# How reactions to cigarette packet health warnings influence quitting: findings from the ITC Four-Country survey

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## ABSTRACT

**Objectives**    To examine prospectively the impact of health warnings on quitting activity. **Design**    Five waves (2002–06) of a cohort survey where reactions to health warnings at one survey wave are used to predict cessation activity at the next wave, controlling for country (proxy for warning differences) and other factors. These analyses were replicated on four wave-to-wave transitions. **Setting and participants**    Smokers from Australia, Canada, the United Kingdom and the United States. Samples were waves 1–2: $n = 6525$; waves 2–3: $n = 5257$; waves 3–4: $n = 4439$; and waves 4–5: $n = 3993$. **Measures**    Warning salience, cognitive responses (thoughts of harm and of quitting), forgoing of cigarettes and avoidance of warnings were examined as predictors of quit attempts, and of quitting success among those who tried (1 month sustained abstinence), replicated across four wave-to-wave transitions. **Results**    All four responses to warnings were independently predictive of quitting activity in bivariate analyses. In multivariate analyses, both forgoing cigarettes and cognitive responses to the warnings predicted prospectively making quit attempts in all replications. However, avoiding warnings did not add predictive value consistently, and there was no consistent pattern for warning salience. There were no interactions by country. Some, but not all, the effects were mediated by quitting intentions. There were no consistent effects on quit success. **Conclusions**    This study adds to the evidence that forgoing cigarettes as a result of noticing warnings and quit-related cognitive reactions to warnings are consistent prospective predictors of making quit attempts. This work strengthens the evidence base for governments to go beyond the Framework Convention on Tobacco Control to mandate health warnings on tobacco products that stimulate the highest possible levels of these reactions.

**Keywords**    Consumer information, graphic warnings, health warnings, tobacco health information, tobacco product labelling.

## INTRODUCTION

There is an increasing body of evidence that larger and graphic health warnings on cigarette packs are noticed more often and increase knowledge about health effects of smoking better than relatively small text-only warnings, as found in many countries around the world (e.g. China, United States, Malaysia) [1–2]. The impact of enhanced pack warnings on altering smoking behaviour are less well studied. One study of the transition to larger text-based warnings in Australia in 1995 found that forgoing cigarettes as a result of noticing the health warnings was a prospective predictor of subsequent quitting activity, but that reported frequency of noticing the warnings was not [3]. This finding shows that immediate reactions to warnings can predict longer-term effects. Another study, using a composite measure of depth of cognitive processing of warnings, found this to be a prospective predictor of quit attempts [4]. However, there have been no other predictive studies.

Table 1 Respondent characteristics for the four countries and four wave-to-wave transitions.

|  | Waves 1–2 n = 6525 | Waves 2–3 n = 5257 | Waves 3–4 n = 4439 | Waves 4–5 n = 3993 |
|---|---|---|---|---|
| Age (mean, SD) | 42.7 (14.2) | 44.1 (14.0) | 44.5 (13.5) | 45.3 (13.6) |
| Cigarettes per day (mean, SD) | 17.1 (10.3) | 16.9 (10.0) | 16.5 (9.5) | 16.9 (9.7) |
| Female % | 55.8 | 56.2 | 57.9 | 58.1 |
| Wave of recruitment |  |  |  |  |
| Wave 1 recruits % | 100.0 | 79.6 | 56.8 | 43.6 |
| Wave 2 recruits % | – | 20.4 | 12.4 | 9.4 |
| Wave 3 recruits % | – | – | 30.8 | 20.3 |
| Wave 4 recruits % | – | – | – | 26.7 |
| Country |  |  |  |  |
| Canada % | 25.0 | 26.7 | 26.3 | 26.8 |
| USA % | 19.9 | 21.0 | 18.2 | 20.3 |
| UK % | 27.3 | 25.3 | 28.2 | 27.0 |
| Australia % | 27.8 | 27.0 | 27.3 | 25.8 |

SD = standard deviation.

Evaluating the effects of interventions such as health warnings that are likely to have only small effects on outcomes such as quitting is difficult, especially when there is limited capacity to control or model other potential determinants of the outcomes [5]. It is unlikely that we could demonstrate by-country differences directly in quitting activity due to health warnings, so we have adopted a less direct approach [5]. We test a mediational model by exploring the relationship between reactions to warnings and subsequent quitting activity. We have already demonstrated that new, stronger warnings led to increased reactions in the United Kingdom [6], so the next step is to show whether these reactions predict quitting prospectively.

Reactions to warnings could also be associated with reductions in desired outcomes as well as facilitating them. Some researchers have argued that strong warnings and various public health campaigns may inadvertently create psychological reactance that could potentially inhibit desirable behaviour change [7,8], including quitting activity [9]. The possibility of a negative effect of reactance was considered by Hammond *et al.* [2], who found no evidence that avoidance of health warnings reduce quitting [2]. In other areas of health, reactance effects have been found for immediate intentions to change behaviour but not longer-term behaviour. For example, emotionally charged messages to promote sun protection behaviour [10] inhibited intentions shortly after being read, but were predictive of increased reported behaviour change at follow-up some months later. Similarly, Jessop & Wade [11] found evidence of greater willingness to binge drink among some study participants in response to a binge drinking and mortality message, but no increase in binge drinking over the following week. Therefore, the evidence for reactive effects of

interventions inhibiting the behaviour that the intervention is designed to motivate is weak, and may be short-term and/or restricted to intentions rather than behaviour. However, while it remains a possibility, it is important to have population-based research to rule out reactance effects to cigarette packet health warnings, especially as the enhancement of pack warnings is a key provision of the World Health Organization's Framework Convention on Tobacco Control [12].

In this paper we use data from five survey waves of the International Tobacco Control Policy Research Survey (ITC) study to examine how responses to enhanced pack warnings impact subsequent smoking cessation. The ITC Four-Country study began in 2002 and includes annual surveys of cohorts of smokers in Australia, Canada, the United Kingdom and the United States. The ITC study provides a vehicle for studying the impact of varying forms of health warnings and of changes in warnings within countries. Warnings range from large graphic Canadian warnings to small text-based US warnings that are on the side of the pack rather than on the main faces, as is the case in the other three countries. The United Kingdom increased the size and contrast of its warnings in early 2003 between waves 1 and 2 of the survey and Australia moved from moderately large text-based warnings to larger graphic warnings in 2006, between waves 4 and 5.

## METHODS

### Sample

Details of the samples used are in Table 1; as detailed in this table, some respondents contributed data to multiple pairs.

*Addiction*

### Design

The study design involved prospective prediction of reactions to health warnings on quit smoking attempts and, among those who tried, quit success (defined as staying quit for at least 1 month), with outcomes measured at the next year's wave of the survey.

A full description of the ITC Project's conceptual framework and methods have been published elsewhere [13,14]. Further details surrounding the ITC Project's methods relating to questions on health warnings have also been been published recently [6]. Critical to this paper is that cohorts are followed annually in four countries, the United States, the United Kingdom, Canada and Australia, with similar sets of questions asked each year.

### Ethical clearance

The study protocol was approved by the institutional review boards or research ethics boards of the University of Waterloo (Canada), Roswell Park Cancer Institute (United States), University of Strathclyde (United Kingdom), University of Stirling (United Kingdom), the Open University (United Kingdom) and the Cancer Council Victoria (Australia).

### Measures

The salience of health warnings was assessed by combining two questions (alpha = 0.67–0.81, waves 1–5): how often over the preceding month respondents had noticed the warnings and read or looked closely at them, both on five-point scales: 'never' to 'very often'. Cognitive responses were assessed by combining three items (alpha = 0.78–0.80, waves 2–5): the extent in the last month to which the warnings both made the respondent think about the health risks of smoking and made them more likely to quit smoking (four-point scales: 'not at all' to 'a lot'), both asked only from wave 2; and in a separate part of the survey, the extent to which 'warning labels on cigarette packages' motivated them to think about quitting in the last 6 months, with response options: 'not at all', 'somewhat' and 'very much'. There were two different types of behavioural response: a single item measure of frequency (if ever) of forgoing cigarettes as a result of the warnings (coded ever versus never): and questions about four kinds of avoiding warnings (cover-up, keep out of sight, use cigarette case or avoid particular labels) from which a binary variable, no avoidance versus any avoidance, was computed.

Potential moderator variables assessed were the demographic variables: country of origin, sex and age (18–24, 25–39, 40–54, 55+ years). Household income and highest level of education attained were assessed where these were equated across the four countries and coded into low, medium and high. In addition we controlled for reported cigarettes per day (using a square root transform to improve normality) and intention to quit (assessed on a four-point scale: planning in the next month, considering in next 6 months, considering beyond 6 months, no interest).

Outcomes assessed at the next wave of the survey were reporting having made a quit attempt of at least 24 hours since the previous wave and, among those, whether the quit attempt lasted for at least 1 month as an indicator of short-term success. Smokers quit for less than 1 month at follow-up were excluded from these analyses.

### Analysis

Logistic regression analyses were used to predict making quit attempts between waves and, separately, among those who tried, success of attempts. We conducted four wave-to-wave replications of the associations, although only three replications were possible for the cognitive reactions, which were not assessed at wave 1. Analyses controlled for demographic factors, cigarettes per day and country. We also checked for interactions with country, looking particularly at the United Kingdom for waves 1–2 analyses and Australia for waves 4–5 analyses, as in these two cases new stronger warnings were introduced between the surveys, so some of the quitting may have been stimulated by this and thus the previous wave reactions might not fully reflect subsequent impact. As no interactions with country were found for the focal cases or any others, these interaction terms were removed from the final models reported. In secondary analyses, we tested to see whether the effects on quit attempts were mediated by intention at the wave in which the reactions were reported.

## RESULTS

Table 2 presents the range of intercorrelations between the four measures of reactions to pack warnings for the waves in which they were collected. All these were

**Table 2** Ranges of intercorrelations of the four measures of reactions to warning labels across waves.

|  | 1 | 2 | 3 |
|---|---|---|---|
| 1. Salience | – | | |
| 2. Cognitive reactions | 0.48–0.49 | – | |
| 3. Forgoing | 0.27–0.30 | 0.43–0.46 | – |
| 4. Avoidance | 0.15–0.19 | 0.24–0.29 | 0.19–0.24 |

All correlations are significant at the 0.01 level (two-tailed).

**Table 3** Percentages making quit attempts, between waves and of those the percentage quit for at least one month.

| Period | Intersurvey interval (days) | Outcome | Canada % | United States % | UK % | Australia % | Average % |
|---|---|---|---|---|---|---|---|
| Waves 1–2 | 203 | % Quit attempt | 43.9 | 36.5 | 31.4 | 34.3 | 36.3 |
| | | % ≥ one month quit | 45.2 | 39.5 | 53.6 | 43.7 | 45.5 |
| Waves 2–3 | 388 | % Quit attempt | 43.4 | 39.0 | 36.0 | 43.6 | 40.7 |
| | | % ≥ one month quit | 55.2 | 49.3 | 63.0 | 52.6 | 55.2 |
| Waves 3–4 | 458 | % Quit attempt | 39.8 | 39.9 | 41.5 | 42.7 | 41.1 |
| | | % ≥ one month quit | 57.3 | 50.9 | 69.7 | 58.9 | 59.7 |
| Waves 4–5 | 361 | % Quit attempt | 37.5 | 36.1 | 35.2 | 43.9 | 38.3 |
| | | % ≥ one month quit | 56.9 | 56.4 | 68.0 | 59.0 | 60.0 |

**Table 4** Bivariate associations between mean levels of reactions to warnings and making quit attempts by the next survey wave.

| | | Warning salience | | Cognitive reactions | | Forgoing warnings | | Warning avoidance | |
|---|---|---|---|---|---|---|---|---|---|
| | | Quit attempts | | Quit attempts | | Quit attempts | | Quit attempts | |
| | | No | Yes | No | Yes | No | Yes | No | Yes |
| Waves 1–2 | M | 2.73 | 2.97** | – | – | 0.09 | 0.18** | 0.14 | 0.22** |
| | SE | 0.19 | 0.03 | – | – | 0.00 | 0.01 | 0.01 | 0.01 |
| Waves 2–3 | M | 2.95 | 3.07** | 1.70 | 1.98** | 0.09 | 0.18** | 0.15 | 0.21** |
| | SE | 0.02 | 0.03 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| Waves 3–4 | M | 2.83 | 3.00** | 1.69 | 1.93** | 0.09 | 0.16** | 0.15 | 0.19* |
| | SE | 0.02 | 0.03 | 0.01 | 0.02 | 0.00 | 0.01 | 0.01 | 0.01 |
| Waves 4–5 | M | 2.81 | 2.96** | 1.68 | 1.93** | 0.08 | 0.16** | 0.12 | 0.15* |
| | SE | 0.02 | 0.03 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |

M: mean; SE: standard error. $*P < 0.01$; $**P < 0.001$.

positive and the pattern and strength of associations observed were similar for all survey waves.

Table 3 presents data on the percentage making quit attempts between waves and the percentage quit for at least one month among those who did. The varying inter-survey interval is responsible for some of the wave-to-wave variability. While there was relatively more quitting activity in Australia in the wave where the warning labels was strengthened, there is no such pattern for the United Kingdom or any association for short-term success.

There were significant positive bivariate associations between all four of the warning label reactions and making a quit attempt by the next survey wave (see Table 4), but no consistent pattern of associations for predicting short-term success.

Table 5 presents the summary results for independent prediction of making quit attempts for the reactions for each of the four wave transitions studied (i.e. independent of other reactions). These analyses also controlled for demographic factors and cigarette consumption (model A), and then controlled additionally for intentions to quit (model B). It can be seen that both cognitive responses and forgoing cigarettes were consistent predictors of making a quit attempt across all wave-to-wave transitions where they were measured. Both remained significant predictors after controlling for quit intentions although the size of the effects were reduced, especially for cognitive responses, suggesting partial mediation. Neither warning salience nor warning avoidance had a consistent independent relationship. Salience had a significant positive relationship in one wave transition, but a significant negative relationship in another, with nothing significant after controlling for intentions. Avoidance of the product warning was a significant independent predictor for the wave 1–wave 2 transition, but was not significant in the other wave transitions, although in all cases the odds ratio was positive.

Table 6 shows the multivariate relationships for the four types of reactions and the success of quit attempts among those who tried. There were no consistent effects.

## DISCUSSION

This study demonstrates that some reactions to warning labels have consistent and independent predictive power for the making of subsequent quit attempts, but does not appear to extend to predicting success of those attempts. This finding for a predictive effect is consistent with most

**Table 5** Predictors of having reported quit attempts at surveys in waves 2 to 5.

| Unweighted | Wave 2 OR (95% CI) | Wave 3 OR (95% CI) | Wave 4 OR (95% CI) | Wave 5 OR (95% CI) |
|---|---|---|---|---|
| Model A | | | | |
|   Salience | 1.07 (1.02–1.12)** | 0.94 (0.89–0.99)* | 0.96 (0.91–1.02) | 0.96 (0.91–1.02) |
|   Cognitive reactions | a | 1.57 (1.43–1.72)*** | 1.44 (1.31–1.58)*** | 1.46 (1.32–1.61)*** |
|   Forgoing | 1.69 (1.43–1.99)*** | 1.30 (1.08–1.57)** | 1.43 (1.18–1.74)*** | 1.40 (1.14–1.72)** |
|   Avoidance | 1.32 (1.14–1.52)*** | 1.15 (0.98–1.34) | 1.04 (0.89–1.22) | 1.04 (0.86–1.24) |
| Model B (adjusted for quit intention) | | | | |
|   Salience | 1.02 (0.98–1.07) | 0.96 (0.90–1.02) | 0.97 (0.91–1.02) | 0.97 (0.91–1.03) |
|   Cognitive reactions | a | 1.28 (1.16–1.41)*** | 1.14 (1.03–1.26)* | 1.16 (1.04–1.29)** |
|   Forgoing | 1.38 (1.16–1.65)*** | 1.23 (1.01–1.49)* | 1.42 (1.16–1.74)** | 1.30 (1.05–1.62)* |
|   Avoidance | 1.17 (1.01–1.37)* | 1.09 (0.93–1.29) | 1.03 (0.87–1.22) | 1.03 (0.85–1.25) |

OR: odds ratio; CI: confidence interval; all ORs were adjusted for age, sex, income, education, country and daily cigarette consumption; *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$. [a]Relevant questions not asked in the wave 1 survey.

**Table 6** Quit success (for at least 1 month) among smokers who had made attempts for four wave-to-wave transitions.

| | Waves 1–2 OR (95% CI) | Waves 2–3 OR (95% CI) | Waves 3–4 OR (95% CI) | Waves 4–5 OR (95% CI) |
|---|---|---|---|---|
| *Unweighted* | | | | |
|   Salience | 0.94 (0.87–1.02) | 0.94 (0.86–1.04) | 1.01 (0.92–1.10) | 1.00 (0.90–1.12) |
|   Cognitive reactions | a | 1.02 (0.87–1.19) | 1.17 (1.00–1.37)* | 1.02 (0.86–1.22) |
|   Forgoing | 0.99 (0.76–1.30) | 1.04 (0.77–1.40) | 1.02 (0.75–1.39) | 0.66 (0.48–0.93)* |
|   Avoidance | 1.02 (0.80–1.30) | 0.98 (0.76–1.26) | 0.77 (0.59–0.99)* | 1.18 (0.85–1.64) |

OR: odds ratio; CI: confidence interval; all ORs were adjusted for age, sex, income, education, country and daily cigarette consumption; *$P < 0.05$. [a]Questions not asked in the predictor wave.

of the previous literature and, at least in the case of making quit attempts, is consistent with theorized effects. The stronger the warnings, the greater they stimulate cognitive and behavioural reactions [6], and this is translated in some cases into the stimulation of quit attempts. The finding that the effects may be partly independent of intentions suggests that reacting to warnings has the potential to trigger spontaneous quit attempts, which is quite common [15], as well as to enhance intentions.

We have generally ignored the isolated significant effects, especially when the results across different survey waves were not consistently in the same direction. This means that we make no claims for any clear effects on smoking cessation outcomes; i.e. preventing relapse. It should come as no surprise that reactions to health warnings when smoking do not predict outcomes once quit, as the ex-smoker will no longer have cigarette packs with them, so their potential effects on the success of quit attempts are likely to be diluted. Further, there is no reason to believe that reactions to packs while smoking would be associated strongly enough with reactions after quitting for effects to persist.

In this paper we found no consistent effect of warning avoidance on subsequent behaviour, but the trends were for a positive effect, and the bivariate effects were always positive and significant. This is further evidence against the position that cigarette packet warning avoidance is an indicator of psychological reactance that might inhibit desired behaviour change (e.g. quitting), as postulated by some theorists [9], indeed any effects, albeit indirect, are positive.

We found no evidence of interactions with country in the analyses. This was generally expected, as the by-country differences in strength of warnings are measured directly by the strengths of reactions to them. The two instances where this might not be so were where new stronger warnings were introduced between survey waves (waves 1–2 for the United Kingdom and waves 4–5 for Australia). We are unclear of what implications there are for failure to find interactions in these cases. Overall, the findings are consistent with the reactions (most notably cognitive responses and forgoing cigarettes) having a causal impact on subsequent quit attempts; however, it remains possible that some unmeasured third variable is responsible for both. The only possibility we can think of is something like overall motivation to quit. However, we had a measure of quit intentions and at least part of the effects were independent of it so it seems unlikely that motivation can explain the findings,

although it is possible that a more comprehensive measure of it might. Further, if motivation was the unmeasured third party, we would expect interactions with country (as a proxy for warning strength) as the variance in warnings should weaken the relationship between the reactions to the warnings and the unmeasured motivation. In the absence of a plausible alternative mechanism for the findings we conclude that a causal role for the reactions to the warnings is likely.

Regardless of their causal role, it is clear that the measures of cognitive responses and forgoing cigarettes are useful indicators of the potential effectiveness of pack health warnings. These measures can now be used as intermediate indicators of warning label effectiveness, which should be useful in pre-testing of potential new warning content and form.

Replicating the associations several times is a major strength of this study, as it provides an indication of the stability of the associations. Further, the specificity of the effects demonstrates that the predictive relationships are, as expected, stronger for the reactions that are conceptually closest to making quit attempts, such as being triggered to think about quitting or to forgo smoking a cigarette.

### Implications for policy makers

These data provide the strongest evidence to date that health warnings stimulate reactions that are predictable antecedents of quitting attempts. While the effects are mediated partly through intentions to quit, there is clear evidence that some of the effect is independent of intentions (at least as measured in this study). Based on the findings from this study, and the absence of any credible alternative hypothesis to explain the findings, we conclude that the stronger the warnings the greater the reactions, and thus the greater the quitting activity they evoke. That said, the total impact on smoking prevalence is too small to estimate accurately. Health policy makers should be seeking to implement strong, large, graphic warnings to maximize their effectiveness in achieving their goal of warning people off continuing to smoke. This strengthens the case for the strongest possible implementation of the Framework Convention on Tobacco Control (FCTC) requirements on health warnings.

Given the growing international interest in improving health warnings on tobacco products [16] there is also a need for more research on the optimal design of such warnings. In particular, there is a need to strengthen the evidence base in non-English speaking countries, in countries with low literacy levels and for the impact of warnings on youth experimenters and new smokers. The measures validated here as indicators of subsequent cessation could be used by developers of warnings to test their probable impact.

### Declarations of interest

None.

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