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# Barriers to quitting smoking – a survey among 1000 adult cigarette smokers in Germany

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**Funding:** This study was commissioned by Philip Morris GmbH, Germany.

**Potential competing interests:** Alexander K. Nussbaum, Christoph Neubert, and Nelson Tewes are employees of Philip Morris GmbH, an affiliation of Philip Morris International. Phil Westwood is contracted and paid by Philip Morris International.

## Abstract

**Background:** It is well known that smoking has serious health effects. Despite public health initiatives to discourage smoking initiation and encourage smoking cessation, overall smoking rates have been constant for years and 17 million people currently smoke in Germany.

**Purpose:** This study aims to characterize barriers preventing adult smokers in Germany from quitting cigarette smoking and assessing the general motivation to quit smoking cigarettes. This approach allowed to probe for correlations between quit motivation, barriers, smoking behaviors and smokers' characteristics.

**Materials and methods:** Computer-assisted web interviews were conducted with 1,000 smokers aged 19 years and older in Germany between May and June 2021. Quotas on age, gender and federal state were used to ensure the respondent profile was representative for the smokers in Germany. Data on demographics, smoking behavior, quit attempts perceptions and usage of alternatives to cigarettes were collected.

**Key Findings:** The majority of smokers in Germany (54 %) report that they are not motivated to stop smoking cigarettes. Barriers and motivations to quit smoking cigarettes differed and allowed a distinction in subgroups of smokers. The most prominent subgroups constitute smokers over 50 years of age and smokers of disadvantaged socioeconomic status (education and income). Only 29 % of smokers in Germany intend to stop smoking and only 3 % of them plan to stop smoking in the following month.

**Conclusion:** Smokers cannot be considered as a homogeneous group of people, their motivation to stop smoking differs, which requires a differentiated approach towards them in order to be able to successfully move adult smokers away from cigarettes, the most harmful way of tobacco and nicotine consumption. Inclusive interventions based on the Tobacco Harm Reduction principle could prove useful, especially for smokers that do not quit smoking cigarettes.

## Introduction

In Germany, approximately 17 million women and men currently smoke cigarettes, with an overall smoking prevalence of 30.9 %, as of December 2021 <sup>[1]</sup>. It is well known that smoking has serious health effects, and 127.000 persons per year

die from smoking related diseases in Germany [2]. Nevertheless, smoking prevalence in Germany has remained unchanged for the last five years [1]. This is likely linked to the fact that the majority of smokers in Germany no longer engage in serious quit attempts [1] [3]. The ongoing *German Survey on Smoking Behavior (DEBRA)* recently found that 89% of smokers in Germany had not made a serious attempt to quit smoking in the past twelve months [4], a striking observation, considering that for many smokers it may take 30 or more quit attempts before being successful [5]. The overall long-term abstinence rate of smokers attempting to quit smoking cigarettes is only 3%-6% [6].

For adult smokers who would otherwise continue to smoke, the complete switch to science-based, smoke-free alternatives, such as e-cigarettes or heated tobacco products, although not risk free, could be a better choice [7]. Switching to better alternatives presupposes the availability of information, a key aspect for a consumer-based decision [8][9][10]. Physicians and medical professionals are the most important source of information for smokers [11]. However, they themselves state to experience information gaps with regards to smoking and smoke-free alternatives. The availability of information for the relative harm of nicotine in Germany is often outdated and one-sided. Therefore, the misconception of the relative harm of nicotine could be one reason why smokers refrain from choosing smoke-free alternatives, which still contain nicotine.

While the DEBRA-study provides a representative, bi-monthly look at patterns and trends of smoking and quitting in Germany, it does not investigate the exact nature of barriers or motivations for quitting smoking cigarettes or continued smoking cigarettes, respectively. This study assesses the overall level of motivation to quit smoking cigarettes among adult smokers in Germany, as well as specific barriers currently preventing them from quitting cigarette smoking. Results are matched with socio-economic features. The perception of the relative risk of nicotine was also probed.

While behavioral therapy combined with pharmacotherapy is one approved measure to assist smokers in quitting smoking [12], harm reduction [2] measures (like the acceptance of scientifically substantiated smoke-free alternatives for adult smokers who do not quit smoking cigarettes altogether) could even accelerate the discontinuation of cigarette smoking.

[1] Kotz et al. define a “serious quit attempt” as an attempt to quit with the intention to never smoke again

[2] "The principle of harm reduction in the context of nicotine dependence argues that because most of the harmfulness of smoking is based not on nicotine but on other constituents of tobacco smoke, the health and life expectancy of current smokers could be significantly improved by encouraging as many of them as possible to switch to a smokeless source of nicotine."- Royal College of Physicians, 2016

## Methodology

The survey was conducted in Germany from 25<sup>th</sup> May to 4<sup>th</sup> June 2021. During this period a sample of 1,000 respondents completed the survey (n=1,000). The fieldwork was conducted by Gesellschaft für Konsumforschung – GfK.

Respondents consisted of adults aged 19 years and older who smoked at least one cigarette per day. Pregnant and breast-feeding women, individuals affiliated with the tobacco industry and its retail businesses, individuals employed by market research and public relations institutions and journalists were excluded. Respondents were recruited from two online panels (Bilendi/Clint) and interviewed via Computer Aided Web Interviews (CAWI). The questionnaire consisted of

27 closed-ended questions and one open-ended question.

Data collection included socio-demographic and socio-economic characteristics as well as tobacco and nicotine product use behavior. In addition, questions were asked about gender (male/female), education, occupation, living conditions, household income, living area, quitting barriers and motivation and about previous attempts to quit smoking cigarettes, including the tools chosen and the respondents' perceptions of these tools. To keep the costs manageable for determining the household income, the number of persons in a household was not weighted according to their need, deviating from the recommendation from the Organization for Economic Cooperation and Development (OECD).

For measuring the quit smoking motivation we used a modified version of the "Motivation zum Rauchstopp Skala" (MRS), a validated German version of The Motivation to Stop Scale (MTSS) [13]. Our adaption consisted of leaving out question No. 5 (*I want to quit smoking cigarettes and hope to do so in the near future*) and adding additional two questions (*I definitely want to quit and aim to within the next 12 months; I definitely want to quit and aim to within the next 6 months*). Additional covariates were probed relating to cigarette smoking habits and quit attempts, correlated to socio-demographic and socio-economic characteristics.

Characteristics of the German smoker population were determined as follows: Distribution of the smokers within the German population was described previously, including the covariates gender, age and German state affiliation [14]. To closely match the German smoker population in a n=1,000 sample size, according to age, gender and German federal state affiliation quotas were defined for selecting the respondents within this study (SUPPL 1). Initially, we chose the following age groups: 18-24; 25-39; 40-64; 65+ years. However, during the study, we changed the age profile of the groups to generate a more balanced profile among the various age groups. The initially chosen age groups concentrated the majority of respondents (47.9%) within the age group 40-64 years (see SUPPL 1).

## Results

### Study Population

Demographic distribution is depicted in **Tab. 1**. with regards to gender, age and income. Distribution on gender matches the German smoker population, with the known smoking prevalences of 32% for males and 25% for females [14][15]. Due to the subsequent changes in grouping the age groups our sample deviates slightly from the estimated age groups of German smoker population [16]. Younger adult smokers (19-34) and smokers between 50-64 years are slightly overrepresented in our sample, while smokers between 35-49 and above 65 years are underrepresented. Previous studies have determined the income of German adult smokers [14]. We subdivided the income groups at a finer granularity as depicted in **Tab. 1**. For all income groups we notice minor deviations, resulting in a slight overrepresentation of in the income group with 1.000 € or less and 1.000-1.999 € income. On the other hand, smokers with an income of 2.000 € and above were underrepresented. 6.8% did not answer the question.

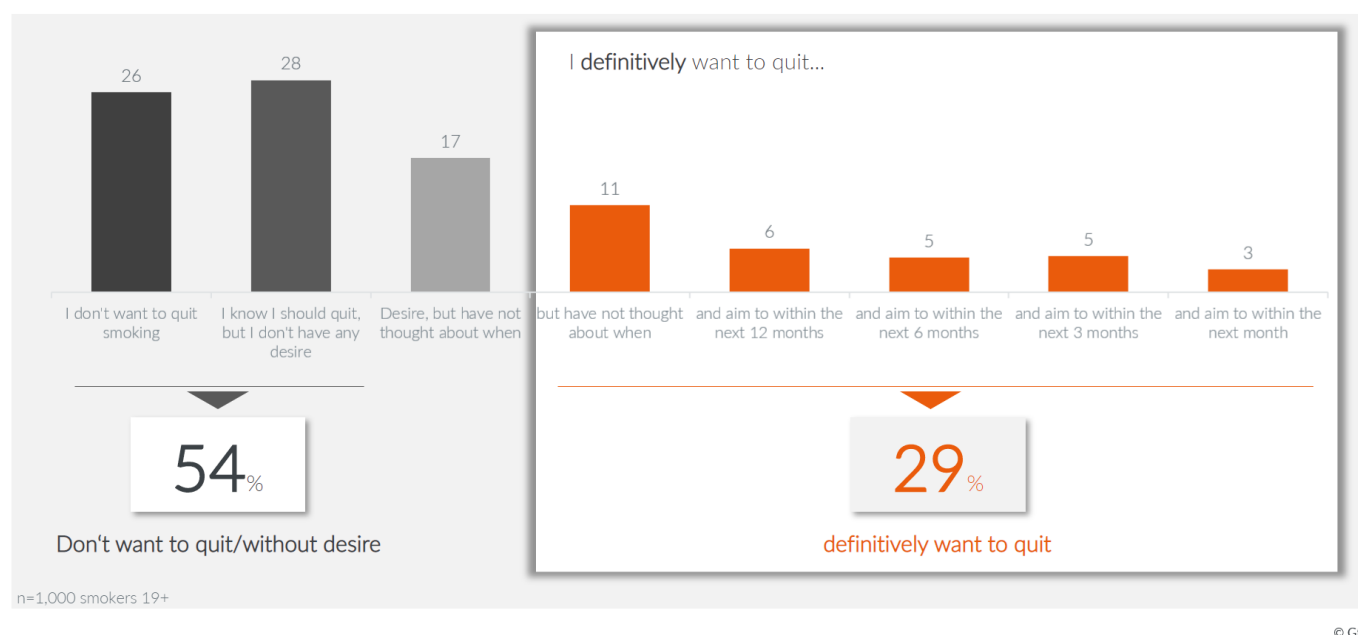
**Tab. 1: Demographics of the study population.** Data are presented as unweighted percentages.

n		Study population (n=1,000)	German smoker population
Gender	Male	56%	56,9%
	Female	44%	43,1%
Age	19-34	30,4%	27,7%
	35-49	23,3%	28,95%
	50-64	34,9%	26,7%
	65+	11,4%	16,65%
Income per month	Below 750 €	4,9%	9,4% (<1.000 €)
	750-999 €	7,3%	
	1.000-1.499 €	13,2%	25,9% (1.001 – 2.000€)
	1.500-1.999 €	14,2%	
	2.000-2.999 €	22,4%	49,1% (2.001 – 4.000 €)
	3.000-3.999 €	18,7%	
	4.000 € and more	12,5%	
	No statement	6,8%	

## Overall motivation to quit smoking cigarettes among smokers in Germany

The overall motivation to quit smoking cigarettes among smokers in Germany is low: 54% of smokers responded that they did not want to quit smoking cigarettes (**Fig. 1**). Although 17 % want to quit in principle, they do not yet know when they will try. Additional 11 % want to quit at all costs, but have not thought about when. Even among the 29 % who want to stop smoking and have set a timeframe, the plan is rarely concrete: only 3 % of them are planning to quit smoking cigarettes in the next month.

Our results are in line with previous research. According to the DEBRA study, about 61 % of all smokers currently do not want to quit smoking cigarettes <sup>[13]</sup>.



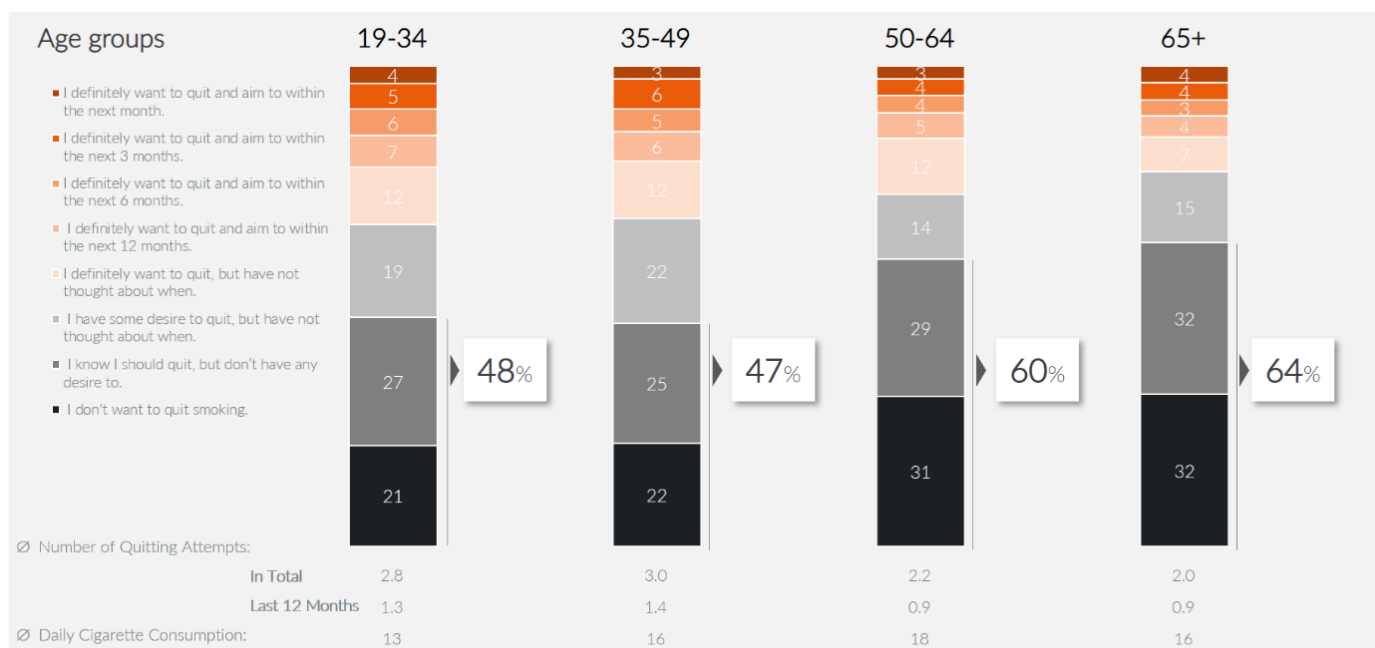
**Fig. 1: The majority of smokers do not want to quit smoking cigarettes.** Original Survey Question (Q1): Which of the following statements is most likely to apply to you when it comes to quit smoking cigarettes? (all numbers in %). Smokers were given eight statements to choose from, as indicated

## Correlates of quit smoking motivation

In order to query why a majority of smokers in Germany are currently not motivated to quit smoking cigarettes, we asked the smokers about their individual motivations and barriers and correlated answers with individual characteristics. Based on their response patterns, three groups of smokers can be identified who are particularly unmotivated to quit smoking cigarettes:

### Smokers middle-aged and older

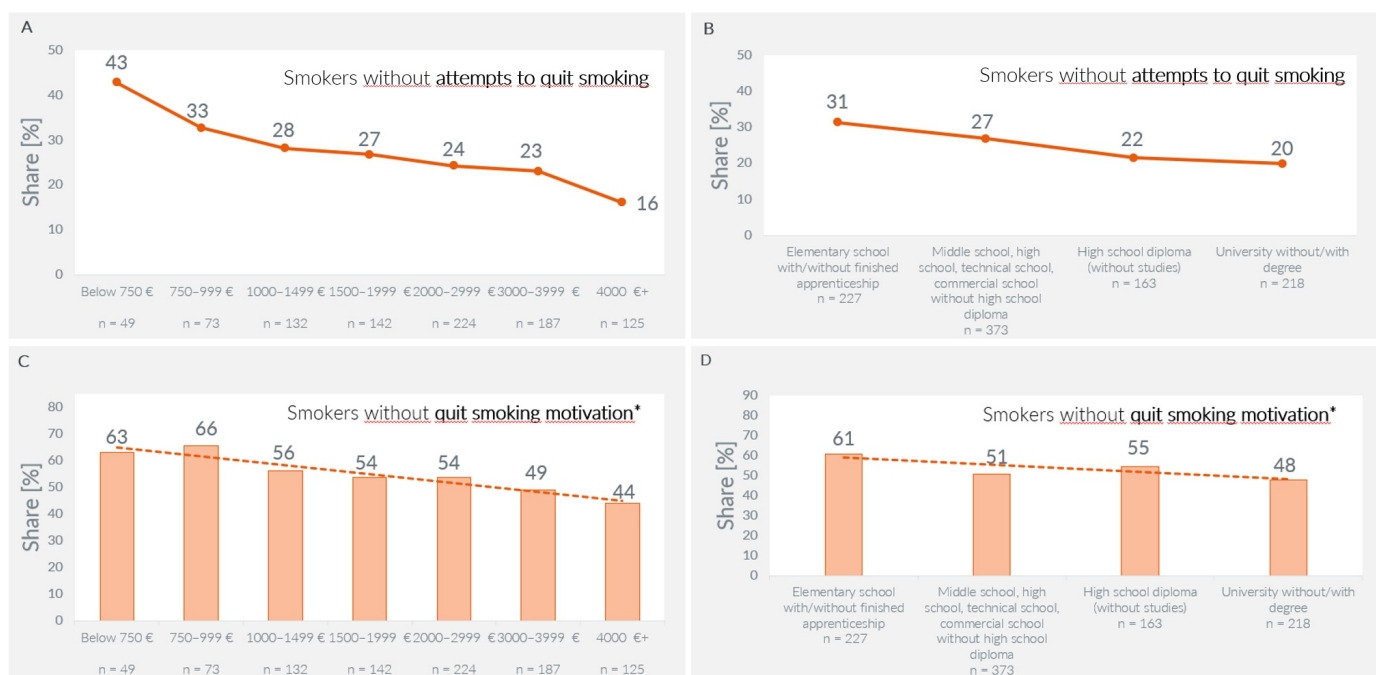
More than 60 % of smokers over 50 are not interested in quitting cigarette smoking (Fig. 2), with this number rising to 64 % among smokers aged 65 and above. These age groups thus differ considerably from the average of 54 % and from smokers aged 19 to 49, with a value of 47-48 %. Smokers aged 50 and above have fewer quit attempts than those under 50 years of age - both in the past twelve months (0.9 vs. 1.3-1.4) and overall (2.0-2.2 vs. 2.8-3.0). They also have a higher average daily cigarette consumption than younger smokers (16-18 vs. 13-16).



**Fig. 2: Motivation to quit smoking in correlation to age.** Smokers were given eight statements to choose from, as indicated. Responses were grouped according to age. Original Survey Question (Q1): Which of the following statements is most likely to apply to you when it comes to quitting smoking cigarettes? Bottom lines: Average number of serious quitting attempts in total and over the last 12 months, as well as average daily cigarette consumption as indicated.

### Socioeconomically disadvantaged smokers

The proportion of smokers without previous (serious) quit attempts and without quit motivation is correlated with both income and education. Smokers in the lowest income group, i.e. below 750 € monthly income, are more than twice as likely not having attempted to quit smoking cigarettes ever, as smokers in the highest income group, i.e. 4000+ € (43 % vs. 16 %) (**Fig. 3A**). They also have lower proportion of smokers without quit smoking motivation (63 % vs. 44 %) (**Fig. 3C**). The percentage of smokers without attempts to quit smoking cigarettes decreases with educational attainment (31 % among lowest attainment vs. 20 % among highest attainment, without quitting smoking attempts) (**Fig. 3B**). A similar correlation can be observed between the educational attainment and the proportion of smokers without motivation to quit smoking (61 % among lowest attainment vs. 48 %, among highest attainment) (**Fig. 3D**).



**Fig. 3: Lower socioeconomic status correlates with fewer quit smoking cigarettes attempts and lower quit cigarette smoking motivation.**

Responses were grouped either according to the monthly gross income or according to the educational background. A-B) Proportion of smokers without attempts to quit cigarette smoking ever, i.e. answering “None” to the question: “How many serious attempts to quit smoking cigarettes have you started?” C-D) Proportion of smokers without quit cigarette smoking motivation, i.e. answering „I do not want to quit smoking“ or „I know I should quit, but I do not have any desire to“ when asked to choose among various statements the one that best describes their motivation to quit smoking.

## Discouraged smokers

19% of all smokers, a subset of the 54 % of smokers currently unwilling to quit smoking cigarettes, appear to be particularly difficult to motivate. We termed them “discouraged smokers” (data not shown), as they display at least one of three characteristics, per our definition: (a) stated to have more than three previous serious attempts to quit smoking cigarettes, or (b) agreed to statement that previous serious quit attempts were unsuccessful or (c) worried they would fail again. In comparison to all other smokers in our study the group of “discouraged smokers” displays a relatively higher familiarity with NRTs which bears testimony to what could be considered “learned failure” (data not shown).

## Which smokers are motivated to quit smoking?

By far the greatest overall motivators for quitting cigarette smoking are “saving money” (73 %) and “feeling better about my health” (71 %). All motivators are cited significantly more often by smokers who state that they want to quit smoking, i.e. 63 % of the smokers, who do not intend to quit smoking cigarettes mention “feeling better about my health”, whereas 81 % of smokers, intending to quit smoking cigarettes are motivated by this motivator.

The group of smokers determined to quit smoking cigarettes (29% of all smokers, **Fig. 1**) can also be identified by other characteristics. Younger smokers in particular seem to be even more amenable to quitting cigarette smoking. 34 % of smokers aged 19 to 34 were “definitely” considering quitting cigarette smoking, compared to, compared to 22% in the 65+ age group (**Fig. 2**). Smokers who definitely wanted to quit smoking cigarettes (29 %, **Fig. 1**) had a higher average level of education (30 % with a university education vs. 19 % among all respondents), are more likely to work full-time (57 % vs.

49 % among all respondents) and have a higher income (average monthly income 2.679€ vs. 2.520€ among all respondents).

### What keeps smokers from quitting cigarette smoking?

Quitting cigarette smoking is difficult, but the reality is that millions of smokers successfully quit smoking every year<sup>[17]</sup>. In the process of quitting cigarette smoking smokers are confronted with barriers. When asking an open question about barriers, the most frequently cited barrier to quitting cigarette smoking is the aspect of "enjoyment of smoking." 21 % of all smokers, especially older smokers (data not shown), cite this as a barrier to quitting cigarette smoking (**Fig. 4**). The lack of readiness to quit smoking is mentioned by 19 % of smokers, whereas the aspect of "addiction" or the "physical craving for nicotine" is mentioned by 15 %.



**Fig. 4: Barriers to quitting smoking.** Original Survey Question (Q5): Why haven't you quit smoking cigarettes yet? What prevents you from doing so? Please describe your answer as detailed as possible (open-ended question; all numbers in %).

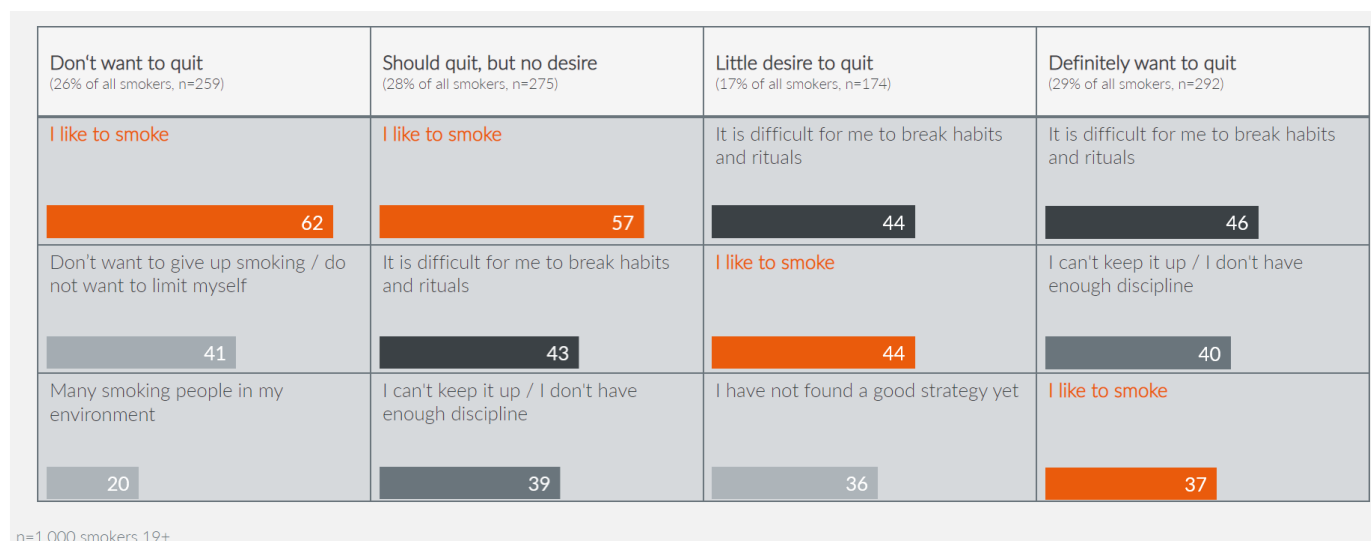
Similarly, smokers report "stress" and "habits" by 13 % each, "taste" by 8 % and "smokers in the environment" by 6 % as barriers that have so far prevented them from quitting smoking cigarettes.

Smokers between the ages of 19 and 34 find it difficult to quit smoking cigarettes, primarily because of the social components of smoking (data not shown). 42 % of them answered that being with other smokers in their environment is a major barrier to quitting cigarette smoking (vs. over 65: < 8 %). 29 % fear that quitting smoking will cause them to miss out on social moments with other smokers (vs. over 65: < 10 %). This concern sets them apart from older age groups (data not shown). However, despite different barriers young smokers are more often motivated to quit smoking cigarettes (**Fig. 2**).

Looking at the barriers for quitting cigarette smoking by level of motivation to quit, smokers who do not want to quit smoking mention the barrier "I like smoking" (62 %) by far the most (**Fig. 5**). On the other hand, this barrier is mentioned by only 37 % of smokers who definitely want to quit. „I like to smoke“ appears characteristic as a barrier of smokers



without motivation to quit smoking.



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**Fig. 5: Barriers to quitting smoking cigarettes by level of quit motivation.** Barriers for quitting cigarette smoking, top three mentions. Original Survey Question (Q6): From your point of view, what are crucial obstacles and difficulties that prevent you from quitting smoking cigarettes? (all numbers in %)

## Dialogue with physicians

Smokers who talk to physicians about quitting smoking are more frequently motivated to quit smoking cigarettes (**Fig. 6**). When smokers talk to physicians about quitting smoking cigarettes (**Fig. 9A**), they are much more specific in their plans (6 % vs. 1 % with a specific plan to quit smoking in the next month) and are less likely to say they do not want to quit smoking cigarettes at all (22 % vs. 33 %). In addition, this group is more likely to show serious past quit attempts (44 % vs. 26 %). The situation is similar for discussions initiated by physicians (**Fig. 6B**): Smokers are more specific in their plans (8 % vs. 4 %, want to quit in the next three months) and less reluctant to quit smoking (19 % vs. 27 %).

A

### Talks with physicians, smokers initiated

Smokers who have had a conversation with their physician about quitting smoking on their own initiative....

- More likely to want to quit within the next month (6% vs. 1%) and less likely to not want to quit at all (22% vs. 33%)
- Are more likely to have made serious attempts to quit smoking (44% vs. 26%)
- Have had a higher number of quit attempts, both within the past 12 months (1.4 vs. 0.8) and overall (2.9 vs. 2.1)

B

### Talks with physicians, physicians initiated

Smokers who have had a conversation with their physician about quitting smoking at the physician's initiative....

- More likely to want to quit within the next 3 months (8% vs. 4%), and less likely to not want to quit at all (19% vs. 27%)
- Are more likely to have made serious attempts to quit smoking (45% vs. 33%)
- Have had a higher number of quit attempts, both within the past 12 months (1.6 vs. 1.0) and overall (3.2 vs. 2.3)

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**Fig. 6: Support from physicians increases the motivation to quit smoking.** Smokers who would approach their physician about quitting smoking (A) and smokers who were approached by their physician about quitting smoking (B) displayed differences in comparison to smokers who

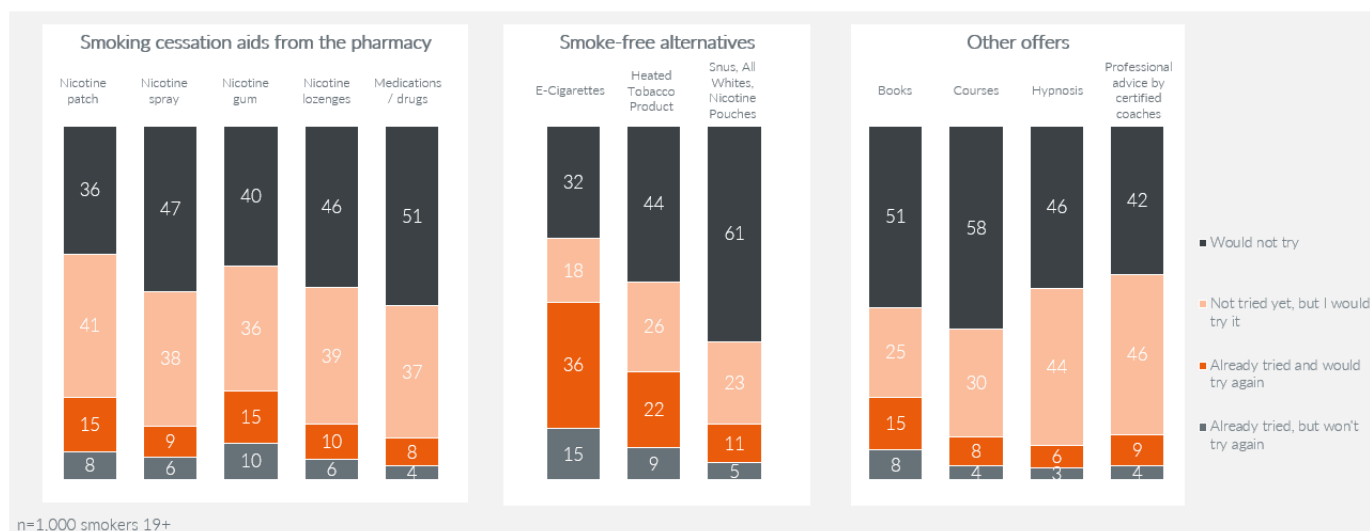
would never confront their physician or were never confronted by their physician about the habit.

## Nicotine replacement therapies and consumption alternatives to cigarettes

Medications available in pharmacies, such as nicotine replacement products, have been shown to support smokers to quit cigarette smoking cigarettes [18]. 41 % of the smokers in our survey state they have not tried nicotine patches but would consider them in the future (vs. 36 % who would not try) (Fig. 7). Nicotine patches thus appear more widely accepted than other pharmaceutical smoking cessation products. Despite this level of acceptance, 54 % of the smokers in our study are not motivated to quit smoking (Fig. 1).

There is now a growing body of scientific evidence that smoke-free products such as e-cigarettes, heated tobacco products and nicotine pouches are significantly less harmful alternatives to continued smoking. Nevertheless, most smokers continue to smoke cigarettes, the most harmful form of nicotine consumption, and show little motivation to change this in the near future (Fig. 1).

E-cigarettes stand out with a relatively high level of acceptance among smokers in our sample (36 % have already tried them and would do so again), also compared to other smoke-free alternatives (Fig. 7). The level of acceptance for other offers, including self-help books, courses, hypnosis and advice by certified coaches, appears similar to that of pharmaceutical cessation aids, but lower than that of e-cigarettes as a smoke-free alternative to continued smoking.



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**Fig. 7: Perception of smoking cessation aids as well as smoke-free alternatives to the cigarette.** Original Survey Question (Q9): What stop smoking aids and alternatives to cigarettes have you already tried / would you be open to try? (all numbers in %)

## Little knowledge about the relative harmfulness of nicotine

Although most of the products listed in Fig. 7 are available in Germany, only few smokers use aids from pharmacies or switch to smoke-free consumption alternatives. Depending on the product type, between 32 % and 61 % of respondents state they would not try nicotine-containing cessation aids or alternatives to continued smoking (Fig. 7, black bars). The

underlying reason could be widespread misconceptions of the relative harmfulness of nicotine. Nicotine, though addictive and not risk-free, is not the primary cause of smoking-related diseases. It is the harmful and potentially harmful constituents—not nicotine—that causes serious disease and death in tobacco users, including fatal lung diseases, like chronic obstructive pulmonary disease (COPD) and cancer <sup>[19]</sup>. Nearly half of all smokers (48 %) in our study perceive nicotine as the primary cause of smoking related diseases in cigarettes and alternatives such as e-cigarettes (**Fig. 8**). More than a quarter (26 %) of smokers are unsure about answering this question. Only 16 % correctly agree with the statement that nicotine is not the primary cause of smoking-related diseases (**Fig. 8**).



**Fig. 8: Misperception of nicotine health risks.** Smokers were asked to agree or disagree with the indicated statement. Original Survey Question (Q13): Please indicate whether you agree or disagree with the following statement (all numbers in %).

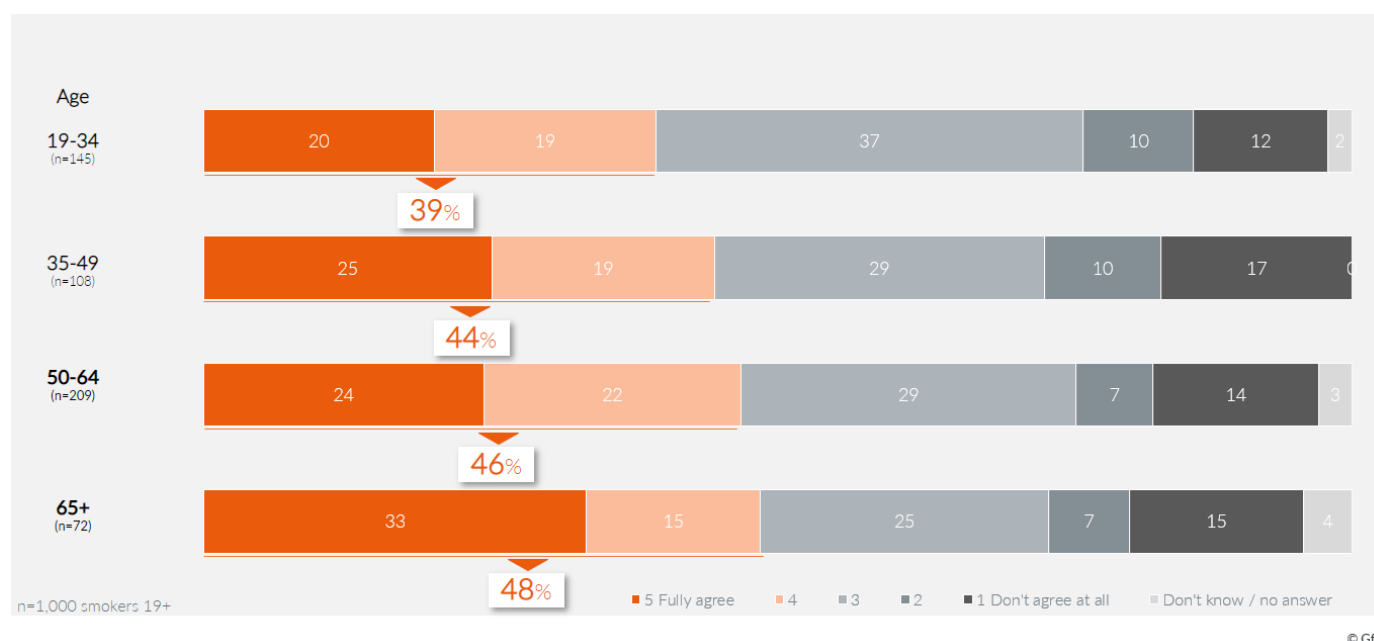
This means 84 % of smokers are misinformed about the relative health risk of nicotine.

This high degree of misinformation about the relative harmfulness of nicotine might act as a barrier to using nicotine-containing smoking cessation products from pharmacies <sup>[20]</sup> or scientifically substantiated smoke-free alternatives <sup>[21]</sup>, such as e-cigarettes, tobacco heaters, or nicotine pouches.

Given these barriers, the question arises if smokers would take other steps to reduce the risk of developing smoking-related diseases.

### Smoke-free products as an alternative to continued smoking

Reducing cigarette consumption has been recommended as a method to reduce harm for those unwilling to quit smoking cigarettes altogether <sup>[22]</sup>. Almost half of the smokers currently unwilling to quit smoking cigarettes would like to reduce their consumption. A total of 24 % of all respondents belong to this group (data not shown).



**Fig. 9: Desire to reduce cigarette consumption.** Smokers who do not want to quit smoking or do not have the desire to quit smoking, here grouped by age, were asked about their intentions to reduce cigarette consumption. Original Survey Question (Q5): To what extent do you agree with the statement: I don't want to quit smoking, but I want to smoke fewer cigarettes and reduce my consumption.

Of the middle-aged and older smokers (35-65+) who do not intend to quit smoking cigarettes almost half (44-48 %) of the respondents agreed with the statement that they want to reduce their consumption (**Fig. 9**). This group of smokers, in particular, can only be motivated to quit smoking cigarettes to a very small extent (**Fig. 2**). As there is no safe level of smoking cigarettes [23][24][25] the group of smokers intending to reduce their consumption could significantly reduce exposure to harmful and potentially harmful constituents, by switching to scientifically substantiated smoke-free alternatives.

However, only about 31 % of the smokers feel well informed about smoke-free alternatives (data not shown). Only 34 to 38 % of smokers who say they do not want to quit smoking are "very familiar" or "fairly familiar" with e-cigarettes.

Therefore, it seems unlikely that they will consider e-cigarettes as an alternative to continued smoking – even though this could go along with a reduction in exposure to harmful and potentially harmful constituents.

## Discussion

The present study among 1,000 smokers on motivations and barriers for quitting cigarette smoking is one of the largest of its kind in Germany to date [26][27]. Our results provide possible explanations for why the prevalence of smoking in Germany has been stagnating for years.

Most German smokers in our study (54 %) are not motivated to quit smoking cigarettes (**Fig. 1**). Among the minority of smokers who want to quit smoking cigarettes (29 %), quit plans are rarely specific; only 3 % plan to quit smoking in the next month (**Fig. 1**).

Our results suggest that smokers in Germany are not a homogeneous group. Their lack of motivation to quit cigarette smoking differs, which requires differentiated approaches towards them in order to be able to successfully move adult smokers away from cigarettes, the most harmful way of nicotine consumption. Smokers from disadvantaged

socioeconomic status show a particularly low motivation to quit. These findings for Germany contradict previous international observations whereby success rates of smoking cessation attempts differed between socioeconomic groups, while the motivation to quit smoking or the number of quit attempts did not [28][29][30]. Others had found a higher socioeconomic status to increase quit attempts and overall smoking cessation motivation [31][32]. These apparent inconsistencies have previously been explained by covariates like ethnicity and differing social norms around smoking [32], which were not collected in our survey.

Smokers over 50 years of age also display a particularly low motivation to quit. They are particularly likely to cite "enjoyment of smoking" as a primary barrier to quitting and are unwilling to change their routines (data not shown). Interestingly, both of these groups, older smokers and those with disadvantaged socioeconomic status, share limited health literacy [33]. Whether limited health literacy correlates with smoking parameters measured here (consumption behavior, motivation to stop smoking, perception) could be the subject of further studies.

A group of discouraged smokers was identified within the group of smokers unwilling to quit. Considering the size of this group, 19 % of all smokers in our survey, future research should attempt to characterize this group in more detail. Our analysis (data not shown) suggests that discouraged smokers are more familiar with NRTs, likely reflecting their higher number of previous quit attempts. Given that these attempts failed, discouraged smokers might be more resistant to quitting smoking cigarettes and could thus profit from information about scientifically substantiated smoke-free alternatives.

Smokers who are not motivated to quit, and therefore continue to smoke cigarettes, frequently cite enjoyment aspects of smoking cigarettes ("I like to smoke") as a quit barrier. When guideline-based methods to quit smoking cigarettes fail, these smokers could benefit from complementary measures, including *tobacco harm reduction*. The complete switch to smoke-free and less harmful alternatives - such as e-cigarettes, heated tobacco products or nicotine pouches – would represent a lower exposure to the toxicants from cigarette smoke, especially for smokers who cite enjoyment aspects ("like to smoke") as a barrier and therefore do not quit smoking tobacco altogether.

A role for vaping products in supporting smokers to abandon cigarette smoking was recently confirmed in a Public Health England evidence review, stating that the success rates are comparable with or higher than licensed medication alone [34][35]. For smokers who are not motivated to quit smoking cigarettes, the daily use of e-cigarettes led to eightfold increased discontinuation rates [36]. However, the acceptance of e-cigarettes remains low [1], which might be caused by widespread misperceptions of the relative harmfulness of nicotine. 48% of smokers wrongly believe that nicotine is the primary cause of smoking-related diseases (**Fig. 8**).

A similar result was also shown in the survey by the *Federal Institute for Risk Assessment (BfR)*, according to which 61 % of all smokers surveyed assessed the health risk of e-cigarettes as "equally high", "rather higher" or "much higher" than that of cigarettes [37].

Physicians are viewed as the most important source of health-related information for smokers in Germany [11]. Smokers who talk to physicians have a higher motivation to quit smoking cigarettes. (**Fig. 9**). However, more than 50 % have not made a serious quit attempt. In the light of these findings, scientifically substantiated smoke-free alternatives could prove advantageous for smokers who would otherwise continue to smoke. Surveys show that medical professionals are often insufficiently informed about smoke-free alternatives [38] and the role of nicotine [39]. Science-based education of

healthcare professionals and an impartial debate about scientifically substantiated smoke-free alternatives and *tobacco harm reduction* could therefore complement existing measures to reduce the detrimental effects of smoking.

In summary, our results suggest that the mere appeal to quit smoking is unlikely to overcome quit smoking barriers in the vast majority of smokers. Future measures to sustainably reduce smoking prevalence in Germany should take these findings into account. Education of smokers should address the role of tobacco combustion as the primary cause of smoking-related diseases, misperceptions about nicotine and smoke-free alternatives to continued smoking. To quit smoking cigarettes is always the best option for current smokers. For those adult smokers, who would otherwise continue to smoke, switching to scientifically substantiated smoke-free alternatives - such as e-cigarettes, heated tobacco products or nicotine pouches - could at least mean a reduction in harm. An integrated strategy and targeted tools, including tools that are based on the tobacco harm reduction principles, are needed to reach smokers who would otherwise continue to smoke.

### Conflict of Interest

Alexander K. Nussbaum, Christoph Neubert, and Nelson Tewes are employees of Philip Morris GmbH, an affiliation of Philip Morris International. Phil Westwood is contracted and paid by Philip Morris International.

### Acknowledgement

We would like to thank the Gesellschaft für Konsumforschung for conducting the fieldwork of this study. We would like to thank Gizelle Baker, Barbara Kis-Tamas and David Gosh for critically commenting and reviewing this study.

### Funding statement

This study was commissioned by Philip Morris GmbH, Germany.

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