The Modified Reasons for Smoking Scale: factorial structure, validity and reliability in pregnant smokers

Katrien Sophie De Wilde MSc RM,1 Inge Tency PhD RM,1 Hedwig Boudrez PhD,2 Marleen Temmerman PhD MD,3 Lea Maes PhD4 and Els Clays PhD5

1Lecturer, Researcher, Department of Health, Odisee University College, Sint-Niklaas, Belgium
2Professor, Stop-smoking Clinic, Ghent University Hospital, Ghent, Belgium
3Senior Full Professor, Department of Obstetrics and Gynaecology, Ghent University, Ghent, Belgium
4Full Professor, Assistant Professor, Department of Public Health, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium

Abstract

Rationale, aims and objectives Smoking during pregnancy can cause several maternal and neonatal health risks, yet a considerable number of pregnant women continue to smoke. The objectives of this study were to test the factorial structure, validity and reliability of the Dutch version of the Modified Reasons for Smoking Scale (MRSS) in a sample of smoking pregnant women and to understand reasons for continued smoking during pregnancy.

Methods A longitudinal design was performed. Data of 97 pregnant smokers were collected during prenatal consultation. Structural equation modelling was performed to assess the construct validity of the MRSS: an exploratory factor analysis was conducted, followed by a confirmatory factor analysis. Test–retest reliability (<16 weeks and 32–34 weeks pregnancy) and internal consistency were assessed using the intraclass correlation coefficient and the Cronbach’s alpha, respectively. To verify concurrent validity, Mann–Whitney U-tests were performed examining associations between the MRSS subscales and nicotine dependence, daily consumption, depressive symptoms and intention to quit.

Results We found a factorial structure for the MRSS of 11 items within five subscales in order of importance: tension reduction, addiction, pleasure, habit and social function. Results for internal consistency and test–retest reliability were good to acceptable. There were significant associations of nicotine dependence with tension reduction and addiction and of daily consumption with addiction and habit.

Conclusions Validity and reliability of the MRSS were shown in a sample of pregnant smokers. Tension reduction was the most important reason for continued smoking, followed by pleasure and addiction. Although the score for nicotine dependence was low, addiction was an important reason for continued smoking during pregnancy; therefore, nicotine replacement therapy could be considered. Half of the respondents experienced depressive symptoms. Hence, it is important to identify those women who need more specialized care, which can include not only smoking cessation counselling but also treatment for depression.

Introduction

The health consequences of smoking during pregnancy for both mother and child are well documented. There is an increased risk of placental abruption, intrauterine growth restriction, pre-term birth, low birth weight, stillbirth, infant death, respiratory problems after birth and sudden infant death syndrome [1,2]. In Europe, the prevalence of smoking during pregnancy ranges from 7.6% in the Netherlands [3] to 31% in Spain [4]. In Flanders – the northern region of Belgium – the prevalence of smoking in women is 22.7% in the year prior to the pregnancy, decreasing to 12.3% during pregnancy [3], meaning that 10% quit when they plan a pregnancy or as soon as they discover they are pregnant. Hence, pregnancy is for some women a good opportunity to change smoking habits [5]. A systematic review of qualitative studies investigating the psychological and social factors around women attempting to quit smoking during pregnancy demonstrated that women were aware of the health risks for the foetus associated with smoking [6]. However, knowledge of potential health risks was not sufficient to motivate them to quit [6,7]. The findings of Gilman et al. sug-
gested that nicotine dependence may be the most important health barrier to smoking cessation during pregnancy [8].

Research from da Motta et al. showed that pregnant women continued to smoke for several reasons. Respondents mentioned emotional state, addiction to cigarettes, experiencing pleasure in smoking and influence of others, more specific, of a smoking partner, as factors that hinder smoking cessation. This study, however, was not carried out in pregnant women, but took place between 24 and 48 hours after birth [9]. Smoking pregnant women reported significantly higher scores on a depression scale [Beck Depression Inventory (BDI) scale] compared with non-smoking pregnant women [10]. Thus, experiencing depressive symptoms may also be a reason for continued smoking during pregnancy.

In general, smoking has been described as a way for individuals to control their feelings. According to Tomkins, four basic motivational characteristics of the behaviour of smokers can be distinguished: smoking to increase a positive affect, smoking to reduce a negative affect, habitual smoking or smoking with no affect and addictive smoking, which entails both positive and negative affect [11].

Based on this model, Horn and Waingrow originally created the Reasons for Smoking Scale (RSS), a 23-item scale with six subscales: handling, pleasure, habit/automatism, stimulation, tension reduction/relaxation and addiction [12,13]. The RSS was modified by Raymond Niaura to include a ‘social smoking’ subscale in addition to the traditional subscales [14]. This Modified Reasons for Smoking Scale (MRSS) consists of 21 questions measuring seven subscales. The MRSS is a widely accepted scale that offers the opportunity to make a more integral assessment of the smoker and to extend the assessment procedure with a more detailed psychological profile. In addition, the MRSS is practical to use because it is a short questionnaire that takes no longer than a few minutes to complete [15].

A number of studies confirmed the validity and reliability of translated versions of the MRSS. Berlin et al. tested the French version of the MRSS in male and female smokers who attended a smoking cessation programme and had a high intention to quit [14]. de Souza et al. tested the Brazilian version of the MRSS in male and female respondents who volunteered to donate blood and did not have the intention to quit smoking [16]. The Dutch version of the MRSS was tested by Boudrez and De Bacquer in male and female smokers who volunteered at the stop-smoking clinic and had a high intention to quit [15].

To our knowledge, there are no studies describing the use of the MRSS in pregnant women. The main aim of this study was to test the factorial structure, validity and reliability of the Dutch version of the MRSS in a sample of smoking pregnant women who subscribed for prenatal care. In addition, we wanted to obtain more insight into the reasons for continued smoking during pregnancy and into the profile of pregnant smokers, which is a necessary knowledge to develop tailored interventions or appropriate counselling.

Methods

Design

This study is part of a larger survey with an observational, longitudinal design, aiming to provide insight into the determinants of smoking and smoking cessation among Flemish pregnant women [10,17].

Data were collected at three points in time: before 16 weeks of pregnancy (T0), between 32 and 34 weeks of pregnancy (T1) and at least 6 weeks postpartum (T2).

Only data from smokers recruited at T0 were used in the present study, except for the test–retest reliability analysis for which data of smokers at T0 and T1 were used.

The study was approved by the Ethical Committee of Ghent University Hospital. All respondents provided oral and written informed consent and were assured of confidentiality.

Sampling

Recruitment and data collection took place between September 2008 and December 2012. Convenience sampling was used. As dropout of respondents could be expected in a longitudinal study, special attention was paid to the recruitment of pregnant smokers.

A total of 627 respondents were recruited, of which 102 were smokers (16.3%) at T0.

Two recruitment procedures were followed. Firstly, respondents were recruited by the research team during prenatal consultations in two hospitals. One hundred twenty-five women were recruited in the Ghent University Hospital and 140 women in AZ Nikolaas at Sint-Niklaas (total 265 women). At these locations, all respondents participated in a CO measurement using the Smokerlyzer Micro (Bedfont Scientific Ltd., Maidstone, Kent, England), a biochemical validation of the smoking status [18]. The first questionnaire was filled out at the moment of recruitment when there was enough time left; otherwise, the questionnaire was answered by telephone a few days later. Secondly, 467 registered gynaecologists and 198 registered independent midwives were sent requests to assist in recruiting respondents. Twelve gynaecologists and 10 midwives, geographically spread over Flanders, agreed to participate in the project. Through their mediation, 370 additional women were recruited. Data from these women were obtained through telephone survey without CO measurement.

Self-reported measurements

Smoking behaviour

At every time point, respondents were asked to provide details about their previous and current smoking status, daily consumption (cigarettes per day) and intention to quit. Data of all respondents categorized as smokers at T0 were used in this study. For the test–retest reliability analysis, data on the subgroup of women who were smokers at T0 and T1 were used. Daily consumption was coded into two levels: nine or less cigarettes per day and 10 or more cigarettes per day. Intention to quit was coded into two levels: no or low intention to quit and moderate or high intention to quit.

We used the Dutch version of the Fagerström Test for Nicotine Dependence (FTND) as an accepted and standard measurement of physical dependence on nicotine in order to test concurrent validity with subscales of the MRSS [19]. Scores on the test range from 0 to 10; a score between 1 and 2 indicates low nicotine dependence, between 3 and 4 low-to-moderate dependence, 5–7 moderate dependence and 8 or more indicate high dependence. Nicotine
dependence was assessed using the sum of the FTND and was coded into two levels: low (0–4) and high (5–10).

The Dutch version of the MRSS was administered, including 21 questions measuring seven subscales: addictive smoking, pleasure to smoke, tension reduction, social smoking, stimulation, automatic smoking and handling [14]. Answers were given on a Likert scale ranging from 1 (never) to 5 (always). The subscale score consisted of the sum of the scores on the questions belonging to that specific subscale.

**Depressive symptoms**

In order to test concurrent validity with subscales of the MRSS, the Dutch version of the BDI [20] was used for assessing the self-reported degree of depression [21]. The BDI examines an individual’s emotional condition in the week prior to assessment and is well suited for use in a primary care setting, both as a rapid screening test for depression during pregnancy and as a longitudinal assessment for depression [22,23]. It measures 21 emotional, behavioural and somatic symptoms, which are each rated from 0 to 3 [20]. Higher scores on the total inventory indicate an increased severity of depression [24]. The BDI was coded in two levels: nine or less indicating no symptoms of depression, and 10 or more indicating at least mild mood disturbance.

**Socio-demographic variables**

The questionnaire included the following variables: age, educational level, employment status and gravidity. Age was coded into two levels: <27 years (mean of the sample of smokers) and ≥27 years. Respondents were asked for the highest grade or year of school completed. The variable education was coded into two levels: secondary school certificate or lower, meaning 12 years of education or less, or college or university degree. Unemployed women and housewives were classified as not having a paid job; working women and women on maternity leave were classified as having a paid job. Gravidity was coded into primigravida (pregnant for the first time) or multigravida.

**Statistical analysis**

Characteristics of the respondents were described using mean and standard deviation for continuous variables and range and percentiles for categorical variables.

Structural equation modelling was performed to assess the construct validity of the MRSS [25]. An exploratory factor analysis (EFA) was conducted, followed by a confirmatory factor analysis (CFA). The weighted least squares means and variance adjusted estimation method was used for ordinal variables. Scaling of the latent variables was carried out indirectly by fixing the factor loading of the first observed item at one. A number of fit indices were considered to assess the fit of the proposed model to the empirical data [26]. The overall chi-squared fit index was calculated, but it is known to be largely influenced by sample size and therefore rarely used to evaluate a model fit. For the root mean square error of approximation (RMSEA), a value <0.06 was considered as a good fit, a value <0.08 was considered as an acceptable fit and a value >0.10 led to rejection of the model. For the comparative fit index (CFI) and the Tucker–Lewis index (TLI), a threshold value >0.90 was considered as a good fit [27]. Standardized factor loadings >0.50 were perceived as good, loadings >0.40 indicated an acceptable correlation and those <0.40 were perceived as low. Cronbach’s alpha was computed to examine the internal consistency of the MRSS subscales. A value of ≥0.70 was considered as good; a value of ≥0.60 as acceptable. Item–total correlations were accepted if they were between 0.30 and 0.70.

Test–retest reliability (T0 before 16 weeks of pregnancy, T1 between 32 and 34 weeks of pregnancy) was computed using the intraclass correlation coefficient (ICC). A value of ≥0.70 was considered as good; a value of ≥0.60 as acceptable.

Some of the subscales showed skewed distributions; they were described through median values and interquartile ranges; correlations among subscales and age and educational level were examined through Spearman correlation coefficients.

Concurrent validity of the MRSS subscales was examined by means of associations with nicotine dependence (FTND), daily consumption, depressive symptoms (BDI score) and intention to quit. For reasons of consistency, we used non-parametric Mann–Whitney U-tests to examine these associations.

All the analyses were performed using IBM SPSS 21 (IBM, Armonk, NY, USA), except the EFA and CFA, which were conducted using Mplus version 6 (Muthén & Muthén, Los Angeles, CA, USA).

**Results**

**Sample characteristics**

Results of 97 respondents were included, all of them were pregnant at the time of the study. The mean age of the sample was 27.3 ± 5.4 years, ranging from 17 to 41 years. Most respondents (70.1%) had a maximum of 12 years of education, 23.7% had a bachelor or masters’ degree, 6.2% was missing. Forty-two women (43.3%) were primigravida; 55 women (56.7%) were multigravida (range 2–8). Thirty-eight women (39.2%) worked full time, 22 (22.7%) worked part time, two (2.1%) were on maternity leave and 24 (24.7%) had no paid job (9.3% missing).

The mean daily cigarette consumption was 9.3 ± 6.2 cigarettes (range 1–28); the score on the FTND ranged between 0 and 7 with a mean score of 2.60 ± 1.86. The mean age at which the women started smoking was 15.2 ± 2.4, ranging from 10 to 23 years. The mean score on the BDI was 10.98 ± 6.57 (range 0–36; 17.5% missing), suggesting that many respondents experienced depressive symptoms. Thirty-five respondents (36.0%) had a normal score of 9 or lower; 45 respondents (46.2%) had a score of 10 or more (17.8% missing). In the group with an elevated score, 15 respondents (15.3%) even had a score of at least 15, the indicator of clinical depression; 30 respondents (30.9%) had a score between 10 and 14, suggesting a mild emotional disturbance.

**Construct validity, internal consistency and test–retest reliability**

The factorial structure of the MRSS in this sample of pregnant women was first verified with an EFA, which resulted in a seven-factor solution (based on the criterion of eigenvalue >1), with a good model fit (RMSEA = 0.04; CFI = 0.978; TLI = 0.945; \( \chi^2 = 97.35, P = 0.15 \)). The factor containing only one item was not retained. One factor with only negative loadings was also not...
retained. Seven items (1, 2, 9, 12, 15, 16 and 17) were deleted due to low loadings <0.40 on all factors. For the remaining items, a clear five-factor structure was recognized. This structure was tested and confirmed in a CFA, demonstrating an acceptable model fit (RMSEA = 0.074; CFI = 0.94; TLI = 0.91; $\chi^2 = 84.13$, $P = 0.01$) and factor loadings $\geq 0.40$.

Results are reported in Table 1, showing standardized factor loadings of the CFA, together with Cronbach’s $\alpha$ values for internal consistency. Cronbach’s $\alpha$ showed higher values after deleting items 21 and 13 from the social function and habit subscales, respectively. An additional CFA for the five-factor structure without items 21 and 13 indeed showed a slightly improved model fit (RMSEA = 0.075; CFI = 0.96; TLI = 0.94; $\chi^2 = 52.45$, $P = 0.02$). We therefore decided to delete both items and retain a final structure of 11 items belonging to five subscales. Internal consistency was good for the subscales tension reduction and social function (Cronbach’s $\alpha > 0.70$), acceptable for the subscale addiction (Cronbach’s $\alpha > 0.60$) and borderline acceptable for the subscales pleasure (Cronbach’s $\alpha > 0.59$) and habit (Cronbach’s $\alpha > 0.58$). The item–total correlation for the three-item subscale tension reduction ranged between 0.589 and 0.668.

The test–retest reliability of the subscales was assessed for 75 respondents who reported to be a smoker at T0 and T1 (dropout of 22.7%). The ICC was good ($>0.70$) or acceptable ($>0.60$) for all subscales (Table 1).

### Descriptive results for the subscales

Table 2 presents the median value and the interquartile range for all subscales. The highest scores were found for the subscales tension reduction, pleasure and addiction. Significant positive correlations were detected among the different subscales (Table 2).

In order to control for potential confounders, correlations between the subscales, age and educational level were examined. A significant negative correlation between age and the subscale social function was observed. No significant correlation was observed between the subscales and educational level (results not shown).

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**Table 1 Results of confirmatory factor analysis (standardized factor loadings), internal consistency (Cronbach’s alpha) and test–retest reliability (intraclass correlation coefficient) of the MRSS in 97 pregnant smokers**

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Tension reduction</th>
<th>Social function</th>
<th>Pleasure</th>
<th>Addiction</th>
<th>Habit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I smoke cigarettes to keep myself from slowing down.</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Handling a cigarette is part of the enjoyment of smoking it.</td>
<td></td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Smoking cigarettes is pleasant and relaxing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I light up a cigarette when I feel angry about something.</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. When I have run out of cigarettes, I find it almost unbearable until I can get one.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I smoke cigarettes automatically without even being aware of it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7. It is easier to talk and get along with other people when smoking.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I smoke cigarettes to stimulate me, to perk myself up.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Part of the enjoyment of smoking a cigarette comes from the steps I take to light up.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I find cigarettes pleasurable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. When I feel uncomfortable or upset about something, I light up a cigarette.</td>
<td></td>
<td></td>
<td>0.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I am very much aware of the fact when I am not smoking a cigarette.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. I light up a cigarette without realizing I still have one burning in the ashtray.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. While smoking I feel more confident with other people.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. I smoke cigarettes to give me a ‘lift’.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. When I smoke a cigarette, part of the enjoyment is watching the smoke as I exhale.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. I want a cigarette most when I am comfortable and relaxed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. When I feel ‘blue’ or want to take my mind off cares and worries, I smoke cigarettes.</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. I get a real gnawing hunger for a cigarette when I haven’t smoked in a while.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. I’ve found a cigarette in my mouth and did not remember putting it there.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.71</td>
</tr>
<tr>
<td>21. I smoke much more when I am with other people.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cronbach’s $\alpha$</td>
<td>0.79</td>
<td>0.85</td>
<td>0.56</td>
<td>0.67</td>
<td>0.47</td>
</tr>
<tr>
<td>Intra-class correlation coefficient**</td>
<td>0.79***</td>
<td>0.65***</td>
<td>0.78***</td>
<td>0.74***</td>
<td>0.61***</td>
</tr>
</tbody>
</table>

* $P < 0.05$  ** $P < 0.01$  *** $P < 0.001$ (two tailed).
1 Cronbach’s alpha after deleting item 21.
2 Cronbach’s alpha after deleting item 13.
3 Seven items were not retained in the confirmatory factor analysis (CFA) due to negative loadings or loadings below 0.40 in the exploratory factor analysis.
4 One subscale with only one item was not retained in the CFA.
5 Test–retest reliability analysis was performed on a smaller sample of 75 respondents.

MRSS = Modified Reasons for Smoking Scale.

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**Concurrent validity**

We examined associations between the different subscales and nicotine dependence, daily consumption, depressive symptoms and intention to quit (Table 3).

There was a significant association between nicotine dependence and the subscales tension reduction (Mann–Whitney $U = 814.000; P < 0.01$) and addiction (Mann–Whitney $U = 788.000; P < 0.01$): women with a higher FTND score scored higher on these subscales.

There was also a significant association between daily consumption and the subscales addiction (Mann–Whitney $U = 1630.000; P < 0.01$) and habit (Mann–Whitney $U = 1531.000; P < 0.01$): women who reported a higher daily consumption scored higher on these subscales.

**Discussion**

To our knowledge, this study was the first to examine the factorial structure, validity and reliability of the Dutch version of the MRSS in a sample of smoking pregnant women who registered for prenatal care. As a second aim, we wanted to obtain more insight into the reasons for continued smoking during pregnancy and into the profile of pregnant smokers, which is necessary for developing tailored interventions or appropriate counselling.

Our study population consisted of pregnant women with lower daily cigarette consumption and lower nicotine dependence than the study populations of previous psychometric research on the MRSS of Berlin *et al.* and Boudrez and De Bacquer [14,15]. In the present study, the mean daily consumption was 9.3 ± 6.2 cigarettes (range 1–28), while others registered a mean daily consumption in women of 25.1 ± 7.5 cig/day [14] and 21 cig/day [15], which is more than double compared with our study population. The score on the FTND ranged between 0 and 7 with a mean score of 2.60 ± 1.86 which is lower than in previous studies (6.3 ± 1.9 in Berlin *et al.* and 6.3 in Boudrez and De Bacquer) [14,15]. Characteristics of our study population were more comparable with de Souza *et al.*, who found a mean daily consumption of 15 ± 9.2 cig/day, and a FTND score of 3.7 ± 2.4 [14]. It should be taken into account that the inclusion criteria for the other studies were different and that our study population was pregnant unlike the respondents in previous research. It is known that pregnant women reduce their daily consumption compared with the months before their pregnancy [28].

Berlin *et al.* tested the French version of the MRSS in male and female smokers who registered in a smoking cessation programme [14], de Souza *et al.* tested the Brazilian version of the MRSS in male and female respondents who volunteered to donate blood [16]. They both confirmed the factorial structure with seven subscales of the original MRSS. Boudrez and De Bacquier tested

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**Table 2** Descriptive results for and correlations among the MRSS subscales (Spearman’s correlation coefficient) in 97 pregnant smokers

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Median IQR</th>
<th>Tension reduction</th>
<th>Social function Pleasure</th>
<th>Addiction</th>
<th>Habit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension reduction</td>
<td>4.0 (3–4.33)</td>
<td>1</td>
<td>0.254*</td>
<td>0.160</td>
<td>0.330**</td>
</tr>
<tr>
<td>Social function</td>
<td>2.0 (1–3)</td>
<td>1</td>
<td>0.150</td>
<td>0.150</td>
<td>−0.020</td>
</tr>
<tr>
<td>Pleasure</td>
<td>3.5 (3–4)</td>
<td>1</td>
<td>0.213*</td>
<td>0.213*</td>
<td>0.016</td>
</tr>
<tr>
<td>Addiction</td>
<td>3.5 (3–4)</td>
<td>1</td>
<td>0.297**</td>
<td>0.297**</td>
<td>1</td>
</tr>
<tr>
<td>Habit</td>
<td>2.5 (1.5–3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05. **P < 0.01. ***P < 0.001 (two tailed).

IQR = interquartile range; MRSS = Modified Reasons for Smoking Scale.

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**Table 3** Association of MRSS subscales with smoking behaviours and depressive symptoms in 97 pregnant smokers

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Tension reduction MD (IQR)</th>
<th>P-value</th>
<th>Social function MD (IQR)</th>
<th>P-value</th>
<th>Pleasure MD (IQR)</th>
<th>P-value</th>
<th>Addiction MD (IQR)</th>
<th>P-value</th>
<th>Habit MD (IQR)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependence (FTND)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (n = 81)</td>
<td>12 (9–13)</td>
<td>0.146</td>
<td>7 (6–8)</td>
<td>0.088</td>
<td>9 (6.5–10)</td>
<td>0.120</td>
<td>5 (3–6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High (n = 13)</td>
<td>13 (12.75–14.25)</td>
<td>0.230</td>
<td>7 (6–8)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily consumption</td>
<td>0.230</td>
<td></td>
<td>7 (6–8)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤9 cig/day (n = 47)</td>
<td>12 (8–13)</td>
<td></td>
<td>7 (6–8)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥10 cig/day (n = 50)</td>
<td>12 (10–13)</td>
<td></td>
<td>7 (6–8)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressive symptoms (BDI score)</td>
<td>0.223</td>
<td></td>
<td>7 (6–8)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–9 (n = 33)</td>
<td>12 (9–13)</td>
<td></td>
<td>7 (6–8)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥10 (n = 46)</td>
<td>13 (10–13)</td>
<td></td>
<td>7 (6–9)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention to quit</td>
<td>0.696</td>
<td></td>
<td>7 (6–9)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (n = 35)</td>
<td>12 (9–13)</td>
<td></td>
<td>7 (6–9)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High (n = 62)</td>
<td>12 (9–13)</td>
<td></td>
<td>7 (6–9)</td>
<td>0.778</td>
<td>8 (6–9)</td>
<td>0.001</td>
<td>6 (5.25–8.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P-value based on results of Mann–Whitney U-test.

BDI = Beck Depression Inventory; FTND = Fagerström Test for Nicotine Dependence; IQR = interquartile range; MD = median; MRSS = Modified Reasons for Smoking Scale.
the Dutch version of the MRSS in male and female smokers who volunteered at a stop-smoking clinic [15]. They identified four factors; however, a different method was applied, forcing alternative models in case a factor included less than three items. In the present study, the seven original factors were identified using EFA, but due to a factor containing only one item and another factor with only negative loadings, these items were not retained. Based on CFA and reliability analyses, the final solution included five subscales with good to (borderline) acceptable internal consistency and good to acceptable test–retest stability: tension reduction, social function, pleasure, addiction and habit. The subscales handling and stimulation were not retained in the final solution. This could mean that only the most important reasons for smoking remain relevant during pregnancy. This is in line with other findings from da Motta et al., where the mostly cited reasons were pleasure, dependency, stress or negative emotions and influence of others [9].

Research shows that most pregnant smokers endorse smoking as an essential coping mechanism, even if they are aware of the health consequences [6]. In the present study, the highest score was found for the subscale tension reduction indicating this is the main reason why pregnant women continued smoking. The transition to motherhood and corresponding role changes can influence the stress level [29] and, possibly, smoking can be a way to relieve stress or to cope with stressful situations. The subscales pleasure and addiction scored almost as high as the subscale tension reduction. Besides smoking in order to relieve stress, pregnant women also smoked because they enjoy smoking or because they expressed that they are addicted to cigarettes, although the FTND showed no excessive high scores in this sample. Habit and social function had the lowest scores. The items in the MRSS regarding habit refer to situations where someone is not aware of the fact that she is smoking. Probably, a pregnant woman is very aware of lighting up a cigarette, especially when she is in the presence of others. Social control and the taboo regarding smoking during pregnancy could influence the scores on these subscales.

Concurrent validity of the MRSS subscales in relation to several variables was examined. In line with the study of Berlin et al., we found a significant relationship between daily consumption and the subscale addiction [14]. Women who had a higher daily consumption indicated that they smoked more for reasons of addiction. It is known that addiction to cigarettes can hinder smoking cessation [9]. There was also a significant association between nicotine dependence and the subscales tension reduction and addiction, meaning that women with higher FTND scores reported a higher cigarette consumption. It was remarkable that the mean score on the FTND was 2.6, indicating that respondents had a low average physical dependence. It could be that they experienced a more psychological dependence and were concerned about having craving symptoms. The most common symptoms of nicotine withdrawal are both physical and psychological: dysphoric or depressed mood, insomnia, irritability, frustration, anger, anxiety, restlessness, difficulty concentrating, decreased heart rate and increased appetite or weight gain [30]. It is important for health care workers to discuss possible craving symptoms prior to quitting and to search for any solution taking into account the preferences of the client. Advising the intake of nicotine replacement therapy (NRT) is one way to deal with craving symptoms. NRT is the only pharmacotherapy for smoking cessation that has been tested in randomized controlled trials (RCTs) conducted in pregnancy. Suter et al., conducted a comprehensive review regarding the effects of nicotine on the foetus and the effect of NRT during pregnancy, including the use of the nicotine containing patch and gum and the e-cigarette [31]. Until now, there is lack of evidence whether NRT – regardless of the method of administration – is effective or safe when used to promote smoking cessation in pregnancy or whether it has positive or negative impacts on pregnancy outcomes. Therefore, further research on the efficacy and safety of NRT during pregnancy is needed, in particular evidence from placebo-controlled RCTs investigating higher doses of NRT than those already tested in previous studies [31,32]. The use of bupropion and varenicline is contraindicated during pregnancy [33]. Extensive research showed an elevated risk for ventricular septal defect in women who used bupropion during the first trimester of their pregnancy [34]. Harrison-Woolrych et al., performed a nationwide cohort study on the use of varenicline during pregnancy in New Zealand during a period of 4 years. Only 23 of 2739 pregnant women reported the use of varenicline while pregnant. Adverse outcomes were identified in 5 of 17 live births, but it was difficult to assess the possible role of varenicline. Because of the limited numbers of cases in this study, it was difficult to draw conclusions, and further research is necessary [35].

Although we did not find a significant relationship between the MRSS subscales and depressive symptoms, we observed that the majority of the respondents (46.2%) scored above 10 on the BDI. Symptoms of depression may contribute independently to persistent smoking during pregnancy [36]. Depressed persons may smoke to immediately improve their sense of well-being or as a quick reward. These responses may make it more difficult for depressed pregnant women to quit smoking [37]. Previous research on this sample of respondents showed that most smoking women were low educated (maximum of 12 years of education) and a significant relationship between smoking, low educational level and depression was established in this study [10]. Therefore, it is important to identify those women who need more specialized care, which can include not only smoking cessation counselling but also treatment for depression.

The strength of the present study is that it is the first to examine the factorial structure, validity and reliability of the Dutch version of the MRSS in smoking pregnant women through a longitudinal study. This scale was already tested in a population of men and women, whether or not considering smoking cessation, but to our knowledge, the MRSS was never investigated in a pregnant population. Particular strengths of the study are the availability of detailed assessments of smoking behaviour and psychological profile in pregnant women, the use of interview-based data collections and biochemical validation of the smoking status.

A limitation that deserves consideration is the relatively small sample size of the present study. In total, data of 97 respondents were eligible for analysis. However, this is the first time that the MRSS was tested in pregnant women; the novelty of this small sample needs to be considered. There are generally two types of recommendations for required sample size in factor analysis: based on the minimum absolute number of cases or based on the subject-to-variable ratio [38]. In this study, the subject-to-variable ratio is close to the recommended minimum of 5:1 [39,40].
Modification of smoking scale for pregnancy: results of a cross-sectional study

K. De Wilde et al.

Modified Reasons for Smoking Scale in Pregnancy

Conclusion
In conclusion, validity and reliability of the MRSS were shown in a sample of pregnant smokers who subscribed for prenatal care. Based on data from 97 pregnant smokers, we found a factorial structure for the MRSS of 11 items within five subscales showing an acceptable to good model fit. Results for internal consistency and test–retest reliability of the five subscales were good to acceptable. The results of this study thus suggest that the MRSS is appropriate for use in pregnant smokers.

Tension reduction was the most important reason why pregnant women smoked, followed by pleasure and addiction. Although the average score for nicotine dependence was low in this sample, addiction was an important reason for continued smoking during pregnancy and NRT could therefore be considered. Half of the respondents experienced depressive symptoms. Hence, it is important to identify those women who need more specialized care, which can include not only smoking cessation counselling but also treatment for depression.

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References


