CORRESPONDENCE

E-Cigarettes and the Use of Conventional Cigarettes

A Cohort Study in 10th Grade Students in Germany

by PD Dr. phil. Matthis Morgenstern, Alina Nies, Michaela Goecke, MA; and Prof. Dr. phil. Reiner Hanewinkel in issue 14/2018

No Solid Evidence Base

The authors of the cohort study (1) asked 10th grade students how regularly they smoked conventional cigarettes or e-cigarettes. However, Morgenstern et al. did not publish the relevant data. Instead they reported whether the youngsters had "ever smoked," that is, if once in their lives they had tried a few puffs of a cigarette or e-cigarette. The authors themselves imply that ever smoking does not constitute a clinically or health relevant parameter. To obviate the conclusion that this might also mean that their study could be irrelevant, Morgenstern et al. switch from statistics to semantics. Phrases such as "initiation of daily tobacco use" or "onset of smoking" imply more frequent follow-up consumption than is supported by the published data.

Although the authors concede on several occasions that they were unable to draw causal conclusions, elsewhere they claim that the adolescents had been "animated" by the use of e-cigarettes to use conventional cigarettes. Assumptions of causality would require to also investigate the opposite question—namely, how many adolescents had been animated after using e-cigarettes not to smoke conventional cigarettes. The authors could have calculated this on the basis of their data, but they did not do so (or have not published their findings).

Similar reservations (2–4) have been expressed about cohort studies in the past, which Morgenstern et al. cite in their article, and whose study design informed their own study. The blatant weakness of these studies lay in deducing from adolescents' willingness to experiment that they entered into long-term cigarette consumption, and to not even consider possible exit effects. The succession of a long list of one-sided, speculative publications obviously extends the publication list of the participating authors, but it does not amount to a solid evidence base on which to balance the benefits and risks of e-cigarettes.

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Conflict of interest statement
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Outdated Evidence

The data presented by Morgenstern et al. (1) are outdated because the sale of e-cigarettes to underage customers in Germany was banned in April 2016, immediately after the data had been collected. Many adolescents try out e-cigarettes, but only very few vape on a regular basis. And if they do then they often use liquids not containing nicotine (2). Furthermore, most of the underage consumers of e-cigarettes were already smoking before they started vaping. If consumption of e-cigarettes really is a gateway to smoking tobacco, as Morgenstern et al. say, then the proportion of adolescent never smokers has fallen notably since e-cigarettes were brought to market more than 10 years ago. In actual fact, the opposite is the case: in Germany, the proportion of never smokers among 12–17 year olds reached a historical high in 2016—namely, 80% (3). The same is true for the USA, where the fall in the numbers of smokers in adolescents and adults has accelerated since e-cigarettes were introduced.

It cannot be excluded that this positive trend will reverse at some point, as demonstrated by the hype surrounding new devices such as "Juul". For this reason, I agree with the authors in recommending that trends on the e-cigarette market should be studied attentively. Such monitoring does, however, require unbiased observers, which do not only consider the hypothetical risks of e-cigarettes for a small number of adolescents, but also the possible benefits for the 18 million German citizens who still smoke tobacco cigarettes and thus run the risk of an early death from the sequelae of tobacco consumption (4).

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Indication of a Propensity for Addiction

Any form of smoking is harmful, and not smoking is the ultimate sociopolitical and medical objective. This is not what is being discussed. Morgenstern et al. (1) in their article interpreted the consumption of e-cigarettes as a gateway to cigarette consumption in the following six months, with a relative risk of 2.2. The question is whether this is a legitimate position or whether experimenting with e-cigarettes is already a manifestation of a propensity for addictive behavior. Binge drinking—which has the second highest relative risk—is similar. It is therefore not the e-cigarette as such but the fact of the consumption of an e-cigarette, in the same way as a prior drinking binge, that shows the already existing propensity of a person to develop an addiction.

The e-cigarette per se does not create later cigarette smokers. This is reflected in the comment in an article by Kotz et al. (2), that consumption of e-cigarettes in persons who had never smoked tobacco was low, at 0.3%. The fact that people with addiction potential and lower willingness to take risks at first try out another product seems logical. On this background it would have been important to differentiate between the different e-products and the societal phenomenon of hookah/shisha smoking. As Dr. Ute Mons, director of the cancer prevention office at the German Cancer Research Center (DKFZ) said at the 2017 annual meeting of the Austrian Society of Pneumology (quote): "Whereas for shishas it has been proved that they are associated with a similar risk to health as cigarette smoking, according to current research evidence the potential for harm of e-cigarettes is notably lower than that of conventional cigarettes" (3).

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Weak Tobacco Control Policy

I have been conducting research into smoking cessation and e-cigarettes for years, and I welcome a contribution from Germany (1). For the UK, comprehensive data are available on tobacco smoking as well as on the use of e-cigarettes (which do not contain tobacco), as we recently summarized (2). The data show that adult and adolescent users of e-cigarettes are almost exclusively smokers or former smokers. Data from 60 000 adolescents from representative surveys have shown that this group tries e-cigarettes, but that only very few never-smokers (0.1–0.5%) go over to regular e-cigarette consumption.

Furthermore, people change from smoking to the far less harmful e-cigarettes, and this also applies to adolescents (2, 3). In the past two years, 14 sometimes contradictory review articles on "e-cigarettes for smoking cessation" have been published in the international literature (2). In England, the data are clearer, and reliable estimates have shown that e-cigarettes have resulted in 22 000 to 57 000 additional quitters annually (2).

The main indicator for a "gateway effect" is the trend in smoking prevalence. The drop in prevalence has continued since e-cigarettes became popular, and now only about 16% of those aged 16 or over in the UK smoke (in Germany, this proportion is about 28%). This relative success is in large parts due to strong tobacco control policies. These include:

- High and rising prices for tobacco products
- A ban on tobacco advertising
- Comprehensive smoke-free legislation
- Health warnings on tobacco packaging (and standardized packaging)
- Campaigns and treatment services for smokers.

When European countries are ranked according to their tobacco control policies, Germany and Austria occupy the bottom two places (4). Insufficient tobacco control policies constitute a higher risk for a sustained high prevalence of smoking than potential gateway effects.

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E-Cigarettes and Quitting Tobacco

E-cigarettes are controversial in Germany because they initially do not disrupt nicotine dependence. The available evidence, by contrast, supports the use of e-cigarettes in quitting tobacco. Not without reason, the UK NHS favors this therapeutic approach (1, 2, 4). The UK government uses the published data in support of publicizing the benefits of e-cigarettes (4). A 2016 Cochrane review recognized benefits from successfully giving up tobacco cigarettes, and in the other subjects it acknowledged benefits owing to a reduction in the number of tobacco cigarettes consumed; the authors identified a need for more studies because the data are currently unsatisfactory. In 2018, this demand has already been met to a substantial degree.

A study recently published in *The BMJ* calculated a potential reduction in harm owing to using e-cigarettes that reached unexpected levels: by using e-cigarettes, 1.6 million premature deaths can be prevented over 10 years in the US alone if a pessimistic scenario is assumed. An optimistic assumption points to 6.6 million prevented premature deaths (2). Other studies too have found that e-cigarettes are suitable for quitting tobacco smoking.

A US study published in 2017 described an improvement in the rate of successful tobacco smoking cessation from 4.8% to 8.2% thanks to the use of e-cigarettes. *Deutsches Ärzteblatt* and the German Federal Ministry of Health too described the benefits of e-cigarettes in 2017, among other reasons because the hypothesis of the e-cigarette as a gateway drug seems to have been disproved (www.aerzteblatt.de/nachrichten/73991).

Different powerful lobby groups would like to see e-cigarettes to be presented in an unfavorable light because their turnovers and associated financial gains are at risk of being diminished.

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Additional literature is available from the author.

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In Reply:

We welcome the lively discussion among readers of *Deutsches Ärzteblatt International* that our article has triggered (1). We would like to add a factual rectification: in our study, prior consumption of e-cigarettes did not only predict the trying-out of conventional cigarettes but also the transition from experimental to daily smoking.

The five readers' contributions primarily discuss the potential use of e-cigarettes as a smoking cessation aid. In our view, current empirical data do not allow any valid conclusions about the utility/benefits of e-cigarettes. The 2016 Cochrane analysis was based on only two randomized controlled studies (2). In the context of a new, large and comprehensive, pragmatic study of occupational smoking cessation measures (quitting smoking in the workplace), providing e-cigarettes at no cost helped only very few employees to give up (3). The latest meta-analysis on the efficacy of e-cigarettes as a smoking cessation aid was published in 2018 and concluded that using e-cigarettes reduces the chance of successfully quitting smoking by 39% (4). In order to minimize the harms of smoking, the UK is focusing on e-cigarettes. Advertising is therefore prohibited for tobacco products but allowed for e-cigarettes. At the population level, a strong increase in consumption of e-cigarettes was observed in England between 2006 and 2016, but no reduction in the number of conventional cigarettes smoked on a daily basis (5).

An initial study on the suitability of e-cigarettes as smoking cessation aids in young adults recruited 5128 Swiss men aged 20 (6). An observational study conducted over 15 months investigated whether consumers of e-cigarettes differed from non-consumers in terms of the number of cigarettes smoked, successful quitting, or attempts at quitting. A beneficial effect of e-cigarette consumption was not seen at follow-up—neither in view of smoking cessation nor of a reduction in cigarette consumption.

In our study, 215 10^{th} grade students smoked conventional cigarettes every day at the time of the first data collection. Of this baseline total, 200 had also consumed e-cigarettes at the first data collection (93.0%). At follow-up, 10 of the previously daily smokers reported that they did not consume conventional cigarettes at all, which equates to a smoking cessation rate of 4.7%. Of the 10 adolescents who had quit smoking conventional cigarettes, nine had consumed e-cigarettes and one had'not. The relative smoking cessation rate in the group of e-cigarette consumers was therefore 4.5% and in the group of non-e-cigarette consumers, 6.7%. Three of the nine adolescents with e-cigarette experience had consumed e-cigarettes in the 30 days before the follow-up data collection. The one student without e-cigarette experience was completely smoke-free, that is, he wasnnot consuming e-cigarettes at follow-up either.

We obviously welcome every smoker who manages to give up smoking by using e-cigarettes. The consumption of e-cigarettes is, however, not risk-free

for health, because a large number of ultrafine particles as well as nicotine are being inhaled, which may cause pulmonary or systemic inflammatory reactions, which in turn encourage atherosclerosis and raise the risk for cardiovascular and respiratory disorders (7). About two thirds of smokers died from such disorders (4). The medium term and long term sequelae of e-cigarette consumption and the passive burden on third parties owing to aerosolized e-cigarette liquids have not been studied at all to date. For us, the question therefore arises whether it is justifiable from an ethical perspective to recommend to 18 million smokers in Germany a measure that is currently not guideline-conform nor evidence-based.

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