Smokers' risk perceptions and misperceptions of cigarettes, e-cigarettes and Nicotine Replacement Therapies.

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Abstract

Introduction and Aims: To identify the range and coherence of smokers and recent ex-smokers' general beliefs about the harms associated with smoking and the implications of these beliefs for their assessments of the relative harms and addictiveness of various nicotine containing products.

Design and Methods: The study consisted of 18 single participant interviews with current smokers or vapers (13M, 5F) and 3 focus groups (15M, 14F) with current smokers/vapers and recent quitters. Both individual interviews and focus groups included semi-structured discussions of how nicotine and cigarette smoke cause disease and addiction, and a structured task involving rating the relative harmfulness and addictiveness of 17 nicotine products against a reference, popular, cigarette.

Results: Most participants were able to give adequate accounts of what makes cigarette smoking harmful and addictive but this general knowledge was not consistently applied to making harmfulness and addictiveness judgements about specific products. Many participants applied simple affect-based heuristics to harmfulness and addictiveness judgments, even when they had apparently demonstrated more sophisticated knowledge earlier. Most used binary safe/dangerous thinking, with addictiveness and harmfulness strongly linked and a decoupling of satisfaction and addictiveness.

Discussion and Conclusions: Many smokers appear to have reasonable general knowledge of the risks of smoking but cannot reliably apply this knowledge to practical risk judgements. We need to rethink how we communicate with the public about the risks of smoking, and using other nicotine products, in ways that allow them to make more informed decisions about their smoking.

Keywords: harm reduction, risk communication, tobacco smoking, addiction, heuristics

Introduction

The “light” cigarette deception [1-3] convinced many that tobacco harm reduction is simply a tobacco industry ruse. This was not a major problem while there were no promising harm reduction proposals but that is no longer the case. The long-term use of certain types of smokeless tobacco and pharmaceutical nicotine are both less harmful than smoking [4-8]. However, these products are seen as having limited appeal as substitutes for cigarettes. However, the emergence of electronic cigarettes (or nicotine vapourisers), and their rapid uptake suggests that harm reduction might be feasible for significant numbers of smokers, including many who have repeatedly failed to quit [8-10].

As long as alternative nicotine products remain less satisfying than cigarettes, perceived harm differentials will be the main factor motivating their use. This does not necessarily mean smokers must be able to accurately quantify the disease and mortality risks of using different kinds of nicotine product in order to make informed decisions; a more basic understanding of the causes of harm may be sufficient. For instance, it follows from an understanding that exposures to combustion products are the main source of harm from smoking that non-combusted nicotine products should be less harmful [8]. Utilising that distinction would take smokers much of the way to understanding that cigarettes are both the most dangerous and the most addictive form of nicotine delivery [11].

To make informed decisions and then successfully act on them, smokers need relevant information but they also need to understand that information in ways that evoke consistent desires to act. To understand this dynamic, we use CEOS (Context, Executive and Operational Systems) theory [12,13]. CEOS theory is in large part a theory of the constraints on self-regulation. It focusses on ways largely conscious “Executive processes” are constrained by largely unconscious “Operational processes”. For action consistent with Executive goal pursuit to occur, it needs to overcome affective forces, typically experienced as feelings, arising in the Operational system, which support competing actions. For example, smokers can know “in theory” that smoking is harmful, and that they should quit, but find it difficult to resist strong urges that result from past positive experiences. There are two broad

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routes to Executive decision making: elaborated evaluation of facts and possible mechanisms; and heuristic thinking [14]. Heuristic thinking is based on affective reactions to the context in which a decision is made, including whatever memories are evoked. They need not be combined into any kind of overall understanding, but can each operate effectively independently, unlike an elaborated model where there is an attempt at coherence. CEOS postulates that because affective reactions are the basis of heuristic decision making (i.e. decisions made by means other than deliberative analysis of the facts), they will have more influence over behaviour than elaborated reasoning, unless that elaborated reasoning can be imbued with comparable affective force. Public health communications that bring to life the adverse consequences of smoking (e.g. graphic health warnings on packs [15] or anti-smoking messages in the electronic media [16]), are generally understood by tobacco control practitioners to increase smokers' concern about health harms and thus to increase the likelihood of quit attempts. However, generating negative affect toward smoking only motivates desire to act; it does not help smokers decide on the best course of action. Most smokers find quitting difficult and repeated failure to quit can motivate a search for easier options than quitting, such as switching to another type of cigarette that is believed to be less harmful, such as smoother/weaker tasting cigarettes (which were previously marketed as "mild" or "low tar" in Australia) or roll-your-own cigarettes. [17]

To investigate the knowledge smokers possess about the causes of harm from smoking, as well as how they apply it to product use decisions, we conducted research guided by the mental models research framework [18-23]. By mental model, we mean some form of elaborated conceptualisation that can be applied across contexts. This research framework is concerned with understanding the analytic/ deliberative capabilities of people and their ability to integrate expert knowledge about specific risks and apply it. The first step in the applying the mental models approach to a risk communication problem is to identify the range of beliefs (both correct and incorrect) that people articulate about a particular risk. The models identified are then compared to expert knowledge to identify important errors, gaps and/or inconsistencies that need to be addressed in future risk communications (e.g. providing missing knowledge, or facilitating understanding of the implications of existing knowledge).

Australian smokers might be expected to have a high level of expert knowledge integrated into their mental models of smoking risks, as there have been mass media anti-smoking campaigns, including TV advertisements, every year since 1985, and tobacco packaging is standardised, with large graphic health warnings on the front of packs and text warnings on one side.

Two main questions guided the research we report here:

1. What differences in harmfulness and addictiveness do participants discern within and between three main categories of nicotine products (cigarettes, e-cigarettes and nicotine replacement therapies [NRT] products), and to what extent do these form a coherent mental model?
2. Do participants who have reasonably systematic mental models of the harmfulness and addictiveness of cigarettes and other nicotine products use their models consistently in making specific judgements about particular products and is the tendency to use heuristics largely restricted to those with poorly formed models?

Methods

Participants and recruitment procedures. Eighteen single participant interviews (13 males, 5 females, age range 21 to 55 years). All were either currently smoking (n=14), using e-cigarettes (n=3) or both (n=1). Participants were recruited by flyers in cafes and networked snowball sampling from acquaintances of researchers and earlier participants. Most were employed professionals and service industry workers (n=9) or tertiary students (n=4), with high interest in quitting or who had recently switched to e-cigarettes. There were also five long-term welfare recipients, all with low interest in quitting.

There were three focus groups, with 29 participants (14 females, 15 males, age range 18 to 61 years), including 11 who had quit smoking within the last two years. None were currently solely e-cigarette users. They were recruited through a market research recruitment

company and included roughly equal numbers of students, professionals, tradespeople and retail/manufacturing and service workers.

All interviews and focus groups were conducted in Melbourne, Victoria, Australia in February and March 2016. All participants were paid for their time.

Interview procedure: The single participant interviews had three main sections:

1. Discussion of the participant's smoking history (including usual brand, changes and reasons for brand choices) and use of NRT and e-cigarettes.
2. "Mental models"/ general knowledge interviewing, concerning knowledge/beliefs about the role of nicotine and other smoke constituents in causing disease and addiction. The interviewer asked the following open questions if they were not addressed spontaneously:

"What can you tell me about nicotine?" "What can you tell me about cigarette smoking that makes it so harmful?" "What is in cigarette smoke that makes it so harmful?" and [If interviewees mentioned "toxic chemicals" in cigarettes] "How do those toxic chemicals get to be there?" This part of the interview was flexible to facilitate following participants' trains of thought.
3. A structured decision making task, involving making relative harmfulness and addictiveness judgments about 15 products, in relation to a "standard" cigarette, Winfield Blue (medium taste strength, the highest selling brand variety in Australia). Labelled sheets of paper forming a 7-point Likert scale (much less, moderately less, marginally less, the same, marginally more, moderately more, much more) were then laid out in front of participants. The interviewer placed the pack of Winfield Blue on the sheet marked "the same" and participants were given the products one by one to place on the scale. The participants were given the products to rate on harmfulness on the first run through and addictiveness on the second. They were also asked to talk about their reasons for making their decisions or to simply think aloud as they did so.

Materials. The 17 products compared with Winfield Blue in the decision making task were: seven other factory made cigarettes – Winfield Red (a stronger tasting cigarette), Winfield

White (in early interviews) or Winfield Gold (in later interviews and focus groups, as White had low recognition and Gold was better known) (a weaker/smoothest tasting cigarette), Marlboro Red (a stronger tasting, US style cigarette), Benson and Hedges Rich (a premium or luxury cigarette), Alpine Original (a standard strength menthol cigarette), Choice Blue (a budget standard strength cigarette) and Horizon Blue (a budget standard strength cigarette); two types of Roll your own (RYO) tobacco – Champion ruby (the most popular RYO brand) and Choice Original Blue (a budget brand); three types of personal vapouriser – a Luxury Lites disposable e-cigarette (labelled as containing no nicotine), a Vype “cigalike” e-cigarette (labelled as containing nicotine) and an EgoT “vape pen” e-cigarette (refillable); and five nicotine replacement products – two Pharmacy Care brand nicotine lozenges (2 and 4 mg), Nicabate strips (2.5 mg), Nicorette Inhalator (15 mg) and Nicorette QuickMist spray (1 mg).

Differences in the approach for the focus groups: In the focus groups, the facilitator aimed to maximise interactions between participants, to reveal the range of beliefs held within the group. During the decision making exercise, participants took turns to place products on the scale, either making decisions by themselves or consulting the group first. The facilitator invited anyone disagreeing to offer their reasons for doing so, and then, where relevant, fed in beliefs that had been expressed in single participant interviews to gauge their reactions.

Analysis. The interviews were conducted by BK with EN taking notes. At the end of each interview BK and EN identified the important themes emerging on that occasion. The recordings of the individual interviews and focus groups were transcribed by a commercial company. BK read the transcripts, confirmed pre-identified themes were present, and identified any other themes, and discussed them with other authors. The main analysis was of passages of conversation, in which participants explained key concepts and ambiguities about what they meant in particular contexts were resolved. Occurrences of key words or phrases were a matter of secondary interest and we did not quantify these. To avoid spurious impressions of precision, we avoided quantification and classified occurrences of phenomena in terms of rarely, sometimes or commonly, and always (or nearly always).

Ethics approval: Ethics approval for the study was granted by the Cancer Council Low Risk Research Ethics Committee.

Results

General beliefs about harmfulness and addictiveness.

Most participants reported that smoking causes cancer (especially lung cancer) and heart disease, and that inhalation of tobacco smoke is a major factor in the damage caused. More sophisticated accounts noted that disease causing agents in smoke pass into the circulatory system and are then deposited in organs/tissues throughout the body. Less sophisticated accounts included images of “tar” clogging the lungs and arteries.

Generally, participants were comfortable equating harmfulness and addictiveness, often not attempting to differentiate the two. They became less comfortable in discussing aspects of addictiveness or the role of nicotine in relation to the experienced pleasures they got from smoking. They tended avoid discussion of the negative elements or to soften descriptions of the cigarettes they smoked or valued; for example using terms like “rich” to describe strength, while they may have used “strong” or even “harsher” to describe the same characteristic of less valued products.

Most participants reported that nicotine makes smoking addictive and some articulated that this makes nicotine an important indirect cause of harm (e.g. S3: “OK, you’re addicted to nicotine but.... It’s the tar that kills you.”). However, some said that nicotine is a poison and a major direct cause of harm. These respondents were more likely to differentiate the nicotine from what makes cigarette smoking pleasurable. Alternative explanations for the source of pleasure included: the taste and aroma of tobacco smoke, the rituals of cigarette smoking (“...it’s the habit of drawing back and it’s not actually the nicotine”), and psychoactive substances other than nicotine (generally unspecified). By contrast those who were more accepting of nicotine or tobacco as the source of pleasure tended to believe that much of the harm comes from other toxic and/or addictive substances that are added by the tobacco industry. Those who saw nicotine as relatively benign appeared more likely to recognise it as the source of the satisfaction/pleasure.

There was little awareness that the addictiveness of nicotine is strongly related to mode of delivery, with cigarette smoking the most addictive form. By contrast, most knew from experience that satisfaction differs greatly by delivery system.

Many participants reported using sensory experiences to assess relative addictiveness and harmfulness: their judgements were strongly influenced by whether they liked particular products. Unpleasant taste and aroma, and harshness to the throat and chest provided compelling “evidence of the senses” for some cigarettes being more harmful than others. “Budget” cigarettes were often identified as unpleasant tasting and harsher, as were “full strength” cigarettes, particularly Marlboro Red. “Low tar” cigarettes were identified as smoother but not necessarily more pleasant tasting.

Assessment of quality related to both price and sensory characteristics. “Premium” cigarettes were usually identified as pleasant tasting and smoother, and often as less harmful. The two budget brands were frequently judged as more harmful than the more premium Winfield Blue in the decision making task. The very fact of being “budget” or “cheap” was treated by some participants as evidence of greater harmfulness, and many participants stated that budget cigarettes contained more “chemicals.” However, “budget” was also associated with “less satisfying,” even though “less satisfying” was associated with “less harmful” for weaker-tasting brands. This is exemplified in the following focus group discussion snippet regarding Horizon Blue, a budget cigarette.

FA: *Gross! I've never tried them. ...*

BK: [What decision do you make if] *that's all you got to go on, that it's a budget cigarette?*

FB: *I'd say they taste lighter sometimes... But then the idea that it's so cheap, you're like "Oh it must be worse for me."*

FC [interjecting]: *Even though probably they're exactly the same.*

FB: *Since it feels lighter... I think, that it is a lighter cigarette [it] would taste less intense, is better for you. But then you're like, oh!, because it's so cheap, it must have all these crazy chemicals in it.*

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RYO cigarettes usually formed a counterpoint to budget cigarettes for those participants who perceived cigarettes as differing significantly in harmfulness. Many held that RYO cigarettes are “safer” than FM cigarettes, while a few participants held they are more harmful. This contrast in judgments emerged from competing views of “naturalness”, with most holding the “natural = good/safe” heuristic that identifies RYO cigarettes as less harmful; for example, claiming that RYO cigarettes don’t have “chemicals” added and are just “pure tobacco” , while factory made cigarettes have harmful additives. For example, *“My perception is nicotine was tobacco [i.e. two words for the one thing] and it was more pure than all the other stuff [in cigarettes]. At one point I thought rollies were a better idea, because it was tobacco and not all the additional 400 chemicals or whatever it is that you have in there.”*

The contrasting few applied a “natural = raw/ crude/ untreated = dangerous” heuristic to judge RYO cigarettes as more harmful. Two such participants were from rural South Asian backgrounds and one spoke explicitly about dirt and dust being the kind of contaminant he was used to avoiding in food and expected to find in RYO tobacco.

Beliefs about non-combusted nicotine products.

There was general agreement, especially in the focus groups, that e-cigarettes are not as satisfying as cigarettes and many participants held that that vaping is simply not an acceptable substitute for smoking; e.g. *“Like I said, I tried the e-smokes... Even with the nicotine, I still wanted a proper smoke.”*

The importance of affect was clear in participants’ judgements of e-cigarettes. If they didn’t like e-cigarettes, they tended to judge them as close to cigarettes in harmfulness. Similarly, those with negative feelings about e-cigarettes and NRT were likely to judge them as ineffective for quitting. Some also identified NRT as addictive and elaborated that NRT and e-cigarettes are no better than cigarettes, because they simply replace one form of nicotine addiction with another.

When talking about e-cigarettes, many used a “novelty” heuristic, with novelty associated with uncertainty and danger. Some believed e-cigarettes are best judged as no less

harmful than smoking, even if the available scientific evidence says otherwise. Several also noted that the lack of trusted information sources makes them unwilling to consider using e-cigarettes. For these participants, the uncertainty surrounding the harmfulness of e-cigarettes was more threatening than the well-characterised and very high level of harm from cigarette smoking. The following conversation shows this clearly:

S1: *I really don't know about these things [e-cigarettes]... [reading packaging] Nicotine free. So what is in them? Does it say? Nope...*

BK: *So you find it surprising that they don't actually tell you what's in there?*

S1: *Hang on... Here we go... Propylene glycol, oh my god! Yeah that sounds pretty damn wrong to me. [other content on related topics, then this summary] But stuff that I don't know about, I'll remain pessimistic about.*

Inconsistencies in responding: It was common for participants in both interviews and focus groups to make inconsistent assertions at different points in the conversations. These inconsistencies most often became apparent when conducting the decision making task. Participants were sometimes aware of these clashes but appeared unconcerned. Judgements about specific products that were inconsistent with previously reported understanding included rating non-smoked products as more harmful than some smoked ones; wide ranges in perceived harmfulness of the smoked products (after previously stating all cigarettes are pretty much as bad as each other); and rating e-cigarettes with nicotine as more harmful than nicotine-free ones (after previously stating nicotine is not a major cause of harm).

Some participants talked about *smoke* as the specific source of harm then made judgements about e-cigarettes and NRT mouth spray consistent with the intuition that inhaling anything is dangerous. For example, a participant who had focused previously on the harms of smoke, summarised her reasons for equating e-cigarettes with cigarettes: *"I still have this concern that just because something's vapour borne, rather than smoke borne, that it's still not necessarily that great for your lungs..."*

Some participants made new distinctions in the decision making task. For example, when explaining rating a budget cigarette as more harmful, when previously his focus was on

similarity of harm, a participant said: *“My lungs, definitely kick up a bit more of a stink smoking the cheaper cigarettes. Not much – like they’re all bad for you – but maybe a little bit more.”*

Even where non-combusted products were rated as less harmful than all the cigarettes, it was often only marginally less, rather than the more realistic “much less”, even among some who has accepted a large harm differential earlier.

What happened if beliefs were challenged? In two of the three focus groups, group deliberation led to convergence around the evidence-based position following a discussion where inconsistent beliefs were challenged. In one case this was led by two highly articulate participants, and in the other it was facilitated by BK. Several participants noted that heuristics about “safer” cigarettes are only credible if you don’t subject them to any critical scrutiny; as soon as you do, they crumble. (e.g. *“I feel like I assume that a cheap cigarette is less quality tobacco, therefore it’s worse for me... [but] if I think about it for more than a second, I know they’re all [equally] bad for me.”*). In the focus group which did not converge toward an evidence-based position, there was a dominant participant who resisted any challenges to his existing beliefs, constantly shutting down discussion by reiterating that knowing smoking is bad for him won’t stop him and vaping is only for idiots. The group (and facilitator) eventually gave in.

Discussion

Overall, participants were generally comfortable equating harmfulness and addictiveness, but were more ambiguous, or even inconsistent, when it came to relating satisfaction and addictiveness. The role of nicotine was often distanced from addictiveness when it was viewed as the source of pleasure, but when viewed as the source of harm and/or addictiveness, other factors were focused on when discussing satisfaction. In many cases, having a reasonably coherent mental model did not preclude reverting to situational heuristics in decision making.

When speaking in the abstract, most participants demonstrated at least some knowledge of how smoking causes disease and dependence. However, many then made belief-inconsistent heuristic judgements about specific products. Although able to demonstrate knowledge of the basic facts, they apparently had not integrated the facts into mental models that were compelling enough to override affect-based heuristics

The finding that many participants saw relative taste strength and harshness as a reliable indicator of relative harmfulness and addictiveness demonstrates the importance of sensory experiences in shaping beliefs and it has important policy implications. It helps to explain why banning specific terms such as “Light” and “Mild” has been insufficient to end the “Light/Mild” deception [2]. Where experiences of use are different, people will find a way to label those experiences, either by continuing to use the old terms, or by using new ones “conveniently” provided by the manufacturers, such as “smooth” and “fine” [24]. While banning the engineering features or ingredients that make some cigarettes “smoother” would be the most decisive course of action, tobacco control messages that acknowledge some cigarettes provide a compelling illusion of reduced harm would be more effective than current messages that simply bluntly state they are no less harmful.

Some participants erroneously believed that toxic chemicals added to cigarettes or to the tobacco are the main cause of the harms of smoking, so more “natural” or “pure” tobacco is not very harmful to smoke. Messages that leverage pre-existing negative affect towards “chemicals” may be leading smokers to believe that the tobacco industry directly adds these toxic chemicals to cigarettes, a misunderstanding often used inappropriately to differentiate RYO cigarettes from factory-made ones. If chemicals are discussed it may be important to make it clearer that the toxic chemicals are largely produced by the combustion and thus come out of cigarettes.

Most participants knew that nicotine is the active ingredient in cigarette smoke and the cause of its addictiveness, although some disputed this and attributed addictiveness at least partly to “chemicals,” and/or behaviour-based experiences. Only a few understood that it is the way nicotine is delivered that determines both satisfaction and addictiveness. More often participants either denied nicotine was the addictive component or, when focusing on

addiction, ignored nicotine as a source of enjoyment. This separation of enjoyment from addiction allows a more generalised view that addiction is bad, and when this was linked to nicotine, may facilitate belief that using NRT is just as harmful as smoking.

CEOS theory holds that, while people automatically question propositions that are inconsistent with their experiences, they don't spontaneously question the veracity of their heuristic-based beliefs, because the operational mechanism for raising doubt is absent (i.e. a feeling of discomfort). People must then make a conscious decision to think the issue through. This is only likely to occur when gaining a better understanding becomes important. The finding that rational explanations could be ignored when making judgements is consistent with this explanation. People can clearly hold contradictory beliefs and tend to act on heuristics over analysis. Bloom's typology of learning [25,26] elucidates this, distinguishing between knowing isolated facts; conceptual understanding, where implications are at least partly understood; and practical knowledge where the implications are sufficiently well understood to inform choices. It is clear from our findings that little of the information held about smoking is practical knowledge. However, the experience from the focus groups in particular indicates that people can readily build a more coherent conceptual understanding when they are motivated. What we don't know is whether, having built this new understanding, participants subsequently applied it to thinking about their smoking or reverted to prior ways of thinking.

Our findings that affect-based heuristics are being used to make product choices are consistent with CEOS theory [12, 13]. Heuristics are generated to make sense of the primary affective response and then to justify acting on the basis of what feels right. Situations where what "feels right is not right" characterise experiences with many hard to maintain health behaviours. A major challenge for public health communicators is to find ways to turn mere facts into practical knowledge; that is, is knowledge that has been related to experiences such that it has become consistent with feelings about the issue or has allowed feelings to change to be congruent with the facts, so is primed to influence behaviour. To achieve this, requires careful consideration of what people might need, not a simple focus on what might most directly motivate action.

There is a dynamic interplay between our experiences and how we label them. Communication is most effective when the terms used have the same affective connotations as the intended message. This can be facilitated by judicious choice of terms, with terms used to motivate action given positive valence, and those concerning things to discourage given negative valence (see Table 1). For example, less harmful in relation to smoking still evokes harm, while safer suggests acceptability. Judicious use of terms can help reinforce a sense of difference between smoking and using non-combusted nicotine that would help smokers to make harm reducing or harm minimising choices. For example, it would help smokers to understand that NRT use is highly unlikely to be dependence forming and not simply “swapping one addiction for another”, and e-cigarettes are likely to have markedly lower harm than smoking.

Study limitations. We identified a number of misperceptions that were held by large proportions of participants but cannot know how prevalent they are on the basis of this small qualitative study. We have conducted a follow-up quantitative survey to try to find out more about how widely they are held and to better understand their interrelationships.

Conclusions

Smokers’ understanding of the causes of the harms from smoking is often inadequate to ground informed decision making, and even when they have a reasonably coherent mental model, may not apply it, relying instead on context-driven heuristics. These findings fit well with a dual process model that identifies limits on propositional knowledge in judgements when it clashes with affect-based heuristics. Smokers clearly need more help to transform authoritative information into practical knowledge if they are to take more informed action. Finding communication strategies that present factual information in ways that relate to people’s experiences in ways that can correct or neutralise inappropriate heuristic judgements represents an important challenge for tobacco control, and most likely other areas of public health.

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Table 1. Terms relating to the same topic which support different heuristics.

	Descriptors	
Topic	Positive	Negative
Novelty	Excitement	Uncertainty
Natural	Authentic/unspoiled	Raw/untreated
Added components	Enhanced	Contaminated/ tainted
Manufactured	Refined/improved	Manipulated
Low price	Bargain	Cheap
High price	Quality	Expensive
Attractiveness	Hard to resist	Addictive
Harm reducing	Safer	Less harmful

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