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Construct and Predictive Validity of Three Measures of Intention to Quit Smoking: Findings From the International Tobacco Control (ITC) Netherlands Survey

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Abstract

Introduction: The aim of the study was to compare the construct validity and the predictive validity of three instruments to measure intention to quit smoking: a Stages of Change measure, the Motivation To Stop Scale (MTSS), and a Likert scale. We used the Theory of Planned Behavior as theoretical framework.

Methods: We used data from the International Tobacco Control Netherlands Survey. We included smokers who participated in three consecutive survey waves (n = 980). We measured attitude, subjective norm, and perceived behavioral control in 2012, intention to quit with three instruments in 2013, and having made a quit attempt in the last year in 2014. We conducted Structural Equation Modeling with three models for the instruments of intention separately and with one model that included the three instruments simultaneously.

Results: All three instruments of intention were significantly and positively related to attitude and perceived behavioral control but none was related to subjective norm. All three instruments were significantly and positively related to making a quit attempt. The relation of the Likert scale with making a quit attempt (β = 0.38) was somewhat stronger than that of the Stages of Change
measure ($\beta = 0.35$) and the MTSS ($\beta = 0.22$). When entering the three instruments together into one model, only the Likert scale was significantly related to making a quit attempt.

**Conclusions:** All three instruments showed reasonable construct validity and comparable predictive validity. Under the studied conditions, the Likert scale performed slightly better than the Stages of Change measure and the MTSS.

**Implications:** An assessment of the Stages of Change, the Motivation To Stop Scale, and a Likert scale showed comparable predictive and construct validity as measures for intention to quit smoking. All three instruments can be used in future research; however, under the studied theoretical framework, that is, the Theory of Planned Behavior, the Likert scale performed slightly better than the other two instruments.

**Introduction**

According to the Theory of Planned Behavior (TPB), if smokers evaluate smoking cessation as positive (attitude), if they think that important others want them to quit smoking (subjective norm), and if they are convinced that they can quit (perceived behavioral control), this results in high intention to quit, leading to a higher likelihood of actually quitting. Previous research has confirmed that intention to quit is the strongest predictor of making a future quit attempt. It is important for researchers to use the most valid instruments to assess these theoretical concepts. The aim of our study was to determine and compare the construct validity and the predictive validity of three different instruments that were used to measure intention to quit smoking in previous research: (1) an assessment of the Stages of Change, (2) the Motivation To Stop Scale (MTSS), and (3) intention measured by a Likert scale.

The Stages of Change concept is part of the Transtheoretical Model, which distinguishes three stages before behavior change: precontemplation (not planning to quit), contemplation (planning to quit within the next 6 months), and preparation (planning to quit within the next month). In the present study, we used a slightly modified algorithm and subdivided the precontemplators by adding a group of smokers who plan to quit smoking beyond the next 6 months because previous research has shown that the group of precontemplators often is not homogenous. The MTSS was developed for use in large-scale tracking surveys by West et al. in collaboration with the English Department of Health, and is based on the PRIME Theory of motivation. The instrument incorporates intention (eg, “I intend to stop smoking in the next month”), desire (eg, “I want to stop smoking”), and belief (eg, “I think I should stop smoking”) to quit. Another frequently used method to measure intention to quit smoking is by means of a Likert scale, for example, by asking how likely it is that smokers would quit within a specific time frame.

Previous studies assessing the validity of measures of intention to quit smoking have been conducted for the Stages of Change, and these have found mixed results. Studies about the validity of the MTSS have found a good predictive validity of the instrument. We are not aware of any studies about the validity of Likert intention scales in tobacco control research. To the best of our knowledge, this is the first study that analyzes and compares three different measures of intention to quit smoking regarding their construct and predictive validity. Construct validity refers to the extent to which an instrument adequately assesses the theoretical construct it is intended to and was designed to measure. In particular, hypothesized relations of a construct with other constructs should then be reflected by the empirical relations between measurements of these constructs. In the present study, an instrument of intention has good construct validity if it is positively related to measurements of attitude, subjective norm, perceived behavioral control, and making a quit attempt. Predictive validity refers to the extent to which an instrument can predict a certain outcome that is measured later in time. In the current study, a strong association between the instruments for intention and making a quit attempt would be indicative of good predictive validity.

In the present study, we addressed the following research questions: (1) which of the three instruments has the best construct validity? (2) which of the three instruments has the best predictive validity? and (3) do the different instruments have added value when used together in one model?

**Methods**

**Design and Sample**

We used data from three consecutive survey waves from the International Tobacco Control (ITC) Netherlands Survey, which is part of the global ITC Project. The ITC Netherlands Survey follows a prospective cohort design with annual surveys. Data for Wave 6 were collected in May–June 2012, for Wave 7 in May–June 2013, and for Wave 8 in May–June 2014. The ITC Netherlands Surveys were conducted using computer-assisted web interviews among a probability sample of Dutch smokers and quitters. Respondents who were lost to follow-up between survey waves were replenished by recruiting new respondents from the same sampling frame.

For the current study, we included respondents aged 15 years and older who participated in Waves 6–8 ($n = 1210$) and who were smoking in Waves 6 and 7. This resulted in an analysis sample size of $n = 980$. Respondents were classified as smoker if they had smoked at least 100 cigarettes in their lifetime and were currently smoking cigarettes at least monthly.

**Measurements**

**Covariates (2012)**

An overview of the measured variables is given in Table 1. We included sex, age, monthly gross household income, level of completed education, the Heaviness of Smoking Index (HSI), daily versus occasional smoking status, and whether or not respondents had made a quit attempt in the previous year (measured in 2012) as covariates into the analyses. Age was categorized into: 15–24 years, 25–39 years, 40–54 years, and 55 years and older. Monthly household income was categorized into three levels: low (<2000 Euros), moderate (2000–3000 Euros), and high (>3000 Euros). Completed education was also categorized into three groups: low (primary education and lower prevocational secondary education), moderate...
(middle prevocational secondary education and secondary vocational education), and high (senior general secondary education, [pre] university education, and higher professional education). The HSI was used as indicator of the level of nicotine dependence. This index is the sum of the categorized number of cigarettes smoked per day and the time to the first cigarette of the day. The HSI ranges from 0 to 6, with a higher score indicating higher nicotine dependence.\textsuperscript{33}

**TPB Determinants of Intention to Quit (2012)**

Smokers’ attitude toward quitting smoking was measured by asking: “If you quit smoking within the next 6 months, this would be…” Respondents used a five-point Likert scale to indicate their responses on three continua: unwise to wise, unpleasant to pleasant, and negative to positive.\textsuperscript{34} Cronbach’s alpha for these items was 0.84.

Subjective norm about quitting was measured by asking smokers: “How do you think that most of the people who are important to you would feel about your quitting smoking within the next 6 months?” Respondents answered this question on a five-point Likert scale (1 = strongly disapprove, 5 = strongly approve).\textsuperscript{35}

Perceived behavioral control to quit smoking was measured by asking smokers: “Suppose you want to quit smoking within the next 6 months, will you be able to resist smoking when: …you just woke up?”, “…you have experienced something annoying?”, “…you are having a cup of coffee or tea?”, “…you are drinking alcohol?”, and “…you are offered a cigarette?” Response options for these questions were: “I will certainly be able” (5), “I will probably be able” (4), “Maybe I will be able, maybe not” (3), “I will probably not be able” (2), and “I will certainly not be able” (1).\textsuperscript{36} Cronbach’s alpha for these items was 0.84.

**Intention to Quit (2013)**

The first measure of intention was an assessment based on the Stages of Change. Smokers were asked: “Are you planning to quit smoking: ...within the next month?” (4), “…within the next 6 months?” (3), “…sometime in the future, beyond 6 months?” (2), and “…or are you not planning to quit?” (1).\textsuperscript{37} Respondents also had the opportunity to answer with “don't know”. Those respondents were subsequently asked: “If you had to choose, what would you answer to this question be: Are you planning to quit smoking…” with the same response options as used in the first question.

The second measure was the MTSS. Smokers were asked: “Which of the following best describes you?” Response options were: “I don’t want to stop smoking” (1), “I think I should stop smoking but don’t really want to” (2), “I want to stop smoking but haven’t thought about when” (3), “I really want to stop smoking but don’t know when I will” (4), “I want to stop smoking and hope to soon” (5), “I really want to stop smoking and intend to in the next 3 months” (6), and “I really want to stop smoking and intend to in the next month” (7).\textsuperscript{38}

For the third measure, we used the question: “Are you planning to quit smoking within the next 6 months?” Respondents answered this question on a five-point Likert scale (1 = very unlikely, 2 = unlikely, 3 = maybe, maybe not, 4 = likely, 5 = very likely).\textsuperscript{39}

**Quit Attempts (2014)**

To measure whether respondents had attempted to quit, we asked all respondents: “Have you made any attempts to stop smoking in the last year?” (yes/no).\textsuperscript{40}

**Results**

**Attrition Analyses**

We compared respondents who were included in the analysis sample (n = 980) with respondents who were excluded, either because they quit smoking in Wave 7 or dropped out of the cohort (n = 624). The mean age of smokers who were included (40.8 years) was higher than the mean age of smokers who were excluded (36.1 years) (t = 5.97, p < .001). Smokers who were included had a higher level of nicotine dependence (t = 2.29, p < .05). The proportion of daily smokers compared to occasional smokers was higher in the analysis sample than in the group that was excluded (χ² = 10.1, p < .01). Smokers who were included did not differ regarding the sex distribution, their income, education, attitude toward quitting, perceived behavioral control to quit, subjective norm about quitting, and any of the three intention instruments.
Sample Description
In 2012, most respondents of the analysis sample (n = 980) were daily smokers (93.1%) and had made no quit attempt in the previous year (70.7%) (see Table 1). Furthermore, most respondents had quite a low intention to quit smoking in 2013. Regarding the Stages of Change measure, most smokers (58.9%) planned to quit sometime in the future, beyond 6 months. Almost one-third of the smokers (32.6%) scored level 2 of the MTSS, indicating that they thought they should stop smoking but did not really want to. Most smokers (39.1%) scored level 3 of the Likert scale, indicating that they “maybe or maybe not” would quit smoking within the next 6 months. In 2014, 33.5% of the respondents had made a quit attempt in the previous year.

Correlations
Table 2 shows the correlations between the TPB determinants (measured in 2012), the three intention measures (in 2013), and making a quit attempt (in 2014). Attitude, subjective norm, and perceived behavioral control were significantly correlated with all three intention instruments. Attitude correlated more strongly (range from r = 0.35 to r = 0.39) with all three instruments than subjective norm (range from r = 0.15 to r = 0.24) and perceived behavioral control (range from r = 0.19 to r = 0.24). Furthermore, attitude was highly correlated with subjective norm (r = 0.48, p < .001). All three measures of intention correlated significantly with making a quit attempt (the Likert scale: r = 0.35, p < .001; the Stages of Change measure: r = 0.32, p < .001; and the MTSS: r = 0.31, p < .001).

Structural Equation Models
Models with Separate Instruments of Intention
The model fit indicators of the three models were reasonable (CFI = 0.93–0.94, TLI = 0.88–0.89, RMSEA = 0.03–0.04). The factor loadings of attitude and perceived behavioral control were all significantly positive related to making a quit attempt (β = 0.32, p < .001; and the MTSS; β = 0.31, p < .001).

The model that included the Stages of Change measure explained 27% of the variance in making a quit attempt. Attitude (β = 0.37, p < .001) and perceived behavioral control (β = 0.16, p < .01) were significantly and positively related to the Stages of Change measure, but subjective norm was not significantly related (β = 0.04, p = .43) (see Figure 1A). Furthermore, the Stages of Change measure was significantly and positively related to making a quit attempt (β = 0.35, p < .001).

The model that included the MTSS explained 20% of the variance in making a quit attempt. Attitude was significantly and positively related to the MTSS (β = 0.43, p < .001), as was perceived behavioral control (β = 0.09, p < .05) (see Figure 1B). In contrast, subjective norm was not related to the MTSS (β = –0.01, p = .77). Moreover, the MTSS was significantly and positively related to making a quit attempt (β = 0.22, p < .001).

The model that included the Likert scale explained 27% of the variance in making a quit attempt. Attitude (β = 0.32, p < .001) and perceived behavioral control (β = 0.18, p < .001) were significantly and positively related to the Likert scale, but subjective norm was not (β = –0.04, p = .38) (see Figure 1C). The Likert scale was also significantly and positively related to making a quit attempt (β = 0.38, p < .001).

Model With All Three Instruments of Intention
Figure 2 shows the results of the model with all three instruments of intention entered at once. All three instruments were related to attitude. The Stages of Change measure and the Likert scale were also significantly and positively related to the Likert scale, but subjective norm was not (β = –0.01, p = .77) (see Figure 1D). The Likert scale was also significantly and positively related to making a quit attempt (β = 0.38, p < .001).
### Table 2. Pearson Correlations Between the TPB Determinants (2012), Intention to Quit Measures (2013), and Making a Quit Attempt (2014)

<table>
<thead>
<tr>
<th>Included measures</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Attitude toward quitting (2012)</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. Subjective norm about quitting (2012)</td>
<td>.48***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Perceived behavioral control to quit (2012)</td>
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<td>.05</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Stages of Change (2013)</td>
<td>.39***</td>
<td>.24***</td>
<td>.22**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Motivation to Stop Scale (MTSS) (2013)</td>
<td>.39***</td>
<td>.20***</td>
<td>.19**</td>
<td>.71***</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Likert scale (2013)</td>
<td>.35***</td>
<td>.15***</td>
<td>.24***</td>
<td>.69***</td>
<td>.67***</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>7. Quit attempt (2014)</td>
<td>.17***</td>
<td>.11**</td>
<td>.10**</td>
<td>.32***</td>
<td>.31***</td>
<td>.35***</td>
<td>1.00</td>
</tr>
</tbody>
</table>

* *p < .01, **p < .001.

### Figure 1. Structural Equation Models assessing the pathways between the TPB determinants (2012), (A) the Stages of Change measure (2013), (B) the MTSS (2013), (C) the Likert scale (2013) and making a quit attempt (2014). To simplify the presentation, the covariates and factor loadings were left out, and only pathways and estimates of interest are depicted. Dashed arrows indicate nonsignificant estimates. The reported results are for standardized variables. MTSS = Motivation To Stop Scale; TPB = Theory of Planned Behavior.
related to perceived behavioral control. However, in this model, only
the Likert scale was significantly related to making a quit attempt
($\beta = 0.31, p < .001$). The other two instruments did not have a sig-
nificant contribution in addition to the Likert scale in explaining the
variation in quit attempts.

Discussion

The aim of the current study was to determine the construct as well
as the predictive validity of three measures of intention to quit smok-
ing in the context of the TPB.1 We compared a measure of the Stages
of Change, the MTSS, and a Likert scale.

Our first research question was which of the three instruments
had the best construct validity. None of the tested instruments was
positively related to subjective norm about quitting, but all of them
were positively related to attitude about quitting, perceived behav-
ioral control to quit, and attempts to quit. This indicates that all three
instruments had comparable and reasonable construct validity
in our study. Previous research has also found a weak relation be-
tween subjective norm and quit intention.6 Therefore, it is possible
that our results are not an indicator for low validity of the instru-
mients for quit intention but that subjective norm is actually weakly
related to intention to quit smoking.

The second research question was which instrument had the best
predictive validity. The model that included the Likert scale had the
highest explained variance in making a quit attempt. Furthermore,
the relation of the Likert scale with making a quit attempt was
slightly stronger than the relation of the Stages of Change measure
and the MTSS. Therefore, the predictive validity of the Likert scale
was somewhat better than that of the Stages of Change measure and
the MTSS. It should be noted that all three instruments were signifi-
cantly positively related to making a quit attempt.

We also entered all three instruments together in one model to
examine whether they would have added value to each other (third
research question). Only the Likert scale was significantly and posi-
tively related to making a quit attempt in that model. The other two
instruments seemed to add no extra information to the prediction
of making a quit attempt. This means that in future studies, under
conditions that are similar to those of the present study, it is not
necessary to add more than one instrument of intention to a model
that aims to explain quit attempts.

The three instruments used different response options and labels
which led to different categorizations of intention, and smokers were
allocated into subgroups in a different way. The Stages of Change
measure uses four response options, and all of them include fixed
time frames of when a smoker plans to quit. The MTSS is more
sensitive by using seven response options of which some use fixed
timeframes. The Likert scale only asks about the intention to quit
in the next 6 months and uses no further timeframes. Researchers
of future studies should be aware of those differences between the
instruments. If one wants to use an instrument with the highest pre-
dictive validity and relatively high construct validity under the TPB,
the Likert scale seems to be a good choice. However, if one wants
to have more information about when exactly a respondent plans to
quit and, for example, wants to tailor an intervention based on the
moment a smoker intends to quit, a researcher might prefer using the
Stages of Change measure or the MTSS.

Limitations

The current study has several limitations. First of all, we only inves-
tigated whether attitude, subjective norm, and perceived behavioral
control would be related to the three measures of intention to quit.
It is possible that other constructs are related to intention as well,
such as the “processes of change” of the Transtheoretical Model.42
However, these variables were not included in the ITC Netherlands
Survey. Second, we used mainly observed variables in the current
study. It would be important to compare our results with models
that solely use latent variables, in particular, for subjective norm
because subjective norm was not related to any of the intention
instruments. It is possible that full construct validity could not be
shown due to the single item measure that we used for subjective
norm, making correlations with this measure prone to attenuation
effects because of its moderate reliability. Third, there was 1 year
between the measurements of the TPB determinants, the measure-
ments for intention to quit, and making a quit attempt. It is possible
that a different time interval might produce different results. Fourth,
we could not adjust our analyses for respondents’ baseline intention
to quit because the MTSS was only since 2013 included into the
ITC Netherlands Survey. Finally, our results may not be fully gen-
eralizable to the whole population of Dutch smokers. Smokers who
were less addicted and occasional smokers were more likely to be

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* $p < .05$, **$p < .01$, ***$p < .001$
excluded from the analyses. In particular, we found higher dropout of young respondents, which has been reported in a previous publication about attrition in the ITC Netherlands Survey.\footnote{\textsuperscript{10}}

**Conclusion**

In this study of smokers in the Netherlands, a measure of the Stages of Change, the MTSS, and a Likert scale showed comparable and reasonable construct validity as well as comparable predictive validity as instruments of intention to quit. The conditions of construct validity and predictive validity were slightly better met by the Likert scale in comparison with the other two instruments in our study.

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**Declaration of Interests**

JB has received unrestricted research grants relating to smoking cessation from Pfizer. RW undertakes research and consultancy and receives fees for speaking from companies that develop and manufacture smoking cessation medications (Pfizer, J&J, McNeil, GSK, Nabi, Novartis, and Sanofi-Aventis).

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