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Smokers' understandings of addiction to nicotine and tobacco: A systematic review and interpretive synthesis of quantitative and qualitative research

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ABSTRACT

Background: Despite the centrality of addiction in academic accounts of smoking, there is little research on smokers' beliefs about addiction to smoking, and the role of nicotine in tobacco dependence. Smokers' perspectives on nicotine's role in addiction are important given the increasing prevalence of non-tobacco nicotine products such as e-cigarettes. We conducted a systematic review of studies investigating smokers' understandings and lay beliefs about addiction to smoking and nicotine. **Method:** We searched PubMed, Embase, CINAHL and PsycINFO for studies investigating lay beliefs about addiction to smoking. Twenty two quantitative and 24 qualitative studies met inclusion criteria. Critical interpretive synthesis was used to analyse the results. **Results:** Very few studies asked about addiction to nicotine. Quantitative studies that asked about addiction to smoking showed that most smokers believe that cigarettes are an addictive product, and that they are addicted to smoking. Across qualitative studies, nicotine was not often mentioned by participants. Addiction to smoking was most often characterised as a feeling of "need" for cigarettes resulting from an interplay between physical, mental and social processes. Overall, we found that understandings of smoking were more consistent with the biopsychosocial model of addiction than with more recent models that emphasise the biological aspects of addiction. **Conclusion:** Researchers should not treat perceptions of addiction to smoking interchangeably with perceptions of addiction to nicotine. More research on lay beliefs about nicotine is required, particularly considering the increasing use of e-cigarettes and their potential for long-term nicotine maintenance for harm reduction.

IMPLICATIONS

Quantitative studies show that most smokers believe that smoking is addictive and that they are addicted. A feeling of "need" for cigarettes was central to qualitative accounts of addiction, but nicotine was not often discussed. Overall, smokers' understandings of addiction reflect a biopsychosocial model rather than a neurobiological one. Given the growing market for e-cigarettes and therapeutic nicotine, more research is required on lay beliefs about nicotine and addiction.

INTRODUCTION

Nicotine was declared addictive by the U.S. Surgeon General in 1988,[1] and it is increasingly recommended that nicotine addiction be approached as a disorder requiring medical treatment.[2-4] Various measures of nicotine dependence have been developed, validated and are in regular use in both research and clinical applications.[5-8] The constellation of features included in such measures include continued smoking despite known harms, difficulty quitting, feelings of craving or compulsion, and how long after waking someone smokes their first cigarette. An example of a commonly used measure of dependence is the Fagerstrom Test for Nicotine Dependence (FTND).[6] In 2012, this test was renamed the Fagerstrom Test for Cigarette Dependence, in acknowledgement of the fact that dependence on cigarettes encompasses more than an addiction to nicotine[9]. In a similar vein, the DSM-IV labelled addictive smoking as "nicotine dependence"[10] however was labelled "tobacco use disorder" in the DSM 5[5]. The complexity of the relationship between tobacco dependence and nicotine dependence has largely focused on academic arguments about the role of nicotine replacement therapy (NRT), and the neurobiology of nicotine and cigarette smoking.[9] The distinction between nicotine and tobacco dependence has become very relevant to contemporary legal and public health arguments about the potential for dependence on non-tobacco forms of nicotine such as e-cigarettes.[11,12]

Unlike other psychoactive substances such as opiates and alcohol that have long been associated with addiction, nicotine has relatively recently joined the realms of substances defined as addictive. Historically, smoking has been more closely associated with a public health approach than an addiction medicine approach.[13] The increasing recommendation for health professionals to identify smokers and to provide them with pharmacological treatments such as NRT or prescription medications has medicalized smoking to some extent[14]. Also contributing to the medicalization of smoking is the increasing emphasis on the neurobiological aspects of smoking that create and maintain addiction.[15-17] Tobacco dependence is increasingly defined in terms of "nicotine addiction" and is beginning to be labelled a "chronic brain disorder" and a "chronic disease."[3,18]

However, whether smokers view themselves as addicted to nicotine, and the role they ascribe to nicotine in their smoking, is less clear. The answer to this question is important for two current public health debates: 1) the amount of emphasis that should be given to therapeutic nicotine (NRT) for quitting smoking, given the limited population impact of cessation medicines despite widespread availability and public subsidisation in high income countries; and 2) what contribution non-therapeutic nicotine products (e.g. e-cigarettes) will play in reducing the burden of tobacco-related disease. The marketing of NRT a medicinal smoking cessation product, and the recommendation to use it for only a limited period of time, meant that long-term dependence on NRT products has not been a big concern. E-cigarettes have been controversial in the tobacco control field because they are marketed as consumer products that are much safer alternatives to conventional cigarettes. Their potential to foster long-term nicotine dependence and their appeal as a recreational form of nicotine delivery has brought to the fore arguments about how nicotine should be conceptualised and regulated.[11,19,20]

It is important to investigate whether smokers see themselves as addicted to smoking and what meanings they associate with this term. The role that smokers ascribe to nicotine in their

understandings of smoking is likely to influence their views about cessation methods and also switching to alternative nicotine products such as NRT or e-cigarettes.

Only one previous systematic review has examined lay perceptions of addiction to smoking.[21] This review focused on youth perceptions of addiction and the health harms of smoking. The authors found that young people were optimistic about their ability to quit before their smoking became problematic, and many did not believe that they were addicted to smoking. However, this review excluded the views of older and more established smokers. Also, the search strategy may have excluded relevant studies because it only included publications that contained one of the following terms: "invincibility, in denial, denial, invulnerable, optimism." Although a stated aim was to examine perceptions of addiction, no search terms about addiction were used.

Our systematic review aimed to examine smokers' subjective assessment of tobacco addiction in both adolescent and adult smokers, with an emphasis on investigating beliefs about nicotine. We collated data on smokers' perceptions, beliefs, and understandings of addiction to smoking in general, or to nicotine specifically where available. We applied critical interpretive synthesis (CIS)[22] to analyse smokers' understandings of addiction, and the methods by which they have been studied. PRISMA guidelines, which were developed to encourage standardised reporting of systematic reviews, were used to report the method and findings wherever appropriate.[23]

METHODS

Search Strategy

We searched PubMed, Embase, CINAHL and PsycINFO using broad search terms to capture all relevant studies. While search strategies were adjusted for each database's features, the key search terms were: (cigarette OR tobacco OR nicotine OR smoking) AND (addiction OR habit OR dependence OR 'tobacco use disorder') AND (attitude OR belief OR understanding OR

perception OR awareness OR 'health belief'). Supplementary File 1 includes the full search strategy for each database.

Searches were conducted in June 2015, restricting results to English language papers published in peer-reviewed journals in or after 1988, to coincide with the publication of the US Surgeon General's report that declared that nicotine was addictive.[1] The reference lists of relevant studies were manually searched for additional publications that met the selection criteria.

Inclusion/Exclusion criteria

Figure 1 illustrates the process for identifying studies. After excluding 1087 duplicates, 2424 papers were screened by title and abstract, retaining those that involved current or ex-smokers and investigated beliefs, attitudes or self-assessment regarding addiction to tobacco or nicotine. Studies that did not report participants' understandings of "addiction" or "dependence" were excluded. Qualitative studies were included if they explored the meanings that smokers associate with addiction. Quantitative studies were included if they provided smokers' ratings of their own addiction, or their ratings on the general addictiveness of smoking. Two authors (KM and DP) screened the full texts of 97 publications. Five of these studies were identified from the manual searching of reference lists of relevant papers. Where KM and DP disagreed over inclusion, a third author (BW) independently reviewed the paper and inclusion was based on majority judgement. Forty-six papers were deemed to meet the selection criteria.

Data Extraction

Separate data extraction forms were used for qualitative and quantitative papers (Supplementary File 2). One mixed-methods paper[24] was included as qualitative because the quantitative component did not address perceptions of addiction. For each study, BW & DP extracted information on research aims, context and methodology, key findings, conclusions and study quality. Where studies included data from both smokers and non-smokers, only data

from smokers and ex-smokers was extracted. For qualitative studies, all text relating to addiction were imported into NVivo10[25] to enable further analysis.

While formal quality appraisal is common in conventional systematic reviews, many quality appraisal criteria for clinical trials are not applicable to observational studies, and quality appraisal is a contentious exercise for qualitative research.[22,26,27] For this review, formal quality appraisal in the form of scoring or ranking studies was not appropriate because it predominantly included qualitative or cross-sectional survey studies. Instead, we integrated reporting criteria from the NICE guidelines (quantitative and qualitative)[28,29] & STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklists[30] into our extraction forms and quality concerns informed our interpretation of these studies. These reporting guidelines include many items which assist researchers in judging the quality of a study such as details about selection of participants, validity and generalizability of the results, how the study was explained to participants, and the explicitness of data analysis methods. No papers were excluded based on judgements about quality.

Analysis

Quantitative studies (n=22) varied in aims, methodology and survey items; therefore meta-analysis was not possible. For qualitative studies (n=24), DP conducted a secondary analysis of extracted results (i.e., participant quotes and authors' interpretations) using Nvivo 10. KM independently coded eight randomly chosen studies and differences were discussed until a consensus was reached. Codes were organized into themes, and then further into overarching thematic domains.

We drew on the approach of critical interpretive synthesis (CIS) to interpret the identified literature.[22] CIS has been applied to a wide range of research areas and is particularly useful when reviewing a methodologically diverse body of literature.[22,26,31] A CIS approach goes

beyond the aggregation of data and aims to interpret the findings. The process of CIS includes an evolving research question; a pragmatic approach to quality appraisal based strongly on relevance rather than specific criteria of methodological rigour; and a critical approach to key concepts and assumptions.[22]

RESULTS

Quantitative Studies

Key characteristics and results of the 22 quantitative studies (20 research papers and 2 research letters)[32-53] are provided in Table 1. These were published between 1990 and 2012 and were cross-sectional designs, with the exception of one prospective cohort study.[39] The study target populations varied, with some focused exclusively on smokers (n=12), while others also included non-smokers for comparison (n=10). Most focused on adults (n=14), while a number recruited adolescents only (n=6), and a minority included both age groups (n=2). Some included subgroup analysis based on: age (n=2); sex (n=2); smoking status (n=11); and/or ethnicity (n=3).

There were substantial differences between studies in the way perceptions of the addictiveness of smoking were measured. Some studies asked about perceptions of personal addiction, e.g., "Are you [not at all, somewhat, or very] addicted to cigarettes?[39] Others used more general questions about the addictiveness of smoking, particularly when comparing smoker and non-smoker ratings. For example, one study asked participants "How much of a risk is it for someone to get addicted if they try smoking cigarettes even once?"[37] Several studies asked participants to provide ratings of both their own addiction to cigarettes, and the general addictiveness of tobacco/cigarettes.[40,49,52,53]

Other aspects of smoking included: the ease/difficulty of quitting;[38,41,43,44,46] the addictiveness of tobacco compared to other drugs;[34,40,49] and the extent to which they believed addiction was

a reason for their smoking.[42,45] In many cases, participants' perceptions of addiction were not the major focus of the study, however, ratings of addiction were included as a relevant variable.

Another important difference between studies was whether participants were asked about addiction to "cigarettes", "smoking", "tobacco", or "nicotine". Most items asked about the addictiveness of "tobacco", "cigarettes" or "smoking". Only two papers contained items that specifically questioned participants about addiction to nicotine.[52,53] Weinstein and colleagues[52] asked "If a teenager starts smoking half a pack of cigarettes a day, how long do you think it takes them to show signs of nicotine addiction?" However, they switched to asking about addiction to cigarettes when questioning participants about their own addiction: "Do you consider yourself addicted to cigarettes?" The survey administered by Zinser and colleagues[53] included the item "People who smoke cigarettes regularly are addicted to nicotine." No quantitative studies asked if participants personally felt they were addicted to nicotine.

The included studies consistently found that the majority of smokers agreed that smoking is addictive[32,34,36,37] or that 'smokers' in general are addicted.[33,40,42,53] The single study that asked whether people who smoke are addicted to nicotine found that 89% Latino participants and 94% non-Latino Whites agreed with the statement.[53] When asked whether they personally were addicted, most adult daily smokers reported that they were.[39,52,53] Adolescent smokers were less likely than adults to agree that they personally were addicted,[32,52] but most agreed that smoking was addictive,[34,36,41] and that quitting would be difficult.[35] Other groups who were less likely to report being addicted to smoking were Hispanics in US studies[46,49,53] and lighter or "occasional" smokers.[39,40,48]

While most studies did not ask about different aspects of addiction to smoking, there were exceptions. Four studies presented more than one explanation for smoking e.g., asking to what extent participants agreed that smoking was a habit and/or an addiction, or that addiction to

smoking was physical and/or mental.[42-44,48] Where participants were given the option to rate their agreement with each item separately, both smoking as a habit and an addiction were endorsed in adults.[42] One study found that smokers reported psychological addiction to be more of a motive for smoking than physical addiction, but the difference was not large.[44] Three further studies suggested that smokers tend to agree that smoking tobacco is as addictive as other drugs (e.g. cocaine or heroin)[34,40,49].

Common methodological limitations included the absence of reporting on response rates; a lack of descriptive statistics on addiction-related variables; information about ethical clearance not being provided; and a lack of clarity about how participants were categorised in relation to smoking status.

Qualitative Studies

Twenty three qualitative studies were included from 24 papers (one study was reported in two separate papers) published between 1997 and 2015[24,54-76]. Details of the studies are included in Table 2. Data collection methods were primarily focus groups, individual interviews, or a combination of both. One study used Q-methodology[61]. Sampling strategies varied, with most papers including current smokers (n=12) or a combination of current smokers and ex-smokers (n=8). Three papers included data from never smokers in their sample[64,69,73]. Fourteen papers focused on adults and ten on adolescents.

Similar to the quantitative studies, exploring smokers' understandings of addiction was not the explicit aim for many studies. However, addiction often arose as a major theme as it was closely tied to discussions around starting and stopping smoking. Although some studies did not report their interview questions, and the results presented were not always linked to specific questions, discussions of addiction appeared to arise from a range of questions about quitting, reasons for

smoking, and thoughts about smoking in general. This shows that addiction is a central concern of smokers.

Many studies did not provide sufficient information to allow judgements on study quality. There was often limited reporting on the role of the researcher in the analysis, including whether multiple team members coded the data, and how researcher beliefs and practices may have influenced the results (reflexivity); details about interview questions; recruitment methods or the study's context; evidence to support claims (e.g., few participant quotes); and the analytic approach. These issues are not uncommon in the reporting of qualitative research, particularly in journals with tight word count restrictions, where methodological detail is often sacrificed to allow more room for the reporting of results.

Qualitative findings across studies revealed smokers attach a range of meanings to their addiction. We first discuss common ways in which smokers described addiction to smoking. We then delineate the ways in which these 'signs' of addiction were used by some participants to separate themselves from "addicted smokers" or to downplay their own addiction. Last, we explore instances where discussions around nicotine arose, and draw preliminary conclusions about the role of nicotine in smokers' understandings of addiction.

1. What does addiction look like to smokers?

The most commonly reported sign of addiction to smoking was a feeling of "need" for cigarettes that was seen to set apart addicted smokers from non-addicted smokers[55,56,59,63-69,73]. The feeling of need was often associated with the sensation of craving, such as "sweating at the bit for a fag"[55], "not satisfied until I have one"[67] and "twitching... aching for a cigarette"[65]. Smokers described having emotional withdrawal symptoms, such as "you get these mood swings and temper and everything"[76], and "you feel more nervous"[66]. Frequent reference to

physical withdrawal symptoms occurred across studies including headaches[58], insomnia[54], nausea[59], concentration difficulties[54,59], shakiness[63,68], cold sweats and dry mouth[63]. Smoking cigarettes relieved these symptoms, but was also associated with pleasure in the form of "a tingly feeling"[69], a "buzz"[70], a pleasurable smell and taste[74], or an enjoyable feeling "going down my throat"[65]. Smoking was often portrayed as necessary to enable 'normal' functioning. In some studies, participants described "tanking up" prior to periods of enforced abstinence[56] and exaggerated reactions to running out of cigarettes, such as willingness to walk for two hours to buy more[63].

Another key aspect of addiction according to smokers was diminished control over smoking, and an associated difficulty in quitting. Addiction was seen as, "trying and trying to give up"[56], "want to quit, but can't"[64] or "if it controls you"[58]. Control was tied to notions of choice and those who denied that they were addicted to smoking asserted their autonomy in statements such as "I feel like I'm not addicted because I can stop myself at any time. I choose to smoke that cigarette"[58], and "Every time it is my own decision to smoke"[54]. The themes of need and control are closely linked, as demonstrated by one participant who stressed that her smoking was not a need, but a "want." She reflected on times when she had said no to a cigarette as evidence that her addiction is "not too bad".

> "I mean the amount of times I've said no when people have offered me and I say no and they say go on have one, but I go no it's alright (laughs), yeah so I'd say you know I'm not too bad really 'cos some people just smoke for the sake of it, I try and just smoke when I want one."[62]

A number of factors were offered to explain why only some people become addicted, with frequent references to "overdoing smoking"[59]. In particular, some smokers were viewed as being very controlled and constrained, whilst others were thought to smoke excessively. Views

that, “a cigarette every so often doesn’t get you addicted”[65] ; “the more that somebody smokes for a while, the greater the chance of them getting addicted”[59]; or “if I was addicted to smoking then I’d be smoking every day”[55] reveal how notions of excess and addiction are intertwined.

Some studies noted a highly physical conception of the process of addiction, employing ideas of tolerance in regards to the development of addiction. Tolerance was seen as a gradual progression towards addiction: “they just need a little bit and then they need more and then they need more”[59]; “It’s a boring feeling after a while. It doesn’t feel the same anymore. You have to like smoke more to get that feeling – to get that like little high”[69]. Inherent in these descriptions was the identification of subtypes of smoking behaviour, based on varying criteria. These included: the “in control social smoker” vs the “habitual smoker” vs the “full-fledged addicted smoker”[55]; light vs moderate vs heavy degrees of addiction[59]; and “wanting/enjoying” vs “needing” cigarettes[63]. In each case the process of becoming addicted was associated with progression and moving up a ladder of smoking typologies. This comparison between different smoker ‘types’ was common across studies.

2. Ambivalence about addiction to smoking

Many participants expressed uncertainty about whether they were addicted to smoking, or as to the nature or strength of their addiction. This was particularly the case for adolescent smokers[54,59,70,71]. While an acknowledgement of addiction in some form was common, views on what this meant varied widely. Where addiction was challenged, alternative discourses of smoking were often employed, commonly that it was primarily a social activity. 'Social smoking' was presented as an alternative to addiction e.g., “I do have a craving like other people, but it’s more a social thing really”[55] or as a precursor to addiction from which smoking progresses to become “more than just sitting with friends”[55]. One participant stated that the

social aspects were as addictive as nicotine: “it is a social aspect of their life that they have become dependent on, as much as the nicotine, you know. I think the social setting of it all is something that is somewhat addictive itself”[63]. Adolescents in particular frequently referenced the social aspects of smoking.

'Habit' was another frequently employed term across studies. While its meaning was not often elaborated on, several studies suggested that smokers associated it with regular and repeated smoking. Yet, how this relates to 'addiction’ was often unclear due to the varied use of the term both within and across studies. Phrases such as, “I think it’s a habit, it’s not really an addiction…”; “probably an addiction now, it used to be a habit, but now it’s not”[55]; and “not a habit, it’s an addiction”[56], seem to suggest a dichotomy, in which 'habit' is conceived as a distinctly different phenomenon to 'addiction'[56,63]. However, other examples reveal less simplistic conceptualisations of the addiction/habit divide.

> `(. . .) It's like it's a drug, it's er addictive, er I do enjoy it sometimes um, I suppose really it's become part of my life, it's a habit really . . . I think if you haven't had a fag for a long time the first fag you have is like a stimulant, it's um goes straight into the bloodstream and goes to the brain . . . I think it relaxes people um and I think then it just becomes a habit, a habit-forming er er thing really (. . .). It's just a habit it's just a just a really nasty horrible bad habit and I just don't think I can break out (. . .)'[62]

Taken together, smokers appear to use the term “habit” to refer to the routine nature to their smoking behaviour. While it is sometimes framed as being in contrast to addiction, others refer to it being a sign of addiction.

Across studies there was recognition of the stigma associated with being an addicted smoker. Resisting addiction was seen as a matter of being “strong enough”[66], revealing a negative perception that “they are weak if they are addicted because they don’t have the willpower to

quit"[59]. This conceptualisation of addiction more closely aligns with a moral rather than neurobiological framing of addiction.

There was a tendency across studies for participants to use depersonalised language to distance themselves from discussions of their own smoking or addiction. Bortorff and colleagues[59] explicitly observed this in their interviews with adolescent smokers, and we also found this depersonalisation to be common across studies. One example is the limited use of personal pronouns in accounts of addiction, with references to smoking's effect on "*the* body", "*the* brain" or "*the* bloodstream"[59,62]. For example "Your body says you need one at that time; you just can't ignore what your body says."[59]. Similarly, when discussing addiction, many participants discussed smoking in general terms rather than reflecting on their own smoking. If they did refer to their own smoking, it was often in comparison to 'other' smokers who they considered heavier smokers, and more addicted. For example, Farrimond, Joffe and Stenner[61, p.995] stated that some participants made "positive comparisons between themselves as 'social smokers' and addicted smokers, for example, by emphasising their high self-control and external 'social' motivation." Young people used this strategy of distancing themselves from addiction by comparing themselves to older and heavier smokers[55,59].

3. How do smokers understand the role of nicotine in addiction to smoking?

As described above, feeling a need to smoke was seen as a sign of addiction to smoking. But what aspect of smoking was "needed" was often not clarified. While some participants specifically discussed the role of nicotine, it was uncommon for researchers to probe about nicotine, and many of the discussions about smoking and addiction did not mention it. The chemical composition of cigarettes in general was seen as playing a role in promoting

addiction, but participants rarely elaborated on how nicotine contributed to their addiction to cigarettes, and some displayed misunderstandings. For example, one participant implicated the tobacco industry in adding an addictive ingredient to cigarettes, suggesting they were unaware that nicotine is naturally found in tobacco: "If the cigarette manufacturers are putting stuff in the cigarettes that make your body addicted to 'em, then how are you going to quit?"[57].

While nicotine was only occasionally discussed, the physical nature of addiction to smoking was often acknowledged. Cravings were described as when the body "needs the stuff" [62]; and "is basically crying out for a fag"[56]. Others referred specifically to the brain in describing this physical process, claiming the "brain tricks you"[63] and "forces you to think you need a cigarette" [59]. One participant explained that the brain "is already addicted to it, and the thinking just can't go away"[57]. These participants often used such physical descriptions to attribute responsibility and development of addiction to the "the body" or "the brain", situating them as entities external to themselves over which they had little or no control.

Where discussions about the role of nicotine did arise, it was often in the context of comparing tobacco dependence to other drug addictions. For example, "it's like it's a drug"[62], "we're just junkies, we need nicotine"[56], "it's worse than heroin"[57], or "smokers are preoccupied with where the next nicotine fix is, the nicotine monkey on their backs"[61]. Although, others denied this relationship, claiming they don't view their relationship to smoking like that of "a heroin addict"[55]

Accounts of addiction that refer to nicotine in the "bloodstream"[57,62], a "chemical dependency"[57,62]; and "tolerance"[59], reflect – with varying degrees of sophistication - a biomedical understanding of 'nicotine dependence'. Participants across studies often presented addiction as a "physical need", however we found that physical descriptions of addiction were

rarely discussed in isolation from other factors such as family and peer influence. These influences were seen to act at a young age either through access to cigarettes[59,65], children "getting used" to the idea of smoking[59,62], or direct pressure to smoke[69]. A further psychosocial influence that arose was one's personality, with some mentioning an "addictive personality"[74] or "inner weakness"[59,73]. Such a personality was attributed to genetics, immaturity[59] or one's mental health status[73]. These discussions implicated a complex web of factors that are seen to mediate addiction, illustrating a common view that tobacco dependence is not caused solely by the brain's exposure to nicotine.

DISCUSSION

DiFranza has written that "Those who claim to have the power to define nicotine addiction are burdened to provide that they can identify it more accurately than those who live with it every day of their lives."[77, p.1] In this research, we reviewed studies examining smokers' perceptions and understandings of addiction to smoking. By prioritising participants' own views and interpretations, theoretical debates surrounding the nature of addiction to smoking can become grounded in the daily lives and realities of cigarette smokers. The quantitative findings summarised here suggest that most smokers agree that smoking is addictive and that they themselves are addicted to cigarettes. However, when smokers are asked open-ended questions about what addiction means to them, a complex and multidimensional picture emerges. Moreover, there remains a considerable number of smokers who express ambivalence about their own addiction or reject the "addicted" label entirely, even if they believe smoking is addictive for others.

Our qualitative analysis shows that addiction is perceived as a complex process involving relationships between physical processes and sensations, behavioural patterns and the social

contexts in which these occur. A feeling of "need" and lack of control over smoking were identified by smokers as the most common signs of addiction, and these align with the 'craving' and 'loss of control' criteria of the DSM 5[5]. These symptoms that smokers recognise are also consistent with other self-reported data on nicotine addiction, where a developmental sequence of "wanting, craving, needing" was identified during quit attempts[78]. However, smokers often distanced themselves from these symptoms of addiction by referring to addiction in a general way, and using depersonalised terms. Descriptions of smoking as a social practice or habit were sometimes invoked as an alternative to addiction. While the difficulty of quitting was often acknowledged, it was also common for smokers to maintain some sense of autonomy over their smoking. Overall, we found that subjective understandings of smoking were more consistent with the biopsychosocial model of addiction than with more recent models that emphasise the neurobiological or genetic aspects of addiction.[79-81]

Largely absent from this literature was a thorough investigation of smokers' understandings of 'nicotine addiction' – as most studies neglected to ask participants specifically about nicotine. It was more common to ask about addiction to smoking, tobacco or cigarettes. Prior to the emergence of e-cigarettes, nicotine and tobacco were by and large interchangeable since the vast majority of long-term nicotine consumption was in the form of smoking cigarettes. Previous studies may not have specifically explored nicotine separately from other aspects of addiction because addiction to nicotine separated from smoking tobacco was less common. It is important to ask about smoking and cigarettes, as addiction to smoking cannot be reduced to nicotine dependence. However, understanding how smokers conceptualise the role of nicotine in their smoking is more and more important in light of increasing recommendation for smokers to use NRT, and because of the growing market for e-cigarettes, which offer nicotine in a form that could induce and sustain addiction, but without smoking tobacco. Smokers' attitudes to, and ideas about, nicotine addiction, may influence the uptake and use of non-tobacco nicotine

products as substitutes for tobacco cigarettes. More specifically, if people do not believe that nicotine plays a central role in their smoking, they may be less likely to use NRT to assist quitting and be less interested in switching to e-cigarettes.

The qualitative studies we reviewed show that smoking is rarely understood primarily through the lens of nicotine addiction. This suggests that a biomedical understanding of addiction to smoking, where nicotine induces neurochemical changes to the brain which make it very difficult to stop, does not dominate lay beliefs about addiction to cigarettes. These findings are consistent with previous research on how addicted individuals understand the biological basis of their addiction[15,82-84]. While the physical aspects of addiction are often acknowledged, smokers' explanations of addiction are much broader, referring to the role of peers, routine, emotions, habits, inner strength or weakness, and contextual cues. These aforementioned aspects of smoking are not often linked with the mechanisms of nicotine dependence. The role of nicotine in addiction, where it was discussed, was often glossed over, rather than considered in detail. These findings suggest that promises of effective nicotine delivery may not provide sufficient motivation for many smokers to switch from combustible cigarettes to reduced harm alternatives such as NRT or e-cigarettes. Other factors, such as the extent to which e-cigarette use satisfies the social factors that smokers believe contribute to their addiction (e.g. the smoking 'routine' and sociability)[85] could influence its acceptability as a substitute for smoking. Therefore the use of e-cigarettes (vaping) as a social practice may be just as important as it's more functional role of relieving nicotine withdrawal symptoms.

These findings may partly explain the limited uptake of medicinal cessation aids, despite evidence of efficacy from clinical trials, wide availability, promotional advertising and public subsidisation to make them more affordable. Cessation medicines may be viewed as addressing only one aspect of addiction (nicotine dependence), which smokers may not consider to be the most important factor driving their addiction. Furthermore, many have

written of the increasing stigmatisation of smokers that has occurred as tobacco use has become denormalised[11,86-89]. The extent to which medicinal cessation aids are associated with notions of substance (nicotine) addiction and the identity of a nicotine addict may make them unattractive to smokers given the techniques used by smokers to distance themselves from 'addiction'[90]. This strong association between cigarettes and nicotine, and negative perceptions of being addicted, may also deter some smokers from experimenting with nicotine containing e-cigarettes[91]. Further research on how attitudes towards addiction influence smokers' choices in relation to quitting smoking would be helpful.

These findings have a number of methodological implications. In limiting our review to literature on smokers' understandings, the question arose - '*who is a smoker*?' How should we classify those who have recently taken up, or stopped smoking, or who smoke regularly but do not classify themselves as smokers? Our approach was to include any studies that claimed to include smokers or ex-smokers and to explicitly report the criteria used to identify and classify their participants. In doing so, we found there was significant diversity in the way that smoking status was classified across the reviewed studies. A number of studies provided either no information on how smokers were classified, or very vague descriptions of smoking status such as 'known smokers'[66] or 'those with recent smoking experience'[65]. Furthermore, very few studies discussed the rationale or implications of their chosen classifications.

This has a number of implications for interpretations of the above findings. First, adding these disparate classifications to the existing variation between study populations and context resulted in a sample of studies representing a very heterogeneous body of 'smokers'. Hence, the reported findings should be interpreted as providing an overall indication of the range of ways in which smokers conceptualise addiction. Further research in this area should ensure that methods for selecting and classifying smokers are reported. This is crucial both for reporting and analytical purposes.

A second methodological issue surrounds variation in the questions used to investigate addiction to smoking. It is likely that the framing of these questions significantly constrained the possible range of responses. For example, studies asking both "is tobacco physically addictive?" and "is tobacco mentally addictive?" presuppose that these are the ways in which addiction is experienced and preclude consideration of other explanations of addiction. While it is necessary to limit responses among large samples of smokers, qualitative literature can inform the most pertinent and useful questions to ask when there is limited scope. Finally, although investigations of addiction were not the primary aim of many studies, addiction consistently arose as a central theme. In the qualitative studies, detailed discussions of addiction sometimes arose from questions exploring smoking in general. This illustrates the significance of the concept of addiction both within smokers' relationship with smoking as well as smoking research more broadly.

Based on these results, we recommend that researchers should not treat perceptions of addiction to smoking interchangeably with perceptions of addiction to nicotine. There is little research on perceptions of nicotine addiction, and more is needed, particularly considering the increasing use of non-tobacco nicotine products and the potential for long-term nicotine maintenance [19]. Researchers should be deliberate in their choice of terms used in surveys and interviews to examine understandings of addiction to smoking and nicotine to improve the clarity of their research findings.

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COMPETING INTERESTS

None

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Figure 1 – Process of Study Inclusion

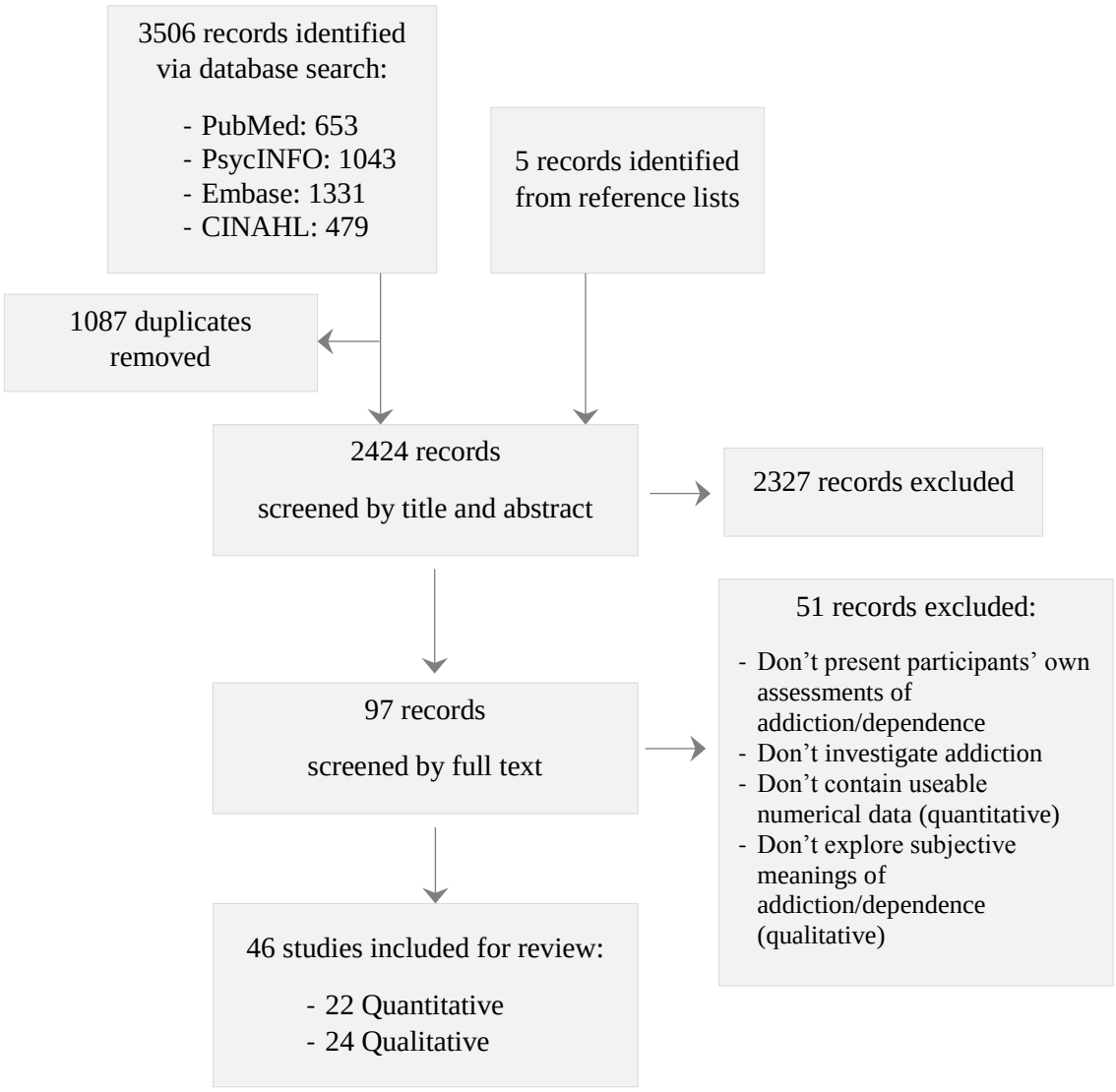

Figure 1 – Process of study inclusion