

When Warnings Wear Thin: Repeated Exposure, Habituation and the Fading Power of Pictorial Cigarette Warnings in India

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Abstract

Background.

Pictorial health warnings on Indian cigarette packs cover 85% of the surface, yet a small set of images is repeated thousands of times each year, raising the question of whether warnings retain their force once a smoker has seen them countless times.

Objective.

To test whether, how and for whom pictorial-warning effectiveness declines with cumulative exposure among Indian adults.

Methods.

Cross-sectional survey of 418 adults (326 current smokers) in India. Seven constructs exposure, wear-out sensitivity, attentional avoidance, behavioural avoidance, current emotional impact, current cognitive processing and quit-related behaviour were measured on five-point scales and modelled using confirmatory factor analysis and structural equation modelling. Bootstrapped serial mediation (5,000 resamples), interaction and quadratic exposure terms, a paired recalled-versus-current emotion test and a smoking-duration ANOVA were estimated.

Results.

The model fitted well ($\chi^2/df = 2.16$; CFI = .928; RMSEA = .047). Exposure raised wear-out ($\beta = .408$) and wear-out accelerated non-linearly (quadratic term $\beta = .173$, $p = .003$). Recalled first-exposure emotion exceeded current emotion ($\Delta = 0.79$, $t = 11.46$, $p < .001$). Wear-out did not directly suppress current emotion or cognition; attentional avoidance predicted both and fed behavioural avoidance ($\beta = .670$), which predicted quitting ($\beta = .427$). A larger perceived warning buffered wear-out ($\beta = -.146$); rotation did not. Long-term smokers showed the most wear-out and least quitting.

Conclusion.

Warning wear-out is real, accelerating and concentrated in long-term smokers, but avoidance signalled retained impact rather than indifference. Larger warnings, visible rotation and cessation support for heavy smokers are indicated.

1. Introduction

A cigarette pack is among the objects a smoker looks at most often. Someone who gets through twenty cigarettes a day meets the pictorial warning at least twenty times, which adds up to well over seven thousand viewings across a single year.¹ India pushes this exposure further than almost anywhere else: the graphic warning now occupies 85% of the principal display area, yet only a small set of images circulates at any time before being rotated.^{2,3} The result is a large population of smokers who see the same disturbing pictures, at very high frequency, for months on end. This revives a question that has occupied communication researchers for decades whether a warning that genuinely unsettles a person the first time keeps that power once it has been seen thousands of times.^{4,5}

The gradual loss of response to a repeated message is known as the wear-out effect.⁴ It matters for policy in a direct way. If a warning worked the same on its thousandth viewing as on its first, the value of the whole programme would depend only on how good the image is. But if repetition dulls the shock, quietens the thinking the image provokes and weakens its pull towards quitting, then the long-run return on the policy will be smaller than first-exposure studies imply.^{6,7} The practical question is therefore not whether the warnings work once, but whether they keep working a question that bears on how often images should be rotated, whether they should be enlarged, and where scarce cessation support should be directed.

India offers an unusually demanding test of these ideas. Tobacco use remains widespread the most recent national survey put adult tobacco use at close to 29% and the country moved early and hard on packaging, mandating pictorial warnings that cover 85% of both faces of the pack from 2016 under the Cigarettes and Other Tobacco Products Act.²⁰ In principle this maximises the reach of every image; in practice it also maximises repetition, because the same few pictures are met by the same smokers thousands of times before they are changed. High coverage combined with low image turnover is exactly the condition under which advertising and habituation research would predict the fastest wear-out,^{10,11} yet almost all direct evidence on warning wear-out comes from countries with smaller warnings, larger image libraries or shorter exposure histories. Establishing whether, and how quickly, wear-out occurs under Indian conditions is therefore both a theoretical and a practical priority.

Most of what is known about warning wear-out comes from high-income settings and rests heavily on experimental and eye-tracking work.^{8,9} Far less is known about a setting like India, where coverage is among the highest in the world, the smoker population is large and young, and a sizeable share of cigarettes is bought as single sticks that can be handled without ever seeing the pack. India therefore sits close to an upper bound on warning exposure, and it is precisely where habituation, if it occurs at all, should be easiest to detect. This study asks three linked questions among Indian adults. Does warning effectiveness decline with cumulative exposure, and if so, does that decline run in a straight line or accelerate? Through what psychological route does it operate does becoming used to a warning simply switch off feeling and thought, or does something more active happen? And for whom is wear-out strongest?

2. Conceptual Background

The model tested here draws on three traditions. Advertising wear-out theory describes an inverted-U over repeated exposures: a message first gains effect as audiences move from unfamiliarity to recognition, then loses it as continued repetition breeds boredom and irritation, with wear-out fastest when messages are simple, uniform and frequent^{4,10,11} a fair description of a handful of pack images encountered daily. Perceptual habituation theory grounds this in attention: the orienting response that a novel stimulus triggers weakens steadily with repetition until the stimulus no longer captures the eye,¹² a pattern confirmed for warnings by eye-tracking and psychophysiological studies showing that experienced smokers look at the warning area less and react to it less strongly than newer smokers.^{13,14,15}

Defensive avoidance theory introduces a complication. Some smokers who most actively avoid warnings covering packs, using sleeves, buying loose sticks remain emotionally engaged rather than habituated, so avoidance and concealment cannot simply be read off as proof that a warning has stopped working.^{9,16} This study therefore separates two kinds of avoidance: attentional avoidance, a perceptual response rooted in habituation, and behavioural avoidance, a physical response rooted in defensive avoidance and in the resistance that an intrusive, repeated message can provoke.¹⁷ The residual feeling-based and thinking-based responses are framed, respectively, by the peripheral and central routes of the Elaboration Likelihood Model⁵ and by the threat-and-coping logic of the Extended Parallel Process Model.¹⁸ The resulting adaptive wear-out model predicts that exposure drives habituation and tuning-out; that tuning-out, rather than habituation itself, governs what remains of present-day emotion and thought; and that physical avoidance, far from marking indifference, may feed quitting behaviour. It further predicts that wear-out accelerates rather than rising evenly with exposure, that a larger warning slows it, and that long-term smokers carry the heaviest burden of it.

3. Methods

3.1 Design and setting

A cross-sectional survey of adults was conducted in urban and semi-urban India. The cross-sectional design is the predominant approach in the international warning-label literature and keeps the present findings comparable with it.^{1,8} As is standard in structural-equation work with observational data, directional language refers to theoretically specified paths estimated from the data rather than to experimentally established causation.¹⁹

3.2 Participants and sampling

A non-probability purposive strategy, supplemented by snowball referral, was used to recruit daily smokers, occasional smokers, former smokers and never-smokers, because pictorial warnings act on the whole exposed population and not on current smokers alone. The minimum age was 18, the legal

age for tobacco purchase in India. Data were gathered through two parallel channels face-to-face administration of a printed questionnaire in shops, markets, workplaces, and educational and health settings, and an identical online version so that respondents with limited digital access were not excluded. After screening for straight-lining, excessive missingness (more than 15% of items) and internal inconsistency, 418 valid cases were retained. The two channels were complementary: face-to-face contact reached respondents with lower digital literacy and income, who are routinely under-represented in online smoking surveys, while the online channel widened geographic reach and reduced interviewer effects on sensitive items such as daily consumption and quit intention.

The sample was young (61.3% aged 18–35; the largest band, 18–25, made up 35.9%) and predominantly male (70.1%), mirroring the wide male–female gap in Indian smoking.²⁰ Two-thirds held a graduate degree or above (graduate 43.8%, postgraduate 24.2%), while 11.5% had no formal schooling; monthly family income was spread across all bands, the commonest being ₹25,000–50,000 (27.8%). Current smokers comprised 78.0% of the sample (daily 40.9%, $n = 171$; occasional 37.1%, $n = 155$), with former smokers (7.9%, $n = 33$) and never-smokers (14.1%, $n = 59$) making up the remainder. For the wear-out analyses, current smokers were additionally grouped by smoking duration into new (≤ 1 year), mid-term (2–5 years) and long-term (> 5 years) categories. Of 412 respondents answering the noticeability item, 290 (70.4%) reported noticing the warning pictures a high baseline that makes habituation a real possibility.

3.3 Measures

Seven latent constructs were measured on five-point Likert scales (1 = strongly disagree to 5 = strongly agree), each adapted from established instruments. Exposure and Context captured how often the smoker handled the pack and met its warning.^{6,21} Wear-Out Sensitivity captured the felt sense that the warning had become familiar, repetitive and emotionally flat.^{4,14} Attentional Avoidance captured automatic look-away and non-reading the self-report counterpart of the eye-tracking avoidance documented in the literature.^{12,13} Behavioural Avoidance captured physical acts such as covering or turning the pack, using a case and buying loose sticks.^{16,22} Current Emotional Impact and Current Cognitive Processing were worded in the present tense to capture what survived of the feeling-based and thinking-based routes.^{5,23} Quit-Related Behaviour captured delaying, cutting down, quit attempts and help-seeking.^{24,25} Perceived warning-size adequacy entered as a moderator. A parallel set of recalled first-exposure emotion items, worded identically but referring to first sighting, supported a within-person emotional-change score.

3.4 Analysis

Analyses used SPSS 26 and AMOS 26. Internal consistency (Cronbach's α), confirmatory factor analysis and the Fornell–Larcker criterion established the measurement model.^{26,27,28} A full structural model was then estimated by maximum likelihood, with fit judged against conventional cut-offs χ^2/df below 3, CFI and TLI of at least .90, and RMSEA and SRMR no greater than .08.²⁷ Two serial-mediation routes were

tested with bias-corrected bootstrapping using 5,000 resamples.²⁹ Interaction terms (exposure × size, exposure × rotation) and a quadratic exposure term were formed after mean-centring. A paired-samples t-test compared recalled and current emotion, and a one-way ANOVA with Tukey follow-up compared the three smoking-duration groups.

4. Results

4.1 Measurement model

All seven constructs were reliable, with Cronbach's α ranging from .763 (behavioural avoidance) to .872 (wear-out sensitivity), every value clearing the .70 threshold²⁶ (Table 1). The confirmatory factor analysis fitted well ($\chi^2/df = 1.92$; CFI = .946; TLI = .937; RMSEA = .041; SRMR = .046).²⁷ Composite reliability exceeded .70 and average variance extracted exceeded .50 for every latent construct, and each construct's square-root AVE was larger than its inter-construct correlations, supporting convergent and discriminant validity²⁸ (Table 1).

4.2 Structural model

The full model fitted well ($\chi^2/df = 2.16$; CFI = .928; TLI = .914; RMSEA = .047; SRMR = .052) and explained 47.4% of the variance in quit-related behaviour, 54.6% in current emotion and 59.5% in wear-out (Fig. 1; Table 2). Three results stand out. First, exposure worked through two separate channels: frequency of contact drove habituation (exposure → wear-out, $\beta = .408$), while time since first exposure drove mental tuning-out (→ attentional avoidance, $\beta = .279$; both $p < .001$). Second, and against expectation, wear-out did not directly drain present-day emotion or thought both paths were near zero and non-significant whereas attentional avoidance strongly predicted each (→ emotion $\beta = .634$; → cognition $\beta = .411$; both $p < .001$). Third, avoidance ran in two steps: wear-out fed attentional avoidance ($\beta = .421$), which strongly fed behavioural avoidance ($\beta = .670$), while wear-out on its own slightly reduced physical avoidance ($\beta = -.146$). Quit-related behaviour was driven by current cognition ($\beta = .520$) and by behavioural avoidance ($\beta = .427$) but held back by a strong negative direct effect of wear-out ($\beta = -.470$; all $p < .001$). The shares of variance explained are comparable with those reported in other warning-label structural models,⁹ suggesting that the adaptive wear-out framework captures a substantial part of what moves smokers under repeated exposure.

4.3 Mediation

Both hypothesised indirect routes were significant: the four-step avoidance route (exposure → wear-out → attentional avoidance → behavioural avoidance → quitting; effect = .094, 95% CI [.042, .171]) and the three-step thinking route (exposure → attentional avoidance → cognition → quitting; effect = .118, 95% CI [.063, .203]). Because both effects are positive, exposure continued to nudge smokers towards quitting even when wear-out was high, but the push now travelled through the avoidance and thinking routes rather than through first-exposure shock.

4.4 Non-linear wear-out and the size buffer

Adding the quadratic term improved the model (exposure², $\beta = .173$, $p = .003$; $\Delta R^2 = .028$), and its positive sign means the wear-out curve bends upward: it stays fairly flat at low exposure and then climbs more steeply once exposure passes a threshold (Fig. 2). A larger perceived warning buffered the process (exposure $\times$ size, $\beta = -.146$, $p < .01$), flattening the slope of exposure on wear-out. Perceived rotation regularity did not (exposure $\times$ rotation, $\beta = -.010$, n.s.) a meaningful null, since awareness of rotation in this sample was weak and a rotation that smokers do not notice cannot slow habituation.

4.5 Emotional decline from first exposure to the present

The most direct test of wear-out compared recalled first-exposure emotion with current emotion within the same respondents. Recalled emotion was substantially higher than current emotion (3.93 versus 3.14), a mean fall of 0.79 of a scale point that was highly significant ($t = 11.46$, $p < .001$, $n = 352$; Table 3). On a five-point scale this is roughly the distance between a warning that clearly affects a smoker and one that does so only mildly. Read alongside the structural finding that wear-out did not directly suppress current emotion, the picture is subtle: emotion has fallen from its first-exposure peak exactly as classical theory predicts, yet a substantial level remains, sustained mainly through the attentional-avoidance route rather than driven down by habituation.

4.6 Who wears out fastest

Across smoking-duration groups the pattern was orderly and significant (Table 3). Wear-out rose from new to mid-term to long-term smokers (2.81, 3.36, 3.94; $F = 18.72$, $p < .001$), while current emotion fell (3.92, 3.45, 3.01; $F = 12.65$) and quit-related behaviour fell (3.21, 2.89, 2.41; $F = 10.84$; both $p < .001$). Tukey tests placed long-term smokers significantly apart from new smokers on all three measures, with mid-term smokers in between. The between-group fall in emotion mirrors, in cross-section, the within-person decline measured directly above.

5. Discussion

Five things follow from these results. First, wear-out in India is real but neither total nor steady. Exposure clearly raises it, and it climbs from new to long-term smokers, but the significant quadratic term shows it accelerates rather than rising evenly. Much of the wear-out literature has treated the decline as linear or smoothly asymptotic;^{4,6,14} the Indian data instead suggest a flatter early phase followed by a steeper fall once the same images have been in use long enough. The practical reading is that images should be replaced sooner than a linear assumption would advise, because the marginal loss of effect grows over time. In operational terms, the upward bend implies that rotation intervals set by the calendar alone may be too slow; tying replacement to cumulative exposure, or simply shortening the cycle, would keep images on the flatter early part of the curve where they still work.

Second, emotion does fall from its first-exposure peak. The within-person decline of 0.79 of a point, echoed by the between-group fall from new to long-term smokers, is clear evidence of emotional wear-

out, exactly as classical theory predicts.^{4,5} Recalled-emotion measures carry obvious limits, but the size and consistency of the drop make measurement artefact an unlikely sole explanation.

Third and this is the paper's central contribution that emotional decline does not mean the warning has stopped working. Wear-out did not directly drain current emotion or thought; attentional avoidance did the predictive work. The most coherent reading, consistent with recent experimental findings, is that looking away is a way of managing a warning that still disturbs the smoker, not proof that it has become inert.^{9,23} What looks like indifference on the surface may be active coping with an image that retains its bite the wear-out paradox. This reframes a long-standing assumption in the field, where avoidance has often been read as evidence of failure.^{13,16}

These findings sit alongside, rather than against, the international evidence. Experimental and trial work has shown that pictorial warnings outperform text and can raise quit attempts,^{8,25} but that evidence is drawn largely from first or short-term exposures. The present results trace what happens over the longer arc that a real smoker lives through: the first-exposure punch documented in those studies is genuine, but it erodes, and what sustains the warning thereafter is a quieter process of coping and avoidance rather than continued shock. Seen this way, wear-out is less a failure of the instrument than a predictable second phase in its working life one that policy can manage through image turnover and targeting rather than treat as a reason to abandon graphic warnings.

Fourth, avoidance has a constructive endpoint. Wear-out fed mental tuning-out, which fed physical avoidance, which in turn predicted quitting behaviour. Hiding the pack, turning it over, using a case or buying loose sticks have usually been treated as signs that the smoker has shut the warning out;¹⁶ in these data they are among the strongest signals that the warning has disrupted the smoker's routine in the way the policy intends.

Fifth, two policy levers separate cleanly. A larger warning slowed wear-out, while clearer rotation did not, at least as smokers currently perceive it. The size result extends the familiar point that bigger warnings are harder to ignore^{1,30} into the long-run, repeated-exposure setting. The rotation null is informative rather than disappointing: rotation can only help if smokers register it, and awareness here was weak. Because long-term smokers were simultaneously the most habituated, the least emotionally engaged and the least active in quitting, the evidence points to a coherent package larger warnings, rotation that is frequent and visibly different, and cessation support aimed squarely at heavily exposed, long-duration smokers.³¹ For India specifically, where coverage already stands at 85%, the lever with the most remaining headroom is not size but the turnover and salience of the image set, paired with targeted cessation outreach. The findings also caution against judging the programme by avoidance statistics alone, since avoidance here marked engagement as often as disengagement. Because the smokers who need help most are also those least reached by the warning's emotional appeal, linking the pack warning to an accessible quitline or a clinic referral printed on the pack may matter more in India than further increases in image size.

6. Limitations and Conclusion

Several limits temper these conclusions. The design is cross-sectional, so the directional paths are theoretically rather than experimentally established. The emotional-decline test relies on recalled first-exposure feeling, which is open to memory bias. The sample, recruited purposively in urban and semi-urban areas, is younger and more educated than the national smoker population, so the absolute levels reported here should be generalised with caution even though the internal relationships are likely to be robust. A longitudinal or experimental rotation study would test the acceleration finding more stringently. Finally, all constructs were self-reported in a single instrument, so common-method variance cannot be ruled out, although the good discriminant validity and the presence of several non-significant and oppositely-signed paths argue against a simple method-bias account.

Within these limits the picture is consistent. Warning wear-out among Indian smokers is real, accelerates with cumulative exposure and falls hardest on long-term smokers. Yet the warnings continue to move smokers towards quitting even under heavy repetition, and the avoidance that is so often read as failure frequently signals the opposite. Keeping the instrument effective therefore depends less on coverage, which is already high, than on refreshing the image set before its effect accelerates downward, making rotation visible, and concentrating cessation support on the smokers who have seen the warnings the most.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the principles of the Declaration of Helsinki. The research used an anonymous, non-interventional, self-administered questionnaire survey of adults and did not collect any personally identifying information. The study protocol was reviewed by the Departmental Research Committee, Department of Business Administration, Gauhati University, Guwahati, India, which determined that formal approval from an institutional ethics committee was not required for this category of minimal-risk, anonymous survey research. Participation was entirely voluntary, and informed consent was obtained from all individual participants prior to their completion of the questionnaire. All participants were aged 18 years or above.

Clinical trial number

Not applicable.

Consent for publication

Not applicable. This manuscript does not contain any individual person's identifying data, images or other personal details.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available in order to protect participant confidentiality, but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

SC conceived and designed the study, developed the survey instrument, collected and analysed the data, and drafted the manuscript. SS supervised the research, contributed to the study design and the interpretation of the results, and critically revised the manuscript. Both authors read and approved the final manuscript.

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Tables

Table 1: Reliability and validity of the measurement model (N = 418)

Construct	Items	Cronbach's α	CR	AVE	$\sqrt{\text{AVE}}$
Exposure and Context (EC)	2	.835	—	—	—
Wear-Out Sensitivity (WOS)	4	.872	.87	.63	.79
Attentional Avoidance (AA)	2	.806	.81	.58	.76
Behavioural Avoidance (AV)	3	.763	.83	.60	.77
Emotional Impact, Now (EI-N)	3	.803	.84	.64	.80
Cognitive Processing, Now (CP)	3	.803	.79	.56	.75
Quit-Related Behaviour (BR-Q)	4	.788	.86	.62	.79

Note. CR = composite reliability; AVE = average variance extracted. Thresholds: $\alpha \geq .70$, CR $\geq .70$, AVE $\geq .50$. EC was modelled as a two-item exposure index and is reported with α only. CFA fit: $\chi^2/df = 1.92$, CFI = .946, RMSEA = .041, SRMR = .046.

Table 2: Standardised path coefficients of the structural model

Path (outcome ← predictor)	β	p	Decision
WOS ← Exposure	.408	< .001	Accepted
AA ← Time since first exposure	.279	< .001	Accepted
AA ← WOS	.421	< .001	Accepted
AV ← AA	.670	< .001	Accepted
EI-N ← AA	.634	< .001	Significant
CP ← AA	.411	< .001	Significant
EI-N ← WOS	-.087	n.s.	Not accepted
CP ← WOS	.028	n.s.	Not accepted
BR-Q ← CP	.520	< .001	Accepted
BR-Q ← AV	.427	< .001	Accepted
BR-Q ← EI-N	-.172	< .05	Significant (negative)
BR-Q ← WOS (direct)	-.470	< .001	Significant (negative)
WOS ← Size adequacy	.556	< .001	Significant

Note. WOS = Wear-Out Sensitivity; AA = Attentional Avoidance; AV = Behavioural Avoidance; EI-N = Emotional Impact, Now; CP = Cognitive Processing, Now; BR-Q = Quit-Related Behaviour. n.s. = not significant ($p > .05$). R^2 : WOS = .595, EI-N = .546, BR-Q = .474.

Table 3: Emotional decline and differences by smoking duration

Panel A. Recalled vs. current emotional impact (paired-samples, n = 352)				
Measure	Mean	SD	t	p
Recalled emotion at first exposure	3.93	1.05	—	—
Current emotion (EI-N)	3.14	1.23	—	—
Emotional decline ($\Delta = 0.79$)	—	—	11.46	< .001
Panel B. Group means by smoking duration (one-way ANOVA)				
Variable	New (≤ 1 yr)	Mid (2–5)	Long (> 5)	F
Wear-Out Sensitivity (WOS)	2.81	3.36	3.94	18.72
Emotional Impact, Now (EI-N)	3.92	3.45	3.01	12.65
Quit-Related Behaviour (BR-Q)	3.21	2.89	2.41	10.84

Note. Five-point scales (1–5). All F-tests significant at $p < .001$; Tukey tests show long-term smokers differ from new smokers on all three variables.

Figures

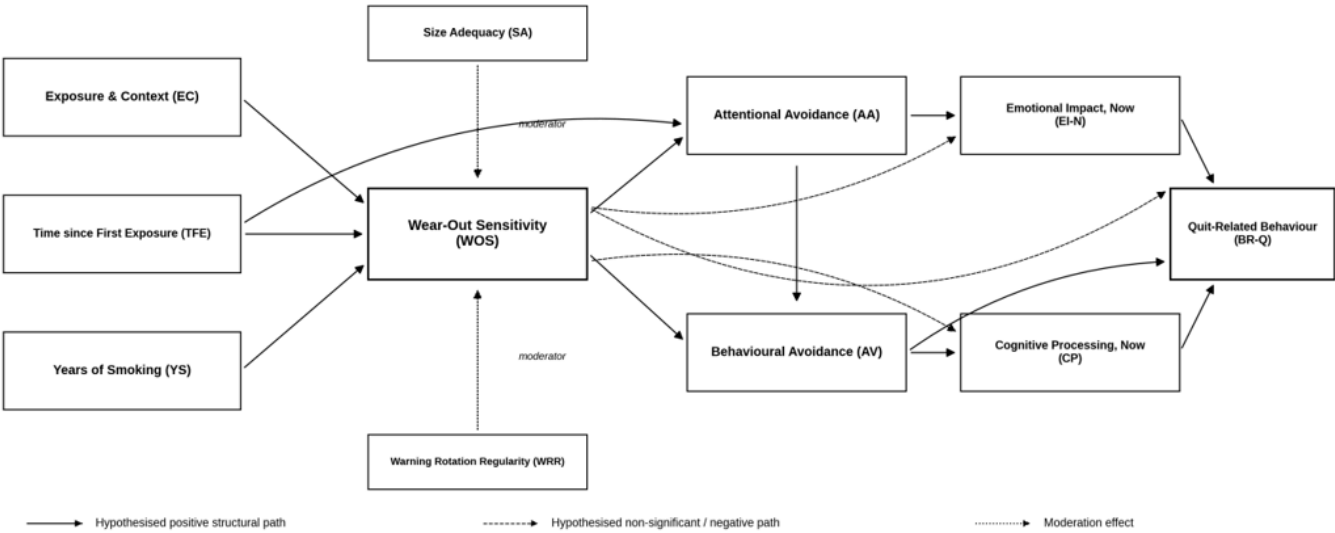


Figure 1

Structural model of the adaptive wear-out framework (standardised estimates).

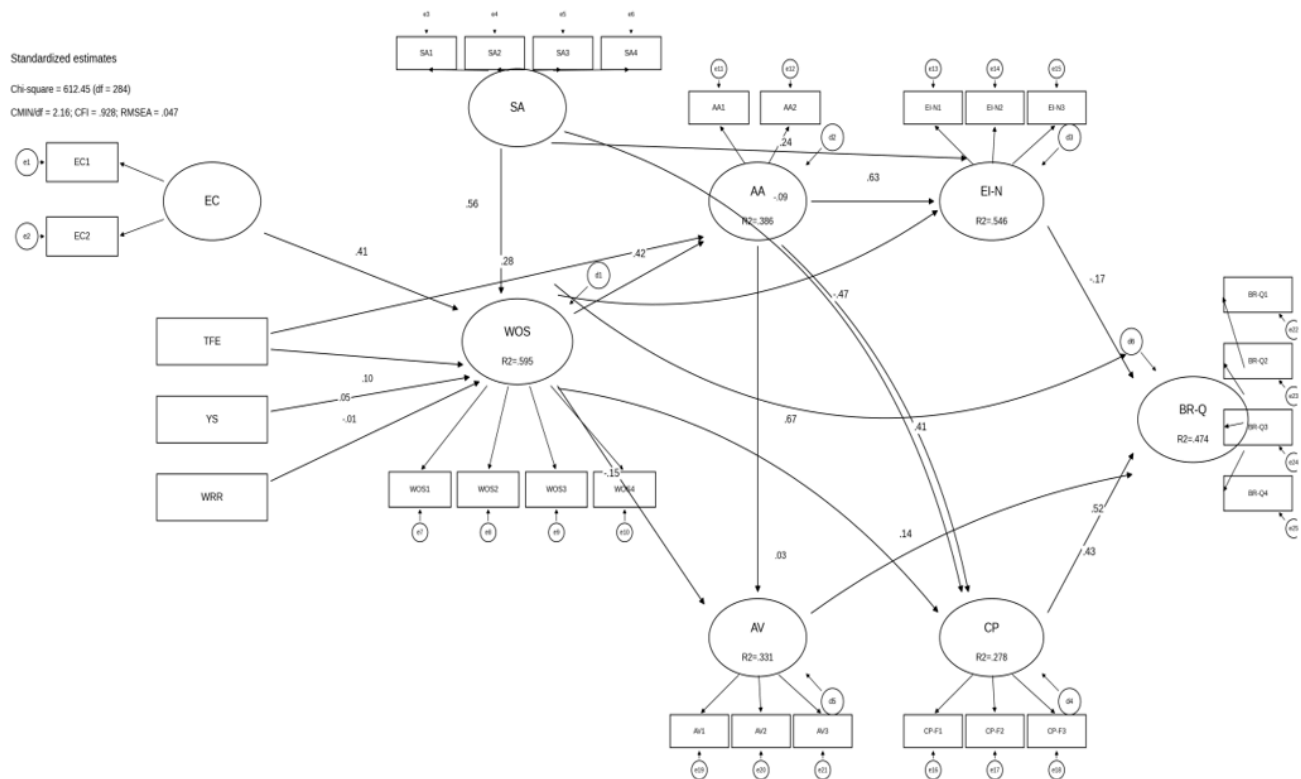


Figure 2

Predicted wear-out sensitivity across levels of exposure: quadratic fit versus linear reference.