

Hardening is dead, long live softening; time to focus on reducing disparities in smoking

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The hardening hypothesis proposes that as smoking prevalence declines, the proportion of 'hard-core' or 'hardened' smokers increases. The intuitively plausible logic is that less addicted and more motivated smokers are more likely to quit, leaving behind a growing proportion of 'hardened' smokers. If true, the hypothesis has implications for policy formulation and smoking cessation practice. For example, smokefree policies, health promotion campaigns and smoking cessation support services may need to be modified to ensure they reach and support quitting among the growing proportion of hardened smokers. Also, hardening would strengthen the justification for harm reduction strategies due to the need to provide less harmful alternatives to the increasing proportion of 'hardened' smokers who struggle to quit.

There are many ways in which hardening could manifest, creating multiple hypotheses which can be tested. For example, the population of smokers could become: (1) more highly addicted (eg, an increase in heavier or more dependent smokers); (2) less motivated to quit (eg, more smokers with no or low intention to quit, not making quit attempts or with lower self-efficacy about quitting); and (3) increasingly disadvantaged and marginalised (eg, more smokers who are disadvantaged or have mental health conditions). The net effect should be a reduced rate of quitting among the smoking population over time.

So what is the evidence for hardening? Most studies that have looked at the different aspects of hardening, either singly or in combination, are repeated surveys from the same population. Investigations from a variety of countries have generally found little or no evidence in support of the hypothesis.^{1–13}

The study reported in this edition of the journal by Brennan and colleagues adds to this (lack of) evidence through a rigorous analysis of repeated cross-sectional surveys in Victoria, Australia between 2001 and

2015.¹⁴ Strengths of the study include the long time period investigated, the wide range of hardening indicators studied, an analysis of hardening within demographic subgroups and sensitivity analyses of the findings.

Another approach is to compare indicators of hardening between populations with different levels of smoking prevalence. The hardening hypothesis would predict that lower smoking prevalence will be associated with increased proportions of 'hardened' smokers or indicators of hardening among smokers. Again, most evidence suggests otherwise.^{15, 16} For example, a study of US States and 31 European countries at multiple time points found lower prevalence was associated with fewer mean cigarettes smoked per day and increased quit attempts within populations.¹⁶

Due to the intuitive nature of the hypothesis, negative findings of studies investigating hardening have often been viewed as surprising.¹⁷ However, this should not be the case. If groups of smokers are considered as dynamic populations, a range of determinants of the rates of inflows and outflows of smokers are apparent which could plausibly negate hardening and instead result in softening.

For example, in most settings, nearly all new smokers joining the smoker population will be young, and many will be lighter daily or social smokers, who may be more motivated to quit. Also, while heavier smokers may be less likely to leave the smoker population by quitting, they will be more likely to leave by dying or possibly through quitting in response to developing a serious illness. The interplay of these factors will influence whether the proportion of more heavily addicted and less motivated to quit smokers increases or decreases in any smoker population over time.

In addition, the smokers in a population are not fixed in their behaviours and motivations. They will be affected by tobacco control programmes such as smokefree policies, increases in tobacco taxation and standardised packaging. If these measures are effective, they will reduce the mean number of cigarettes smoked

and increase motivation to quit among existing smokers, again causing softening, particularly if some interventions (eg, price increases) impact more on heavier smokers.² For these reasons, and maybe others, softening of the smoker population as prevalence decreases and tobacco control efforts intensify is at least as plausible as hardening.

So what remains of the hardening hypothesis, and how relevant is it to tobacco control practice? Most studies investigating hardening have occurred in relatively high-income countries (HICs), often with active and comprehensive tobacco control programmes. This begs the question of whether hardening could be a feature of lower-income and middle-income countries (LMICs) or countries with less well developed tobacco control activities. This is worth investigating, as some authors have begun to do.^{18, 19} For example, Yin *et al* found high levels of hardened smokers in a range of LMICs.¹⁸

Another possibility is that while hardening may not have been found in whole populations, this may mask hardening among priority subpopulations such as smokers with mental illness, low socio-economic status (SES) and indigenous smokers. Brennan *et al* found mixed evidence for this. The proportion of hardcore low SES smokers and smokers with no intention to quit in the next 6 months did not decline between 2001 and 2015 in Victoria, while smokers in higher SES groups showed substantial softening in these indicators.¹⁴ However, for most other indicators, softening occurred to a similar degree across all SES groups. Unfortunately, investigation of hardening among Australia's indigenous peoples was not investigated due to small numbers included in the surveys.

Other studies have found mixed results in this regard, but most report softening with few differences by SES, ethnicity or presence of mental distress. For example, while a US study reported softening occurred among high but not low SES smokers,⁴ a Dutch study found similar levels of softening over time by education level.¹² A New Zealand study reported little evidence for hardening, with similar findings for Māori (indigenous peoples of New Zealand) and non-Māori smokers.¹³ Studies from California have found similar degrees of softening among smokers with varying levels of psychological distress and from different ethnic populations.^{20, 21}

Finally, while hardening may not be occurring in the form of smoker populations becoming more addicted and less motivated to quit, it could occur through

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the proportion of marginalised smokers (eg, people with mental illness, low SES, homeless, prisoners, disadvantaged minority ethnic groups and indigenous peoples) increasing over time. This seems highly plausible, though where it has been specifically investigated, it has sometimes not been found to be the case—for example, an Australian study found no evidence of increasing prevalence of disadvantage or psychological distress among smokers over a 13-year period.⁵

In summary, the hardening hypothesis, as it is commonly formulated, is largely unsupported by the evidence, at least from HICs with advanced tobacco control programmes and low smoking prevalence. Rather the evidence is of softening. This was also the conclusion of a recent review of the hardening hypothesis.²² Exploring the alternative hypothesis of softening now seems a more credible line of enquiry.^{20 21} Investigation of whether softening is also occurring in LMICs, in countries with higher smoking prevalence and less comprehensive tobacco control programmes, and in disadvantaged population subgroups should be a priority. The issue of whether marginalised people make up a growing proportion of the smoker population should be monitored and investigated. However, there is already substantial evidence of disparities in smoking prevalence for marginalised groups in many jurisdictions. This surely requires that addressing equity should be a key concern for tobacco control practitioners and that identifying and implementing pro-equity interventions is the highest priority.

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