have a high level of nicotine dependence, have smoked for a considerable number of years and, most importantly, show little to no intention to quit.[2]

According to the *hardening hypothesis*, current anti-smoking policies are more likely to affect smokers who are less dependent on tobacco than those who are more dependent.[3] Therefore, light smokers (i.e., smokers who smoke less cigarettes per day, who are more willing to quit, or who experience less symptoms of nicotine dependence) are more likely to cease smoking than hard-core smokers. In other words, current policies and interventions tend to make light smokers quit, leaving a larger portion of hard-core smokers in the total population of smokers.[4] Although the hardening hypothesis has faced mixed evidence,[5] research has shown that hard-core smokers are less likely to be affected by tobacco control measures.[6] This emphasises the importance of developing interventions targeting hard-core smokers.

For smokers in general, the study of perceived costs and benefits (or 'pros and cons') of smoking is particularly important in predicting motivation to quit and actual quitting attempts.[7–9] Many theories, like the Health Belief Model,[10] the Theory of Planned Behaviour,[11] the Transtheoretical Model,[12] and the Social Cognitive Theory[13] acknowledge the influence of perceived pros and cons in the process of behavioural change. Evidence suggests that hard-core smokers differ from non-hard-core smokers in their perceived pros and cons of smoking and quitting. For example, hard-core smokers are less likely to consider smoking as a possible cause of health damage for themselves[14] and they are also less likely to acknowledge the possible adverse health effects of second hand smoking.[6] However, until now, relatively little is known about the perceived pros and cons of smoking and smoking cessation in the specific subgroup of hard-core smokers. Knowledge on the attitudes of hard-core smokers towards smoking and smoking cessation may help to develop interventions specifically targeting this group.

Although research on smoking cessation in general population smokers has yielded substantial knowledge about the perceived pros and cons of smoking, there is a lack of central focus. Some studies only investigate the perceived pros and cons of smoking,[15–17] while others only target the perceived pros and cons of smoking *cessation* (or 'quitting').[18,19] Some attempted to combine both concepts,[20] but did not explicitly investigate the four different perspectives involved (i.e., pros of smoking, cons of smoking, pros of quitting, and cons of quitting).

We argue that it is important to assess all four perspectives explicitly to obtain the most comprehensive view on attitudes towards smoking and quitting. For example, smokers may see many pros and few cons of quitting but may keep on smoking for just one perceived pro of smoking (e.g. it helps them to relax). Moreover, the perceived pros and cons of smoking do not necessarily mirror the perceived pros and cons of quitting. Smokers may, for instance, smoke to feel socially accepted by friends, but may not necessarily think that quitting would make them less accepted by friends. Investigating all four perspectives may reveal contradictory beliefs that (hard-core) smokers have towards smoking and quitting. In this study we therefore investigate all four perspectives in hard-core smokers.

Former hard-core smokers have successfully gone through the process of quitting and they might provide additional insights into the balance of motives to stop or to continue smoking. Current hard-core smokers, who have not yet permanently quit, might lack the experience to identify the crucial pros or cons that might tip the balance of motives from smoking continuation towards smoking cessation.

In summary, in the present study we investigated the perceived pros and cons of smoking and quitting among hard-core smokers by conducting a focus group study among low and high SES current hard-core smokers, and among low and high SES former hard-core smokers. The aim of the current study was to gain insight into the perceived pros and cons of both smoking and smoking cessation in hard-core smokers.

Methods

Participants

Participants were recruited via an online survey sample (Survey Sampling International, SSI). Over 5000 Dutch panel members were invited to fill out a small screener designed to identify eligible participants. Participants were eligible if they were current or former hard-core smokers.

Previous studies identify three basic characteristics of hard-core smokers: relative high tobacco consumption, little intention to quit, and resilience to societal pressures as indicated by a relatively long smoking history. We translated these into six criteria for our screener. Smokers were defined as hard-core if they a) smoked every day,[6,21] b) smoked on average 15 cigarettes or more a day,[6,21] c) had not attempted to quit smoking in the past year,[6,14,21,22] d) were not planning to quit within 6 months,[6,14,21,22] e) had been smoking at least 15 years in their lifetime, and f) were 35 years or older. As for the last criterion, we selected these older smokers, because smoking-related pros and cons tend to differ between younger and older smokers.[23] They have surpassed young adulthood and have reached a stable smoking habit with commensurable smoking-related cognitions.

Former hard-core smokers were also aged 35 or older and had been smoking at least 15 years in their lifetime. All participants had been smoking more than 15 cigarettes daily at one point in their life. All former hard-core smokers had stopped smoking for at least one year at the time of the interviews. We identified about 1350 current and about 900 former hard-core smokers, of which 314 current and 132 former hard-core smokers were interested in attending a focus group interview. After exclusion of participants who were unable to attend due to time and/or geographical limitations (all focus groups were conducted in the same two cities, restricting our sample to those participants who lived nearby or were willing to travel far), 31 former and 32 current hard-core smokers participated in our focus group study.

All participants were aged 35-79 (M = 54.7, SD = 7.6) and groups sizes were 2-10. Table 1 presents the background characteristics of the current and former smokers. We used t-tests to analyse differences between the two groups. At the start of the interview, all participants introduced themselves and all but two former smokers indicated the number of years they had quit. This ranged between 1.5 and 40 years (M = 10.0, SD = 8.1). Participants received compensation for their travel expenditures and an additional 45 euros for their participation.

Table 1. Sample Characteristics.

	Current smokers (n = 32)	Former smokers (n = 31)
Demographics		
Female, N (%)	11 (34.4%)	11 (35.5%)
Age (SD) [a]	52.7 (7.0)	56.8 (7.6)
Years smoked in life (SD) [a][b]	36.5 (8.2)	31.0 (9.9)
Socioeconomic status [c]		
Low	18 (56.3 %)	18 (58.1 %)
High	14 (43.8 %)	13 (41.9 %)
Intention to quit		
Within 1 year	4 (12.5 %)	
Within 5 years	4 (12.5 %)	
Not quitting, but smoking less	12 (37.5 %)	
Not quitting and not smoking less	12 (37.5 %)	
Nicotine dependence		
FTND (SD) [d]	6.13 (1.5)	5.97 (1.8)
Cigarettes per day [d]	26.7 (8.1)	32.7 (16.9)

[a] Significant difference between current and former hard-core smokers (p < .05). [b] For all participants a minimum of 15 years was required. [c] Socioeconomic status was measured as the highest completed education. [d] Former smokers filled out the Fagerström Test for Nicotine Dependence (FTND) for the period "they smoked the most".

Procedure

Using the standardized procedures of Goldman and Schmaltz,[24] we conducted 11 focus group interviews among current hard-core smokers (n = 32) and former hard-core smokers (n = 31) in the Netherlands. Focus group research is a research method suitable for investigating opinions, beliefs and perceptions on non-sensitive topics, like smoking.[25] We held separate focus groups for participants of low and high SES, because SES has shown to be an important factor in the outcome beliefs of smoking,[26] and the prevalence of hard-core smokers is higher among those with a lower SES.[6] We based SES on the highest completed level of education (Dutch abbreviations in brackets), because education has shown to be a good predictor of SES in the Netherlands.[27] Low SES had primary education, lower secondary education (MAVO), or lower to middle level vocational education (LBO, MBO). High SES had higher secondary education (HAVO, VWO) or tertiary education (HBO, University). Of the 11 groups, 4 were conducted among low SES current hard-core smokers, 3 among high SES current hard-core smokers, 2 among low SES former hard-core smokers and 2 among high SES former hard-core smokers.

At the start of the interviews written informed consent and demographic data were obtained. Participants also completed the Dutch version of the Fagerström Test for Nicotine Dependence (FTND[28,29]). Participants were ensured their responses were anonymous and would only be used for research purposes. Each focus group lasted ± 45-75 minutes and was led by a moderator skilled in qualitative methods. To avoid biased responses, we selected moderators who had little prior experience with research on tobacco control (BS, EW). Participants were first asked what they personally consider to be important pros and cons of smoking. They then completed a questionnaire (± 5 minutes) in which they listed what they personally consider to be the three most important pros and cons of smoking. We used the same procedure (i.e., first a group discussion, then the questionnaire) to assess the pros and cons of quitting. At the end of the discussion, we probed for additional reasons and arguments to smoke or to quit smoking.
The study protocol was approved by the Medical Research Ethics Committee of the Erasmus MC.

Analysis of the structured questionnaires

The questionnaire data were analysed in three steps. First, we imported the data in QSR NVivo 8 and we coded all perceived pros and cons of smoking and quitting listed in the questionnaire data *in vivo*. These questionnaire data yielded 145 separate codes (i.e., 145 separate pros and cons of smoking and quitting). In the second step, two authors (JB, MS) independently extracted main categories based on the thematic content of the codes. Consensus among the coders was high. They then met to refine the main categories and to distinguish (when necessary) subcategories. Together they arranged all survey codes among different categories, reaching full consensus.
In a third step we quantified all codes which were classified in the previous stage. Since no participant listed the same pro or con twice, the number of references for each code also represented the number of participants who explicitly reported this specific pro or con. This allowed us to compare different pros and cons, using these numbers of participants. It also allowed us to compare categories based on the portion of all references within a perspective (i.e., pros of smoking, cons of smoking, pros of quitting, cons of quitting). Finally, we compared the four different perspectives based on the content of their categories In Table 2, we present these data according to smoking status, but not according to SES group, because we found no relevant differences there.

Analysis of the transcripts

The transcript data were also analysed in three steps. First, we conducted a procedure for note based analysis.[25] In this technique, the co-moderator makes notes during the focus group to capture important non-verbal behaviours of the participants. The leading moderator listens for inconsistent, vague or cryptic comments and probes for understanding. For each issue the moderator offers a summary of the answers to key questions and seeks confirmation from the focus group participants. Immediately after the interview, the moderator and co-moderator debrief and note additional themes, hunches, interpretations and ideas. The recordings of the focus groups are then transcribed verbatim (JB).
In a second step two authors (JB, MS) independently coded the interview transcripts of one focus group for thematic content. Consensus was high and, after discussing the codes, the authors reached full consensus over the coding procedures. The first author (JB) coded the remaining transcripts accordingly, which yielded 188 separate codes. The coding of these remaining transcripts was overseen by two other authors (TS, MK) to ensure reliability.

In the third and final step, two coders (JB, MS) arranged the codes from the focus group transcripts into the main and subcategories found in the questionnaires. We used the same classification as used for the questionnaires, because the questionnaires served as summary for the participants: i.e. participants listed their most important pros and cons immediately after discussing them. Some pros or cons could be categorized in more than one theme, but for matters of clarity, we categorized every single pro and con in just one single (sub)category. The initial difference in coding between the two authors was acceptable with 85.1% agreement consensus on main categories. Full consensus (100%) was easy to reach. Percentage agreement is a commonly used method of calculating intercoder reliability.[30] Together, the two coders evaluated the main categories and the subcategories once more to ensure the validity of these categories.

Results

Main categories

We used the qualitative data of the questionnaires and the transcripts to group the perceived pros and cons of smoking and smoking cessation into 6 main categories and 14 subcategories. For each main category we selected one exemplary quotation that best reflects that main category. These quotations are presented in Table 3.

The first main category was 'Finance' and entailed the perceived financial pros and cons. Because all arguments in this category concerned the financial costs of smoking and the absence of these costs when one has quit, we did not identify any subgroups here.

The second main category we found was 'Health', which included physical health consequences of smoking and quitting. In this category we distinguished 6 subcategories: 'Serious problems and diseases', 'Minor health issues', 'Physical fitness', 'Hygiene', 'General', and 'Appearance'. The first two subcategories included several health-related issues ranging from cancer to coughing. We considered long-term, life-threatening issues (such as cancer) to be a serious problem and more short-term, non-lethal issues (such as coughing) to be a minor health issue. When participants reported arguments about their perceived level of energy or tiredness we placed these arguments in the 'Physical fitness' subcategory. We categorized physical changes related to hygiene (e.g., bad breath, yellow fingers and bad teeth) in the 'Hygiene' subcategory and physical changes related to one's overall appearance (e.g., unhealthy looking skin or hair) in the 'Appearance' subcategory. We placed more abstract remarks, like "smoking is bad for my health" and "quitting will improve my health", in a 'General' subcategory. Interestingly, participants tended to focus more on short-term health consequences than on long-term health effects of smoking.

The third main category was 'Intrapersonal Processes'. This was the most diverse and therefore least straightforward of all the main categories. However, almost all of the perceived pros and cons grouped here were related to the psychological and physiological factors caused by nicotine intake. The accompanying subcategories were: 'Addiction and Dependence', 'Stress', 'Adherence to Rules', and 'Killing Time'. Although the first two subcategories show some overlap (many stress-related pros and cons could, for example, also have been categorized as arguments related to 'Addiction and Dependence'), these two categories are still fundamentally different. In general, the 'Addiction and Dependence' category included the physical aspects that maintain the tobacco addiction (e.g., feelings of pleasure or reward).

Table 2. Perceived pros and cons of smoking and quitting.

	Smoking				Quitting			
	Pros		Cons		Pros		Cons	
	Current HCS	Former HCS	Current HCS	Former HCS	Current HCS	Former HCS	Current HCS	Former HCS
1. **Finance**	•		c [a]	c	p [a]	p	•	
2. **Health**	•		cc	cc	pp	pp	•	•
Serious Problems and Diseases			•	•	•		•	•
Minor Problems	•		•	c	•	p	•	•
Physical Fitness			c	c	p	p	•	
Hygiene			•	•	•	•		
General Health					p	•		
Appearance			c	•		•		•
3. **Intrapersonal Processes**	ppp	ppp	•	c	p	p	ccc	cc
Addiction / Dependence	p	p	•	c			cc	c
Stress	pp	pp					c	c
Adherence to Rules	•		•	•	•	•		
Killing Time	•	•		•	•	•	•	•
Miscellaneous	•	•			•	•		
4. **Social Environment**	p	pp	c	c	•	•		c
Children			•	•	•			
Social Exclusion	p	pp	c	•	•	•	•	c
Miscellaneous		•	•	•	•	•		•
5. **Physical Environment**			c	c	•	p		•
Odours			c	c	•	p		•
Safety			•	•	•	•		
6. **Food and Weight**	•	•		•	•	p	c	c
Other	•		•					
No Pros or Cons	•	•	•	•	•	•	•	c

[a] The perceived pros and cons for current and former hard-core smokers. The number of p's (c's) represent the percentage of all pros (cons) within a subgroup: • (< 10 %), p or c (10-30 %), pp or cc (30-50 %), ppp or ccc (> 50 %). Themes in bold represent main themes.

The 'Stress' subcategory, on the other hand, described the psychological aspects of the addiction and mainly includes (internal and external) triggers to smoke, like negative emotions and stress-factors. Finally, 'Adherence to Rules' described the (psychological) effects of smoking restrictions and 'Killing Time' entailed arguments about countering boredom. As shown in the Table 3, the psychological effects were sometimes less severe than expected beforehand.

The fourth main category was 'Social Environment' and included arguments involving (significant) others. We identified two associated subcategories: 'Children' and 'Social Exclusion'. In general, this main category included arguments about the perceived influence others have on smokers, as well as the influence smokers have on others. The subcategory 'Children' entailed arguments about one's own children, as well as the children of others and children in general. Arguments about the perceived level of social integration within the family, among friends or in society were placed in the 'Social Exclusion' subcategory.

The fifth main theme entailed the 'Physical Environment' of the smoker. Within this main category we identified the subcategories 'Odours' and 'Safety'. Most arguments here focussed on the smell smoking causes in clothing, house or car (i.e., 'Odours'). 'Safety' arguments were usually about the dangers of causing fire.

The sixth and final main category included pros and cons concerning 'Food and Weight'. The arguments in this category were usually about the changes in body weight due to quitting and the accompanying related change in diet.[31] Due to the large homogeneity of the pros and cons, we did not distinguish any subcategories here.

Since we aimed to categorize all pros and cons, an additional category was created. The very small number of arguments which could not be grouped in any of the six categories described above were classified as "Other". An example of such an argument comes from one smoker who reported he "liked to blow smoke rings".

We labelled all statements from current and former hard-core smokers who said that they could not come up with any argument for one of the perspectives as "No pros or cons". For example, a few former smokers could not remember any con of quitting, while some of the current smokers could not come up with any pro of smoking.

Differences between perspectives
Although the pros and cons of smoking largely mirrored those of quitting, there were some noticeable differences. Many pros of smoking (e.g., feelings of pleasure) were also mentioned as a con of quitting (e.g., missing moments of pleasure). Conversely, many cons of smoking (e.g., health problems) corresponded with certain pros of quitting (e.g., better health). Although there were many similarities, four major differences emerged.

The most pronounced difference was found the Food and Weight category. Many smokers and former smokers indicated that quitting makes one gain weight (con of quitting). Conversely, almost no one reported that they smoked to lose or keep weight. Apparently, weight is only an issue for quitting, but not for smoking.

The second major difference was in the Social Environment category. Although being part of a group was usually considered an important pro of smoking, quitting does not necessarily mean that one is no longer part of that group. Therefore, social ingratiation is usually an important pro of smoking, but to a lesser extent a con of quitting.

Table 3. Example Quotations.

Main category	Example quotation	Participant
1. Finance	That is what made me quit smoking. It cost too much money. And at that time I did not have a lot of money, but I smoked it all away, until I thought: "What am I doing?"	Female former hard-core smoker with high SES
2. Health	In those days [when I smoked], when I had a cold, I sometimes had a cough for over four, five weeks. And I always had to have a handkerchief with me. Nowadays, I have a handkerchief with me for over four days, without even using it. And when I have a cough, it is gone in two days.	Male former hard-core smoker with low SES
3. Intrapersonal Processes	A con [of quitting] was that in the beginning I felt something was missing, I did not know what to do. […] But I got rid of those cravings within a couple of months. I did not worry too long.	Male former hard-core smoker with low SES
4. Social Environment	Only smoking neighbours visit me […] partly because we are neighbours. But non-smoking neighbours do not visit us and we do not visit them. We even do not visit some relatives who do not want you to smoke in their house.	Male current hard-core smoker with low SES
5. Physical Environment	Yes, I loved it when I had quit. Everything was much fresher. […] For me, the biggest advantage was that that my house was clean and fresh.	Female former hard-core smoker with low SES
6. Food and Weight	I quit smoking twice. […] The first time I gained 13 kilos and the second time, about five years ago, I gained 24 kilos. I was so deeply unhappy. […] It was madness. I will never do it again, I will never quit smoking again.	Female current hard-core smoker with low SES

Note: Example quotation for each main category with participant information.

Thirdly (although less visible in Table 2), children appeared to be a very good motivator to quit smoking, but did not serve as a prominent con of smoking. Many smokers mentioned that their second-hand smoke does not harm their children, because they do not smoke in the presence of children. Consequently, hardly anyone reported negative effects on children as a con of smoking. However, many did mention many positive effects of quitting on children (or pregnancy). If someone quits smoking, he or she is considered to be a good example for their children. Also, these children will not be exposed to second hand smoking (anymore). Fourthly, many smokers mentioned the reduction of stress as an important motivator to smoke. However, not having this relaxant seemed less important as a con of quitting, especially for former smokers. Perhaps they had found another way of reducing feelings of stress.

Discussion

Overview

In this focus groups study we identified 6 main categories and 14 subcategories in perceived pros and cons of both smoking and quitting in current and former hard-core smokers. The results suggested that the four different perspectives on smoking and quitting (i.e., pros of smoking, cons of smoking, pros of quitting, and cons of quitting) are essentially different. We found few pronounced differences in perceived pros and cons between current and former smokers and no differences between participants of high and low SES.

Main categories

Finance appeared to be an important con of smoking and pro of quitting. Smoking is relatively costly and tobacco products continue to increase in price. Many countries have implemented policies to increase the price of tobacco products and these policies are thought to target low SES smokers in particular.[32,33] In our focus group study, however, we found no indication that low SES smokers are more affected by cigarette prices than high SES smokers. Both groups reported this theme equally often.

Health was a second major con of smoking and pro of quitting. Both smokers and former smokers reported that smoking lowers one's physical fitness and makes one less attractive (e.g., fainted skin or hair). Smoking also causes minor health problems (e.g., coughing) and is sometimes associated with bad hygiene (e.g., yellow fingers and bad teeth). Quitting is believed to negate these negative effects of smoking. It was interesting that the participants hardly mentioned major health problems like lung cancer or cardiovascular diseases. Many anti-smoking campaigns use these major health issues as their main argument,[34] but hard-core smokers may be unaffected by these messages.

The third major category we distinguished was Intrapersonal Processes. Current smokers, in particular, deemed these arguments to be important pros of smoking and cons of quitting. However, participants reported pros and cons in all four perspectives, emphasising the importance and diversity of this theme. It was reported that smoking gives feelings of pleasure and relieves tensions. Nevertheless, when someone quits, he or she will temporarily miss these feelings of pleasure and may find it difficult to relieve stress. Former smokers recalled that these negative effects turned out better than expected. They did not experience withdrawal symptoms as much as the current smokers currently anticipate. Perhaps these accounts of former smokers may help convince current smokers to quit.

The social environment was also an important topic. Both current and former smokers mentioned that, in their early teens, smoking helped them make friends and made them feel part of a group. Later on in life, however, smoking lost a significant part of this social function. For former smokers, this was still an important pro of smoking. Although many current smokers mentioned that smoking still makes them feel comfortable among friends and strangers, they also reported feeling like a societal outcast due to all the tobacco control policies and smoking restrictions in the Netherlands. Smokers also mentioned receiving many negative comments about their smoking behaviour from non-smokers and former smokers, and that these people try to convince them to quit. Not surprisingly, not receiving these comments and no longer feeling a social outcast were considered pros of quitting. These results are in line with others who emphasised the influence of the social network on smoking and quitting behaviour.[35]

The fifth theme was Physical Environment, which mostly contained cons of smoking and pros of quitting. The majority of arguments in this theme were about the smell and stench from smoking. Both current and former smokers reported that smoking makes their house, car, and clothes smell and acknowledge that quitting will make this smell disappear over time. Since most smokers are aware of this con of smoking, this could be a relevant topic for future research on third hand smoking (i.e., consequences of tobacco smoke that linger after the cigarette has already been extinguished). Third hand smoking has been investigated in houses[36] and cars[37] but could also be a topic in interventions targeting hard-core smokers.

The sixth theme was Food and Weight and was only found relevant as a con of quitting. The arguments in this category were about gaining weight after quitting and an (often) accompanying change in diet. Many smokers expect to gain weight after quitting, which was confirmed (but to a lesser extent) by the former smokers. This theme appears to be specific to the cons of quitting as no similar arguments were given in the other perspectives.

Finally, we found that some participants were unable to generate any pros of smoking or cons of quitting. Despite having smoked for many years, they could not give any rationale for their smoking behaviour. For some participants this was quite an eye-opener. In a clinical setting, emphasising that one does not have any pros of smoking, may serve as a starting point for some smokers to consider quitting.

Differences between subgroups

We found few major differences in perceived pros and cons between current and former smokers. In general, former smokers seem to have a more comprehensive view on both smoking and quitting. While many current smokers tend to focus on the barriers of quitting, former smokers are usually more positive about smoking cessation. This is probably due to the change of beliefs after quitting. It is known that outcome beliefs tend to shift after quitting [38], and perhaps the longer one has quit, the larger the shift. In our study, the number of years quit ranged between 1.5 and 40 years. We were therefore able to capture the outcome beliefs from various time stages after quitting. Secondly, many former smokers did not experience major negative consequences (e.g., gaining weight or extreme withdrawal effects), or only to a slight extent. However, former smokers discovered some unexpected benefits of quitting, like regaining their taste and appetite.

We held different focus groups for low and high SES participants, because SES has shown to be an important factor in the outcome beliefs of smoking [26], and the prevalence of hard-core smokers is higher among those with a lower SES [6]. However, no notable difference emerged between the two different socioeconomic groups. We also found no difference between men and women. Even on the topic of weight control, where some found substantial differences [39], we found no indication that more women than men consider this an important con of quitting. However, this may be due to the relatively small sample size.

Proposing the Distorted Mirror Hypothesis

Although the pros and cons of smoking and the pros and cons of quitting show a similar pattern, there are some differences. Therefore, we propose the Distorted Mirror Hypothesis. According to this new hypothesis, many pros of smoking are similar to certain cons of quitting. Conversely, many cons of smoking correspond to certain pros of quitting. Like a mirror, the pros and cons of smoking are reflected in the cons and pros of quitting, respectively. This mirror, however, is distorted: not all pros (and cons) of smoking are similarly reflected in the mirror of quitting (e.g., arguments related to social cues). Further, the mirror of quitting also reflects elements that do not exist in the pros and cons of smoking (e.g., arguments related to weight).

Four major differences were found in the 'distorted mirror': a) weight gain is an important con of quitting, but weight loss or maintenance are not important pros of smoking, b) social integration is an relatively important pro of smoking, but losing friends is not a con of quitting, c) saving the health of children is a pro of quitting, but harming these children with smoke is not a con of smoking, and d) stress reduction is an important pro of smoking, but this seems less important as a con of quitting.

This knowledge could be useful in future research or interventions targeting (hard-core) smokers. A clinician treating smokers who consider social integration as an important pro of smoking, could point out that quitting is not likely to isolate these smokers from their social environment. Tobacco control advertisements targeting hard-core smokers are advised not to focus on the possible harms of smoke to children, but to focus on the health benefits of quitting for these children. Similarly, interventions targeting smokers who use tobacco as a way to relax may use the accounts of former smokers to inform current smokers that it is possible to find relaxation after quitting. The differences brought forth by the distorted mirror may help to increase the effectiveness of interventions targeting these specific cognitions. The importance of message framing has been emphasised before.[40] Framing a health message as a gain has different effects on persuasion than framing the message as a loss. Research on the framing of smoking cessation messages has further shown that these effects are influenced by gender and health risk perception.[41] Different groups of (hard-core) smokers need different messages. Therefore, it is important that this distinction is also made clear in future research on the perceived pros and cons of smoking and quitting.

Study limitations

Our study may be limited in the extent to which the results are generalizable. Considering our relative small sample size, the results are not statistically generalizable. However, the aim of our study was to uncover all possible pros and cons within the population of hard-core smokers and to generalize to broader concepts and theory. Our results are therefore what Polit and Beck[42] described as analytic generalizable: using individual qualitative data to find broader constructs or theory that are applicable to the entire (sub)population. We therefore believe that the pros and cons we have found and the theory we formulated, are applicable to the Dutch population of hard-core smokers as a whole. Future quantitative research may investigate the statistical generalizability of these pros and cons. Also, the causal relationship between these pros and cons and actual smoking or quitting behaviour could not be determined by the current qualitative research and future quantitative research may provide more insight in this as well. Some pros or cons may have been left unmentioned by participants, because of the group setting in which the interviews were carried out. For example, concerns about sexual activity have not been expressed, perhaps because participants did not feel comfortable sharing those. Also, there are topics (e.g., partners) that are not cited in this paper. These topics may have been implied in more general remarks about social environments, but were never mentioned explicitly.

In our study we used the reports of former hard-core smokers to gain a more comprehensive view on the pros and cons in current hard-core smokers. These reports must be interpreted in the light of former smokers' current smoking status. Smoking-related cognitions tend to change after quitting,[38] and the narratives of the former smokers may therefore be influenced by retrospective recall. However, almost all pros and cons mentioned by current smokers were also mentioned by former smokers, and vice versa. Since the main aim of our study was to gain knowledge on hard-core smokers in general (not only the former smokers), the influence of retrospective recall on our general results is limited.

Another possible limitation of our study could be our definition of a hard-core smoker. Although various definitions are applied in this field,[2] we used three well-known core concepts: relative high tobacco consumption, little intention to quit and a resilience to societal pressures. The most notable difference between our definition and that of others, is that we only included smokers who have smoked more than 15 years in their lifetime. Many studies acknowledge the resilience to societal pressures to quit as a characteristic of 'hard-coreness', but set a less tight criterion (i.e., included smokers who smoked daily for only the past five years). On the other hand, recent research also suggest that the number of years smoked does not influence the effectiveness of quitting attempts.[43] Consequently, the differences between the studies of others and ours related to the number of years smoked is probably negligible. A recommendation for future research is to incorporate other factors that could play a role in predicting different pros and cons. In our study we compared participants based on their smoking status (current vs. former smokers), their SES (low vs. high) and, to a lesser extent, gender. However, other predictors of pros and cons may also play a role in this respect. Nicotine dependence, for example, may change one's attitudes towards smoking and quitting. Similarly, these attitudes may be influenced by personality traits, self-efficacy, features of the social environment and demographic characteristics (e.g., occupation, age, having children). It is established that smoking behavior (and therefore cognitions about smoking and quitting) differs across countries.[44] Since we only included Dutch hard-core smokers, country of origin may also have been a potential biasing factor. These topics were beyond the scope of this study, but future research may investigate the relation between the perceived pros and cons and these variables more thoroughly.

Conclusions

In this study we categorized the perceived pros and cons of smoking and quitting into 6 main categories: Finance, Health, Intrapersonal Processes, Social Environment, Physical Environment, and Food and Weight. Although the perceived pros and cons of smoking in hard-core smokers largely mirror the perceived pros and cons of quitting, major differences should be taken into account that can be addressed in interventions motivating hard-core smokers to quit. With the Distorted Mirror Hypothesis, this paper therefore addresses an important deficit in our understanding of the pros and cons of smoking. This paper also advances the currently limited literature on hard-core smokers. Future research may address both topics more thoroughly.

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chapter 4

subgroups

Identifying subgroups among hardcore smokers: a latent profile approach

Identifying subgroups among hardcore smokers: a latent profile approach

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Abstract

Background: Hardcore smokers are smokers who have little to no intention to quit. Previous research suggests that there are distinct subgroups among hardcore smokers and that these subgroups vary in the perceived pros and cons of smoking and quitting. Identifying these subgroups could help to develop individualized messages for the group of hardcore smokers. In this study we therefore used the perceived pros and cons of smoking and quitting to identify profiles among hardcore smokers.

Methods: A sample of 510 hardcore smokers completed an online survey on the perceived pros and cons of smoking and quitting. We used these perceived pros and cons in a latent profile analysis to identify possible subgroups among hardcore smokers. To validate the profiles identified among hardcore smokers, we analysed data from a sample of 338 non-hardcore smokers in a similar way.

Results: We found three profiles among hardcore smokers. 'Receptive' hardcore smokers (36%) perceived many cons of smoking and many pros of quitting. 'Ambivalent' hardcore smokers (59%) were rather undecided towards quitting. 'Resistant' hardcore smokers (5%) saw few cons of smoking and few pros of quitting. Among non-hardcore smokers, we found similar groups of 'receptive' smokers (30%) and 'ambivalent' smokers (54%). However, a third group consisted of 'disengaged' smokers (16%), who saw few pros and cons of both smoking and quitting.

Conclusions: Among hardcore smokers, we found three distinct profiles based on perceived pros and cons of smoking. This indicates that hardcore smokers are not a homogenous group. Each profile might require a different tobacco control approach. Our findings may help to develop individualized tobacco control messages for the particularly hard-to-reach group of hardcore smokers.

Background

Smoking is one of the leading causes of preventable death in the world. Reducing its prevalence would improve health globally.[1] An important predictor of quitting attempts is motivation to quit smoking.[2] We therefore need to investigate ways of increasing motivation to quit smoking, especially among smokers with no or low intention to quit.

Hardcore smokers are a group of smokers who have little to no intention to quit. In general, they also smoke heavily and have been smoking for a considerable number of years.[3] Previous research indicated that hardcore smokers are less affected by current tobacco control policies than non-hardcore smokers.[4-6] To reach hardcore smokers and motivate them to quit, we require specialized interventions.[4,6] These interventions should ideally contain individualized tobacco control messages (i.e. tailored information) based on individual characteristics.[7]

Some studies suggest that distinct subgroups ('profiles') exist among smokers with low intention to quit.[8-11] Dijkstra and De Vries,[12] for example, distinguished five profiles among so-called 'pre-contemplators'.[13] While pre-contemplators do not intend to quit smoking within 6 months, they could be occasional or light smokers. Hardcore smokers also do not intend to quit within 6 months, but they smoke at least 15 cigarettes per day and have been smoking for many years. Given that there is heterogeneity in pre-contemplators, one might also expect different profiles among hardcore smokers. Identifying such profiles could help to develop interventions using individualized health promoting messages for hardcore smokers. This could improve the smoking cessation interventions for this group.

According to stage models, such as the Transtheoretical Model, perceived pros and cons indicate motivation to quit, which would predict smoking cessation.[13,14] The profiles found among pre-contemplators varied, besides quitting self-efficacy, in the number of pros and cons of quitting.[12] Among pre-contemplators, Dijkstra and De Vries[12] distinguished between *motivated* smokers, who have many pros of quitting and few cons of quitting; *disengaged* smokers, who scored below average on both pros and cons of quitting; and *unmotivated* smokers, who have few pros of quitting and many cons of quitting. Others also found three similar groups in pre-contemplators.[8] Based on this, we expected to find comparable profiles in our sample of hardcore smokers. As profiles among pre-contemplators vary in their perceived pros and cons, profiles among hardcore smokers may therefore also vary with regard to the perceived pros and cons.

In a previous study, we qualitatively examined perceived pros and cons of smoking and quitting among hardcore smokers.[15] In that study, we found that perceived pros and cons of smoking differed from those of quitting. Weight gain, for example, is an important con of quitting, but weight maintenance was not an important pro of smoking. Also, many believed smoking helped them to maintain social contacts, but few believed they would lose friends if they quit smoking. We therefore concluded that both the pros and cons of both smoking and quitting seem theoretically relevant for identifying profiles among hardcore smokers. In the current study, we used the perceived pros and cons of both smoking and quitting to identify distinct profiles among hardcore smokers. We compared these profiles on quitting self-efficacy, nicotine dependence and smoking history. These covariates are relevant, because hardcore smokers tend to have a lower quitting self-efficacy,[6] have higher nicotine dependence,[16] and started smoking earlier in life than non-hardcore smokers.[4]

A first profile could include motivated smokers who see many cons of smoking and many pros of quitting. They may know that quitting would be beneficial, but may be unable to quit due to their high levels of nicotine dependence.[2] We expected a second profile to include smokers who are rather neutral towards the pros and cons of smoking and quitting. These hardcore smokers may be less nicotine dependent and would experience fewer smoking-related problems, such as withdrawal symptoms[17] or nocturnal craving.[18] They may be less motivated to quit, because they have not yet explicitly considered the benefits of quitting. Finally, we expected a third profile whose members perceived many pros of smoking, but few pros of quitting. Like the unmotivated pre-contemplators in Dijkstra and De Vries,[12] they are probably unmotivated to quit smoking; thinking about quitting may be too threatening for them[19] or perhaps they genuinely do not care about quitting. In practice, this profile may be especially hard to reach through current tobacco-control efforts.

In addition to identifying different profiles, we also investigated which profiles are unique to hardcore smokers. Hardcore and non-hardcore smokers differ in their beliefs about smoking. Hardcore smokers are, for example, less likely to acknowledge the dangers of smoking to their own health or to the health of others.[4] Profiles among hardcore smokers may therefore be different from those among non-hardcore smokers. To investigate such differences, we included a separate sample of non-hardcore smokers who had no intention to quit within six months (i.e., non-hardcore pre-contemplators). This sample is similar to the ones in Dijkstra and De Vries[12] and in similar studies on smokers with low intentions to quit.[4,20] Non-hardcore smokers are generally more positive towards quitting than hardcore smokers.[4,5] Among non-hardcore smokers, we therefore expected to find at least one profile of receptive, but more nicotine dependent non-hardcore smokers. As hardcore and non-hardcore smokers also differ in other beliefs, any additional profile found among non-hardcore smokers may differ from those found among hardcore smokers.

In summary, in this study we used the perceived pros and cons of smoking and quitting to identify profiles among hardcore smokers. We then compared these profiles, using relevant smoking-related variables, such as quitting self-efficacy, nicotine dependence and smoking history. Finally, to investigate how unique they are, we compared them with profiles from a sample of non-hardcore smokers.

Methods

Procedure

Respondents were recruited via an online survey sample (Survey Sampling International). Survey Sampling International has about 11.5 million panellist in 103 countries. From July 2012 to September 2012, Dutch panel members filled out a small selection screener questionnaire that contained the criteria below. We identified 542 hardcore smokers and 367 non-hardcore smokers, and invited all to complete our online survey. To obtain a stratified sample, we pursued an equal representation of sex and socioeconomic status (SES). We distinguished two SES groups, based on participants' highest completed level of education (Dutch abbreviations in brackets). Low SES had primary education, lower secondary education (MAVO), or lower to middle level vocational education (LBO, MBO). High SES had higher secondary education (HAVO, VWO) or tertiary education (HBO, University).

We defined 'hardcore' smokers as those who a) were aged 35 or older, b) smoked every day, c) smoked on average 15 cigarettes or more a day, d) had not attempted to quit smoking in the past year, e) had smoked at least 15 years in their lifetime, and f) had no intention to quit within 6 months. Non-hardcore smokers were those who a) were aged 35 or older, b) smoked 'every day' or 'sometimes', c) had no intention to quit within 6 months, and d) did not meet all criteria for hardcore smokers.
We excluded a small number of participants who showed an obvious lack of motivation to complete the survey honestly. They either answered all items within a scale identically (i.e. straight-lining, n = 55) or gave obvious counterfactual statements about their smoking or quitting history (n = 14). Some did both (n = 2). The remaining 510 hardcore and 338 non-hardcore smokers were included in the analyses.

Measures
Demographics and smoking characteristics. We obtained both basic demographics (i.e. sex, age and SES) and smoking-related characteristics (i.e. age of onset, years smoked in life and intention to quit). Years smoked in life and intention to quit were screener variables we used to identify eligible participants.
Nicotine dependence. To measure nicotine dependence, we used the Dutch version of the Fagerström Test for Nicotine Dependence.[21,22] This six item scale assesses the number of cigarettes smoked per day, time to first cigarette after awakening, and difficulty to refrain from smoking in certain situations. The Fagerström questionnaire includes a categorical item to measure cigarettes per day (i.e. 10 or less; 11-20; 21-30; and 31 or more). We used a separate continuous item to measure cigarettes per day more precisely for the demographic measures.
Quitting self-efficacy. We used a 16-item self-efficacy scale (α = .95) to measure the perceived ability to maintain abstinent after a hypothetical quitting attempt.[23] Each question began with 'Imagine you have quit smoking. Would you be able to refrain from smoking when…?' Respondents then indicated their perceived ability in various situations, such as 'being with friends', 'feeling angry', and 'craving for cigarettes'. The response options ranged from *absolutely not* (1) to *most certainly* (7). This self-efficacy measure has proven reliable in smokers with low quitting intentions.[12,24]
Pros and cons of smoking and quitting. We used four separate scales to measure the perceived pros of smoking, cons of smoking, pros of quitting and cons of quitting. Each scale had 16 statements and participants indicated their level of agreement with each statement. The endpoints were labelled *strongly disagree* (1) to *strongly agree* (7). The topics of these scales where money, health, intrapersonal processes (e.g., stress), social environment, physical environment (e.g. smell of cigarettes) and weight gain. All items were based on a focus group study conducted among another sample of hardcore smokers.[15] Example items were 'Smoking helps me fight boredom' (pro of smoking); 'I feel addicted to smoking' (con of smoking); 'Quitting would improve my health' (pro of quitting); and 'Quitting would make me gain weight' (con of quitting). To avoid order effects, we counterbalanced the four scales. We calculated the Cronbach's alpha for the pros of smoking scale (α = .81), the cons of smoking scale (α = .85), the pros of quitting scale (α = .89) and the cons of quitting scale (α = .79). Reliability was acceptable for all scales.

Statistical analysis
To identify profiles among both hardcore and non-hardcore smokers, we conducted two separate series of latent profile analyses (LPA) in MPlus,[25] in which we included the pros and cons of smoking and quitting scales as predictors. A latent profile analysis is a person-oriented approach to identify distinct, homogeneous subgroups. These subgroups are referred to as latent profiles or classes.[26] We performed a series of models, with each specifying between one and six classes. Theoretical and statistical considerations (i.e., goodness-of-fit indices) were used to identify the most parsimonious number of profiles that appropriately fit the observed data.[26] To identify the optimal number of profiles in all analyses, we primarily used the Bootstrap Likelihood Ratio Test (BLRT).[27] The BLRT compares a solution specifying a certain number of profiles (e.g., three profiles) with a solution specifying one fewer profiles (i.e. two profiles). Significant *p*-values indicate the profile solution with the higher number of class better fits the data. A non-significant *p*-values indicate an equivalent fit between two solutions, with the more parsimonious solution then being preferred. In addition to the BLRT, we also considered other statistical indicators, such as the Akaike Information Criteria (AIC),[28] Bayesian Information Criterion (BIC)[29] and entropy. Entropy is an index ranging from 0 to 1 that indicates how accurate participants are classified in their profiles, with a higher value suggesting a better fit (cf. [30]).
After we performed the LPAs, we used IBM SPSS Statistics 19 to compare all profiles on variables not included in the latent profile analyses (i.e., demographics, smoking history, nicotine dependence, and quitting self-efficacy). We used ANOVA's to compare profiles on continuous variables and chi-square analyses to compare profiles on nominal and ordinal variables. To account for uncertainty of profile membership in these analyses, we used the posterior probabilities of profile membership as weights (cf. [31,32]).
All data used in this study are publicly available from the Open Science Framework (https://osf.io/5brnq/).

Ethics statement
The Medical Ethical Committee of the Erasmus MC declared that the Medical Research Involving Human Subjects Act (also known by its Dutch abbreviation WMO) does not apply to this study. It had therefore no objection to the execution of this research. None of the authors had access to identifying participant information at any time.

Table 1. Sample characteristics.

	Hardcore smokers (n = 510)	Non-hardcore smokers (n = 338)	*Significance*
Demographics			
Female, n (%)	50.4	56.2	NS
Age (*SD*)	52.7 (7.2)	51.6 (7.7)	*p* = .031
Socioeconomic status (%) [a]			
Low	56.5	54.7	NS
High	43.5	45.3	
Smoking History			
Age of smoking onset (*SD*)	16.3 (5.5)	17.2 (4.9)	*p* = .021
Years smoked in life (*SD*) [b]	35.4 (8.4)	31.2 (10.2)	*p* < .001
Nicotine dependence			
FTND (*SD*)	5.3 (1.8)	3.1 (2.4)	*p* < .001
Cigarettes per day (*SD*)	21.2 (6.6)	11.1 (8.4)	*p* < .001
Intention to quit (%)			
Within 1 year	11.6	23.4	*p* < .001
Within 5 years	18.0	13.0	
Not quitting, but smoking less	32.4	34.6	
Not quitting, not smoking less	38.0	29.0	
Smoking-related beliefs			
Quitting self-efficacy (SD) [c]	3.8 (1.1)	4.2 (1.0)	*p* < .001
Pros of smoking (*SD*)	3.5 (0.7)	3.3 (0.7)	*p* < .001
Cons of smoking (*SD*)	4.5 (0.8)	4.4 (0.8)	*p* = .026
Pros of quitting (*SD*)	4.5 (0.8)	4.5 (0.9)	NS
Cons of quitting (*SD*)	3.5 (0.7)	3.3 (0.7)	*p* < .001

[a] Socioeconomic status was measured as the highest completed education. [b] Hardcore smokers had smoked > 15 years by definition. [c] Higher scores indicate more quitting self-efficacy.

Results

Sample characteristics

Demographics and smoking characteristics. Table 1 shows the background characteristics. Hardcore smokers were older than non-hardcore smokers, $F(1, 846) = 4.653$, $p = .031$, $\eta^2 = .005$. They also started smoking at younger age, $F(1, 846) = 5.359$, $p = .021$, $\eta^2 = .006$, had smoked more years in life, $F(1, 846) = 42.338$, $p < .001$, $\eta^2 = .048$, had higher nicotine dependence scores, $F(1, 846) = 226.024$, $p < .001$, $\eta^2 = .211$, smoked more cigarettes per day, $F(1, 846) = 376.353$, $p < .001$, $\eta^2 = .308$ and had higher intention to quit, $\chi^2 (3, N = 848) = 25.744$, $p < .001$, $\phi = .174$. We found no differences on sex, $\chi^2 (1, N = 848) = 2.763$, $p = .096$, $\phi = .057$ and SES, $\chi^2 (1, N = 848) = .249$, $p = .618$, $\phi = .017$.

Quitting self-efficacy. Hardcore smokers had lower quitting self-efficacy scores than non-hardcore smokers, $F(1, 846) = 32.187$, $p < .001$, $\eta^2 = .037$.

Pros and cons of smoking and quitting. Hardcore smokers had higher scores on the pros of smoking, $F(1, 846) = 18.203$, $p < .001$, $\eta^2 = .021$, the cons of smoking, $F(1, 846) = 4.994$, $p = .026$, $\eta^2 = .006$, and the cons of quitting, $F(1, 846) = 21.038$, $p < .001$, $\eta^2 = .024$, than non-hardcore smokers. We found no significant difference in pros of quitting, $F(1, 846) = .230$, $p = .631$, $\eta^2 < .001$.

Latent profile analyses

We analysed the sample of hardcore smokers and the sample of non-hardcore smokers separately. Table 2 shows the goodness-of-fit indices (AIC, BIC, entropy, and BLRT) for the series of LPAs of 510 hardcore smokers. Based on these goodness-of-fit indices, the most parsimonious solution included three profiles. We labelled each profile according to characteristics of its members. Table 3 shows the background characteristics of all profiles.

Among hardcore smokers, the first profile (36%) was labelled *'receptive'*. Compared to members of other profiles, receptive hardcore smokers scored lower on the pros of smoking and the cons of quitting, and higher on the cons of smoking and pros of quitting. The second profile (59%) was labelled *'ambivalent'* and included smokers who scored around the neutral point (4) on all four scales. The third and final profile (5%) was labelled *'resistant'*. Compared to members of other profiles, *resistant* hardcore smokers scored higher on the pros of smoking, but lower on the cons of smoking and the pros of quitting than members of other profiles. Fig. 1 shows average pros and cons scores for these three profiles.

The LPA for non-hardcore smokers indicated that the most parsimonious solution also included three profiles (Table 2). As two profiles among non-hardcore smokers were similar to those found among hardcore smokers, they were labelled similarly. The first profile among non-hardcore smokers (30%) was labelled *'receptive'*. Its members scored higher on the cons of smoking and the pros of quitting than members of the other two profiles. The second and largest profile (54%) was labelled *'ambivalent'* and included members who scored around the neutral point (4) on all four measures. The third profile (16%) included members who disagreed with all four scales. This suggests that members of this profile are psychologically uninvolved in both smoking and quitting. We therefore labelled this profile *'disengaged'*.

Profile characteristics of hardcore smokers

Demographics and smoking characteristics. Among hardcore smokers, we found no significant differences in age, $F(2, 506) = .992$, $p = .371$, $\eta^2 = .004$, sex, χ^2 (2, N = 510) = 1.669, $p = .434$, $\phi = .057$, SES, χ^2 (2, N = 510) = 3.084, $p = .214$, $\phi = .078$, age of onset, $F(2, 506) = .006$, $p = .994$, $\eta^2 < .001$, and years smoked in life, $F(2, 506) = .745$, $p = .475$, $\eta^2 = .003$. We found a significant difference between groups in intention to quit, χ^2 (6, N = 510) = 62.002, $p < .001$, $\phi = .349$.
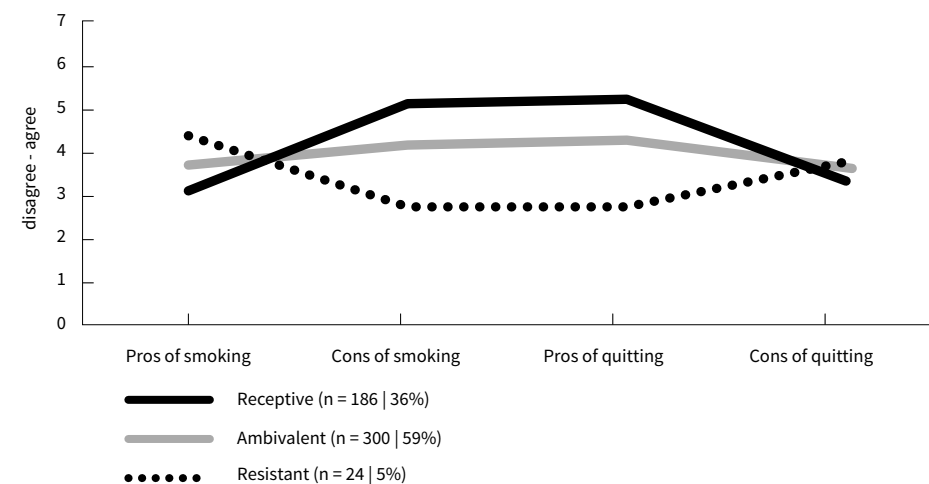
Nicotine dependence. We found one single significant difference in FTND scores, $F(2, 506) = 3.848$, $p = .022$, $\eta^2 = .015$. Receptive hardcore smokers were more nicotine dependent than ambivalent hardcore smokers, $p = .008$. We found no other difference in nicotine dependence. We found also no difference between profiles in cigarettes per day, $F(2,506) = 2.523$, $p = .081$, $\eta^2 = .010$.

Quitting self-efficacy. We found no differences between profiles in quitting self-efficacy, $F(2,506) = .455$, $p = .634$, $\eta^2 = .002$.

Figure 1. Mean scores on pros and cons of smoking and quitting in hardcore smokers. Higher scores indicate higher average agreement with pros or cons.

Table 2. Latent profile analysis models in hardcore smokers and non-hardcore smokers.

	AIC	BIC	BIC (Adjusted)	Entropy	BLRT H0 LL-value	*p*-value
Hardcore smokers						
1 Class	4552.599	4586.474	4561.081	-	-	-
2 Classes	4309.581	4364.628	4323.364	.618	-2268.299	.0401
3 Classes	**4167.676**	**4243.896**	**4186.761**	**.775**	**-2141.790**	**.0439**
4 Classes	4099.934	4197.325	4124.320	.773	-2065.838	.0870
5 Classes	4041.397	4159.961	1071.085	.750	-2026.967	.2328
Non-hardcore smokers						
1 Class	3181.690	3212.275	3186.898	-	-	-
2 Classes	3002.840	3052.540	3011.302	.694	-1582.845	.0039
3 Classes	**2879.252**	**2948.067**	**2890.968**	**.806**	**-1488.420**	**.0019**
4 Classes	2839.478	2927.408	2854.449	.795	-1421.626	.1420
5 Classes	2800.667	2907.712	2818.892	.810	-1396.739	.0436

Note: The optimal number of classes is presented in bold.

Profile characteristics of non-hardcore smokers

Demographics and smoking characteristics. Among non-hardcore smokers, we found no significant differences in age, $F(2, 334) = 2.652$, $p = .072$, $\eta^2 = .016$, sex, χ^2 (2, N = 338) = 964, $p = .618$, $\phi = .053$, and SES, χ^2 (2, N = 338) = 1.358, $p = .507$, $\phi = .063$. Age of onset differed between profiles, $F(2, 334) = 3.076$, $p = .047$, $\eta^2 = .018$. Post hoc analyses showed that receptive non-hardcore smokers began smoking earlier in life than ambivalent non-hardcore smokers, $p = .014$. We found no other significant difference in age of onset. We also found no difference in years smoked in life, $F(2,334) = .191$, $p = .827$, $\eta^2 = .001$. Intention to quit was different between groups, χ^2 (6, N = 338) = 43.717, $p < .001$, $\phi = .360$.

Nicotine dependence. All three profiles differed significantly in FTND scores, $F(2, 334) = 15.856$, $p < .001$, $\eta^2 = .087$. Receptive non-hardcore smokers were more nicotine dependent than both ambivalent non-hardcore smokers, $p = .001$, and disengaged non-hardcore smokers, $p < .001$. Ambivalent non-hardcore smokers were more nicotine dependent than disengaged non-hardcore smokers, $p = .001$. All three profiles also differed in the number of cigarettes per day, $F(2, 334) = 9.788$, $p < .001$, $\eta^2 = .055$. Receptive non-hardcore smokers smoked more than ambivalent non-hardcore smokers, $p = .028$. and more than disengaged non-hardcore smokers, $p < .001$. Ambivalent non-hardcore smokers smoked more than disengaged non-hardcore smokers, $p = .002$.

Quitting self-efficacy. Quitting self-efficacy differed between profiles, $F(2,334) = 10.844$, $p < .001$, $\eta^2 = .061$. Post-hoc analyses revealed that *resistant* non-hardcore smokers had more quitting self-efficacy than both receptive non-hardcore smokers, $p < .001$. and ambivalent non-hardcore smokers, $p < .001$. We found no difference between receptive and ambivalent non-hardcore smokers, $p = .421$.

Table 3. Characteristics of profiles in hardcore smokers and non-hardcore smokers.

	Hardcore smokers (N = 510)			Non-hardcore smokers (N = 338)		
	Receptive (n = 186)	Ambivalent (n = 300)	Resistant (n = 24)	Receptive (n = 101)	Ambivalent (n = 184)	Disengaged (n = 53)
Demographics						
Female, N (%)	53.8 [a]	48.0 [a]	54.2 [a]	59.4 [a]	53.8 [a]	58.5 [a]
Age (*SD*)	52.3 (7.3) [a]	52.9 (7.2) [a]	54.3 (6.5) [a]	51.3 (6.9) [a]	51.2 (8.1) [a]	53.9 (7.6) [a]
Socioeconomic status						
Low (%)	51.6 [a]	59.7 [a]	54.2 [a]	59.4 [a]	53.3 [a]	50.9 [a]
High (%)	48.4 [a]	40.3 [a]	45.8 [a]	40.6 [a]	46.7 [a]	49.1 [a]
Smoking history						
Age of smoking onset (*SD*)	16.3 (4.1) [a]	16.3 (5.6) [a]	16.2 (11.0) [a]	16.2 (3.8) [a]	17.7 (5.4) [b]	17.3 (4.9) [ab]
Years smoked in life (*SD*)	34.9 (8.5) [a]	35.5 (8.2) [a]	37.0 (9.8) [a]	31.4 (9.1) [a]	30.9 (10.4) [a]	31.8 (11.3) [a]
Nicotine dependence						
FTND (*SD*)	5.54 (1.81) [a]	5.09 (1.77) [b]	5.54 (2.02) [ab]	3.98 (2.37) [a]	3.02 (2.23) [b]	1.85(2.14) [c]
Cigarettes per day (*SD*)	22.0 (6.6) [a]	20.8 (6.6) [a]	19.9 (6.4) [a]	13.3 (11.0) [a]	11.1 (7.2) [b]	7.1 (4.4) [c]
Intention to quit (%)						
Within 1 year	21.5 [a]	6.3 [b]	0 [b]	38.6 [a]	19.0 [b]	9.4 [c]
Within 5 years	25.8 [a]	14.0 [b]	8.3 [b]	19.8 [a]	11.4 [b]	5.7 [c]
Not quitting, but smoking less	31.2 [a]	34.0 [b]	20.8 [b]	28.7 [a]	38.6 [b]	32.1 [c]
Not quitting, not smoking less	21.5 [a]	45.7 [b]	70.8 [b]	12.9 [a]	31.0 [b]	52.8 [c]
Smoking-related beliefs						
Quitting self-efficacy (*SD*)	3.85 (1.07) [a]	3.80 (1.06) [a]	3.63 (1.65) [a]	4.06 (.91) [a]	4.16 (.85) [a]	4.78 (1.27) [b]
Pros of smoking (*SD*)	3.09 (.57) [a]	3.75 (.58) [b]	4.41 (.77) [c]	3.12 (.73) [a]	3.44 (.64) [b]	3.37 (.87) [b]
Cons of smoking (*SD*)	5.16 (.45) [a]	4.20 (.45) [b]	2.70 (.42) [c]	5.25 (.44) [a]	4.24 (.42) [b]	3.04 (.45) [c]
Pros of quitting (*SD*)	5.25 (.58) [a]	4.26 (.58) [b]	2.74 (.64) [c]	5.49 (.47) [a]	4.36 (.43) [b]	3.23 (.50) [c]
Cons of quitting (*SD*)	3.29 (.61) [a]	3.71 (.62) [b]	3.62 (1.03) [b]	3.23 (.72) [a]	3.47 (.62) [b]	3.07 (.87) [a]

Note: Profiles were based on pros and cons scales. If profiles within a sample share a superscript character, they are not significantly different from each other (*p* < .05).

Discussion

In this study we used the perceived pros and cons of smoking and quitting to identify profiles in both hardcore smokers and non-hardcore smokers. We found three profiles in hardcore smokers and three in non-hardcore smokers.

Our findings supported our hypotheses about the composition of profiles in hardcore smokers. Dijkstra and De Vries[12] distinguished between motivated, unmotivated and disengaged smokers. In line with Dijkstra and De Vries,[12] we found one profile whose members were receptive to quitting (i.e. agreed with the cons of smoking and the pros of quitting); one profile whose members were ambivalent towards quitting (i.e. scored about neutral on all four pros and cons scales); and one profile whose members were resistant to quitting (i.e. disagreed with the cons of smoking and the pros of quitting). We labelled members of these profiles 'receptive, 'ambivalent' and '*resistant*'.

Our results further suggested that the differences in perceived pros and cons between profiles in hardcore smokers could be partially explained by nicotine dependence. Receptive hardcore smokers, who had a more positive view on quitting than ambivalent hardcore smokers, were also more nicotine dependent than ambivalent hardcore smokers. This contradiction could be explained by the association between nicotine dependence and poorer health status.[33] Receptive hardcore smokers may have faced health-related problems (e.g. coughing) and other smoking-related issues (e.g. smoking restrictions) more frequently than ambivalent hardcore smokers. They may have been more aware of the negative consequences of smoking and thus more positive towards quitting.

Non-hardcore smokers showed a different pattern of profiles than hardcore smokers. In both samples the first two profiles were 'receptive' and 'ambivalent'. Whereas the third profile was '*resistant*' in hardcore smokers, it was 'disengaged' in non-hardcore smokers. The former was rather negative about quitting, while the latter appeared to be uninvolved in either smoking or quitting.

Differences between these profiles might be explained by both daily tobacco consumption and nicotine dependence. Disengaged non-hardcore smokers had lower tobacco consumption and nicotine dependence than all other non-hardcore smokers. Having a low tobacco consumption could make quitting less urgent for these disengaged smokers than for other smokers. *Resistant* hardcore smokers, on the other hand, had a high nicotine dependence, but perceived very few cons of smoking. Perhaps they experienced high levels of cognitive dissonance, because they also believed (or at least pretend) that smoking has many benefits and that quitting has few.[34,35] Tobacco consumption may thus explain the difference between *resistant* hardcore smokers and disengaged non-hardcore smokers. Its role is different between hardcore and non-hardcore smokers, which in line with the literature, that states that both groups of smokers are distinct.[5]

We found several differences between hardcore and non-hardcore smokers. As said, we found that hardcore smokers also smoked more cigarettes per day and had smoked more years in their lives. These differences are explained by the way the two groups were defined. As nicotine dependence is strongly related to cigarettes per day, it is not surprising that hardcore smokers scored higher on nicotine dependence as well. However, we also found other differences. In line with previous research, quitting self-efficacy was lower among hardcore smokers than among non-hardcore smokers [6] and they had started smoking at a younger age. Hardcore smokers also saw more pros of smoking and cons of quitting. Since hardcore smokers are more nicotine dependent than non-hardcore smokers, quitting may be especially difficult for

them. This could explain why hardcore smokers had lower quitting self-efficacy and lower quit intentions than non-hardcore smokers. It also explains why hardcore smokers saw more benefits of smoking and cost of quitting than non-hardcore smokers.

Tobacco control strategies
Current tobacco-control strategies may not be sufficient to involve hardcore smokers in tobacco control.[5,6] The different profiles we found could help to develop individualized health messages or tailored interventions for this group.

While receptive hardcore smokers were more nicotine dependent, they were clearly aware of the disadvantages of smoking and the benefits of quitting. For members of this profile, there is no need to convince them that quitting smoking would be beneficial – they know that already. Instead, interventions targeting this group should aim to increase quitting self-efficacy or minimize nicotine dependence symptoms. Such interventions could stimulate the use of prescription medications and nicotine-replacement therapies. Pharmacotherapies – such as Verenicline and Bupropion – and nicotine-replacements therapies – such as nicotine gums or patches – are effective methods for quitting smoking.[36,37]
Ambivalent hardcore smokers were less nicotine dependent that other hardcore smokers, but they showed ambivalence towards smoking and quitting. Perhaps they have never explicitly considered the advantages of quitting. Ambivalent hardcore smokers may therefore benefit from interventions incorporating motivational interviewing,[38] in which participants are stimulated to explicitly discuss the pros and cons of behavioural change in an open and positive manner.[39]
Resistant hardcore smokers may require more elaborate cognitive interventions. They may also benefit from motivational interviewing to target their pros and cons in the long term. Interventions targeting *resistant* hardcore smokers may need to be longer than those for ambivalent hardcore smokers, as longer motivational interviewing sessions have been shown to increase intervention effectiveness.[38] Resistant hardcore smokers may be unwilling to pursue treatment for tobacco addiction themselves. However, health care providers may propose such interventions during health care visits. Such health care visits may serve as a teachable moment and may stimulate resistant hardcore smokers to start an intervention to quit smoking.[40] To reduce the harm done by current smoking in the short term, interventions for *resistant* hardcore smokers could focus on smoking reduction. Smoking reduction is an effective strategy to quit smoking,[41] especially when combined with nicotine replacement therapies.[42]

Strengths, limitations and future research
A major strength of this study is that we used two separate samples to compare profiles in hardcore and non-hardcore smokers. This allowed us to identify hardcore smokers as a distinct subgroup of smokers, that requires special attention in tobacco control. Another strength of our study is our use of elaborate sets of perceived pros and cons from previous focus group interviews among hardcore smokers. These pros and cons covered the full spectrum of perceived pros and cons relevant to hardcore smokers. A possible limitation of our research is the use of online data collection. Although 94 percent of Dutch households have access to the internet,[43] not all smokers aged 35-65 are willing to take part in an online panel. Since we collected data among online panel members, the results may not be completely generalizable to all hardcore smokers. Another limitation is the use of cross-sectional data. We have no

data on the degree to which profile compositions vary over time. Future longitudinal research may help to identify variables that influence such possible variations. This could help to predict – and perhaps influence – perceived pros and cons in hardcore smokers.
In our study, both hardcore and non-hardcore smokers did not intend to quit within six months. Future research might also investigate profiles in non-hardcore smokers who are more willing to quit smoking. As such smokers are more distinct from hardcore smokers than the non-hardcore smokers in our study, their profiles may offer additional insight into the unique characteristics of hardcore smokers.

Conclusions
We found three distinct profiles among hardcore smokers and each profile might require a different tobacco control approach. We also found that hardcore smokers started smoking earlier in life and have less quitting self-efficacy than non-hardcore smokers. They were also more nicotine dependent, had lower intention to quit smoking, and saw more pros of smoking and cons of quitting. Future research may help to develop theories and interventions for this group. Our study showed that many hardcore smokers are rather positive about quitting. If given the most appropriate intervention, they could thus be stimulated to quit smoking.

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chapter 5

Developing a self-affirmation manipulation and a self-efficacy manipulation: could those improve intention to quit and its predictors among hardcore smokers?

Developing a self-affirmation manipulation and a self-efficacy manipulation: could those improve intention to quit and its predictors among hardcore smokers?

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Abstract

Background: Hardcore smokers have little intention to quit smoking, often have low self-efficacy perceptions and are generally unreceptive to tobacco-control messages. According to the self-affirmation theory, smokers' receptivity to such messages could be increased by self-affirmation manipulations. We investigated the separate and combined effects of a self-affirmation manipulation and a self-efficacy manipulation on hardcore smokers' smoking-related cognitions.
Methods: In Study 1, we tested whether presenting a self-affirmation manipulation before 2 tobacco-control messages increased scores on the Interpersonal Feelings scale among Dutch hardcore smokers. This scale has been used previously to validate self-affirmation manipulations. In Study 2, we developed a manipulation that aimed to increase self-efficacy. We presented both this self-efficacy manipulation and the self-affirmation manipulation together with 2 threatening messages. In a 2 x 2 between-subjects factorial design we tested the effect of the self-efficacy manipulation, the self-affirmation manipulation and a combination of both. Our main outcome variables were intention to quit, attitude and self-efficacy.
Results: In Study 1, self-affirmation increased interpersonal feelings in hardcore smokers. In Study 2, self-affirmation increased self-efficacy, but the self-efficacy manipulation did not. The self-efficacy manipulation did have a positive effect on affective attitude, but a negative effect on cognitive attitude. We found no effects of either manipulation on intention to quit.
Limitations: The self-efficacy manipulation had little effect on hardcore smokers' smoking-related cognitions.
Conclusions: Although self-affirmation combined with threatening messages did not increase intention to quit, it did increase self-efficacy among hardcore smokers. We therefore recommend its use as a part of future interventions targeting hardcore smokers.

Background

Smoking is one of the leading causes of death in the world.[1] It kills about 6 million people each year,[2] including 600.000 non-smokers. As smoking continues to be one of the largest public health problems globally, it is important that we find ways to convince smokers to quit smoking.

One subgroup of smokers, i.e. 'hardcore' smokers, appear not at all receptive to tobacco- control messages.[3] These hardcore smokers have been smoking for many years and have a low intention to quit smoking.[4,5] Compared to other smokers, they smoke more and appear less aware of the health consequences of smoking.[6] In line with previous studies, hardcore smokers in our study smoked at least 15 cigarettes daily, have smoked at least 15 years in their life, have not attempted to quit in the past year and did not plan to quit within the next 6 months.[7,8]

In general, smokers tend to avoid, discard, or rationalise the content of anti-smoking messages.[9–11] Such defensive responses to anti-smoking messages may be particularly present in hardcore smokers.[3,12] It is therefore imperative to investigate ways to tackle such responses among this specific group. Using self-affirmations may be one way to do that.[13]

Self-affirmation theory

According to self-affirmation theory,[14] individuals are strongly motivated to perceive themselves as moral, competent and consistent individuals who act in line with their own values, social norms, and cultural norms (i.e. self-integrity). Tobacco-control messages could threaten this self-integrity.[13,15] They imply, by promoting quitting, that smokers do not act in a healthy manner (i.e. not in line with their own values). To protect their self-integrity, smokers tend to avoid such messages or they come up with counterarguments. Self-affirmations aim to strengthen global self-integrity by affirming an important personal value unrelated to the threat at hand.[16] This way, individuals feel less threatened by, for example, a health message. For smokers, a reminder of situations in which they had been a loyal friend might therefore not only strengthen their self-integrity, but may also distract them away from a threatening anti-smoking message.[17] Self-affirmations have proven to tackle defensive responses in a range of health-related behaviours.[18,19]

The 'kindness questionnaire' is a self-affirmation manipulation that requires little effort to complete.[20] It positively affirms the value 'being social' by asking participants to indicate and describe situations in which he or she had been kind or helpful to others. A previous study showed that this manipulation increased interpersonal feelings and could therefore be used as a self-affirmation manipulation.[17] The kindness questionnaire has been tested before among adolescents,[17] undergraduates,[21] and the general population,[22] but not among hardcore smokers.

In one study among UK smokers with low socioeconomic status, this manipulation increased message acceptance and helped to increase intention to quit.[16] Although it included relatively heavy smokers, however, it did not include *hardcore* smokers. There was, for example, no inclusion criteria concerning intention to quit or smoking history. In the current study we therefore test the kindness questionnaire among hardcore smokers.

Health cognition

Most online interventions target smoking cessation.[23,24] Intention to quit is an important predictor of quit attempts[25] and it is by definition very low among hardcore smokers.[3,7] A number of online interventions have been developed for smokers who intend to quit.[23,24] To our knowledge, however, no online intervention has been developed for hardcore smokers, who have low or no intention to quit. We therefore need to develop materials for such interventions to increase their intention to quit or improve its underlying factors. Attitude towards quitting[26] and the perceived costs and benefits of behaviour change[27,28] are related concepts that are assumed to influence intention to quit. The extent to which the perceived benefits of quitting outweigh the perceived costs, predicts change in smoking behaviour.[29] Therefore, we developed two texts about the pros and cons of smoking and quitting. These texts aim to improve hardcore smokers' attitude towards quitting and to increase their intention to quit. Such texts may threaten hardcore smokers' self-integrity and we therefore used them as 'threatening messages'.

Quitting self-efficacy has also been shown to increase intention to quit.[30] It describes the degree to which one beliefs he or she could successfully quit smoking.[31,32] Hardcore smokers tend to have a lower self-efficacy than non-hardcore smokers.[33] It is therefore important to develop self-efficacy enhancing materials that target this group of smokers in particular. A number of studies used self-efficacy manipulations to improve quitting self-efficacy among smokers.[34] However, no such materials exist for hardcore smokers. In this study, we therefore developed and tested a self-efficacy manipulation for this group in particular. One study combined a self-efficacy manipulation with a self-affirmation manipulation.[35] In this study on sun protection, participants read a sun protection message about either skin cancer or photoageing (i.e. ageing of the skin by ultraviolet radiation). Results suggest that combining self-affirmation with a self-efficacy manipulation could be a useful technique in health promotion.

Current research

In study 1, we investigated whether the kindness questionnaire is an appropriate self-affirmation manipulation for hardcore smokers. Previous research considered this manipulation appropriate if it increased interpersonal feelings.[17] If this manipulation also increases interpersonal feelings among hardcore smokers, it might be considered a suitable self-affirmation manipulation for this group as well. In study 2, we developed a manipulation that aimed to increase self-efficacy. We tested whether this manipulation increased self-efficacy and whether combining this manipulation with a self-affirmation manipulation improved attitude towards quitting, perceived self-efficacy and intention to quit. We also investigated whether these manipulations increased receptivity to online leaflets about quitting[36] and to a subsequent online smoking cessation intervention.[37]

With regard to attitude towards quitting, we assumed that self-affirmed participants would become more receptive to the two threatening messages than controls. We therefore expected that they would have a more positive attitude towards quitting. This would be in line with previous findings among self-affirmed sunbathers, who had a more positive attitude towards sunscreen use than controls.[38] With regard to perceived self-efficacy, we assumed that the self-efficacy manipulation increased perceived self-efficacy. While previous studies found that self-affirmation also increases smokers' self-efficacy,[39,40] we theorized that both manipulations would increase self-efficacy independently and if presented together. As previous studies have shown that intention to quit could also be increased by both self-affirmation[19] and self-efficacy,[30] we theorized that both manipulations would also increase intention to quit independently and if presented together.

Study 1

Study 1 Methods

Participants

We recruited hardcore smokers via an online survey sample (Survey Sampling International). This panel has about 11.5 million members in 103 countries. In October 2013, Dutch panel members completed a screener with the criteria described below. We identified 104 hardcore smokers and allocated them randomly to one of the two conditions (self-affirmation vs. control). Smokers were considered 'hardcore' if they a) were 35-65 years old, b) smoked every day, c) smoked 15 cigarettes per day or more, d) had no quitting attempt in the past 12 months, e) had smoked 15 years or more in life, and f) had no intention to quit within 6 months.[7] None of the participants dropped out of this experiment and we also excluded none of the participants afterwards. Table 1 shows the sample characteristics.

Table 1. Study 1 sample characteristics and outcomes

	Self-affirmation (n = 52)	Control (n = 52)	Range	Significance	Effect size
Demographics					
Age (SD)	52.9 (7.5)	52.2 (7.5)	36 - 65	$p = .640$	$\eta_p^2 = .002$
Years smoked in life (SD)	36.2 (9.1)	35.3 (9.0)	15 - 55	$p = .612$	$\eta_p^2 = .003$
Cigarettes per day (SD)	21.2 (10.6)	22.1 (6.8)	15 - 85	$p = .614$	$\eta_p^2 = .002$
Main outcome measure					
Interpersonal Feelings scale (SD)	3.7 (0.5)	3.4 (0.5)	1.8 - 4.8	$p = .004$	$\eta_p^2 = .078$
Message agreement [a]					
Pros and cons of smoking	3.8 (1.2)	3.9 (1.1)	1 - 5	$p = .931$	$\eta_p^2 < .001$
Pros and cons of quitting	3.3 (1.2)	3.4 (1.2)	1 - 5	$p = .870$	$\eta_p^2 < .001$

[a] Higher scores indicate more agreement with the threatening messages (range 1-5).

Procedure

The experiment was conducted online and participants received credits for their participation. These credits could be spend on money vouchers on the online panel's website. After filling out the screener, participants in the self-affirmation condition completed the kindness questionnaire.[20] This questionnaire

affirms participants' self by reminding them of past acts of kindness.[17] We chose this self-affirmation manipulation over others for its brevity and its simplicity.[41] The kindness questionnaire contains 10 items about past acts of kindness. After each set of 5 items, participants are asked to elaborate in a few sentences on the situations described. The items have been designed in such a way that participants agreed with most statements. Examples are: 'Have you ever been considerate of another person's feelings? (yes / no)' and 'Have you ever been concerned with the happiness of another person? (yes / no)'. Controls received 10 similar items about situations unrelated to kindness, such as using public transport or reading a book. After completing the self-affirmation manipulation or the control questionnaire, participants read two threatening messages. One message discussed the pros and cons of smoking (186 words). The other message discussed the pros and cons of quitting (194 words). The wording and the themes described were based on a previous focus group study among hardcore smokers.[7] Our main outcome measure was the Interpersonal Feelings scale as a measure of self-affirmation.[17]

The ethics committee of the Faculty of Social Sciences at the Radboud University Nijmegen approved the study protocol. Informed consent was obtained online at the start of the experiment and the ethics committee approved of this informed consent procedure.

Measures

Interpersonal Feelings scale. Participants indicated their feelings of love, joy, giving, connectedness, pride and kindness on a five-point scale ranging from 'not at all' to 'extremely'. The scale has proven reliable and self-affirmed participants have shown to score higher than controls on this scale.[17]

Message agreement. After both threatening messages, we asked: "To what extent to you agree with the text above?" Scores ranged from ranging from strongly disagree' (1) to 'strongly agree' (5).

Study 1 Results

Interpersonal Feelings scale. The Interpersonal Feelings scale was reliable in our study, Cronbach's $\alpha = .73$, CI 95% [0.61, 0.80]; $\omega_{total} = .72$, CI 95% [0.59, 0.80]; $GLB = .84$ (cf. [42]). Scores ranged from 1.8 to 4.8. Self-affirmed participants had higher scores (M = 3.7, SD = 0.5) than controls (M = 3.4, SD = 0.5), $F(1, 102) = 8.673$, $p = .004$, $\eta_p^2 = .078$.

Message agreement. Self-affirmed participants did not agree more (M = 3.8, SD = 1.2) than controls (M = 3.9, SD = 1.1) with the message about smoking, $F(1, 102) = .007$, $p = .931$, $\eta_p^2 < .001$. Self-affirmed participants (M = 3.3, SD = 1.2) did also not agree more than controls (M = 3.4, SD = 1.2) with the message about quitting, $F(1, 102) = .027$, $p = .870$, $\eta_p^2 < .001$.

Study 2

In line with previous research,[17] self-affirmed participants had stronger interpersonal feelings than controls in Study 1. The kindness questionnaire may therefore be a suitable self-affirmation manipulation for interventions targeting hardcore smokers. In our second study, we developed a manipulation that aimed to increase self-efficacy. We combined this manipulation with the self-affirmation manipulation. We tested whether they both influence smoking-related cognitions.

Study 2 Methods

Participants

We recruited 379 hardcore smokers via an online panel using the screener described in Study 1. Participants were recruited from November to December 2013 and none of the participants in Study 2 had participated in Study 1. All participants were allocated randomly to one of the four conditions in a 2 (self-affirmation vs. control) by 2 (self-efficacy vs. control) between-subjects factorial design. Of those invited, 47 refused to participate after reading the informed consent and 59 did not complete the experiment. We excluded an additional 29 participants, whose survey time was too long to expect effects (> 30 min., N = 8), who gave obvious bogus answers on the self-affirmation manipulation (e.g., 'kkkk', N = 18) or who completed all scales with the same response option (i.e. 'straightlining', N = 3). Two participants completed the experiment twice and we only included results from their first participation. Table 2 presents the sample characteristics of the 242 participants included in the analysis.

Table 2. Study 2 Sample characteristics and outcomes.

	Control		Self-efficacy	
	Control	*Self-affirmation*	*Control*	*Self-affirmation*
Demographics				
Number of participants	62	56	68	56
Age (SD)	52.0 (8.4)	51.9 (8.1)	52.1 (8.0)	52.7 (6.9)
Years smoked in life (SD)	33.7 (8.7)	35.0 (8.7)	34.2 (9.2)	34.6 (8.3)
Cigarettes per day (SD)	20.8 (6.7)	23.2 (7.4)	20.5 (7.1)	20.6 (5.7)
Main outcome measures [a]				
Affective attitude (SD)	-0.2 (1.1)	0.0 (0.9)	0.1 (1.5)	0.4 (1.1)
Cognitive attitude (SD)	0.2 (1.9)	0.2 (1.3)	-0.3 (1.0)	0.1 (0.8)
Perceived self-efficacy (SD)	-0.1 (0.7)	0.3 (0.6)	0.0 (0.7)	0.1 (0.8)
Intention to quit in 6 months (SD)	0.2 (1.0)	0.2 (1.0)	0.4 (1.5)	0.5 (1.2)
Stage of change [b]	6 / 2	6 / 0	11 / 1	6 / 2
Number of leaflets (SD)	1.5 (1.6)	1.0 (1.2)	1.3 (1.3)	1.3 (1.4)
Interested in online intervention (%) [c]	20 (32.2)	11 (19.6)	19 (27.9)	13 (23.2)

[a] Changes in outcome scores between pre-test (T0) and post-test (T1) measurements. Positive scores indicate a more positive attitude, an increase in self-efficacy or an increase in intention to quit. [b] Number of participants with forward stage change / backward stage change.
[c] Number of participants interested.

Procedure

Similar to Study 1, participants completed the experiment online and received panel credits for their participation. They first completed either a self-affirmation manipulation (i.e. the kindness questionnaire) or the control task. Then, participants in both conditions read two threatening messages (i.e. those from Study 1). Next, participants completed either a self-efficacy manipulation or a control manipulation. The self-efficacy manipulation consisted of three accounts of ex-smokers discussing barriers to quitting and how to cope with them (i.e. smoking-related habits, unsupportive others, and stressful situations). The accounts contained about 200 words each and were based on manipulations from a previous intervention that had shown to increase readiness to quit in among smokers.[43] We have re-written these texts to make them less formal and more relevant for hardcore smokers. The original texts described ways of coping with barriers to quitting in general terms. In our manipulation, this advice was presented by former smokers who had used these strategies themselves in their quit attempt. Controls read three texts of similar size about topics unrelated to smoking cessation (i.e. introduction of tobacco to Europe, cultivation of tobacco, invention of the cigarette). These texts were based on articles from the online encyclopaedia Wikipedia, because Wikipedia articles target a broad audience and have a high level of readability.

Outcomes

Affective and cognitive attitude towards quitting. We used a composite score of two items to measure affective attitude towards quitting. We used another composite score of two other items to measure cognitive attitude towards quitting. Each first item began with 'I think quitting smoking is…', followed by two opposite response options on either side of a 9-point scale. Affective attitude towards quitting was measured by: 'I think quitting smoking is… unpleasant (1) vs. pleasant (9)' and 'I think smoking is... bothersome (1) vs. nice (9)'. Cognitive attitude towards quitting was measured by: 'I think quitting smoking is… bad (1) vs. good (9)' and 'I think quitting is... not sensible (1) vs. sensible (9)'.
Perceived self-efficacy. Participants completed four items of a 16-item self-efficacy scale.[44] The original self-efficacy scale has four subscales (i.e. smoking-related habits, unsupportive others, stressful situations and cravings). For matters of brevity, we selected the one item from each subscale that had the largest correlation with its subscale in a previous study among hardcore smokers.[8] All items started with 'Imagine you have quit smoking. Would you be able to refrain from smoking when…?'. Participants indicated for four situations how confident they were they could remain abstinent. We used a scale ranging from 'not at all' (1) to 'most certainly' (9).
Intention to quit. Participants indicated their intention to quit within 6 months on a scale ranging from 'not at all' (1) to 'most certainly' (10). In addition, we assessed stage of change by asking participants in what time span they were planning to quit smoking (1 month, 6 months, 1 year, 5 years, not quitting but smoking less, not quitting and not smoking less).[45]
Receptivity measures. Participants indicated whether they wanted to receive leaflets about smoking and quitting via email (0 – 5 leaflets) and whether they wanted to visit a subsequent online smoking cessation intervention (yes / no).

Statistical analysis

We measured attitude towards quitting, perceived self-efficacy and intention to quit both before (T0) and after the experiment (T1). We assessed participants' receptivity to information about smoking cessation

after the experiment only (T1). Each main outcome variable was analysed with a 2 by 2 by 2 mixed design ANOVA, in which self-affirmation manipulation (vs. control) and self-efficacy manipulation (vs. control) were between subjects factors and time (pre-test vs. post-test) was the within subjects factor. We found no significant differences between conditions in age, years smoked in life or cigarettes smoked per day. We therefore did not control for any of these variables in the ANOVA's. Suggested cut-off points for η^2_p's are .01, .06 and .14 for small, medium, and large effects.[46,47]

Study 2 Results

Reliability and outcome integrity
Cronbach's alpha's for affective attitude were .71 at T0 and .77 at T1. For cognitive attitude these scores were .86 at T0 and .91 at T1. As both scales had less than 3 items it was not possible to calculate CI's, ω_{total} or GLB for these scale. Perceived self-efficacy was reliable at T0, α = .77, CI 95% [0.70, 0.83]; ω_{total} = .78, CI 95% [0.72, 0.83]; *GLB* = .81, and at T1, α = .84, CI 95% [0.78, 0.88]; ω_{total} = .85, CI 95% [0.79, 0.88]; *GLB* = .87. Kolmogorov-Smirnov Test indicated that affective attitude was strongly positively skewed at both T0, *D* = .178, p < .001 and T1, *D* = .192, p < .001. Cognitive attitude was strongly negatively skewed at both T0, *D* = .193, p < .001 and T1, *D* = .212, p < .001. Most participants therefore scored very low affective attitude and very high cognitive attitude towards quitting.
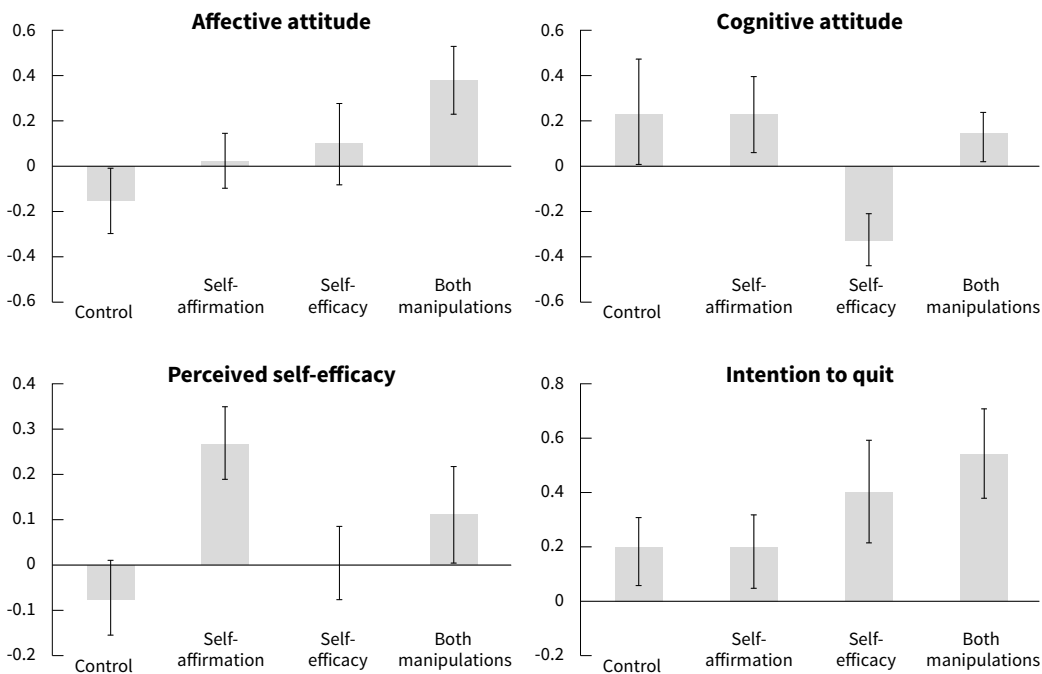
Figure 1. Changes in outcome scores between pre-test (T0) and post-test (T1) in Study 2. Positive scores indicate an increase during the experiment. Error bars reflect standard errors.

Outcomes
Table 2 shows the average changes in scores of our main outcome variables. These changes are also visually represented in Figure 1.

Affective attitude towards quitting. On affective attitude, we found no main effect of time, $F(1, 238)$ = 1.138, p = .287, η^2_p = .005, and no interaction between self-affirmation and time, $F(1, 238)$ = 2.202, p = .139, η^2_p = .009. We did, however, find an interaction between self-efficacy and time, $F(1, 238)$ = 3.909, p = .049, η^2_p = .016. Among those who completed the self-efficacy manipulation, affective attitude became more positive (T0: M = 2.8, SD = 1.9; T1: M = 3.0, SD = 2.0). This effect was not observed for those who did not receive the self-efficacy message (T0: M = 2.6, SD = 1.7; T1: M = 2.5, SD = 1.8). We found no three-way interaction between self-affirmation, self-efficacy and time, $F(1, 238)$ = .120, p = .729, η^2_p = .001.

Cognitive attitude towards quitting. On cognitive attitude, we found no main effect of time, $F(1,238)$ = .593, p = .442, η^2_p = .002, and no significant interaction between self-affirmation and time, $F(1, 238)$ = 1.917, p = .167, η^2_p = .008. Similar to affective attitude, we found an effect of self-efficacy over time, $F(1, 238)$ = 3.893, p = .050, η^2_p = .016. However, among those who received the self-efficacy manipulation, cognitive attitude became more *negative* (T0: M = 7.3, SD = 2.0; T1: M = 7.1, SD = 2.2), while becoming more positive among controls (T0: M = 6.8, SD = 2.5; T1: M = 7.0, SD = 2.4). We found no three-way interaction between self-affirmation, self-efficacy and time, $F(1, 238)$ = .1.946, p = .164, η^2_p = .008.

Perceived self-efficacy. On perceived self-efficacy, we found no main effect of time, $F(1, 238)$ = 3.064, p = .081, η^2_p = .013. We did find a interaction effect between self-affirmation and time, $F(1, 238)$ = 6.882, p = .009, η^2_p = .028. Self-efficacy increased more among self-affirmed participants (T0: M = 3.2, SD = 1.2; T1: M = 3.4, SD = 1.3) than among controls (T0: M = 3.3, SD = 1.1; T1: M = 3.3, SD = 1.2). We found no interaction between self-efficacy and time, $F(1, 238)$ = .229, p = .632, η^2_p = .001, and no three-way interaction, $F(1, 238)$ = 1.827, p = .178, η^2_p = .008.

Intention to quit. Overall*,* intention to quit within 6 months increased significantly during the experiment (T0: M = 2.6, SD = 2.3; T1: M = 2.9,SD = 2.4), $F(1, 237)$ = 16.746, p < .001, η^2_p = .066. However, we found no interaction between self-affirmation and time, $F(1, 237)$ = .179, p = .673, η^2_p = .001, no interaction between self-efficacy and time, $F(1, 239)$ = .3.392, p = .067, η^2_p = .014 and no three-way interaction, $F(1, 239)$ = .173, p = .678, η^2_p = .001. Stage of change also improved over time, $F(1, 237)$ = 16.175, p < .001, η^2_p = .064. Again, we found no interaction between self-affirmation and time, $F(1, 237)$ = .077, p = .782, η^2_p < .001, no interaction between self-efficacy and time, $F(1, 237)$ = .027, p = .869, η^2_p < .001, and no three-way interaction, $F(1, 237)$ = 1.172, p = .280, η^2_p = .005.

Receptivity measures. We performed a 2 by 2 between-subjects ANOVA on the number of leaflets selected at T1. We found no main effect of self-affirmation, $F(1, 238)$ = 1.803, p = .181, η^2_p = .008, no main effect of self-efficacy, $F(1, 238)$ = .028, p = .867, η^2_p < .001, and no interaction effect, $F(1, 238)$ = 1.726, p = .190, η^2_p = .007. A Chi-square test revealed no differences between the four conditions in interest in visiting a subsequent online smoking cessation intervention, χ^2 (3, N = 242) = 2.795, p = .424, ϕ = .107.

Discussion

In two studies we investigated the effect of self-affirmation and a self-efficacy manipulation on the influence of tobacco-control messages on hardcore smokers. In study 1, we found that participants who

completed the kindness questionnaire had stronger interpersonal feelings than controls. This is in line with our hypothesis and previous findings.[17] It suggests that this manipulation may be appropriate for hardcore smokers.

In line with previous research,[39,40] the self-affirmation manipulation increased perceived self-efficacy in Study 2. Perhaps the kindness questionnaire made participants feel good about themselves and thereby increased their general self-efficacy. Because of this boost in mood or self-confidence, participants may have felt more capable of quitting smoking. Contrary to our hypothesis, the self-efficacy manipulation did not increase perceived self-efficacy. As self-efficacy manipulation we used three accounts of ex-smokers sharing how they coped with difficulties after quitting. Perhaps these accounts reminded participants of how difficult quitting could be. This may have therefore been too threatening for them and provoked defensive processing. Not all smokers may experience the same barriers and difficulties of quitting. Future research may therefore aim to develop materials that tailor self-efficacy information to the individual hardcore smoker.[48] This way hardcore smokers learn to cope with situations they expect to be challenging, while not being reminded of all other possible difficulties.

Intention to quit smoking increased in all four conditions, but we found no significant differences between conditions. The overall increase may have been caused by the two threatening messages present in all four conditions. It could also be that merely participating in a study on smoking and repeatedly measuring intentions, increased smokers' intention to quit.[49]

We found small effects of the self-efficacy manipulation on affective and cognitive attitude towards quitting. While the self-efficacy manipulation improved affective attitude, it impaired cognitive attitude. We must, however, interpret these findings with caution. Because we conducted many tests and as the p-values were close to .05, these p-values may well represent Type 1 errors. Participants may perhaps have interpreted both scales differently. Affective attitude was measured by asking how pleasant and nice they thought quitting would be. This may have reminded participants about the feelings of freedom after quitting and may explain why many had a high affective attitude. Cognitive attitude was measured by asking how good and sensible quitting would be. This may have reminded participants about possible barriers to quitting, such as stress and craving after quitting, and may explain why many had a low cognitive attitude

Interventions

Our findings may have two implications for interventions targeting hardcore smokers. First, the kindness questionnaire appeared to increase interpersonal feelings among hardcore smokers. In line with the self-affirmation theory,[14] it could therefore be used as a self-affirmation manipulation for this group. Although the kindness questionnaire did not improve attitude towards quitting or intention to quit, it did seem to increase perceived self-efficacy, which is in line with previous research.[39,40] We therefore recommend using the self-affirmation in interventions targeting hardcore smokers. As the scale takes little effort to complete, the kindness questionnaire may be particularly suitable for web-based interventions. Intention to quit increased in all four conditions. As intention to quit is an important predictor for quit attempts,[25] it may therefore be possible to develop meaningful interventions that both increase hardcore smokers' intention to quit and stimulate these hardcore smokers to attempt to quit. Future research may investigate which determinants increase intention to quit among this group of smokers.

Strengths and limitations

A strength of these studies are the samples sizes used. We included 104 participants in Study 1 and 242 participants in Study 2. This way, our studies had sufficient statistical power.

The content of the threatening messages and the self-efficacy manipulation may have limited our study. Although we found some effects, the materials proved insufficient to change hardcore smokers substantially. Future studies might investigate more elaborate materials that use, for example, motivational interviewing techniques.[50,51] In motivational interviewing, reasons for quitting are not given by a health professional. Instead, smokers are encouraged to come up with these pros and cons themselves. This may be particularly suitable for certain subgroups of hardcore smokers.[8]

Conclusions

The kindness questionnaire is a self-affirmation manipulation that increases perceived self-efficacy among hardcore smokers. We recommend using this brief and easy-to-complete manipulation as a part of future web-based interventions for this group. The self-efficacy manipulation however, did not increase self-efficacy and neither manipulation increased intention to quit. Future research may develop more extensive materials to reach and involve hardcore smokers in tobacco control.

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intervention

chapter 6

Targeting hardcore smokers: the effects of an online tailored intervention, based on motivational interviewing techniques

Targeting hardcore smokers: the effects of an online tailored intervention, based on motivational interviewing techniques

Abstract

Background: Hardcore smokers have smoked for many years and do not intend to quit. They also seem unreceptive to information about smoking cessation. We developed a 30-minute, tailored web-based intervention that includes motivational interviewing principles. It aims to increase hardcore smokers' intention to quit and their receptivity to information about smoking cessation.

Design: In a two-arm experiment, we compared outcome scores of the experimental intervention ($n = 346$) with those of a control intervention ($n = 411$).

Methods: Our main outcomes were intention to quit, quitting self-efficacy, receptivity to information about quitting and interest in a subsequent online intervention. Our secondary outcomes were cigarettes smoked per day and quit attempts. All outcomes were measured directly post-experiment (t_1), after two weeks (t_2) and after two months (t_3).

Results: At t_1, hardcore smokers in the intervention condition were more receptive to information about quitting than controls. At both t_2 and t_3, the average number of cigarettes of those in in the experimental group had reduced was higher than that in the control group. At t_2, but not t_3, significantly more participants in the experimental group had reduced their smoking consumption with at least 50% than among controls. We found no significant differences in intention to quit, quitting self-efficacy, interest in a subsequent online quitting intervention and number of quit attempts.

Conclusions: The intervention increased hardcore smokers' receptivity to information about smoking cessation and decreased their cigarette consumption. Since this intervention could help involve hardcore smokers in tobacco control, we recommend using it in health care settings.

Background

Smoking is one of the leading causes of death and disease in the world.[1] It is therefore imperative to find ways to promote smoking cessation. One group, the so-called 'hardcore smokers', seem particularly unlikely to quit smoking.[2] Hardcore smokers are people who have smoked for many years and have no intention to quit smoking.[3] In 2012, 32% of Dutch smokers could be considered 'hardcore', which equals to 8% of the Dutch general population.[4] Compared to non-hardcore smokers, they have lower quitting self-efficacy[5] and tend to have dysfunctional beliefs about smoking.[6] Dysfunctional beliefs are beliefs that prevent smokers from quitting, such as perceived benefits of smoking and perceived costs of quitting. As hardcore smokers have more such beliefs than non-hardcore smokers,[7] they may be particularly irresponsive to tobacco control interventions.

Whereas many web-based smoking interventions have been developed for the general population,[8–10] no online interventions have been specifically developed for hardcore smokers. Since hardcore smokers seem resistant towards information about quitting, it may be particularly difficult to convince them to quit smoking.[2,11] As they might be unwilling to consider quitting, they need to become more open towards anti-smoking messages first.[12,13] We therefore developed and experimentally tested an intervention that aims to increase hardcore smokers' willingness to read such tobacco control messages. It also aims to increase hardcore smokers' intention to quit smoking, quitting self-efficacy, receptivity to information about quitting and interest in a subsequent online intervention. In the next section, we describe the underlying constructs of the intervention in order of importance for predicting smoking cessation. In the methods section, we describe the intervention components in chronological order.

Increasing intention to quit and its determinants

Intention to quit smoking is a major predictor of quit attempts.[14] Its importance has been emphasised by, for example, the Health Belief Model[15] and the Reasoned Action Approach.[16] To increase intention to quit smoking, we developed one intervention component that aim to improve attitude towards quitting and one that increases quitting self-efficacy. Attitude towards quitting and quitting self-efficacy are two determinants of intention to quit[15–18] and both were important self-reported determinants of smoking cessation in two previous studies among hardcore smokers.[6,11,19]

The first component aimed to improve attitude towards quitting by altering dysfunctional beliefs about smoking and quitting. In line with the Intervention Mapping protocol - a protocol for developing interventions[20,21]-, we selected a set of specific outcome beliefs from a previous focus group study.[6] In that study we identified six themes among hardcore smokers' perceived pros and cons of smoking and quitting. We used these themes as topics for the first component. As hardcore smokers tend to perceive more pros of smoking and more cons of quitting than non-hardcore smokers,[19] the intervention emphasised the cons of smoking and the pros of quitting in this component.

The second component aimed to increase quitting self-efficacy. Self-efficacy is theorized as a prerequisite of change in intention and behaviour change[17,18] and hardcore smokers tend to have a lower quitting self-efficacy than non-hardcore smokers.[5,19] Using the Intervention Mapping protocol,[20,21] we developed four video clips in which ex-smokers explained how they coped with difficult situations after quitting.

Increase receptivity to information about quitting

The third component of the intervention aimed to increase receptivity to anti-smoking information. According to the self-affirmation theory, everyone is motivated to perceive himself or herself as a moral and competent person, who acts according to moral norms or his or her personal values.[22] This sense of self-integrity may be threatened by health messages, because such messages suggest that smokers do not act consistent with personal or moral norms about healthy lifestyles.[23,24] Smokers may therefore avoid or discard such anti-smoking messages.

Self-affirmations tackle defensive responses to a threatening message.[25,26] Self-affirmations are positive reinforcements in another domain than the threatening message. They are believed to distract the self away from the loss of self-integrity. To tackle defensive responses towards messages in our intervention, we included the kindness questionnaire as a self-affirmation manipulation.[27] In a previous study, we found that this manipulation is suitable for hardcore smokers.[11] To further increase receptivity to subsequent quitting information, we incorporated motivational interviewing techniques.[28] These have been used effectively in clinical settings[29] and have been used in an online intervention before.[30] Also, we tailored responses of the digital trainer to participants' responses. Tailoring has been shown to increase the effectiveness of online interventions.[31]
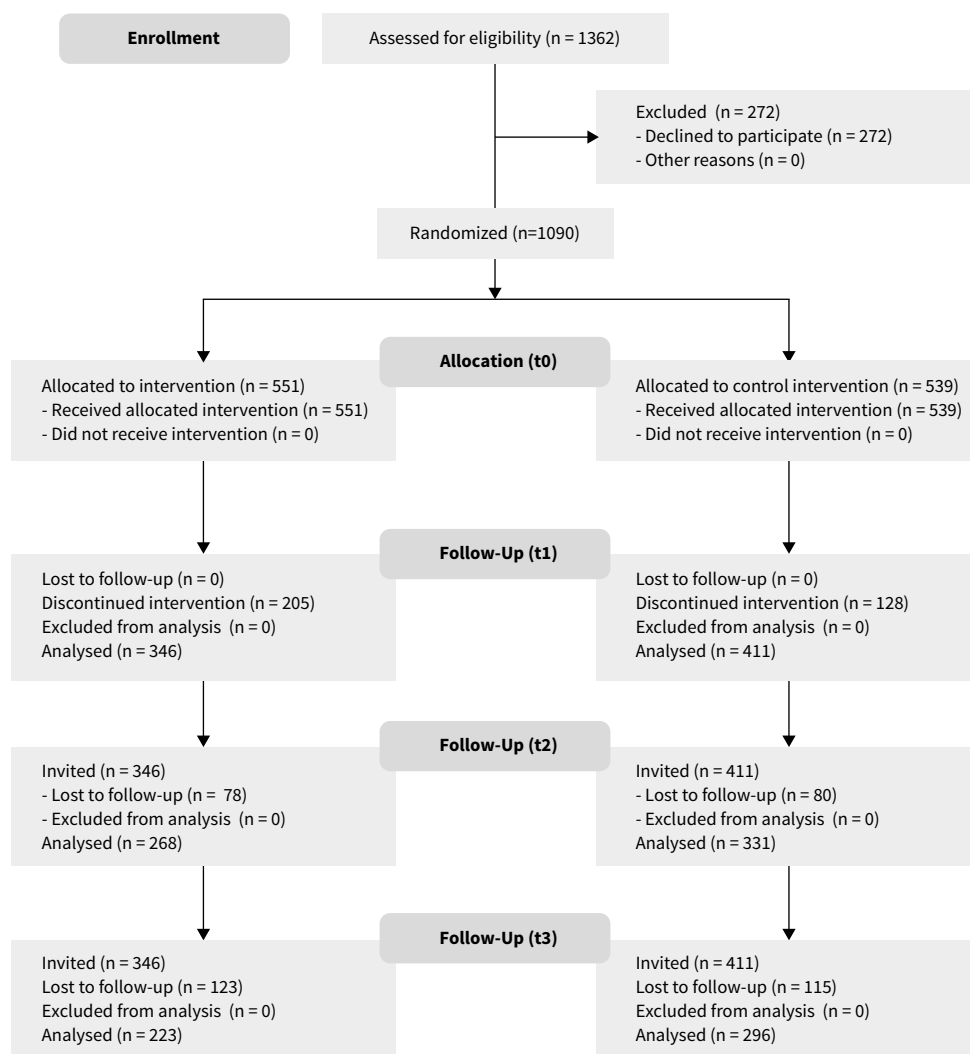
Current study

In the current study we tested a tailored, web-based intervention for hardcore smokers. In a two-arm experiment, we compared outcome scores of the experimental intervention with those of a control intervention. Our main outcomes are intention to quit, quitting self-efficacy, receptivity to information about quitting and interest in a subsequent online intervention. Our secondary outcomes are cigarettes smoked per day and quit attempts.

Methods

Participants

Participants were recruited via an online panel (Survey Sampling International), which has about 11.5 million panellist in 103 countries. We used a screener questionnaire to identify eligible Dutch participants. Participants completed the intervention in October 2014 and follow-up data were collected in November and December 2014. Smokers were 'hardcore' if they a) were 25-65 years old, b) smoked every day, c) smoked 15 cigarettes per day or more, d) had no quitting attempt in the past 12 months, e) had smoked 5 years or more in life, and f) had no intention to quit within 6 months.[6,11,19] We chose a definition that was most similar to most of the definitions that exist in the literature. This way, the results from our study could be compared to the findings of others. In line with previous research, we did not include participants younger than 25 years, because they might nog have reached a stable smoking consumption and might have less stable intentions regarding quitting.[32] As people older than 65 are harder to recruit than younger people, we did not include people older than 65 years.

In the screener, we assessed participants' sex and used their highest attained level of education to determine their socioeconomic status (SES). Low SES participants had primary education, lower secondary education, lower vocational education or middle vocational education. High SES participants had higher secondary education or tertiary education.

Enrollment

Assessed for eligibility (n = 1362)

Excluded (n = 272)
- Declined to participate (n = 272)
- Other reasons (n = 0)

Randomized (n=1090)

Allocation (t0)

Allocated to intervention (n = 551)
- Received allocated intervention (n = 551)
- Did not receive intervention (n = 0)

Allocated to control intervention (n = 539)
- Received allocated intervention (n = 539)
- Did not receive intervention (n = 0)

Follow-Up (t1)

Lost to follow-up (n = 0)
Discontinued intervention (n = 205)
Excluded from analysis (n = 0)
Analysed (n = 346)

Lost to follow-up (n = 0)
Discontinued intervention (n = 128)
Excluded from analysis (n = 0)
Analysed (n = 411)

Follow-Up (t2)

Invited (n = 346)
- Lost to follow-up (n = 78)
- Excluded from analysis (n = 0)
Analysed (n = 268)

Invited (n = 411)
- Lost to follow-up (n = 80)
- Excluded from analysis (n = 0)
Analysed (n = 331)

Follow-Up (t3)

Invited (n = 346)
Lost to follow-up (n = 123)
Excluded from analysis (n = 0)
Analysed (n = 223)

Invited (n = 411)
Lost to follow-up (n = 115)
Excluded from analysis (n = 0)
Analysed (n = 296)

Figure 1. Flow diagram of recruitment and progress throughout the study.

Sex and education are important predictors of hardcore smoking.[32,33] To control for potential biases due to these variables, we used a randomized stratification method.[34] Within each demographic group (i.e., low SES men, high SES men, low SES women, high SES women), participants were alternately allocated to one of the two conditions (i.e., the first low SES man received the experimental intervention, the second one the control intervention, the third one the experimental intervention, etc.). As participants could start the study at a time of their convenience, a near-random allocation to conditions was established within each stratified group. Participants were blinded to conditions other than their own.
The ethics committee of the Faculty of Social Sciences at the Radboud University Nijmegen approved the study's protocol (ECG2013-1308-119a).

Procedure
Directly after the screener, 1362 hardcore smokers were allocated to one of the two conditions (intervention vs. control), stratified by sex and SES. In the introduction of the intervention, we emphasized that we were interested in their opinion about smoking only, that we would not judge their opinion, and that they did not have to quit smoking during the study. Of these 1362 hardcore smokers, 1090 signed informed consent (t_0), 931 completed the demographics, 780 completed the intervention itself and 757 finished the post-test measurements at t_1 (i.e., directly following the intervention). Those who finished the post-test measurements were invited for follow-up. Participants completed one follow-up after two weeks (t_2: *n* = 599) and one after two months (t_3: *n* = 519). Figure 1 shows the recruitment process throughout the study.

Intervention
The intervention (i.e., 'smoke-experts.nl', in Dutch: 'rookexperts.nl') had been pre-tested for readability and comprehensibility in two focus groups among hardcore smokers. The intervention took about 30 minutes to complete and consisted of three components, which will be described here chronologically. In the first component, participants completed the kindness questionnaire,[27] a self-affirmation task designed to tackle smokers' defensive responses to anti-smoking messages.[11,35] The kindness questionnaire contains 10 items asking whether participants have ever performed acts of kindness to others (yes/no). We also asked to elaborate on some of these past acts of kindness.
In the second component, participants were invited to consider several smoking-related topics, such as the health effects of smoking, the effect of smoking on social relations and the money potentially saved by quitting. Because we did not want the intervention to look like a clinical questionnaire, we had created "Kees", an online character who represented himself as a digital trainer and who was interested in the participants' opinion as smoke experts. Participants knew the trainer was not a real person. However, to make the digital trainer as realistic as possible, we showed several photos of him throughout the intervention and composed the text in the intervention in such a way that it seemed as if he was interviewing the participants. Together, participants and the trainer discussed several smoking-related topics, such as the health effects of smoking, the effect of smoking on social relations and the money potentially saved by quitting. With each topic, the trainer first assessed whether participants had dysfunctional beliefs about that topic. The trainer presented a number of potential dysfunctional beliefs and participants indicated whether they agreed with them or not. If they did, the trainer presented a text

that countered this belief or showed a video clip of a former smokers that discussed this topic. As such, the feedback given by the trainer was tailored to the specific beliefs participants had. For example, if participants did not believe quitting could save them money, the trainer would let them calculate how much money they could save and would ask them how they could spend that money. If participants had no dysfunctional beliefs, he continued to the next topic.

The third component covered quitting self-efficacy. The trainer and participants discussed four types of barriers of quitting: smoking-related habits, unsupportive others, stressful situations and cravings. For each type, participants imagined they had quit smoking and encountered four difficult situations. For example, the four situations in which smoking-related habits could lead to relapse were: waking up, drinking coffee, having diner, and having a break. If participants expressed they could not remain abstinent in one or more of those situations, they watched a video clip in which an ex-smoker explained how to deal with these particular situations. Participants therefore only received advice on situations in which they were unsure they could remain abstinent. Previous studies have used similar 'tailored testimonials' before.[36]

The control intervention was similar to the intervention layout and length, but discussed the history and cultivation of tobacco. It contained no tailored messages, no motivational interviewing techniques, and no self-affirmation manipulation.

Demographics and main outcomes
At the start of the experiment (t_0), we measured basic demographics (age, sex, education), smoking-related demographics (cigarettes per day, years smoked in life), and nicotine dependence, using the Fagerström Test for Nicotine Dependence.[37] We measured our main outcomes immediately after the experiment (t_1), after two weeks (t_2) and after two months (t_3). We did not measure our main outcomes at baseline, because these measures were quite lengthy. Including them at baseline would have increased dropout rates early in the study. Also, the responses given at t_0 might have served as an anchor for participants at t_1. This would have influenced participants' answers on the post-test questions.
Quitting self-efficacy. We measured quitting self-efficacy using a three-item questionnaire. These items were: 'I am able to quit smoking', 'I would be able to quit smoking' and 'I could quit smoking'. Answers were given on a visual analogue scale ranging from 'completely disagree' to 'completely agree'. The computer program calculated the indicated position on the scale on a range from 1 to 100. We used the same labels and scoring range to measure intention to quit measure and receptivity to quitting information.
Intention to quit. We measured intention to quit using a three-item questionnaire. The items were: 'I intend to quit smoking someday', 'I will quit smoking in the future' and 'I will quit smoking someday'.
Receptivity to quitting information. Receptivity to information about quitting was measured with a four-item questionnaire. Example items were: 'I am willing to think about smoking cessation', 'I would like to think carefully about smoking cessation', 'I would like to know more about smoking cessation,' and 'Right now, I would like to read something about smoking cessation.'
Stopcoach. At each time point, we offered participants a web-link to a subsequent smoking cessation intervention (iCoach) and asked whether they wanted to see that website (yes / no). iCoach is an online smoking cessation intervention developed by the European Commission (stopsmokingcoach.eu).

Secondary outcomes
Cigarettes per day. At each follow-up, we assessed the average number of cigarettes smoked daily. We calculated individual changes in cigarettes per day at t_2 and at t_3. We also calculated the percentage of participants who reduced their smoking with at least 1 cigarette per day and the percentage of participants who reduced their consumption with at least 50%.
Quit attempts. At each follow-up (t_2 and t_3) we asked participants whether they had attempted to quit after the experiment (t_1). If so, we asked whether they were still abstinent.

Statistical analyses
We compared post-test scores of the experimental intervention with those of the control intervention. We used ANCOVAs to test differences between condition in intention to quit, quitting self-efficacy, receptivity to quitting information and cigarettes per day. All questionnaires were reliable at each time point (Cronbach's $\alpha > .90$; GLB $> .95$; $\omega > .90$). We used a χ^2-test to test condition differences in Stopcoach visit and quit attempts. Suggested cut-off points for η_p^2's are .01, .06 and .14 for small, medium, and large effects.[38,39]

Before conducting the main analyses, we analysed whether selective dropout may have affected our results. We investigated whether those who had dropped out between t_0 and t_1 were different in sex, education, age, years smoked, nicotine dependence and number of cigarette smoked per day from those who had not (i.e., 'completers'), and whether these differences were different between the two conditions. Between t_0 and t_1, dropouts were more likely to be male (56.2%) than completers (39.0%) in the experimental condition, $\chi^2(1, n = 1324) = 19.51, p < .001, \phi = .172$, while among controls, we found no significant difference (45.7% vs. 49.2%), $\chi^2(1, n = 1324) = .75, p = .386, \phi = .034$. Also, dropouts in the experimental condition smoked fewer cigarettes (M = 22.4, SD = 7.0) than completers (M = 23.6, SD = 8.6), while among controls, dropouts smoked more cigarettes (M = 22.3, SD = 6.6) than completers (M = 21.8, SD = 5.5). This interaction was significant, $F(1, 1324) = 4.85, p = .028, \eta_p^2 = .004$. We therefore controlled the results, where possible, for sex and cigarettes per day.

Results
Sample characteristics
Table 1 shows our sample characteristics. At t_1, we found no significant differences between conditions in age, $F(1, 755) = .50, p = .481, \eta_p^2 = .001$, in sex, $\chi^2(1, N = 757) = 3.47, p = .062, \phi = .068$, in educational level, $\chi^2(1, N = 757) = .02, p = .884, \phi = .005$, or in years smoked in life, $F(1, 755) = .34, p = .559, \eta_p^2 < .001$. However, those in the experimental condition were more nicotine dependent than controls, $F(1, 755) = 10.28, p = .001, \eta_p^2 = .013$ and smoked more cigarettes per day, $F(1, 754) = 12.00, p < .001, \eta_p^2 = .016$.

Table 1. Sample characteristics at t_1.

	Intervention	Controls	Significance
Sample size	346	411	
Age (SD)	49.0 (10.4)	48.5 (10.3)	$p = .402$
Sex			
Male	135 (39.0%)	183 (44.5%)	$p = .062$
Female	211 (61.0%)	228 (55.5%)	
Education			
Low	256 (74.0%)	306 (74.5%)	$p = .884$
High	90 (26.0%)	105 (25.5%)	
Years smoked in life (SD)	31.9 (11.1)	31.4 (10.9)	$p = .559$
Nicotine dependence (SD) [a]	6.1 (1.8)	5.6 (1.8)	$p = .001$
Cigarettes per day	23.6 (8.6)	21.8 (5.5)	$p = .001$

[a] Fagerström Test for Nicotine Dependence.
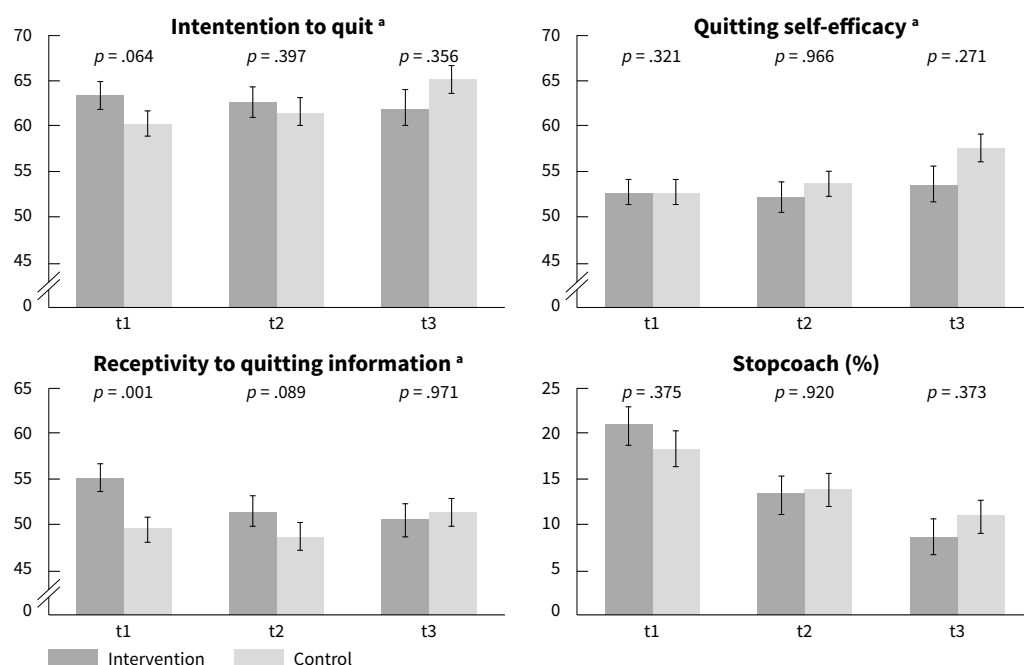
Figure 2. Results for our main outcomes after the experiment (t_1), after 2 weeks (t_2) and after 2 months (t_3). Error bars reflect standard errors of the mean. [a] Controlled for age, sex and cigarettes per day.

Main outcomes

Figure 2 shows scores on the main outcomes at each time point for both conditions.

Quitting self-efficacy. We found no significant difference between conditions at t_1 ($M = 52.6$, $SD = 26.5$ vs. $M = 52.6$, $SD = 27.2$), $F(1, 753) = .99$, $p = .321$, $\eta^2_p = .001$, at t_2 ($M = 52.1$, $SD = 25.9$ vs. $M = 53.6$, $SD = 25.9$), $F(1, 576) < .01$, $p = .966$, $\eta^2_p < .001$, or at t_3 ($M = 53.3$, $SD = 27.8$ vs. $M = 57.5$, $SD = 26.2$), $F(1, 484) = 1.22$, $p = .271$, $\eta^2_p = .003$.

Intention to quit. Although those in the experimental condition had a higher intention to quit at t_1 than controls ($M = 63.5$, $SD = 28.2$ vs. $M = 60.3$, $SD = 26.6$), this difference did not reach statistical significance, $F(1, 753) = 3.43$, $p = .064$, $\eta^2_p = .005$. We also found no significant difference at t_2 ($M = 62.6$, $SD = 28.0$ vs. $M = 61.4$, $SD = 27.7$), $F(1, 577) = .72$, $p = .397$, $\eta^2_p = .001$, or at t_3 ($M = 61.9$, $SD = 29.2$ vs. $M = 65.2$, $SD = 2.6$), $F(1, 489) = .85$, $p = .356$, $\eta^2_p = .002$.

Receptivity to quitting information. At t_1, those in the experimental condition were significantly more receptive to information about quitting smoking than controls ($M = 55.1$, $SD = 26.1$ vs. $M = 49.9$, $SD = 25.4$), $F(1, 753) = 11.54$, $p = .001$, $\eta^2_p = .015$. This difference was no longer present at t_2, $F(1, 574) = 3.00$, $p = .089$, $\eta^2_p = .005$, or at t_3, $F(1, 482) = .01$, $p = .971$, $\eta^2_p < .001$.

Stopcoach. Those in the experimental condition did not request the web link significantly more often (20.8%) than the controls (18.2%) at t_1, $\chi^2(1, N = 757) = .79$, $p = .375$, $\phi = .032$. We also found no significant difference between conditions at t_2, $\chi^2(1, N = 578) = .010$, $p = .920$, $\phi = .004$, or at t_3, $\chi^2(1, N = 485) = .79$ $p = .373$, $\phi = .040$.

Secondary outcomes

Figure 3 shows scores within both conditions for each secondary outcome at t_2 and t_3.

Cigarettes per day. At t_2, those in the experimental condition had significantly reduced their smoking ($M = -1.1$, $SD = 6.2$), while controls had not ($M = 0.3$, $SD = 3.5$), $F(1, 596) = 12.00$, $p = .001$, $\eta^2_p = .020$. Also, more participants in the experimental condition had reduced their smoking (22.4%) with at least 1 cigarette per day than in the control group (13.0%), $\chi^2(1, N = 599) = 5.90$, $p = .015$, $\phi = .124$. Similarly, more participants had reduced their smoking consumption with at least 50% at t_2 in the experimental group (4.9%) than in the control group (0.9%), $\chi^2(1, N = 599) = 8.848$, $p = .003$, $\phi = .122$. Although controls also had reduced their tobacco consumption at t_3, the reduction in the number of cigarettes smoked was still significantly larger in the experimental condition ($M = -1.5$, $SD = 5.1$) than among controls ($M = -0.6$, $SD = 5.0$), $F(1, 516) = 4.03$, $p = .045$, $\eta^2_p = .008$. Again, at t_3, those in the experimental condition had reduced their smoking more often (34.1%) than controls (24.7%), $\chi^2(1, N = 519) = 5.43$, $p = .020$, $\phi = .107$. The group difference in the percentage of participants who had reduced their smoking with at least 50% at t_3 was non-significant, $\chi^2(1, N = 519) = .113$, $p = .737$, $\phi = .015$.

Quit attempts. We found no significant difference in quit attempts between those in the experimental condition (3.7%) and controls (1.5%) at t_2, $\chi^2(1, N = 599) = 2.992$, $p = .084$, $\phi = .071$, and no difference at t_3 (4.9% vs. 4.7%), $\chi^2(1, N = 519) = .011$, $p = .915$, $\phi = .005$. We also found no significant difference in the number of abstinent participants at t_2 (1.1% vs. 0.3%), $\chi^2(1, n = 599) = 1.491$, $p = .222$, $\phi = .050$, and no difference at t_3 (1.3% vs. 1.4%), $\chi^2(1, n = 519) < .001$, $p = .995$, $\phi < .001$.
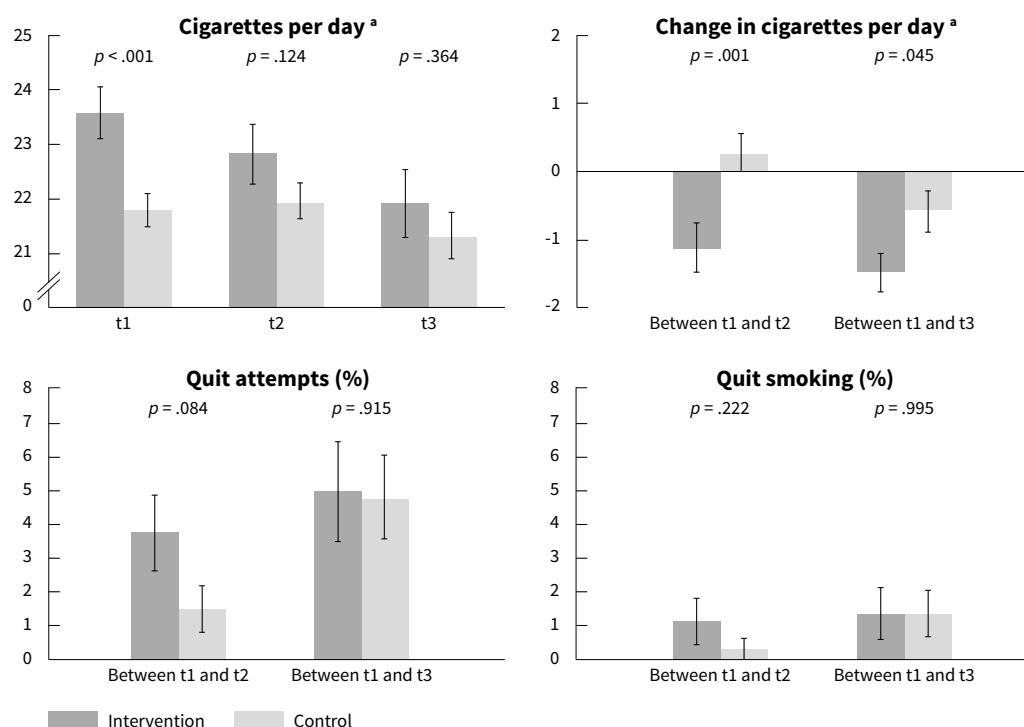
Figure 3. Results for our secondary outcomes at baseline (t_0), after the experiment (t_1), after 2 weeks (t_2) and after 2 months (t_3). Error bars reflect standard errors of the mean.
[a] Controlled for age and sex.

Discussion
We tested a tailored, brief web-based intervention for hardcore smokers. Immediately after the intervention, participants in the experimental condition seemed more open to information about quitting than controls. They also reduced their smoking more often with at least 50% than controls during the two weeks following the intervention. We found no significant differences in intention to quit, quitting self-efficacy, quit attempts or willingness to visit a subsequent intervention.

Self-affirmation manipulation
The first intervention component was a self-affirmation manipulation, designed to increase participants' receptivity towards information about smoking and quitting. Indeed, participants who completed the intervention were more receptive to quitting information than controls. This corroborates earlier research on this manipulation.[11,40]
Although the intervention increased receptivity to quitting information and reduced the number of cigarettes per day, it did not significantly change intention to quit. This is in line with findings from

a recent meta-analysis on the efficacy of self-affirmation manipulation.[41] The authors identified 144 experimental tests on the efficacy of self-affirmation on message acceptance, intentions and behaviour. They found that self-affirmation increased message acceptance, intention and behaviour. However, the effect sizes for message acceptance and behaviour were larger than that for intention. Our intervention too, had a larger effect on smoking behaviour ($\eta_p^2 = .020$) and anti-smoking information ($\eta_p^2 = .015$) than on intention ($\eta_p^2 = .005$, ns). The fact that our results show a similar pattern as those in the meta-analysis on self-affirmation manipulations, suggests that the self-affirmation manipulation in our intervention might have been the most effective part of the intervention.

Other components
The second and third components aimed to increase intention to quit by increasing quitting self-efficacy and by challenging dysfunctional beliefs about smoking and quitting. We found no significant effects on intention to quit and quitting self-efficacy. Because our sample size was substantial, we can be fairly certain that our single-session intervention is not able to change these variables among hardcore smokers. However, additional interventions such as face-to-face motivational interviews[28,42] may help to change these factors, as smokers in the experimental condition did show an increased receptivity to information about quitting smoking.
We found no significant effect on intention to quit, but among those who completed the intervention more participants reduced their smoking consumption than among controls. Also, those who completed the intervention reduced their smoking more on average than controls. As we found no effects on self-efficacy or intention to quit, this reduction in smoking could not be explained through these constructs. In the previous section we suggested that the self-affirmation manipulation might have been the only effective component of this intervention, as those manipulations tend to have a larger effect on behaviour than on intentions. An alternative explanation as to why the intervention did not increase intention and self-efficacy, while changing behaviour, might be that participating in an intervention about the pros and cons of smoking and smoking cessation changed other factors not measured in our study. The intervention might have made participants more aware of their own beliefs about smoking. This awareness could have been triggered when participants smoked in the weeks following the intervention. As a result, participants may have become more conscious about their smoking consumption. As smoking reduction may eventually lead to smoking cessation,[43,44] our intervention may help hardcore smokers to quit smoking in the long term. However, additional research is needed to help understand why this intervention reduced smoking consumption.

Strenghts and limitations
One statistical challenge in our study has been the baseline differences in cigarette consumption between the experimental group and the control group. Given the randomisation procedure, this was not to be expected and therefore a matter of contingency. In our study we first measured cigarettes per day in the screener questionnaire (assessing eligibility), before randomly allocating participants to either the control or the experimental condition. None of the background variables measured before this randomisation had any influence upon the condition the participants were allocated to. Also, our sample size should have been sufficient enough to prevent differences between conditions at baseline. Despite the fact

that our randomisation reduced the chance of having group differences at baseline to a minimum, such chance can never be ruled out completely. After finding the baseline differences, we cancelled out effects that might have been caused by the differences in cigarette consumption (and nicotine dependence) at baseline, by controlling for consumption in every analysis possible.

A methodological challenge of our study is the fact that not all participants in the experimental condition received all components. As we tailored the digital trainer's responses to participants' smoking-related beliefs, only those who had dysfunctional beliefs about smoking received information tackling those dysfunctional beliefs. As a result, only those who had low self-efficacy, received self-efficacy boosting information. Thisself-efficacy boosting information was given through a series of video clip in which an ex-smokers told the participants how to handle specific situations in which participants may relapse after quitting. Although the situations were the same for all participants, the actors in the video clips were of the same gender and socioeconomic status as the participant. This way, participants were better able to identify with the actors. Men, for example, watched video clips of male actors, while women watched videos clips of female actors. However, some actors may have been more credible than others and because of this, the video clips may not have been similarly convincing for all subgroups.

Despite the fact that we controlled for age, sex and cigarettes per day in each analysis, selective dropout may have biased our follow-up data. If in the future this intervention is tested in a randomized controlled trial as part of heath care practice, we believe intention-to-treat analyses are appropriate. For the present stand-alone test, overly conservative estimates due to intention-to-treat analyses might prematurely reject this potentially effective intervention.

A strength of our study is the use of a control intervention that was similar in design and lay-out to the experimental intervention. The only differences between the experimental condition and the control condition were the content and the combination of techniques used. In the experimental condition we used tailored messages, motivational interviewing techniques and a self-affirmation manipulation, but we did not use these techniques in the control intervention. This way, we can be certain that the differences between conditions have been caused by this combination of techniques and content only.[45,46]

Future research might also focus on the different subgroups among hardcore smokers. In the current study, we included smokers of different socioeconomic status, of different ages groups (25-65 years) and of both genders. In this paper we chose to focus on introducing the intervention itself and its effect on the entire group of hardcore smokers. We suggest future research might also investigate whether its effect is different between the two genders, the two socioeconomic groups, and the different age groups.

Practical implications

While there are many web-based interventions available for smokers,[9,10] our intervention is, as far as we know, the first online intervention designed especially for hardcore smokers. Although the long-term effects of our intervention are unclear, it seems to help to reduce smoking and to increase receptivity to quitting information in the short term.

Health professionals (e.g., GP's, dentists, physiotherapists, medical specialists) play an important role in tobacco control. They often encounter hardcore smokers and have shown to be able to effectively motivate some of these smokers to quit smoking.[47,48] However, few hardcore smokers are willing to quit smoking. Also, many health professionals are reluctant to discuss smoking cessation, because they fear it might damage their relationship with the patient.[49] Our intervention may help both hardcore smokers and health professionals in such cases. Health care professionals could offer our intervention to hardcore smokers as an introduction to a next consult. These smokers then complete this intervention at home, before their next consult. As our intervention does not require face-to-face interaction with a health professional, smokers may feel less threatened by the anti-smoking information. After completing the intervention, smokers might have become more able and more willing to discuss smoking cessation during the next visit to the health professional. Medical specialists, psychotherapists, general practitioners or other health professionals who want to involve resistant hardcore smokers in tobacco control could use this intervention as a low-cost introduction to a face-to-face conversation about smoking cessation.

Conclusions

The intervention increases hardcore smokers' receptivity to information about quitting. It also helps to reduce the number of cigarettes per day. We therefore recommend using this intervention to involve Dutch hardcore smokers in tobacco control. The intervention may be used by health professionals before or during treatment.

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chapter 7

discussion

General discussion

General discussion

Introduction

Hardcore smokers have smoked for many years and do not intend to quit smoking.[1] They may be particularly unresponsive to tobacco control messages.[2] Conventional online smoking cessation interventions appear unable to involve these hardcore smokers. While there are many online smoking cessation interventions available,[3] most of these interventions require a certain level of intention to quit. Little is therefore known about smokers with little or no intention to quit.

In the first chapters, we first investigated hardcore smokers' beliefs about smoking. We qualitatively and quantitatively studied their motivations for smoking, barriers of quitting and circumstances in which they would be open to information about quitting. We also investigated subgroup differences among hardcore smokers and identified ways to tailor anti-smoking messages to these subgroups. In the final chapters, we investigated ways to influence hardcore smokers' beliefs about smoking and quitting, and smoking behaviour. We described how we developed an online intervention for hardcore smokers. This intervention aimed to increase hardcore smokers' intention to quit smoking and to make hardcore smokers more receptive to information about smoking cessation. In line with the Theory of Planned Behaviour and the Reasoned Action Approach, the intervention included components that targeted quitting self-efficacy, increased receptivity to anti-smoking messages, and influenced beliefs about the pros and cons of smoking and quitting.

Main findings

We conducted a number of studies to investigate hardcore smokers' smoking-related beliefs and behaviours. In **Chapter 2**, we reported on trends in hardcore smoking in the Netherlands between 2001 and 2012. The hardening hypothesis states that light smokers are more likely to quit smoking than heavy smokers (such as hardcore smokers). Therefore, the prevalence of hardcore smoking among smokers would increase over time. We calculated the prevalence of hardcore smoking in the Netherlands from 2001 to 2012 and investigated whether these trends differed between educational levels. In the general population the prevalence of hardcore smoking decreased from 12.2% to 8.2%. Hardcore smoking

decreased more among higher educated people than among lower educated people. Among smokers, the prevalence of hardcore smoking decreased from 40.8% in 2001 to 32.2% in 2012. As the prevalence of hardcore smoking decreased, instead of increased, we found no support for the hardening hypothesis. Instead, the decrease of hardcore smoking among smokers in the Netherlands between 2001 and 2012 suggests a 'softening' of the smoking population.

In **Chapter 3**, we investigated beliefs about the pros and cons of smoking and quitting among hardcore smokers. We conducted 11 focus group interviews among current and former hardcore smokers. In these focus group interviews participants discussed their main pros and cons of smoking and quitting. Using the qualitative data, we grouped the perceived pros and cons of smoking and smoking cessation into 6 main categories: Finance, Health, Intrapersonal Processes, Social Environment, Physical Environment and Food and Weight. Although the perceived pros and cons of smoking in hardcore smokers largely mirrored the perceived pros and cons of quitting, there were some differences with respect to weight, social integration, health of children and stress reduction. Based on these findings we proposed the 'Distorted Mirror Hypothesis'. This hypothesis states that 1) many pros of smoking mirror the cons of quitting, 2) many cons of smoking mirror the pros of quitting, but that 3) some of these pros and cons are more or less personally relevant for smoking than for quitting. The themes found in this study have been used as conversation topics in our intervention.

In **Chapter 4** we used the perceived pros and cons of smoking and quitting to identify profiles among hardcore smokers. A sample of 510 hardcore smokers completed an online survey on the perceived pros and cons of smoking and quitting. We used a latent profile analysis to identify subgroups among hardcore smokers. Among hardcore smokers, we found three profiles: 'Receptive' hardcore smokers (36%) perceived many cons of smoking and many pros of quitting. 'Ambivalent' hardcore smokers (59%) were rather undecided towards quitting. 'Resistant' hardcore smokers (5%) saw few cons of smoking and few pros of quitting. To investigate whether these profiles exist among hardcore smokers only, we analysed data from a sample of 338 non-hardcore smokers in a similar way. Among non-hardcore smokers, we identified 'receptive' smokers (30%) and 'ambivalent' smokers (54%). A third group consisted of 'disengaged' smokers (16%), who saw few pros and cons of both smoking and quitting. The results suggest that hardcore smokers are not a homogenous group and that each profile among hardcore smokers might require a different tobacco control approach. Ambivalent and resistant hardcore smokers may need interventions based on motivational interviewing, while receptive hardcore smokers may need pharmacotherapies or nicotine replacement therapies. The results also suggest that many hardcore smokers are receptive to information about quitting or could become receptive to such information. An online intervention based on motivational interviewing could therefore stimulate hardcore smokers to consider smoking cessation.

Chapter 5 described two experiments in which we investigated the separate and combined effects of a self-affirmation manipulation and a self-efficacy manipulation on hardcore smokers' smoking-related cognitions. According to self-affirmation theory, self-affirmation manipulations reduces defensive responses to anti-smoking messages. In Experiment 1, we found that the kindness questionnaire[4,5] increased interpersonal feelings, indicating that the questionnaire is a suitable manipulation for hardcore smokers. In Experiment 2, we combined the kindness questionnaire with a self-efficacy manipulation in a 2 x 2 between-subjects factorial design. The self-affirmation manipulation increased perceived

self-efficacy. The self-efficacy manipulation did not increase perceived self-efficacy, but it seemed to influence attitude towards quitting. We found no effects of either manipulation on intention to quit. We recommend using the self-affirmation manipulation in interventions targeting hardcore smokers. In **Chapter 6**, we used results from all previous studies to develop a tailored web-based intervention. This intervention was based on motivational interviewing principles and aimed to increase hardcore smokers' intention to quit and receptivity to information about smoking cessation. In a two-arm experiment, we compared outcome scores of the experimental intervention with those of a control intervention. We measured all outcomes directly post-experiment (t_1), after two weeks (t_2) and after two months (t_3). At t_1, hardcore smokers in the intervention condition were more receptive to information about quitting than controls. At t_2, they had significantly reduced their cigarette consumption (1 cigarette per day on average), while controls had not. At t_3, this difference in smoking reduction was still present. We found no significant differences in intention to quit, quitting self-efficacy, interest in a subsequent online quitting intervention and number of quit attempts. In conclusion, the intervention increased hardcore smokers' receptivity to information about smoking cessation and decreased their cigarette consumption. As this intervention could help involve hardcore smokers in tobacco control, we recommend using this intervention in health care settings.

Theoretical implications

In our studies, we used a number of hypotheses and theories about smoking and smoking cessation. These hypotheses and theories included the hardening hypothesis, the Self-affirmation Theory, the Theory of Planned Behaviour and the Reasoned Action Approach. Our findings provided insight in the underlying psychological processes of hardcore smoking and may therefore have implications for some of these hypotheses and theories.

Hardening hypothesis
In the second chapter, we tested the hardening hypothesis.[6,7] This hypothesis states that in a population of smokers, light smokers are more likely to quit smoking. As a result, over time, the remaining group of smokers would include a larger portion of heavier, 'hardcore' smokers. In countries that have implemented many tobacco control policies, such as smoking bans and tax increases, this group of hardcore smokers would increase in particular. As the remaining hardcore smokers might be especially resistant to tobacco control policies, such policies may therefore become less able to reach and involve the remaining smokers in tobacco control.[2]
Our results, however, showed that between 2001 and 2012, the prevalence of hardcore smoking decreased in the Netherlands. This suggests that, contrary to the hardening hypothesis, the smoking population has softened. This softening could be explained by Rose's model on population health.[8,9]
In contrast to the hardening hypothesis, Rose's model states that tobacco control measures affect all smokers equally. As a result, both light and heavy smokers would reduce their smoking consumption or quit smoking. The smoking population as a whole would then therefore become softer, instead of harder. The softening of the smoking population suggests that in the Netherlands tobacco control policies may affect hardcore smokers and non-hardcore smokers equally.[10,11] Despite this, the prevalence of smoking in the general population has remained somewhat stable over the past two decades. This suggest that overall, the current tobacco control policies in the Netherlands tend to reduce tobacco *consumption*,

but do not necessarily increase smoking *cessation*. Those who were hardcore smoking before, may have reduced their smoking to such extent, that they could no longer be considered a hardcore smoker. Future policies may therefore further stimulate smokers to quit smoking by promoting smoking cessation support through mass media campaigns or through health warning on tobacco packages.
Despite the softening of the smoking population, a group of hardcore smokers still remain. Many individuals within this group will become ill due to smoking-related diseases and may eventually die due to their these conditions. It is imperative that we continue developing interventions that target these hardcore smokers. The current thesis shows ways to increase receptivity to anti-smoking messages among hardcore smokers. This may contribute to the development of more elaborate behavioural smoking cessation interventions for this vulnerable group.

Self-affirmation theory
Defensive responses to anti-smoking messages are common among smokers. According to the self-affirmation theory, people are motivated to perceive themselves as a person who acts according to their own values.[12] Anti-smoking messages tend to do the opposite, because they show smokers that they do not act in line with accepted ideas about a healthy lifestyle. Smokers, and hardcore smokers in particular, would therefore avoid such anti-smoking messages.[13,14]
Self-affirmations tackle defensive responses by either diverting the smokers' attention away from the threatening message or by simply overruling the treat with positive reinforcements in a domain other than the threat. Despite the fact that there are many different self-affirmation manipulations available, the kindness questionnaire seems particularly suitable for hardcore smokers.[15] Contrary to other manipulations, this one is brief and easy to understand. The current thesis shows that the kindness questionnaire could help tackling defensive responses in hardcore smokers. Those who completed the online intervention (which included the self-affirmation manipulation) were more open to information about smoking cessation than controls. They also significantly reduced their smoking consumption. Their intention to quit smoking, however, did not (significantly) increase. These results are in line with findings from two recent meta-analyses on the efficacy of self-affirmation manipulations.
The first meta-analysis by Epton et al.,[16] identified 144 experimental tests on the efficacy of self-affirmation on message acceptance, intentions and behaviour. These experiments were not restricted to smoking, but investigated a range of health-related topics. The authors considered outcomes a measure of message acceptance if they 1) measured whether participants believed performing the recommended health behaviour would reduce a health risk, or 2) measured if the message increased persuasion or reduced message derogation. In our intervention study, we measured whether hardcore smokers were more open to anti-smoking messages. Our measure of receptivity would be a measure of message acceptance according to the Epton et al. criteria.
Epton et al. found that self-affirmation increased message acceptance, intention and behaviour. The effect size for behaviour ($d_+ = .32$) was larger than for message acceptance ($d_+ = .17$). The effect size for intentions was the lowest. ($d_+ = .14$). In our intervention study, we found a similar pattern. The intervention (which included the self-affirmation manipulation) had the largest effect on smoking behaviour ($\eta_p^2 = .020$). It had a lower effect on receptivity to anti-smoking information ($\eta_p^2 = .015$) and intention ($\eta_p^2 = .005$). In fact, the effect on intention was so small, it did not reach statistical significance.

A second meta-analysis by Sweeney et al.[17] also investigated the effects of self-affirmation manipulations. Similar to Epton et al., they also found that self-affirmation increases intention and changed behaviour. In addition, they found that intentions did not predict change in behaviour. Unpublished data indicate that in our intervention too, intention to quit smoking did not predict changes in smoking behaviour (r = -.01, n = 599, p = .767).

The results presented in this thesis seem to be in line with previous findings in self-affirmation experiments. It is possible to tackle defensive responses to anti-smoking messages in hardcore smokers using a self-affirmation manipulation. We therefore recommend using this kind of manipulation in further research on defensive responses to anti-smoking messages among hardcore smokers.

Theory of Planned Behaviour and the Reasoned Action Approach
Beside the self-affirmation theory, we used two other theories for developing our intervention: the Theory of Planned Behaviour [18] and the Reasoned Action Approach.[19] Both theories assume that behaviour change is predicted by an increased intention to change this behaviour. This intention to change is predicted by both one's attitude towards the new behaviour and one's perceived self-efficacy to perform the new behaviour. In our intervention, we incorporated components that aimed to change each of these factors. Our intervention reduced smoking consumption among hardcore smokers. Those who completed the intervention reduced their smoking consumption after two weeks more than controls did. Also, among those who completed the intervention, more people reduced their smoking than among controls. Despite the fact that the intervention changed hardcore smokers' behaviour, it did not seem to change intention to quit smoking, attitude towards quitting, and perceived quitting self-efficacy. Thus, we influenced smoking behaviour, without changing the hypothesized predictors significantly. The Theory of Planned Behaviour and the Reasoned Action Approach appear not to explain these findings and we therefore need to find explanations for these results beyond these models.

One potential explanation could be found in the other main result of the intervention study: an increased receptivity to anti-smoking messages. Those who completed the intervention, which included the self-affirmation manipulation, were more open to information about smoking cessation than controls. This is in line with the self-affirmation theory described above.[12] Perhaps the intervention made some participants more aware of existing beliefs about smoking. In fact, in Chapter 4, we found that some hardcore smokers are quite aware of the many cons of smoking and pros of quitting. These beliefs may have been activated by the intervention and the intervention made hardcore smokers more conscious about their own smoking consumption. Each time they smoked, they may have been reminded of the intervention and their own (positive) beliefs about smoking cessation. As a result, hardcore smokers may have refrained from smoking on a few occasions in the first two months following the intervention. Future research may investigate this hypothesis by measuring smoking-related beliefs during smoking consumption through, for example, ecological momentary assessment.[20]

Another explanation of why our intervention reduced smoking, but did not influence underlying psychological constructs (such as intention to quit) could be that our self-affirmation manipulation may have been the most effective element of our intervention. As described in the previous section, self-affirmation manipulations tend to have a larger influence on health behaviours than on intentions.[16] In our intervention, the components with motivational interviewing and self-efficacy enhancing video clips may have been

simply supporting the self-affirmation manipulation. This would not suggest, however, that these components are redundant. Although the self-affirmation may be essential in increasing receptivity and changing behaviour, it still needs supporting components that tell participants what to do (i.e., stop smoking). One way to test this hypothesis is by developing an intervention that includes both the self-affirmation manipulation and a minimal amount of supporting components that covers the cons of smoking and the pros of quitting. In our intervention, participants discussed six different pros of smoking. They also watched up to four video clips in which ex-smokers explained how they quitted smoking. A more minimal intervention would discuss e.g. only three topics and show just one video clip. If the self-affirmation manipulation is indeed the most effective element, such intervention would still increase receptivity to anti-smoking messages and reduce smoking consumption.

Our findings are not (fully) explained by the Theory of Planned Behaviour and the Reasoned Action Approach. Instead, further research is needed to test alternative hypotheses on how to develop interventions for hardcore smokers.

Methodological considerations

In the current thesis, we used different research methods to investigate smoking-related beliefs among hardcore smokers. Each study had its own individual methodological strengths and limitations, which I described in previous chapters. Below, I discuss some of strengths and limitations our studies have in common.

Defining hardcore smokers
There seem to be little agreement on the definition of hardcore smokers, because many different definitions appear to exist.[21] Generally, most researchers consider hardcore smokers as those who have reached a stable daily smoking consumption and who have little to no intention to quit. Some others also included criteria of nicotine dependence [22,23] or psychological distress.[24,25]

In the current thesis, we defined smokers as hardcore if they a) were older than 35 years (Chapter 2 and 6: 25 years), b) smoked daily, c) smoked 15 cigarettes per day on average, d) had not attempted to quit in the past 12 months, e) had no intention to quit within 6 months and f) had smoked at least 15 years in life (Chapter 2: no minimum; Chapter 6: 5 years). This definition is in line with the current literature and the literature that had been available at the start of this research project. Previous research showed that of all components of hardcore smoking, intention to quit is the largest predictors of quit.[26] As most studies seem to emphasise the importance of low quitting intentions in defining hardcore smokers,[27–30] I believe that having a low intention to quit is the most essential characteristic of being a hardcore smoker. Although we were not able to change intention to quit significantly in our intervention, I do encourage investigating new techniques of increasing this low intention to quit.

The one major difference between our definition and that of others is the number of years smoked in life. We only included those who had been smoking for at least 15 (except in Chapter 2 and 6), while others were more inclusive with a minimum of 5 years [27–29,31] or no such criterion at all.[30,32] A recent study has questioned the need for this criterion. This study tested different criteria for being a hardcore smokers and found that years smoked in life did not predict quitting behaviour.[26] Because of this, I believe the difference between our definition and the definition of others may not have biased our results. Future

research on hardcore smoking might drop this criterion and include smokers who have only been smoking for a few years as well.

A common definition of hardcore smokers would advance research on hardcore smoking. If we would be able to compare prevalence rates of hardcore smoking between countries, this might give insight in policies and practices that are particularly effective in reducing hardcore smoking. If hardcore smoking decreased over time in one country, but increased in another, the former country may have implemented tobacco control policies that were more effective in reducing hardcore smoking than the policies implemented in the latter country. Of course, comparing policies between countries imposes many challenges, but having a common definition would be an essential first step. In section 7.7 I will discuss some policies that may help reducing hardcore smoking.

Collecting data online

Most of the data used in this thesis has been collected online. Participants were recruited through an online panel that included thousands of potential participants experienced in completing online surveys. Online panels allow researchers to study very specific study populations that are hard to recruit otherwise.[33] In the current thesis, we recruited panel members for participating in real-life focus group interviews, an online survey, several experiments and for testing an online intervention.

Recruiting participants online has many advantages.[34] This way of collecting data is convenient for both researchers and participants. Researchers could include participants form hard-to-reach populations and control sampling within these populations. In our study, we included roughly equal numbers of men and women and people with low and high education. An advantage for participants is that they do not have to complete and send back paper questionnaires. This lowers the administrative burden for both them and the researchers. Finally, collecting online allows for testing technological innovations and monitoring their effectiveness through follow-up measurements. This had been particularly true for our intervention study. There are also certain limitations of collection data online. As participants remain anonymous, some of them may give unreliable answers.[35] Participants may, for example, respond with little thought (random responding), falsely exaggerate their beliefs (dissimulation) or deliberately or unconsciously conform to social norms (social desirability). In our study we countered such responses by a thoroughly checking the data. We excluded those who gave the same response to each question (straightlining) and those who give bogus answers (e.g., 'kkkk').

Another limitation is the possibility of selection biases.[34] Firstly, the participants recruited through online panels may represent a subgroup within the target population that is more internet savvy than those outside the panel. Secondly, as online data is collected anonymously, some participants may not feel as committed to the study as they would in paper and pencil studies. This might cause selective dropout at baseline and at follow-up measurements in particular. However, the first type of bias may not have been a problem in our research, as access and ability to use the internet have become near universal in the Netherlands. Fortunately, online data collection also allows for monitoring the second type of selection bias. In our intervention study we were able to investigate differences in demographics and smoking outcomes between those who had completed the study and those who had not. While we found small differences between conditions at baseline, we were able to control for these differences in our analyses. Collecting data online requires researchers to be creative in measuring their outcomes. Traditionally,

research in psychology often used measures of considerable length. Such measures contain many similar items, which exhaust or bore participants. As traditional research is often conducted on campuses, where students are obliged to participate, relatively few participants drop out. Because online data collection offers a large degree of anonymity, participants feel less obliged to complete a study. Participants in online studies might therefore be more likely to drop out if bored or exhausted than participants in campus research. In our research, we aimed to prevent exhaustion by using short scales that are easy to complete. As no such measures were available, we used measures from other fields of research (e.g., on alcohol dependence) to create similar measures for our studies. Unfortunately, we had no opportunity to extensively pre-test all of our measures. Although all measures proved reliable, we were unable to test for internal and external validity. Future research may pre-test both measures more extensively to ensure the internal and external validity of the results.

Directions for health care practice

The current thesis describes an intervention that stimulates hardcore smokers to consider quitting smoking. We did not develop this intervention for research purposes only, but also to help hardcore smokers outside research settings. In this section, I discuss some of the implications of implementing online interventions in health care in general, and our online intervention in particular.

Implementing our intervention

Health professionals (e.g., GP's, dentists, physiotherapists, medical specialists) play an important role in tobacco control. They often encounter hardcore smokers and have shown to be able to effectively motivate some of these smokers to quit smoking.[36,37] However, not all smokers are willing to quit smoking and not all health professionals discuss smoking cessation often, because they fear it might damage the relationship with the patient.[38] In such cases, our intervention may help both hardcore smokers and health professionals. Health care professionals could offer our intervention to hardcore smokers as an introduction to a next consult. Smokers then complete this intervention at home, before this next consult. As our intervention does not require face-to-face interaction with a health professional, smokers may feel less threatened by the anti-smoking information. After completing the intervention, smokers might have become more able and more willing to discuss smoking cessation during the next visit to the health professional.

Our intervention might not only be used to ease a face-to-face conversations about smoking cessation, but may also serve as an introduction to a series of online interventions about smoking cessation. In the current thesis, we tested our intervention as a stand-alone intervention. As such, it increased receptivity towards information about smoking cessation. If our intervention would be implemented, it should be embedded in a wider context, because one single online intervention is too short to encourage hardcore smokers to quit smoking completely. Hardcore smokers require a more intensive series of interventions to quit smoking completely. Many online smoking cessation interventions exist, but they require a level of receptivity to anti-smoking information. As our intervention increases receptivity to such information in hardcore smokers, it might serve as the first one in a series of online interventions motivating hardcore smokers to quit smoking.

As few hardcore smoker actively seek online smoking cessation interventions themselves, they have to be stimulated to do so by others, such as employers or municipal health services. Employers would like

to have healthy employees and would benefit from having as many non-smoking employees as possible. Municipalities would also benefit from having as many non-smoking citizen as possible, as this would reduce health care cost. One way employers and municipalities could try to stimulate hardcore smokers to visit online smoking cessation interventions is by using incentive. Incentives, such as money, vouchers for goods, lottery tickets, have been used in smoking cessation interventions before and have shown to boost cessation rates.[39] To ensure that smokers actually quit smoking after completing a series of online smoking cessation interventions, employers and municipalities would have to measure breath carbon monoxide (CO) and reward former hardcore smokers for having low levels of CO.[40] As such, there are many opportunities for involving other outside health care in stimulating hardcore smokers to quit smoking.

Self-affirmation manipulation

In the current thesis, we used a self-affirmation manipulation to make hardcore smokers more receptive to anti-smoking messages. There are many self-affirmation manipulations available,[41] but most of them are lengthy and require much cognitive effort. The manipulation we used, the kindness questionnaire, is brief and easy to complete, and it has shown to be effective in smoking cessation settings before.[15] In our studies, we found that those who completed the intervention (which included the kindness questionnaire) were more receptive to information about smoking cessation than controls. Although other components might have contributed to this increase in receptivity, the self-affirmation manipulation is a likely cause for this. We therefore recommend using this manipulation in other online interventions. Such interventions may not be limited to smoking cessation. The self-affirmation manipulation has helped to reduce alcohol dependence before,[42] but may also be useful in other contexts in which participants tend to respond defensively. Future research may for example investigate the use of self-affirmation in detecting domestic violence and preventing burnout.

Using motivational interviewing techniques online

In our intervention, we used motivational interviewing techniques.[43] In motivational interviewing, a health professional communicates in an open and non-judgemental way to elicit and strengthen motivations for behaviour change.[44] This reduces defensive responses and stimulates participants to reflect on their behaviour in an unbiased way, and encourages behaviour change. Successful motivational interviewing requires four skills: asking open-ended questions, communicating understanding to the patient, reflecting on patients responses, and summarizing the patients responses.[44] In our intervention, we incorporated all these techniques. After each topic, for example, we praised participants, expressed understanding for ambivalent answers and reflected on their answers.

Although our intervention was designed to reflect a dialogue between participants and a health professional, it was difficult to use open-ended questions the way a real health professional would do in a face-to-face interview. In a face-to-face motivational interview, a health care professional would use open-ended questions from the very start of the conversation (e.g., What do you think about smoking cessation?). The conversation in our intervention was much more structured, because of the very nature of online interventions. We therefore used open-ended questions in such a way that the intervention appeared to use the answers to these questions, but without responding to the content of the participants answer. At the end of the intervention, we reflected on the conversation by using the exact answer given before.

When discussing money, for example, we first asked "Imagine you quit smoking and save money. What would you do with this money?" In the summary, we reflected on the answer by stating "One could do many things with money saved by quitting smoking. When I asked what you would do with such money, you responded: [answer]". This way we were able to use open-ended questions and responses to those questions in a slightly similar way a health professional would, but without having to process the content of the participants' responses.

This thesis shows that motivational interviewing techniques could be used in online settings. Current interventions that use motivational interviewing in face-to-face interviews, require intensive attention of a health professional. In the Dutch V-MIS intervention,[45] for example, primary care midwives use motivational interviewing in a series of face-to-face interviews with pregnant women to discuss smoking cessation. In a few sessions, midwives and pregnant women discuss reasons for smoking and not smoking, ways of avoiding second hand smoke and setting a quit date. This intervention is incorporated in the usual care for pregnant women and requires only a few minutes per session. Despite this, midwives conduct the V-MIS poorly, possibly due to time constraints.[46] One way of improving the implementation of the V-MIS would be by adding an online smoking cessation module. Such module could stimulate pregnant women to consider smoking cessation (as our intervention would do), but may also focus on setting and reminding pregnant women of a quit date, or may provide information about tackling second hand smoking. It is important, however, that such online modules would incorporate motivational interviewing techniques, as that would make pregnant women feel less threatened by the anti-smoking information.

Directions for future research

The current thesis provides some implications for future research. I have discussed many those throughout this discussion. Below I discuss some of the implications that have not yet been covered in the previous sections.

Interventions for hardcore smokers in particular

Currently, there are few online interventions that target smokers with low intention to quit. As far as we know, our intervention is the first one that targets hardcore smokers in particular. Future research may further develop intervention that stimulate hardcore smokers to quit smoking. Although our intervention reduced smoking by one cigarette per day in hardcore smokers, health professionals ultimately aim for complete cessation. Future research may therefore consider smoking reduction and involving significant others as ways of stimulating hardcore smokers to quit smoking.

Smoking reduction. In Chapter 4, we found that hardcore smokers tend to have a lower self-efficacy than non-hardcore smokers. Hardcore smokers who have unsuccessfully tried to quit smoking many times may in particular have a low self-efficacy. Increasing their self-efficacy is therefore crucial in reducing smoking and achieving self-efficacy. One potential effective strategy for increasing their self-efficacy, is by having them gradually reduce the number of cigarettes they smoke per day. As smoking reduction may just as effective as quitting cold turkey in achieving complete abstinence,[47] it may be an effective approach for some hardcore smokers to quit smoking. Although they may not believe they could quit smoking completely, they may believe they could smoke less. By gradually reducing their smoking consumption,

hardcore smokers show themselves that they have the ability to change their smoking behaviour. This may give them enough confidence in their ability to overcome their addiction and could stimulate them to quit smoking altogether. Future research may therefore investigate how reducing smoking might increase quitting self-efficacy among hardcore smokers and might ultimately help them to quit smoking altogether. *Social environment.* Whereas our intervention mainly focussed on increasing self-efficacy and improving hardcore smokers' attitude towards quitting, future interventions might consider involving the social environment. Many smokers find it difficult to quit smoking, because many people around them smoke.[48] Such social barriers may be particularly present among hardcore smokers. Future intervention may therefore offer strategies for coping with these social influences, such as by helping setting rules for a smoke free house or by stimulating receiving social support from others. These interventions may also involve these significant others and may not be restricted to online interventions. Future research may therefore investigate how group interventions[49] or family interventions[50] might help hardcore smokers to quit smoking. Hardcore smoking may also be reduced at the population level. Population interventions, such as mass media campaigns, implementing smoke free areas and reducing exposure to tobacco stimuli have shown to reduces smoking at the population level. In the next section, I described such interventions in more detail.

Directions for policy
One way of further reducing hardcore smoking, would be by implementing policies that aim to reducing tobacco consumption. According to the WHO Framework Convention on Tobacco Control, all countries are obliged to implement effective tobacco control policies.[51] Implementing such policies globally might reduce the global burden attributable to tobacco by as much as 60%.[52] In 2008, the WHO published the MPOWER package, which listed 7 effective tobacco control policies.[53] These policies are: **m**onitoring tobacco use, **p**rotecting people from tobacco smoke, **o**ffering help to those who quit tobacco use, **w**arning about the dangers of tobacco, **e**nforcing bans on tobacco advertising, promotion and sponsorship and **r**aising taxes on tobacco. Each of these policies might reduce both smoking and hardcore smoking.
Monitoring tobacco use. Monitoring tobacco use is an effective method to evaluate the effectiveness of tobacco control interventions. In Chapter 2 we used such monitoring data to investigate trends in hardcore smoking in the Netherlands. We found that the prevalence of hardcore smoking declined between 2002 and 2012. One possible focus of future monitoring of might be the use of e-cigarettes by hardcore smokers. Smokers in the Netherlands have become increasingly aware of e-cigarettes and many smokers consider using e-cigarettes an alternative for smoking in places where smoking regular cigarettes is banned.[54] As hardcore smokers smoke more than non-hardcore smokers, they may be more affected by smoking bans and may be more inclined to start smoking e-cigarettes regularly. If researchers do not take in account e-cigarette consumption in their future estimates of hardcore smoking, they might underestimate the prevalence of hardcore smoking in the future.
Protecting people from tobacco smoke. Introducing smoke-free outdoor areas is a second effective tobacco control policy. It reduces smoking prevalence, smoking consumption and exposure to tobacco smoke in public areas.[55] Hardcore smokers may be particularly affected by such policies, as they tend to smoke more than non-hardcore smokers.[2] People who smoke few cigarettes per day are less nicotine dependent and may be more able to refrain from smoking in places and areas where smoking is not allowed. Hardcore smokers, who are generally more nicotine dependent, may find it harder to refrain

from smoking in such places. In the Netherlands, smoking is not allowed in many public places, such as hospitality venues. However, in areas adjacent to these venues, such as terraces, smoking is allowed in many cases. As smoking exposure in such places is relatively high,[56] the government may consider banning smoking in such places as well. Other potential smoke-free areas are beaches,[57] parks [58] and train stations.[59] As hardcore smokers may be especially affected by such policies, introducing more smoking bans might help further decrease hardcore smoking in the Netherlands and other countries.
Offering help to those who quit tobacco. As hardcore smokers are more nicotine dependent than non-hardcore smokers, quitting without support may be particularly difficult for them. There are many effective methods of quitting smoking, such as individual counseling,[60] telephone counseling,[61] group counseling,[49] nicotine replacement therapies,[62] and many types of pharmacological support.[63,64] Reimbursing such therapies would increase the number of smokers that would use such therapies in the Netherlands [65] and may therefore be especially effective in reducing hardcore smoking. This may be particularly true if such reimbursement policies would be accompanied by a mass media campaign.[65]
Warning about the dangers of tobacco. Broadcasting mass media campaigns are also an effective way of reducing smoking consumption [66]. They also increase smokers' and non-smokers' knowledge about the dangers of tobacco.[67] Hardcore smokers in general know less about the dangers of tobacco than non-hardcore smokers.[31] This may be particularly true for hardcore smokers in the Netherlands, as knowledge about the dangers of tobacco is lower among Dutch smokers than among smokers of other European countries.[68] Therefore, Dutch hardcore smokers in particular, may benefit from mass media campaigns that warn about the dangers of tobacco.
Enforcing bans on tobacco advertising. In the Netherlands, tobacco advertising is restricted. One of the few ways tobacco manufacturers are able to influence current and future smokers is by creating appealing tobacco packages.[69] By banning such advertising and introducing plain packages, smokers would be less attracted to tobacco products.[70] Plain packages do not contain any form of branding (i.e., logos, appealing colors etc.). Instead, all packages have the same unappealing colors and large graphic health warnings. By introducing plain packaging, governments could use the large graphic health warnings to inform smokers and non-smoker about the dangers of tobacco and stimulate them to quit smoking.[70–72] As hardcore smokers tend to smoke more than non-hardcore smokers,[2] they are more exposed to the content of tobacco packages. Introducing plain packaging would therefore be particularly effective in warning hardcore smokers about the dangers of tobacco and informing them about smoking cessation support.
Raising taxes on tobacco. Raising taxes on tobacco products is the most effective policy to reduce tobacco use.[55] It may be especially effective among more vulnerable groups, such as people with lower socioeconomic status.[11,73] One way of enhancing this sensitivity to tax policies even further, might be by increasing taxes on roll-your-own tobacco in particular. In Chapter 2, we found that hardcore smokers are more likely to smoke roll-your-own tobacco than non-hardcore smokers. Roll-your-own tobacco is relatively cheap and for many smokers this is the main reason to smoke roll-your-own tobacco.[74] As hardcore smokers may be more sensitive to financial stimuli than non-hardcore smokers, increasing taxes on roll-your-own tobacco - may be an effective way to stimulate hardcore smokers to quit smoking.

General conclusions

In conclusion, hardcore smokers are a specific group of smokers that require special attention in tobacco control. The current thesis shows that it is possible to involve hardcore smokers in tobacco control and to change their smoking behaviour.

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appendices

Appendices
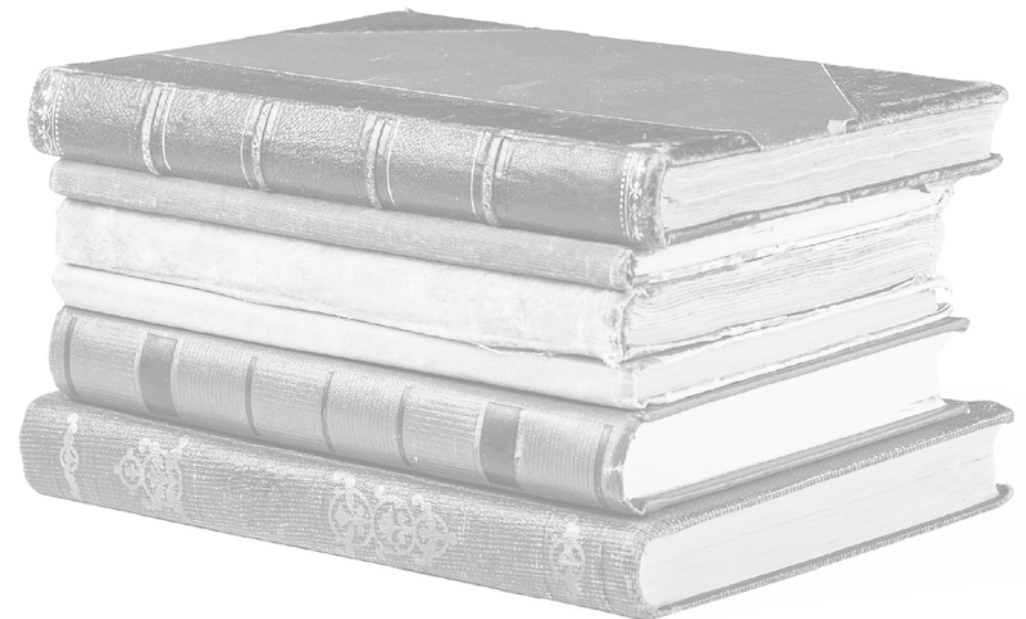
Appendix A

Overview of studies

Tabel B-1. Overview of studies about hardcore smoking cited in this thesis.

		Study			Age		Consumption				History			Intention to quit						Quit Attempts		Other			
Authors	Year	Country	Type	% of smokers	> 25 yrs	≥35 yrs.	> 100c. in life	Daily smoker	≥15 cpd	TTF < 30 min.	12m. ago	5 yrs in life	15 yrs in life	Not in 4w.	Not in 6m.	Not in 12m.	Remain smoking in 5 y.	Never	No inten-tion	Not in last 12m.	Never	Knows Hazards	K10 of 30-50	HSI > 5	Resist social pressure
Chapter 3-5 (Study 1-3)						x		x	x				x		x					x					
Chapter 6 (Study 4)					x			x	x			x			x					x					
Chapter 2 (Study 5)	2015	Netherlands	HCS + Trends	32,2%	x			x	x						x					x					
Emery, Gilpin, Ake, Farkas, & Pierce, 2000	2000	California, US	HCS	5.2 %	x		x	x	x		x							x		x					
Sorg, Xu, Doppalapudi, Shelton, & Harris, 2011	2011	Missouri, US	HCS	7.8 %	x		x	x	x		x							x		x					
Ji et al., 2005	2005	California, US	HCS	10.0%	x			x	x		x								x	x					
Azagba, 2015	2015	Canada	HCS + Trends (-)	14.3 %	x		x	x	x	x	x				x					x					
Jarvis, Wardle, Waller, & Owen, 2003	2003	England	HCS	16%							x	x							x	x					
MacIntosh & Coleman, 2006	2006	UK	HCS	16.1 %				x			x			x					x	x					
Augustson & Marcus, 2004	2004	US	HCS	13.7 %	x			x	x			x			x						x				
Augustson, Barzani, Rutten, & Marcus, 2008	2008	US	HCS	-	x			x	x			x			x						x				
Ferketich et al., 2009	2009	Italy	HCS	33.1 %	x			x	x			x			x						x				
Kaleta et al., 2014	2014	Poland	HCS	39.9	x			x	x		x					x				x					
(Jena & Kishore, 2012)	2012	India	HCS	-				x		x	x					x				x			x		

Tabel B-1. Overview of studies about hardcore smoking cited in this thesis (continued).

Authors	Year	Country	Type	% of smokers	> 25 yrs	≥35 yrs.	> 100c. in life	Daily smoker	≥15 cpd	TTF < 30 min.	12m. ago	5 yrs in life	15 yrs in life	Not in 4w.	Not in 6m.	Not in 12m.	Remain smoking in 5 y.	Never	No intention	Not in last 12m.	Never	Knows Hazards	K10 of 30-50	HSI > 5	Resist social pressure
					Age		Consumption				History			Intention to quit						Quit Attempts		Other			
Kishore et al., 2013	2013	SEA	HCS	18.3-29.7 %				x		x	x					x				x		x			
Lund, Lund, & Kvaavik, 2011	2011	Norway	HCS + Trends (-)	24%	x			x			x				x		x			x					
Docherty, McNeill, Gartner, & Szatkowski, 2013	2014	England	Trends (+)	10-15 %	x					x									x						
Clare, Bradford, Courtney, Martire, & Mattick, 2014	2014	Australia	Trends (+/-)	10.7 %				x			x								x	x		x			
Mathews, Hall, & Gartner, 2010	2010	Australia	Trends (-)	-																			x		
Gartner, Scollo, Marquart, Mathews, & Hall, 2012	2012	Australia	Trends (+/-)	-				x															x		
Warner & Burns, 2003	2003	-	Theory	-				x											x			x			x
Costa et al., 2010	2010	-	Theory	0.03-13.77 %																					
Ip et al., 2012	2012	Canada	Theory	-				x	x			x							x		x			x	
Jena et al., 2012	2012	India	Snus	23.2 %				x		x	x					x				x		x			
Von Soest & Pedersen, 2014	2014	Norway	Adolescents + Trends (+)	-				x																	
Kulik & Glanz, 2015	2015	USA + EU	Trends (-)	-																					

Appendix B

Intervention protocol

Administrative information

Intervention title
'Rookexperts' ('Smoke Experts')

Trial registration
The intervention has been registered at the Dutch Trial Register (NTR4838).

Protocol version
31 December 2015

Funding
This study is supported by the Netherlands Organisation for Health Research and Development (ZonMw) grant 200120002.

Roles and responsibilities
This study will be conducted at the IVO Addiction Research Institute by Jeroen Bommelé, Tim Schoenmakers, Marloes Kleinjan and Dike van de Mheen. Their efforts are overseen by a project committee: Arie Dijkstra and Gjalt-Jorn Peters. This study is funded by a grant from ZonMw and the funding organization has no influence on the design, data collection, analysis and interpretation of the data, nor in writing any article or the decision to submit for publication.

Introduction

Background and rationale
Hardcore smokers are smokers who have been smoking for many years and who do not intent to quit. This makes them vulnerable to disease. As hardcore smokers are unlikely to quit smoking, we need to increase their intention to quit and increase their receptivity to information about quitting.
The experiment compares an experimental intervention (i.e. www.rookexperts.nl, eng: 'smoke experts') with a control intervention. The intervention is designed to increase intention to quit among hardcore smokers and to increase their receptivity to information about quitting. Rookexperts.nl incorporates motivational interviewing techniques, uses a self-affirmation manipulation and gives tailored feedback. We use motivational interviewing to increase smokers' self-efficacy and to change smokers' perceived cons of smoking and pros of quitting. We use a self-affirmation manipulation to tackle smokers' defensive responses. Tailored messages are used to make the website more relevant.
The control intervention is similar to rookexperts.nl in layout and length, but does not contain any 'working elements' (see further on).

Trial design
The experiment has a two-arm between subject design. As sex and education are important predictors of hardcore smoking, we stratify for sex and socioeconomic status (SES, measured by education) in each condition. Within each of the four demographic groups (i.e., low SES men, high SES men, low SES women, high SES women), participants will be alternately allocated to the experimental condition or the control condition. The overall objective is to investigate the superiority of the experimental intervention over the control intervention.

Participants, interventions, and outcomes

Study setting
The study will be conducted online among Dutch hardcore smokers in the Netherlands. We will collaborate with an online sampling organisation ('panel') with a large number of respondents in the Netherlands. This panel will use a screener questionnaire to identify hardcore smokers in their sample. Eligible respondents will continue to www.rookexperts.nl , where they fill out an online informed consent form and then continue to one of the two experimental conditions.

Eligibility criteria
We will only include hardcore smokers. Hardcore smokers (a) are 25-65 years old, (b) smoke daily, (c) smoke 15 cigarettes or more per day on average, (d) have not attempted to quit smoking in the past 12 months, (e) have smoked at least 5 years in their life, and (f) do not intent to quit within the next 6 months. Those who do not meet these criteria will not be included in our study.

Interventions
The intervention (www.rookexperts.nl) is designed to increase intention to quit and receptivity to information about quitting among hardcore smokers. It incorporates motivational interviewing techniques, uses a self-affirmation manipulation and gives tailored feedback. It consists of three components:

In the first component, participants complete the kindness questionnaire, a self-affirmation task designed to tackle smokers' defensive responses to anti-smoking messages. The kindness questionnaire contains 10 items asking whether participants have ever performed acts of kindness to others (yes/no). It also asks to elaborate on some of these past acts of kindness.

In the second component, participants will meet an automated digital trainer who tells them that he is interested in their opinion as smoke experts. Together, they will discuss several smoking-related topics, such as the health effects of smoking, the effect of smoking on social relations and the money potentially saved by quitting. At each topic, the trainer first assesses whether participants has dysfunctional beliefs about that topic. If participants do, the trainer uses motivational interviewing techniques and tailored feedback to tackle these beliefs. For example, if participants do not believe quitting could save them money, the trainer would let participants calculate how much money they could save and would ask them how they would spend that money. If participants have no dysfunctional beliefs within a topic, the trainer continues to the next topic.

The third component covers quitting self-efficacy. The trainer and participants will discuss four types of barriers of quitting: smoking-related habits, unsupportive others, stressful situations and cravings. For each type, participants will imagine they have quit smoking and now encounter four difficult situations. If participants express they cannot remain abstinent in any one of those situations, they will watch a video clip in which an ex-smoker explains how to deal with these particular situations. Participants therefore only receive advice on situations in which they are unsure they could remain abstinent.

The control intervention is similar to the experimental intervention in layout and length, but does not contain any 'working elements'. Participants in the control condition will not receive motivational interviewing techniques, self-affirmation or tailored messages. Instead, they will discuss the history and production of tobacco (instead of smoking-related beliefs).

Outcomes
Our outcomes are 1) intention to quit within 6 months, 2) receptivity to information about quitting, 3) quitting self-efficacy, 4) cigarettes smoked per day, and 5) number of smokers visiting a subsequent intervention website

Participant timeline
The first part of the experiment will take about 30 minutes. The follow-up measurements (after 2 weeks and after 2 months) will take about 10 minutes each. As our experiment will be held online, we are able include many participants simultaneously, and including participants will therefore take two to three weeks at each time point.

Recruitment
Participants will be recruited online via an online sampling organisation (Survey Sampling International). This panel will present a screener questionnaire to potential respondents and eligible respondents are invited to participate in the experiment. The panel has a very large sample of respondents and could increase their sample with respondents from other sampling organisations if necessary. To stimulate an adequate inclusion rate, respondents will receive an incentive upon completing the experiment and both follow-ups (10 euros).

Data collection and monitoring
Allocation
First, we will identify eligible participants using a screener questionnaire. We will then randomly assign these participants to one of the two conditions. We will stratify for sex and socioeconomic status (SES, measured by education) in each condition. Within each of the four demographic groups (i.e., low SES men, high SES men, low SES women, high SES women), participants will be alternately allocated to the experimental condition or the control condition.

Blinding
Both participants and researchers are blind to the conditions participants are allocated. Researchers will only receive simple demographics (age, sex, SES) and an anonymous id-number. They will not receive any information that could lead back to individual respondents. Panel employees are semi-blind to the allocation: They will know which individuals participate (and will received the incentive), and which id-numbers have completed the experiment (to prevent one individual to participate more than once). By default, individuals could not be linked to their results. Only in case of fraud of participants would unblinding be permitted. Panel employees would then link the id-number to personally identifiable information and take appropriate actions.

Data management
Data storage and processing will be in accordance to the Dutch Data Protection Act (Wet Bescherming Persoonsgegevens).

Data monitoring
No data monitoring committee is needed, because we do not use medical data. The study will be overseen by the project committee. We will conduct descriptive analyses when about 10% of the data is collected, to ensure all data is correctly collected. The data collection will only be interrupted when large data collection mistakes are found. Only the main research team (JB, TS, MK and DM) and panel employees have access to these data.

Harms
No harms are anticipated. The only 'harm' could be that our experiment would have participants to stop smoking and live a healthier lifestyle.

Auditing
Study procedures are overseen and approved by all members of the research team and project committee. The funding organization has no influence on the conduct of the study.

Ethics and dissemination
Research ethics approval
The ethics committee of the Faculty of Social Sciences at the Radboud University Nijmegen has approved of the study's protocol (ECG2013-1308-119a).

Protocol amendments
Significant amendments will be communicated to both the ethics committee and the funding organization.

Consent or assent
Informed consent will be obtained at the start of the experiment (after the screener). Participants will receive information about the experiment online and are not able to continue to the experiment without consenting to participation.

Confidentiality
Personal information will not be known to the researchers. They will only receive anonymous data. Panel employees will have no access to this personal information. They will only have access to data about whether or not a participant has completed the experiment.

Declaration of interests
There are no financial or other competing interests to declare.

Access to data
The main research team will have access over the final dataset. After publication of the (first) article, data will be shared with other researchers when asked for. There is no contractual agreement between the researchers and the funding organization (or anyone else) that would limit the researchers' access to the final dataset.

Dissemination policy
We aim to publish a paper about the results in an international scientific journal. Authorship for this paper will be organised within the research team. If the results of this experiment prove to be valuable, IVO Addiction Research Institute may use this knowledge to develop a more extensive online web-based intervention for hardcore smokers.

summary
summary
Samenvatting

Summary

In the Netherlands, about 20,000 people die of smoking each year. This is about one-seventh of all deaths in the Netherlands. Smoking is therefore one of the major contributors to cancer and heart diseases. Despite this, about 23% of the Dutch population continues to smoke and this prevalence has remained stable over the past decade. As smoking continues to kill both smokers and non-smokers, smoking remains a major public health concern, both globally and in the Netherlands. In the current thesis, I describe one group of smokers in particular, who have little to no intention to quit smoking. These 'hardcore smokers' are hard to reach by current tobacco control measures, but are particularly vulnerable to death and disease. Together with others, I developed an online intervention that motivates these hardcore smokers to quit smoking.

Hardcore smokers
One group of smokers is particularly resistant to smoking cessation. These 'hardcore' smokers have reached a stable smoking consumption and do not intend to quit smoking. They seem to be unaffected by tobacco control interventions and may increasingly become a target group for health professionals. There is, however, little known about the smoking-related motivations and beliefs of these hardcore smokers. Compared to non-hardcore smokers, hardcore smokers tend to be older, lower educated, have lower income, started smoking at earlier age and are more likely to be male. They are also less aware of the dangers of smoking and are less receptive to tobacco control measures. Among low SES there are more hardcore smokers than among higher SES groups and this difference is widening. Conventional smoking cessation interventions may not be able to reach these hardcore smokers. As hardcore smokers have a low intention to quit and low self-efficacy, they are not likely to participate in such interventions. We therefore need to develop interventions that target hardcore smokers in particular. Such intervention should not only focus on psychological predictors to smoking cessation, but should also tackle defensive responses of hardcore smokers to such interventions. In the current thesis, I therefore describe several studies that increased our knowledge about hardcore smokers and the online intervention we developed for this group.

Studies in this thesis
Chapter 2 reports on a study on trends in hardcore smoking in the Netherlands between 2001 and 2012. The hardening hypothesis states that light smokers are more likely to quit smoking than heavy smokers (such as hardcore smokers). Therefore, the prevalence of hardcore smoking among smokers would increase over time. We calculated the prevalence of hardcore smoking in the Netherlands from 2001 to 2012 and investigated whether trends differed between educational levels. Among smokers, the prevalence of hardcore smoking decreased from 40.8% in 2001 to 32.2% in 2012. In the general population it decreased from 12.2% to 8.2%. Among the general population, the prevalence of hardcore smoking decreased more among higher educated people than among lower educated people. We therefore found no support for the hardening hypothesis in the Netherlands between 2001 and 2012. Instead, the decrease of hardcore smoking among smokers suggests a 'softening' of the smoking population.

Chapter 3 describes a focus group study that aimed to gain insight into the perceived pros and cons of smoking and quitting among hard-core smokers. We conducted 11 focus group interviews among current hard-core smokers (n = 32) and former hard-core smokers (n = 31), in which participants discussed their main pros and cons of smoking and quitting. Using the qualitative data of both the questionnaires and the transcripts, we grouped the perceived pros and cons of smoking and smoking cessation into 6 main categories: Finance, Health, Intrapersonal Processes, Social Environment, Physical Environment and Food and Weight. Although the perceived pros and cons of smoking in hard-core smokers largely mirror the perceived pros and cons of quitting, there are some major differences with respect to weight, social integration, health of children and stress reduction. Based on these findings we propose the 'Distorted Mirror Hypothesis'. The themes found in this study could be used as conversation topics for an online intervention for hardcore smokers.

Chapter 4 describes a study in which we used the perceived pros and cons of smoking and quitting to identify profiles among hardcore smokers. A sample of 510 hardcore smokers completed an online survey on the perceived pros and cons of smoking and quitting. We used these pros and cons in a latent profile analysis to identify possible subgroups among hardcore smokers. To validate the profiles identified among hardcore smokers, we analysed data from a sample of 338 non-hardcore smokers in a similar way. Among hardcore smokers, we found three profiles: 'Receptive' hardcore smokers (36%) perceived many cons of smoking and many pros of quitting. 'Ambivalent' hardcore smokers (59%) were rather undecided towards quitting. 'Resistant' hardcore smokers (5%) saw few cons of smoking and few pros of quitting. Among non-hardcore smokers, we found similar groups of 'receptive' smokers (30%) and 'ambivalent' smokers (54%). A third group, however, consisted of 'disengaged' smokers (16%), who saw few pros and cons of both smoking and quitting. The results suggest that hardcore smokers are not a homogenous group. Each profile among hardcore smokers might require a different tobacco control approach. The results also suggest that many hardcore smokers are receptive to information about quitting or could become receptive to such information. An online intervention based on motivational interviewing may therefore stimulate hardcore smokers to consider smoking cessation.

Chapter 5 describes an experiment in which we investigated the separate and combined effects of a self-affirmation manipulation and a self-efficacy manipulation on hardcore smokers' smoking-related cognitions. According to self-affirmation theory, self-affirmation manipulations reduce defensive responses to anti-smoking messages. In Study 1, we found that the kindness questionnaire increased scores on the Interpersonal Feelings scale. It is therefore a suitable self-affirmation manipulation for hardcore smokers. In Study 2, we combined the self-affirmation manipulation with a self-efficacy manipulation in a 2 x 2 between-subjects factorial design. The self-affirmation manipulation increased perceived self-efficacy. The self-efficacy manipulation did not increase perceived self-efficacy, but it seemed to influence attitude towards quitting. We found no effects of either manipulation on intention to quit. We recommend using the self-affirmation manipulation in interventions targeting hardcore smokers. In **Chapter 6**, we developed a tailored web-based intervention based on both motivational interviewing techniques and results from previous studies. The intervention aims to increase hardcore smokers' intention to quit and to increase their receptivity to information about smoking cessation. In a two-arm experiment, we compared outcome scores of the experimental intervention (*n* = 346) with those of a control intervention (*n* = 411). We measured all outcomes directly post-experiment (t_1), after two weeks

(t_2) and after two months (t_3). At t_1, hardcore smokers in the intervention condition were more receptive to information about quitting than controls. At t_2, they had significantly reduced their cigarette consumption with an average of one cigarette per day, while controls had not. At t_3, the difference in smoking reduction was still present. We found no significant differences in intention to quit, quitting self-efficacy, interest in a subsequent online quitting intervention and number of quit attempts. In conclusion, the intervention increases hardcore smokers' receptivity to information about smoking cessation and decreases their cigarette consumption. As this intervention could help involve hardcore smokers in tobacco control, we recommend using this intervention in health care settings.

Discussion and conclusion
In the **General Discussion**, I discuss several implications for theory, practice, policy and future research. I conclude that hardcore smokers are a special group of smokers that require special attention in tobacco control. Contrary to what the name suggest, they are not unwilling to quit and could be involved in tobacco control. The current thesis shows that it is possible to involve hardcore smokers in tobacco control and to change their smoking behaviour.

Samenvatting

Jaarlijks sterven ongeveer 20.000 mensen door roken. Dat is ongeveer 1 op de 7 doden in Nederland. Het is hiermee één van de grootste oorzaken van kanker en hart- en vaatziekten. Desondanks rookt ongeveer 23% van de bevolking en dit percentage is het laatste decennium stabiel gebleven. Omdat nog steeds veel rokers en niet-rokers sterven aan de gevolgen van roken, blijft roken zowel wereldwijd als in Nederland één van de grootste gezondheidsproblemen. In dit proefschrift beschrijf ik een groep rokers die bijzonder ongemotiveerd is om te stoppen met roken. Deze groep hardnekkige, 'hardcore' rokers heeft een grote kans om ziek te worden of om te sterven, maar lijkt grotendeels ongrijpbaar voor tabaksontmoediging. Daarom heb ik samen met anderen een online interventie ontwikkeld om deze hardcore rokers te motiveren te stoppen met roken.

Hardcore rokers
Hardcore rokers zijn bijzonder moeilijk te betrekken bij tabaksontmoediging. Zij hebben namelijk vaak een stabiele en relatief hoge tabaksconsumptie en zijn niet van plan te stoppen. Normale online interventies weten hardcore rokers hierdoor maar zelden aan te spreken, terwijl juist deze groep nodig bereikt zou moeten worden door gezondheidsbevorderaars. Er is mede hierdoor ook weinig bekend over hoe deze groep rokers tegen roken en stoppen aankijkt.
In vergelijking met niet-hardcore rokers, zijn hardcore rokers ouder, lager opgeleid en vaker man. Ze hebben een lager inkomen en zijn vaak al op vroege leeftijd begonnen met roken. Ook zijn ze zich minder bewust van de gevolgen van roken voor de gezondheid. Onder mensen met een lagere sociaal-economische status zijn meer hardcore rokers dan onder mensen met een hogere sociaaleconomische status. Dit verschil lijkt de laatste jaren steeds groter te worden.
In dit proefschrift beschrijf ik hoe we op basis van een aantal studies een online interventie hebben ontwikkeld voor hardcore rokers. Hardcore rokers worden namelijk slecht bereikt door de reeds aanwezige tabaksontmoedigende interventies. Dit komt mede doordat ze vaak geloven dat ze niet zouden kunnen stoppen. Daarom hebben wij een online interventie ontwikkeld die zich specifiek op deze groep richt. We focussen hierin op zowel de psychologische factoren van stoppen met roken (zoals vertrouwen in een succesvolle stoppoging) als op de defensieve reactie die veel rokers hebben op tabaksontmoedigende interventies.

Individuele studies
In **Hoofdstuk 2** hebben we gekeken naar de ontwikkelingen in de prevalentie van hardcore rokers in Nederland tussen 2001 en 2012. De *hardening* hypothese voorspelt dat tabaksontmoedigende maatregelen vooral 'lichte' rokers treffen, waardoor er onder rokers een groeiende groep hardcore rokers achterblijft. Om te onderzoeken of dit laatste het geval is, hebben we de prevalentie van hardcore roken in Nederland tussen 2001 en 2012 berekend. We hebben dit ook gedaan voor de verschillende opleidingsgroepen. We vonden dat de prevalentie van hardcore rokers af is genomen, zowel onder rokers (van 40,8% in 2001 naar 32,2% in 2012) als binnen de totale bevolking (van 12,2% in 2001 naar 8,2% in 2012). In de totale bevolking vonden we daarnaast dat de prevalentie onder hoogopgeleiden sterker was gedaald dan onder laagopgeleiden. We hebben dus geen bewijs gevonden voor de *hardening*

hypothese. Sterker nog, de daling in hardcore roken tussen 2001 en 2012 duidt op een '*softening*' van de rokerspopulatie.

Hoofdstuk 3 beschrijft een focusgroepstudie, waarin we inzicht wilden krijgen in de waargenomen voor- en nadelen van roken en stoppen onder (ex-)hardcore rokers. We hebben hiervoor 11 focusgroepen gehouden onder huidige hardcore rokers (n = 32) en mensen die vroeger hardcore roker waren, maar nu gestopt zijn (n = 31). In deze focusgroepen bediscussieerden de deelnemers hun waargenomen voor- en nadelen van roken en stoppen. Op basis van de transcripten hebben we een aantal thema's binnen de waargenomen voor- en nadelen van roken en stoppen kunnen vinden. Deze thema's zijn: Financiën, Gezondheid, Intrapersoonlijke Processen, Sociale Omgeving, Fysieke Omgeving en Gewicht. Hoewel de voor- en nadelen van roken overeenkomen met de voor- en nadelen van stoppen, vonden we enkele verschillen met betrekking tot gewichtsbehoud, sociale omgeving, gezondheid van kinderen en stressvermindering. Op basis van deze verschillen hebben we de *Distorted Mirror Hypothesis* opgesteld. De gevonden thema's zouden ook als gespreksonderwerp gebruikt kunnen worden in interventies voor hardcore rokers.

In **Hoofdstuk 4** hebben we aan de hand van de thema's uit de vorige studie een vragenlijst opgesteld over de waargenomen voor- en nadelen van roken en stoppen. Deze vragenlijst hebben we vervolgens afgenomen onder 510 hardcore rokers. Met behulp van een *latent class analysis* hebben we vervolgens profielen onderscheiden. Die profielen hebben we vervolgens vergeleken van de profielen binnen een steekproef van 338 niet-hardcore rokers. Onder hardcore rokers vonden we drie groepen. Ontvankelijke hardcore rokers (36%) zagen veel nadelen van roken en veel voordelen van stoppen. Ambivalente hardcore rokers (59%) stonden erg tegenstrijdig tegenover stoppen. Weerbarstige hardcore rokers zagen juist weinig nadelen van roken en weinig voordelen van stoppen. Onder de niet-hardcore rokers vonden we vergelijkbare groepen van ontvankelijke (30%) en ambivalente rokers (54%). Er was echter ook een groep onverschillige rokers (16%), die weinig voor- en nadelen zagen van zowel roken als stoppen. De resultaten laten zien dat hardcore rokers geen homogene groep vormen, maar dat het bestaat uit verschillende subgroepen die elk hun eigen benadering nodig hebben. De resultaten laten daarnaast zien dat een grote groep ontvankelijk is voor informatie over stoppen met roken of hiervoor ontvankelijk gemaakt kan worden. Mogelijk kan een online interventie op basis van motiverende gespreksvoering hardcore rokers meer openstellen voor stoppen met roken.

In **Hoofdstuk 5** hebben we de invloed van een self-affirmatie manipulatie en een self-efficacy manipulatie op rook-gerelateerde cognities getest. Volgens de self-affirmatietheorie zouden self-affirmatie manipulaties weerstand ten aanzien van antirookboodschappen weg moeten nemen. In Studie 1 (n = 104) hebben we daarom getest of de kindness-vragenlijst geschikt is als self-affirmatie manipulatie voor hardcore rokers. Dit bleek zo te zijn. In Studie 2 (n = 242) hebben we deze manipulatie gecombineerd met een self-efficacy manipulatie. Uit deze studie bleek dat de self-affirmatie manipulatie de eigeneffectiviteit verhoogt en dat de self-efficacy manipulatie de attitude ten aanzien van stoppen beïnvloedt. We vonden geen andere effecten. Op basis van deze resultaten raden wij aan om de self-affirmatie manipulatie te gebruiken in interventies voor hardcore rokers.

In de **Hoofdstuk 6** hebben we een online interventie ontwikkeld, waarin we hardcore rokers door middel van technieken uit de motiverende gespreksvoering aanspoorden om na te denken over hun rookgedrag. We gebruikten hierbij vooral ook de kennis uit de eerdere studies. Het doel van de interventie is om de

stopintentie te verhogen en hardcore rokers meer open te stellen voor vervolginformatie over stoppen met roken. In een experiment vergeleken we de interventie (n = 346) met een controle-interventie (n = 411). Alle uitkomstmaten werden niet alleen direct na het experiment gemeten (t_1), maar ook na twee weken (t_2) en na twee maanden (t_3). Hardcore rokers die de interventie hadden doorlopen stonden op t_1 meer open voor informatie over stoppen dan rokers in de controlegroep. Ook rookten zij op t_2 gemiddeld 1 sigaret minder, terwijl rokers in de controlegroep nog evenveel rookten. Op t_3 was dit verschil nog steeds aanwezig. We vonden geen andere effecten. De interventie lijkt hardcore rokers dus open te stellen voor stopinformatie en ook minder te laten roken. We raden dan ook aan om deze interventie te gebruiken in de gezondheidszorg.

Discussie en conclusie

In de **Algemene Discussie** bespreek ik hoe dit proefschrift de theoretische kennis op dit gebied aanvult en hoe het gebruikt kan worden om toekomstig onderzoek naar tabaksverslaving richting te geven. Ik ga ook in op de gevolgen voor de praktijk en het toekomstige beleid. Ik kom hierbij tot de conclusie dat hardcore rokers een speciale groep vormen en deze groep speciale aandacht nodig heeft binnen de tabaksontmoediging. In tegenstelling tot wat de naam 'hardcore' rokers suggereert, staan hardcore rokers niet per definitie onwelwillend tegenover stoppen en zijn ze zeker te betrekken bij tabaksontmoediging. Dit proefschrift laat zien dat het mogelijk lijkt hardcore rokers te betrekken bij tabaksontmoediging, hen na te laten denken over het veranderen van hun rookgedrag en hun rookgedrag te veranderen.

Dankwoord

Een promotieonderzoek is als een hardloopwedstrijd. Op sommige stukken heb je wind mee en ga je flink vooruit. Op andere stukken heb je tegenwind en ga je niet zo snel als je zou willen. Je loopt vaak over bekende paden en gebaande wegen. Soms kom je ook langs plekken die je van tevoren niet kende. Dat maakt zo'n loop ook zo leuk en interessant. Het mooie aan een hardloopwedstrijd is dat je hem niet in je eentje hoeft te lopen. Ook in mijn promotie-'marathon' hebben vele van jullie met mij meegelopen en mij aangemoedigd. Dank jullie wel daarvoor. Dankzij jullie leek het parcours veel korter.

Geen enkele loper loopt ongetraind een marathon. Voor een marathon moet je trainen onder begeleiding van coaches. Ook ik heb drie geweldige coaches gehad die mij hebben ondersteund tijdens mijn promotie-marathon. Tim, jij hebt mijn promotieonderzoek van het dichtst bij meegemaakt. Dank je wel dat je mij altijd met raad en daad hebt bijgestaan. Ik vond het heel fijn dat jij mijn dagelijks begeleider was en dat je deur altijd letterlijk en figuurlijk open stond. Dike, dank je wel voor je positiviteit gedurende mijn hele promotieonderzoek. Jij hield met jouw grote ervaring altijd het overzicht en met jouw steun kon ik mijn proefschrift naar een hoger niveau tillen. Marloes, jij hebt mij kennis laten maken met het tabaksonderzoek. Dank je wel voor alle hulp. Hoewel Nijmegen een flink stuk met de trein is, had ik altijd het idee dat jouw hulp nooit ver weg was.

Net als bij elke sport, kun je ook bij het hardlopen terugvallen op goeroes en experts. Als je tegen bijzondere dingen aanloopt, weten zij altijd raad. Leden van de projectgroep, dank jullie wel dat ik van jullie kennis en expertise gebruik mocht maken. Bedankt, Regina, voor je hulp bij de eerste studies, Arie, voor je kennis over interventies bij rokers, Enny, voor je hulp bij het experiment en Gjalt-Jorn, voor je hulp bij de vele statistische uitdagingen van dit project. Coauteurs Barbara, Michelle, Elske, Marc, Gera en Bill, bedankt dat jullie mee hebben geschreven aan papers in mijn proefschrift. Dankzij jullie feedback zijn de papers nog beter geworden.

Hoewel je zelf moet lopen bij een marathon, kunnen anderen je wel degelijk helpen. Ze kunnen je aanmoedigen en motiveren. Ook langs mijn parcours stonden mensen die met hun enthousiasme ervoor zorgden dat ik sneller ging lopen. Collega's van het IVO, bedankt dat jullie er voor mij waren. Ik heb veel bewondering voor de passie die jullie hebben voor het helpen van kwetsbare doelgroepen. Ik kijk met een glimlach terug naar de mooie tijd bij jullie en zal de vele gezellige lunches niet snel vergeten. Collega's van het Trimbos, bedankt voor jullie steun en interesse tijdens het afronden van mijn promotieonderzoek. Ik ben er trots op dat ik samen met jullie elke dag mee kan werken aan een rookvrije samenleving.

Bij elke marathon staan natuurlijk ook meerdere waterposten. Op moeilijke momenten kun je je opfrissen, zodat je snel weer je weg kunt vervolgen. Ik ben erg gelukkig met mijn geweldige familie en vrienden, bij wie ik ook langs kon gaan op moeilijke momenten. Oma, opa Chris, tante Helma, ome Peet, tante Carola, Cindy, Ronald, Jordy, Elodie, Jade, Michel, Kiki, Joost, Sara, Sanne en de atleten van AV Gouda, dank jullie wel dat jullie voor mij een waterpost wilden zijn tijdens mijn promotieonderzoek. Casper en Finn, bedankt dat jullie met mij de laatste meters lopen en naast mij staan tijdens de ceremonie.

Pap en mam, net als bij elke loop staan jullie ook bij deze promotie-marathon te wachten bij de finish. Dit keer volgt geen medaille, maar een heel grote bul. Ook die is vast de traditionele foto waard. Bedankt dat jullie mij altijd de ruimte hebben gegeven om mijn eigen loop uit te stippelen. Dankzij jullie kon ik dit doen!

Tot slot, het zit er bijna op. Ik heb de promotie-marathon bijna uitgelopen. In de verte zie ik de klok, hoor ik de muziek en voel ik de spanning van het publiek. Bedankt, iedereen die de laatste meters met mij meeloopt. Over een paar honderd meter zit het erop.

De finish is in zicht. ☺

Curriculum Vitae

English

Jeroen Bommelé was born on 13 March 1987 in Gouda. In 2005, he completed secondary education ('gymnasium') at De Goudse Waarden in Gouda. Subsequently, he started studying Psychology at Utrecht University. In 2009, he obtained a Bachelor's degree in Psychology and in 2010, he obtained a Master's degree in Social Psychology.

From November 2010 until May 2015, he worked at both IVO Addiction Research Center and Erasmus MC as a PhD student. During this period he developed and tested an online intervention that aims to involve hardcore smokers in tobacco control. He also obtained a Master's degree in Public Health at the Netherlands Institute for Health Sciences (NIHES). Jeroen is specialized in both qualitative and quantitative research methods.

From the summer of 2015 onwards he works at the Trimbos Institute as a scientific researcher and is involved in various tobacco-related and drug-related studies.

Nederlands

Jeroen Bommelé is geboren op 13 maart 1987. In 2005 behaalde hij zijn gymnasiumdiploma aan De Goudse Waarden in Gouda. Hierna begon hij aan zijn studie psychologie aan de Universiteit Utrecht. Hij behaalde daar in 2009 zijn bachelordiploma in de psychologie en in 2010 zijn masterdiploma in de sociale psychologie.

Van november 2010 tot aan mei 2015 werkte Jeroen bij het IVO Instituut voor onderzoek naar Leefwijzen en Verslaving en het Erasmus MC aan een promotieonderzoek. Hij ontwikkelde en testte een online interventie dat hardcore rokers aanzet na te denken over stoppen met roken. In deze periode behaalde hij ook een masterdiploma in de Public Health (maatschappelijk gezondheid) bij het Netherlands Insitute for Health Sciences (NIHES). Jeroen is gespecialiseerd in kwalitatief en kwantitatief onderzoek op het gebied van tabaksontmoediging.

Vanaf de zomer van 2015 werkt Jeroen bij het Trimbos-instituut als wetenschappelijk medewerker. Hij werkt daar aan verschillende studies op het gebied van tabaks- en drugsverslaving.

Academic publications

International peer-reviewed articles

Targeting hardcore smokers: the effects of an online tailored intervention, based on motivational interviewing techniques.
Jeroen Bommelé, Tim M. Schoenmakers, Marloes Kleinjan, Gjalt-Jorn Y. Peters, Arie Dijkstra and Dike van de Mheen. (2017). *British Journal of Health Psychology*. Advance online publication. doi:10.1111/bjhp.12256

Prevalence of hardcore smoking in the Netherlands between 2001 and 2012: a test of the hardening hypothesis.
Jeroen Bommelé, Gera E. Nagelhout, Marloes Kleinjan, Tim M. Schoenmakers, Marc C. Willemsen and Dike van de Mheen (2016). *BMC Public Health, 16* (754). doi:10.1186/s12889-016-3434-x.

Identifying subgroups among hardcore smokers: a latent profile approach.
Jeroen Bommelé, Marloes Kleinjan, Tim M. Schoenmakers, William J. Burk, Regina van den Eijnden and Dike van de Mheen (2015). *PLoS ONE, 10* (7): e0133570. doi:10.1371/journal.pone.0133570.

Reminders of behavioral disinhibition increase public conformity in the Asch paradigm and behavioral affiliation with ingroup members.
Kees van den Bos, E. A. Lind, Jeroen Bommelé and Sebastian D. J. VandeVondele (2015). *Frontiers in Psychology, 6*:837. doi:10.3389/fpsyg.2015.00837.

Perceived pros and cons of smoking and quitting in hard-core smokers: a focus group study.
Jeroen Bommelé, Tim M. Schoenmakers, Marloes Kleinjan, Barbara van Straaten, Elske Wits, Michelle Snelleman and Dike van de Mheen (2014). *BMC Public Health, 14* (175). doi:10.1186/1471-2458-14-175.

Submitted articles and articles in revision

Combining a self-affirmation manipulation and a self-efficacy manipulation: could that improve intention to quit and its predictors among hardcore smokers?
Jeroen Bommelé, Tim M. Schoenmakers, Marloes Kleinjan, Gjalt-Jorn Y. Peters, Enny Das, Arie Dijkstra, Regina van den Eijnden and Dike van de Mheen. *Submitted*.

Other Publications

Notitie: Derdehands rook
Jeroen Bommelé and Margriet van Laar (2017). Utrecht: Trimbos-instituut, AF1553, pp 1-8.

Notitie: Zien roken, doet roken?
Jeroen Bommelé Margriet van Laar and Marloes Kleinjan (2016). Utrecht: Trimbos-instituut, AF1461, pp 1-9.

Strategische Verkenning: Communicatie naar jongeren in het kader van tabaksontmoediging.
Jeroen Bommelé, Margriet van Laar and Marloes Kleinjan (2016). Utrecht: Trimbos-instituut, *AF1460*, pp 1-36.

Factsheet: Waarschuwende afbeeldingen op tabaksverpakkingen.
Esther Croes, Jeroen Bommelé and Gera E. Nagelhout (2016). Utrecht: Trimbos-instituut, *AF1468*, pp 1-10.

Notitie: Zien roken, doet roken?
Jeroen Bommelé Margriet van Laar and Marloes Kleinjan (2016). Utrecht: Trimbos-instituut, *AF1461*, pp 1-9.

Factsheet: Het bespreken van (stoppen met) roken door de huisarts en anderen zorgverleners (tandartsen, medisch specialisten en verloskundigen).
Marloes Kleinjan, Jeroen Bommelé, Jacqueline Verdurmen and Margriet van Laar (2016). Utrecht: Trimbos-instituut, *AF1438*, pp 1-9.

Legalisering van online gokken in Nederland: kansen of bedreigingen?
Jeroen Bommelé (2011). *Tijdschrift voor gezondheidswetenschappen*, *89* (8), pp 409-410.

PHD Portfolio

Summary of PhD training and teaching
Name PhD Student: Jeroen Bommelé
Erasmus MC Department: Public Health
Research School: NIHES
PhD period: 2010-2015
Promotor: H. van de Mheen
Supervisors: Tim Schoenmakers and Marloes Kleinjan

1. PhD training

	Year	Workload (Hours/ECTS)
General Courses		
– English Biomedical Writing and Communication	2014	3 ECTS
– Inleiding in Kwalitatief Analyseren	2011	16 hours
Universiteit van de Humanistiek		
Specific courses (e.g. Research school)		
– Master of Science in Public Health, NIHES	2010-2014	70 ECTS
Seminars and workshops		
– Presenting yourself and your work	2014	4 hours
Presentations		
– Focusgroepen onder hardcore rokers		
Forum Alcohol en Drugs Onderzoek	2012	8 hours
– Profielen onder hardcore rokers		
Forum Alcohol en Drugs Onderzoek	2013	8 hours
– Profielen onder hardcore rokers		
Nederlands Netwerk voor Tabaksonderzoek	2013	8 hours
– Profiles among hardcore smokers		
European Health Psychology Society Conference	2014	40 hours
– Self-affirmatie onder hardcore rokers		
Forum Alcohol en Drugs Onderzoek	2014	8 hours
– Self-affirmatie onder hardcore rokers		
Nederlands Netwerk voor Tabaksonderzoek	2015	8 hours

2. Teaching

Supervising practicals and excursions, Tutoring		
– NIHES course 'From practice to solution in Public Health'	2015	8 hours
– Supervising 1 master student	2015-2016	40 hours

Hardcore smokers:
Developing and evaluating an online intervention

Background
Hardcore smokers have little to no intention to quit smoking. These 'hardcore smokers' are hard to reach by current tobacco control measures, and are particularly vulnerable to death and disease. In our multi-study research project, we developed and tested an online intervention that involves hardcore smokers in tobacco control.

Methods and results
In study 1, we found that the prevalence of hardcore smoking in the Dutch general population decreased from 12.2% in 2001 to 8.2% in 2012. In study 2, we conducted 11 focus groups among current and former hardcore smokers, and distinguished 6 themes in the pros and cons of smoking and quitting: Finance, Health, Intrapersonal Processes, Social Environment, Physical Environment, and Food and Weight. In study 3, we used a latent profile analysis of survey data to find 3 subgroups among hardcore smokers: receptive, ambivalent and resistant hardcore smokers. In study 4, we experimentally validated a self-affirmation manipulation for hardcore smokers. In study 5, we experimentally tested an online, tailored intervention for hardcore smokers. This intervention contains a self-affirmation manipulation and multiple elements that use motivational interviewing techniques to tackle dysfunctional beliefs about smoking. The intervention increased hardcore smokers' receptivity to information about smoking cessation.

Conclusions
Hardcore smokers are a special group of smokers that require special attention in tobacco control. Contrary to common perception, they are not completely unwilling to quit and could be involved in tobacco control.