



# Optimizing smoking cessation guideline implementation using text-messages and summary-sheets: A mixed-method evaluation



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## ARTICLE INFO

### Article history:

Received 26 March 2019

Revised 22 July 2019

Available online 13 August 2019

### Keywords:

Implementation

Text messages

Smoking cessation care

Tobacco dependence guideline

Healthcare professionals

## ABSTRACT

**Objectives:** Implementation of smoking cessation care (SCC) guidelines is suboptimal. This mixed-method study evaluated a two-component implementation strategy for the revised Dutch multidisciplinary tobacco dependence treatment guideline, which consisted of the provision of text-messages and summary-sheets tailored to specific healthcare professional (HCP) groups, i.e., gynecologists, midwives, pediatricians, practice nurses and respiratory nurses.

**Design:** Observational study with baseline (T1), intermediate (2-months, T2) and follow-up (8-months, T3) survey measurements, and interviews between T2 and T3.

**Method:** Data were collected December 2016–January 2018. Three hundred-ten, 228, and 174 HCPs completed T1, T1/T2, and T1/T2/T3, respectively, and 32 HCPs were interviewed. We examined reach, feasibility and acceptability of the implementation strategy; whether baseline factors related to HCP's strategy evaluation; change in implementation outcomes over time (i.e., knowledge, intentions to use the guideline, satisfaction with own SCC delivery, and provision of quit-advice); and whether baseline factors related to change in implementation outcomes.

**Results:** Text-messages had good reach, and text-messages and summary-sheets were evaluated positively on feasibility and acceptability. Results showed improvements over time in tested knowledge (assessed through false/true statements) and self-reported knowledge about SCC, as well as satisfaction with own SCC delivery. Provision of quit advice showed an improvement among pediatricians only. Improvements in knowledge were stronger among non-smoking HCPs, and HCPs with lower skills and self-efficacy at baseline.

**Conclusions:** Guideline implementation often does not occur spontaneously. Guideline implementation may be facilitated by providing text-messages and summary-sheets to HCPs. Text-messages may be more beneficial if tailored to the individual HCP.

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## 1. Introduction

Healthcare professionals (HCPs) have an important role in helping smokers quit.<sup>1</sup> However, the implementation of guidelines for smoking cessation care (SCC) is suboptimal.<sup>2–11</sup> For example, although quit advice is recommended in many SCC guidelines,<sup>12–14</sup> both HCPs and smokers themselves report that many smokers are not advised to quit.<sup>15–17</sup> Strategies that improve SCC should take group-specific factors into account because

adherence to SCC guidelines and the barriers experienced differ between HCP groups.<sup>15,17</sup>

The implementation process of guidelines –and interventions more generally– occurs through several phases, as described by Rogers in his theory on diffusion of innovations.<sup>18</sup> Building on the work of Rogers, several frameworks aiming to capture and facilitate the implementation of innovations were developed. One of the most widely cited frameworks is the Consolidated Framework for Implementation Research (CFIR). The CFIR helps to identify which factors influence innovation implementation and divides these determinants into four distinct categories, namely the 'inner and outer setting' in which the intervention resides, the HCP and the implementation process.<sup>19</sup> Research into SCC indeed showed that successful guideline implementation depends

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on factors at the level of the HCP (e.g., knowledge, skills, outcome expectancies), the HCP's environment (e.g., availability of time, resources), and the patient (e.g., quit motivation).<sup>3–5,8,9,15,17,20–28</sup> Also, several theoretical frameworks focus specifically on guideline characteristics such as length, wording and format in explaining clinical guideline implementation.<sup>29–32</sup>

Many implementation tools and types of training have been developed to improve the implementation of (SCC) guidelines. However, over a third of guidelines are not accompanied by any implementation tool.<sup>33,34</sup> The effectiveness of implementation strategies generally depends on how well they fit into the context in which the guideline needs to be implemented, and the preferences of the HCPs embedded in this context. Research showed that many HCPs are reluctant to take part in elaborate (often costly) training programs on SCC because they lack time to participate, have other priorities, do not see the added value, or do not want to provide SCC.<sup>27,34,35</sup> Digital implementation strategies are potentially useful because they require less HCP time, and can be used on a wide scale at low costs. A recent systematic review showed that digital education on SCC for HCPs is at least as effective as traditional approaches.<sup>36</sup> Examples of such strategies applied to SCC guidelines include e-learning programs,<sup>37</sup> digital reminders<sup>38</sup> and digital decision support systems or summary sheets that provide HCPs with advice on how to provide SCC tailored to their patient category.<sup>39,40</sup> Another promising route to improving the implementation of SCC guidelines is through text-messages. Many studies have shown that text-messages effectively help smokers to quit smoking.<sup>41</sup> Text-messages are relatively cheap and user-friendly, can be provided in smokers' daily lives and at times when they need them most, and their content can be tailored to individual smokers' needs. Similarly, although their use has not been studied among HCPs, text-messages targeted at HCPs most likely have several advantages when compared to elaborate (digital/non-digital) training programs, such as limited investment of time and money, easy integration within daily practice when messages are received during workdays, and potential to function as reminders for providing SCC.

The current mixed-method study evaluated a two-component implementation strategy to optimize implementation of the revised Dutch multidisciplinary tobacco dependence treatment guideline,<sup>14</sup> which consisted of text-messages and online summary-sheets tailored to specific HCP groups. For instance, for pediatricians, the summary sheets contained a specific message such as "pediatricians can help parents quit smoking, parents of children with lung disease are more motivated to quit to reduce second-hand smoking". For gynecologist, the summary sheet stated for example stated that "pregnant women can use nicotine-replacement medications". Gynecologists, midwives, pediatricians, practice nurses and respiratory nurses were included, such that HCP groups with different levels of experience in SCC were represented.<sup>17</sup> The implementation strategy aimed to improve HCPs' knowledge about the guideline, intentions to use the guideline, satisfaction with their own SCC delivery, and provision of quit-advice to patients who smoke (identified as a key task in the guideline<sup>14,42</sup>).

## 2. Method

### 2.1. Objectives

The following research questions (RQs) were examined using quantitative questionnaire data: To what extent does the implementation strategy reach HCPs, and is it feasible and acceptable to them (RQ1)? Which baseline factors are related to HCPs' evaluation of the text-messages and summary-sheet (RQ2)? To what

extent do tested and self-reported knowledge, intentions to use the guideline, satisfaction and provision of quit-advice improve over time among HCPs who are exposed to the implementation strategy (RQ3)? Which baseline factors are related to improvement in these outcomes (RQ4)? We also conducted interviews with a subset of participants to explore perceptions of the guideline and experiences with the text-messages and summary-sheet (RQ5).

### 2.2. Design

Observational study with baseline (T1), intermediate (2-months, T2) and follow-up (8-months, T3) online questionnaire assessments, and individual interviews between T2 and T3. Results on implementation of the guideline at baseline are reported elsewhere.<sup>17</sup>

### 2.3. Participants

Three hundred sixty-four HCPs started to fill out the T1 questionnaire, of whom 310 (85%) completed T1. Of these, 228 (74%) also completed T2 (sample A), and 174 (56%) completed T1, T2 and T3 (sample B). Sample A included 31 gynecologists, 40 midwives, 23<sup>16</sup> pediatricians, 79 practice nurses (i.e. nurses working in general practice), and 58 respiratory nurses. Sample B included 15 gynecologists, 26 midwives, 16 pediatricians, 66 practice nurses and 51 respiratory nurses. Interview participants ( $n = 32$ ) were five gynecologists (three in training), five pediatricians, seven midwives, seven practice nurses, and eight respiratory nurses (one pediatric). Recruitment details are reported elsewhere.<sup>17</sup>

### 2.4. Procedure

Data were collected in The Netherlands between December 2016 and January 2018. Participants were informed online on the study aim and procedure, the voluntariness of participation, and confidential and anonymous treatment and analysis of data. After providing informed consent online, participants completed the baseline questionnaire in which they also provided their mobile phone number. The summary-sheet was sent automatically by e-mail upon questionnaire completion, and participants received the first text-message in the following week (see [Supplementary Materials A](#) for an example summary-sheet for practice nurses). Text-messages were then sent twice weekly on week days between office hours for four months (totaling 35 messages, see [Supplementary Materials B](#), for example, text-messages for practice nurses). Text-messages and summary-sheets were both tailored to HCP group. The summary-sheets (size 1 A4; developed in collaboration with HCPs) presented the main guideline recommendations and a schematic overview of SCC steps. Text-messages addressed determinants of SCC implementation identified in the literature. Participants were invited by e-mail to fill out the intermediate and follow-up questionnaires. Participants who did not respond received maximum two reminders by e-mail. On average T1 and T2 were 79.46 ( $SD = 18.37$ ) days apart, and T1 and T3 200.62 ( $SD = 20.94$ ) days. Given that recruitment of midwives and gynecologists was somewhat delayed, the periods between measurements were slightly shorter in these groups.<sup>1</sup> All questionnaires were distributed through the Qualtrics program

<sup>1</sup> The T1-T2 interval was shorter for gynecologists ( $M = 67.29$ ,  $SD = 12.29$ ) and midwives ( $M = 66.16$ ,  $SD = 7.39$ ) than for pediatricians ( $M = 81.87$ ,  $SD = 26.98$ ), practice nurses ( $M = 85.52$ ,  $SD = 18.71$ ), and respiratory nurses ( $M = 85.26$ ,  $SD = 13.68$ ). Similarly, the T1-T3 interval was shorter for gynecologists ( $M = 171.00$ ,  $SD = 14.01$ ) and midwives ( $M = 187.31$ ,  $SD = 14.01$ ) than for pediatricians ( $M = 191.83$ ,  $SD = 18.92$ ), practice nurses ( $M = 210.07$ ,  $SD = 17.19$ ), and respiratory nurses ( $M = 209.92$ ,  $SD = 14.61$ ).

([www.qualtrics.com](http://www.qualtrics.com)). Three gift coupons of €100.- and six of €50.- were distributed among participants who completed all questionnaires.

At the end of the T2 questionnaire participants were asked whether they were willing to participate in an interview on SCC, the guideline and the text-messages. Individual semi-structured interviews were conducted via telephone. Participants received information on the interviews before deciding to participate, including that the interview would be audio-recorded. Participants provided verbal informed consent, audio-recorded in a separate file. The first and fourth author and a trained master student conducted six, ten, and sixteen interviews respectively. The interviews lasted 24 min on average (range 14–34 min) excluding informed consent. Data collection continued until data saturation was reached. Interviews were transcribed verbatim. Interview participants received a €20.- gift coupon. The procedure was cleared for ethics by a Medical Ethical Committee (P16.301).

## 2.5. Measures

Variables used for the quantitative analyses are described below (see Ref. 17 for more details). We based the selection and operationalization of variables on previous work.<sup>4,10,20,21,43–46</sup> There were no missing values, except for provision of quit-advice (10, 4, and 1 missing at T1, T2, and T3 respectively among participants who completed the respective questionnaire).

### 2.5.1. Baseline variables (T1)

**Background characteristics.** Participants provided their gender, year of birth, profession, number of years worked as professional, previous participation in SCC training, and smoking status (never-smoker/ex-smoker/current smoker). Participants also indicated how many of their patients were smokers (%).

**Barriers to guideline usage.** Participants indicated to what extent six pre-specified factors (i.e., guideline adaptability, guideline complexity, and lack of time, materials, patient reimbursement, referral possibilities, SCC training) were barriers to guideline usage, with answer categories [1] 'not at all', [2] 'not', [3] 'a little', [4] 'slightly', [5] 'strongly'.

**Psychosocial participant characteristics.** Answer categories for psychosocial characteristics were [1] 'completely disagree' – [5] 'completely agree'. We measured self-efficacy with five items ( $\alpha = 0.83$ ). All items on the self-efficacy scale started with 'I feel confident I can provide.' followed by tasks listed in the guideline. We furthermore measured outcome expectancies with three items ( $\alpha = 0.83$ ), such as "If I implement the guideline as prescribed, more patients will quit smoking". We measured agreement with the guideline's content, attitude, motivation, skills, role identity, descriptive and injunctive norms, social support with one item each.

### 2.5.2. Outcome variables (T1, T2, T3)

**Feasibility (T2).** Feasibility of summary-sheet ( $\alpha = 0.86$ ) and text-messages ( $\alpha = 0.83$ ) was evaluated with three items each, i.e., 'The information provided is sufficient to use the guideline as intended', 'The information provided is relevant to use the guideline as intended' and 'The [summary-sheet/text-messages] match with my work as a [HCP group, e.g., midwife]'. Answer categories were [1] 'completely disagree' – [5] 'completely agree'.

**Acceptability (T2, T3).** Acceptability of text-messages was evaluated with the following item at T2 and T3: 'What do you think of the number of text-messages that you have received?', with answer categories [1] 'far too few', [2] 'too few', [3] 'slightly too few', [4] 'perfect', [5] 'slightly too many', [6] 'too many', [7] 'far too many'. In addition, at T3 participants were asked 'Did the time you needed to read the text-messages match the resulting gain?',

with answer categories [1] 'not at all', [2] 'no', [3] 'neutral', [4] 'yes', [5] 'definitely'.

**Reach (T2, T3).** One item evaluated reach of text-messages: 'How many of the text-messages that you received did you read?', with answer categories [1] 'none', [2] 'fewer than half', [3] 'about half', [4] 'slightly more than half', [5] 'more than half', [6] 'almost all', [7] 'all'.

**Knowledge (T1, T2, T3).** We measured self-reported knowledge with one item (i.e., 'I have sufficient knowledge to implement the guideline correctly', [1] 'completely disagree' – [5] 'completely agree'). Knowledge was also tested with five (correct/incorrect) statements about the guideline's content, which participants rated as correct or incorrect (e.g., 'Using two types of nicotine replacement therapy is more effective for quitting smoking than using one type'). Four statements were used in all groups and one statement was specified per group (e.g., focusing on minors for pediatricians). A score was calculated by adding the number of correctly rated statements (range 0–5).

**Intentions to use the guideline (T1, T2, T3).** Participants rated their agreement with 'I intend to implement the guideline correctly', [1] 'completely disagree' – [5] 'completely agree'.

**Satisfaction with own implementation (T1, T2, T3).** Satisfaction was measured with one item, 'In general, how satisfied are you with how you implement the guideline?', [1] 'very dissatisfied' – [5] 'very satisfied'.

**Provision of quit-advice (T1, T2, T3).** Participants indicated what percentage of their patients who smoke they advised to quit smoking.

## 2.6. Statistical analyses (RQ1–RQ4)

Participants with  $\geq 1$  missing values were excluded from the analysis. We first performed attrition analyses (independent samples *t*-tests and  $\chi^2$ -analyses) to assess whether those who completed only T1 differed on baseline characteristics from those who completed T1 and T2 (sample A), and from those who completed all three measurements (sample B). We used descriptive statistics for RQ1, using data from sample A for T2 and sample B for T3. For RQ2, we first performed univariable linear regression analyses for feasibility, acceptability and reach at T2 (using sample A). These were followed by one multivariable linear regression analysis per outcome, including variables that showed an association with the respective outcome at  $p < .10$  in the univariable analyses. For RQ3 we used dependent samples *t*-tests for each of the outcomes (i.e., knowledge, intention, satisfaction, quit-advice), comparing T1 and T2 in sample A and comparing T1, T2 and T3 in sample B. Finally, for outcomes that improved from T1 to T2, we conducted univariable and multivariable linear regression analyses as for RQ2, using change scores between T1 and T2 as dependent variables (sample A). We ensured that the assumptions of all analyses were met.

## 2.7. Qualitative analysis (RQ5)

Qualitative data were analyzed according to the principles of the Framework approach<sup>47,48</sup> which combines inductive and deductive analysis. EM and LP independently developed a coding tree based on the interviews of two randomly selected participants and available literature. The coding trees were compared and combined into one coding tree which was then used to code the two interviews. The coded transcripts were discussed and minor changes were made to the initial coding tree. All interviews were coded using Atlas.ti. A trained master student coded seventeen transcripts (gynecologists, midwives and pediatricians) and LP coded fifteen transcripts (respiratory and practice nurses). In order to ensure inter-coder reliability EM independently coded six

additional, randomly selected transcripts. The coded transcripts were discussed and any discrepancies were resolved through discussion. Agreement in coding between authors was high; for less than 5% of the codes assigned additional discussion was necessary to reach consensus'. Data from all participants were combined and interpreted in a cross-case analysis to identify themes. Results on participants' evaluation of the implementation strategy are reported.

### 3. Results

#### 3.1. Attrition analyses

Attrition after T1 was not significantly associated with background or psychosocial characteristics at T1, except for HCP group and SCC training. Specifically, midwives, gynecologists, and participants who had not participated in SCC training in the past were significantly more likely to drop out, whereas practice nurses and those with previous SCC training were significantly less likely to drop out (see [Supplementary materials C](#) for attrition analyses and sample characteristics). All variables positively related to drop-out were included in the multivariate analysis models.

#### 3.2. Reach, feasibility and acceptability (RQ1)

Message reach was good, as the majority of participants had read 'all' (74% at T2, 65% at T3) or 'almost all' text-messages (20% at T2, 25% at T3), and only 3% and 2% had read fewer than half of the messages at T2 and T3, respectively.<sup>2</sup> At T2 participants were positive about feasibility of the summary-sheet ( $M = 3.94$ ,  $SD = 0.54$ ) and text-messages ( $M = 3.82$ ,  $SD = 0.63$ ), with evaluations of the summary-sheet being somewhat more positive,  $t(227) = 2.91$ ,  $p < .01$ . Participants were satisfied with the number of text-messages that they had received, with 64% (T2) and 63% (T3) indicating that the number of messages was good; 8% (T2) and 9% (T3) indicating that they would have liked more messages; and 25% (T2) and 26% (T3) indicating that the number was somewhat high. Only 4% (T2) and 2% (T3) indicated that they had received too many messages. Many participants at T3 considered the time investment/gain ratio to be good (49%), 39% were neutral about this, and a minority of 12% indicated that reading the messages had cost too much time in relation to perceived gain.

#### 3.3. Explaining feasibility of text-messages and summary-sheets (RQ2)

Univariable linear regression analyses showed that feasibility of the text-messages was evaluated more positively by participants with lower baseline levels of self-efficacy and tested knowledge, stronger role identity, and more positive outcome expectations (see [Table 1](#)). Furthermore, participants who reported stronger injunctive norms and experienced lack of patient reimbursement as a stronger barrier to providing SCC were more positive about the text-messages. The multivariable model showed that participants were more positive about the text-messages if they had lower self-efficacy and tested knowledge, and more positive outcome expectations of providing SCC.

<sup>2</sup> Due to a system error a number of messages were sent outside office hours. 61 participants indicated at T3 that this had happened, of whom 36 (59%) did not find this annoying, 16 (26%) somewhat annoying, 4 (7%) annoying, 2 (3%) very annoying, and 3 (5%) incredibly annoying. Being more annoyed was significantly related to perceiving the message frequency as too high ( $r = 0.32$ ,  $p = .01$ ) and a less beneficial time investment/gain ratio, ( $r = -0.47$ ,  $p < .001$ ), but not to message reach ( $r = -0.13$ ,  $p = .33$ ). Five participants cancelled the text-messages, of whom 2 had lost their job, 1 preferred e-mails over text-messages, 1 found the messages uninteresting, and 1 did not provide a reason.

The univariable regression analyses showed different results for feasibility of the summary-sheets, such that participants were more positive if they were themselves ex-smokers (vs. never-smokers), had stronger intentions to implement the guideline, and higher self-efficacy, self-reported knowledge, skills, role identity, outcome expectations, descriptive norms, and social support. Furthermore, participants who perceived guideline adaptability and complexity as barriers to providing SCC were less positive about the summary-sheets. As such, univariable results for self-efficacy and knowledge were in opposition directions for the text-messages and summary-sheet. Furthermore, tested knowledge and injunctive norms were related to the evaluation of text-messages, whereas self-reported knowledge and descriptive norms were related to the summary-sheets evaluation. The multivariable model for the summary-sheets showed that participants who were ex-smokers, had more positive outcome expectations and did not perceive guideline adaptability as a barrier evaluated the summary-sheets more positively.<sup>3</sup>

#### 3.4. Changes in guideline implementation outcomes (RQ3)

Results showed significant improvements in tested knowledge, self-reported knowledge and satisfaction from T1–T2 in sample A (see [Table 2](#)).<sup>4</sup> However, whereas all groups improved on self-reported knowledge, only pediatricians improved on tested knowledge. Satisfaction improved in all groups except for midwives. No changes were found in intentions to use the guideline and provision of quit-advice in sample A.

In sample B, significant changes between time points were found in all outcomes. Tested knowledge improved from T1 to T3 among respiratory nurses, and from T1 to T2 among midwives. Midwives however showed a decrease in tested knowledge from T2 to T3, such that they answered fewer questions correctly at T3 than at T1. Self-reported knowledge increased in all groups. For respiratory nurses, the increase in self-reported knowledge between T1 and T2 was followed by a decrease between T2 and T3, although knowledge levels at T3 were still significantly higher than those at T1. Overall, intention to use the guideline did not change much, although both practice and respiratory nurses showed a significant decrease between T2 and T3. However, intentions did not differ between T1 and T2, nor between T1 and T3. With regard to satisfaction, significant improvements over time were found in all groups. Finally, pediatricians provided quit-advice to a larger percentage of patients who smoke at T3 than at T1, but no significant changes were found in the other groups.<sup>5</sup>

#### 3.5. Explaining changes in guideline implementation outcomes (RQ4)

Univariable analyses for tested knowledge showed that increases in knowledge were significantly stronger among those with lower baseline self-efficacy (see [Table 3](#)). This effect remained in the multivariable model (this model also included SCC training, with  $p < .10$  in the univariable model, as predictor).

Univariable analyses showed that self-reported knowledge increased more among participants who had not participated in SCC training, had never smoked themselves (vs. current smokers), and participants with lower agreement with the guideline's con-

<sup>3</sup>  $t$ -tests showed that evaluation of the messages and summary-sheet did not differ significantly between respiratory nurses working with adults or children.

<sup>4</sup> Bivariate Spearman's correlations showed that changes from T1–T2 in tested and self-reported knowledge and quit-advice were not significantly related to feasibility, acceptability and reach of the text-messages and summary-sheets at T2, see [Supplementary Materials D](#).

<sup>5</sup>  $t$ -tests showed that changes in improvement in tested knowledge, self-reported knowledge and satisfaction did not differ significantly between respiratory nurses working with adults or children.



**Table 1**  
Explaining feasibility of text-messages and summary-sheet at T2 by baseline variables (N = 228): Linear regression analyses.

Predictor variables (T1)	Feasibility text-messages		Feasibility summary-sheet	
	Univariable	Multivariable	Univariable	Multivariable
<i>Participant characteristics</i>				
Age	0.04		0.05	
Gender (male)	0.10		0.05	
<i>Profession</i>				
PN (ref.)	0		0	0
Gynecologist	−0.03		−0.14 <sup>†</sup>	0.02
Midwife	0.07		−0.13 <sup>†</sup>	0.01
Pediatrician	0.03		−0.08	0.04
RN	−0.06		−0.13 <sup>†</sup>	−0.11
Years worked	0.04		−0.02	
SCC training	−0.08		0.04	
<i>Smoking status</i>				
Never (ref.)	0		0	0
Ex-smoker	0.00		0.19 <sup>**</sup>	0.17 <sup>*</sup>
Current	−0.08		−0.03	−0.03
<i>Patient characteristics</i>				
% smoker	−0.11		0.08	
<i>Psychosocial determinants</i>				
Agreement content	0.05		0.08	
Attitude	0.08		0.12 <sup>†</sup>	−0.01
Motivation	0.11		0.13 <sup>†</sup>	−0.11
Intention	0.07		0.14 <sup>*</sup>	0.05
Self-efficacy	−0.14 <sup>*</sup>	−0.17 <sup>*</sup>	0.14 <sup>*</sup>	0.03
Knowledge (tested)	−0.18 <sup>**</sup>	−0.15 <sup>*</sup>	0.04	
Knowledge (self-report)	−0.02		0.19 <sup>**</sup>	0.15 <sup>†</sup>
Skills	0.01		0.19 <sup>**</sup>	0.04
Role identity	0.18 <sup>**</sup>	0.14 <sup>†</sup>	0.17 <sup>*</sup>	0.07
Outcome expectations	0.25 <sup>***</sup>	0.24 <sup>***</sup>	0.18 <sup>**</sup>	0.17 <sup>*</sup>
Descriptive norms	−0.02		0.13 <sup>*</sup>	0.03
Injunctive norms	0.16 <sup>*</sup>	0.42	0.10	
Social support	0.07		0.18 <sup>**</sup>	0.01
<i>Barriers</i>				
Guideline adaptability	−0.01		−0.24 <sup>***</sup>	−0.23 <sup>**</sup>
Guideline complexity	−0.03		−0.20 <sup>**</sup>	0.00
Time	0.00		−0.13 <sup>†</sup>	−0.05
Materials	−0.04		−0.10	
Patient reimbursement	0.14 <sup>*</sup>	0.12 <sup>†</sup>	−0.06	
Referral possibilities	0.05		−0.06	
Training	0.07		−0.12 <sup>†</sup>	0.08

Note. Values reported in the table are  $\beta$  values. PN = practice nurse; RN = respiratory nurse; SCC = smoking cessation care. Multivariable model for text-messages  $R^2 = 0.16$ ,  $p < 0.001$ ; summary-sheet  $R^2 = 0.17$ ,  $p = .01$ .

<sup>†</sup>  $p < .10$ .

<sup>\*</sup>  $p < .05$ .

<sup>\*\*</sup>  $p < .01$ .

<sup>\*\*\*</sup>  $p < .001$ .

tent, less positive attitudes toward the guideline, lower motivation to use the guideline, and weaker skills and social support to use the guideline. Increases in self-reported knowledge were also stronger among those who experienced lack of training in SCC as a barrier. Only the effects of own smoking status and skills remained significant in the multivariable model, such that knowledge increased more strongly among those who had never smoked and reported weaker baseline skills.

Finally, univariable analyses showed that all baseline variables that were related to changes in self-reported knowledge were also related to changes in satisfaction (in the same direction), except for smoking status. However, none of these associations remained significant in the multivariable model.

### 3.6. Qualitative evaluation of the implementation strategy (RQ5)

Interview findings (from 32 HCPs) were in line with the results presented above. Participants' experiences suggested that an implementation strategy was necessary to help them provide SCC according to the guideline. Whereas a few participants regularly used the guideline itself, the majority indicated that they never

or only rarely consulted it. Many were held back by the guideline's extensive content which made them "lose sight of the big picture" (P4, practice nurse), or which they considered irrelevant for practice, because for example "practice nurses don't need to know exactly how it's backed up scientifically, they just want to know what to do" (P10, practice nurse). Similarly, a pediatrician (P28) stated that the guideline was "very good as background information but of course a guideline is always difficult to read and to remember, that's how it works with guidelines". Finally, a gynecologist (P31) commented that "there are guidelines that are launched but not necessarily implemented in a good way, so these text-messages are practical".

The large majority of interview participants was positive about the study's implementation strategy. Study participation also appeared to facilitate SCC implementation beyond participants themselves. Several participants for example discussed the text-messages with colleagues or put the summary-sheet in a place where colleagues could see it. One gynecologist whose colleagues also participated in the study stated that "we should make this [SCC] work in our group, pay more attention to it and use the study tools more" (P17).

**Table 2**  
Guideline implementation outcomes at T1, T2 and T3 per group.

	M (SD)				
	N = 228* (sample A)		N = 174 (sample B)		
<b>Outcome variables</b>					
Knowledge (tested)	T1	T2	T1	T2	T3
Gynecologists	2.16 (0.82)	2.32 (0.87)	2.20 (0.77)	2.27 (0.80)	1.67 (1.05)
Midwives	1.84 (0.90)	2.19 (0.81)	1.81 (0.85) <sup>a</sup>	2.19 (0.80) <sup>b</sup>	1.19 (0.80) <sup>ab</sup>
Pediatricians	1.83 (0.98) <sup>a</sup>	2.43 (0.84) <sup>a</sup>	2.00 (1.10)	2.38 (0.89)	1.88 (1.02)
Practice nurses	2.47 (1.07)	2.44 (0.89)	2.53 (1.07)	2.45 (0.88)	2.53 (0.86)
Respiratory nurses	2.33 (0.98)	2.55 (0.86)	2.29 (0.99) <sup>a</sup>	2.57 (0.90)	2.65 (1.09) <sup>a</sup>
Total	2.22 (1.06) <sup>a</sup>	2.41 (0.86) <sup>a</sup>	2.28 (1.02)	2.43 (0.87) <sup>a</sup>	2.23 (1.09) <sup>a</sup>
Knowledge (self-report)	T1	T2	T1	T2	T3
Gynecologists	2.32 (1.05) <sup>a</sup>	2.97 (0.98) <sup>a</sup>	2.07 (1.03) <sup>ab</sup>	3.33 (1.11) <sup>a</sup>	3.00 (0.76) <sup>b</sup>
Midwives	2.84 (1.15) <sup>a</sup>	3.34 (0.81) <sup>a</sup>	2.73 (1.12) <sup>a</sup>	3.31 (0.84) <sup>a</sup>	3.19 (0.98)
Pediatricians	2.35 (0.98) <sup>a</sup>	2.91 (0.73) <sup>a</sup>	2.38 (1.02) <sup>a</sup>	2.88 (0.72)	3.31 (0.70) <sup>a</sup>
Practice nurses	3.41 (0.92) <sup>a</sup>	3.76 (0.83) <sup>a</sup>	3.41 (0.91) <sup>ab</sup>	3.82 (0.80) <sup>a</sup>	3.73 (0.74) <sup>b</sup>
Respiratory nurses	3.22 (1.10) <sup>a</sup>	3.73 (0.89) <sup>a</sup>	3.22 (1.14) <sup>ab</sup>	3.75 (0.89) <sup>ac</sup>	3.55 (0.78) <sup>bc</sup>
Total	3.02 (1.11) <sup>a</sup>	3.49 (0.91) <sup>a</sup>	3.04 (1.11) <sup>ab</sup>	3.59 (0.90) <sup>a</sup>	3.49 (0.82) <sup>b</sup>
Intention to use guideline	T1	T2	T1	T2	T3
Gynecologists	3.74 (0.68)	3.81 (0.65)	3.60 (0.73)	3.93 (0.80)	3.73 (0.70)
Midwives	3.92 (0.71)	4.05 (0.80)	3.96 (0.72)	4.15 (0.83)	4.00 (0.85)
Pediatricians	3.96 (0.77)	3.52 (0.95)	3.94 (0.85)	3.38 (1.02)	3.75 (0.58)
Practice nurses	4.21 (0.65)	4.36 (0.72)	4.21 (0.67)	4.39 (0.68) <sup>a</sup>	4.11 (0.70) <sup>a</sup>
Respiratory nurses	4.14 (0.51)	4.25 (0.68)	4.16 (0.50)	4.31 (0.65) <sup>a</sup>	4.04 (0.63) <sup>a</sup>
Total	4.06 (0.66)	4.13 (0.78)	4.08 (0.68)	4.20 (0.79) <sup>a</sup>	4.01 (0.70) <sup>a</sup>
Satisfaction	T1	T2	T1	T2	T3
Gynecologists	2.26 (1.29) <sup>a</sup>	3.16 (1.37) <sup>a</sup>	2.07 (1.03) <sup>ab</sup>	3.53 (1.51) <sup>a</sup>	3.87 (1.51) <sup>b</sup>
Midwives	3.48 (1.50)	3.80 (1.38)	3.38 (1.53) <sup>a</sup>	3.50 (1.21) <sup>b</sup>	4.46 (1.42) <sup>ab</sup>
Pediatricians	2.61 (1.59) <sup>a</sup>	3.30 (1.46) <sup>a</sup>	2.25 (1.57) <sup>ab</sup>	3.19 (1.52) <sup>a</sup>	3.31 (1.54) <sup>b</sup>
Practice nurses	4.81 (1.22) <sup>a</sup>	5.34 (0.88) <sup>a</sup>	4.79 (1.23) <sup>ab</sup>	5.30 (0.88) <sup>a</sup>	5.30 (1.07) <sup>b</sup>
Respiratory nurses	4.66 (1.33) <sup>a</sup>	5.12 (1.26) <sup>a</sup>	4.57 (1.36) <sup>ab</sup>	5.02 (1.30) <sup>a</sup>	5.22 (1.08) <sup>b</sup>
Total	3.98 (1.66) <sup>a</sup>	4.52 (1.49) <sup>a</sup>	4.05 (1.65) <sup>ab</sup>	4.60 (1.44) <sup>ac</sup>	4.84 (1.37) <sup>bc</sup>
Provision of quit-advice	T1	T2	T1	T2	T3
Gynecologists	39.58 (38.65)	47.10 (34.37)	43.13 (42.70)	60.67 (36.78)	63.67 (32.81)
Midwives	53.71 (42.58)	56.29 (37.57)	50.92 (41.28)	51.25 (35.55)	57.96 (34.44)
Pediatricians	23.48 (36.72)	26.09 (34.21)	20.63 (35.26) <sup>a</sup>	32.50 (36.06)	45.63 (43.77) <sup>a</sup>
Practice nurses	68.20 (32.03)	73.63 (28.35)	70.03 (31.43)	73.30 (28.21)	71.08 (27.59)
Respiratory nurses	65.16 (29.86)	65.96 (33.95)	62.22 (29.89)	64.27 (34.47)	66.82 (31.91)
Total	56.16 (37.74)	59.91 (35.87)	57.62 (36.81) <sup>a</sup>	62.24 (34.69)	64.78 (32.69) <sup>a</sup>

Note. Superscripts indicate significant differences between time points within groups at  $p < .05$ .

\* N = 216 for the analysis of quit-advice in Sample A and N = 166–174 in sample B.

**Text-messages.** Most interview participants appreciated the concise texts and message frequency, although a few considered the frequency to be “on the edge” (P28, pediatrician) of what was acceptable. For many the messages served as a reminder of providing SCC. Text-messages were experienced as more urgent than other types of communication by some, because “these were the only text-messages I received, no one sends me text-messages” (P15, practice nurse). Similarly, one gynecologist in training (P31) described his experience with the messages as follows: “I liked them, they were practical, of course it was partially about the guideline but also in general like, your motivation as a physician and how to motivate patients (...) and the advantage of those messages is that you receive them as some sort of push notification, so that makes you read the brief texts”. Like this gynecologist, many participants stated that the messages had motivated them to provide SCC.

Most participants did not think that their SCC attitudes or practice had changed, possibly because they already found SCC important. Others however stated that they had become more attentive to smoking in their patients, or spent more time and effort addressing smoking with their patients than before. Similarly, several participants perceived their SCC knowledge to have increased. One midwife (P19) used her new knowledge directly with patients: “You can provide clearer information and elaborate on it when they have questions about nicotine patches or whatever. That’s not

asked often so before you had to search for information but now I think, oh I know that, because this and that. Yes, it has definitely helped”. In addition to reporting increased knowledge, this midwife also appeared more self-confident in providing SCC. Another practice nurse (P15) described positive responses from patients when she used example sentences from the messages to address smoking. Participants appreciated knowledge that was practically applicable, such as facts that they could use in consultations, or background knowledge on medication, additional information resources, or referral possibilities. Several gynecologists, practice nurses and respiratory nurses however stated that they were already familiar with much of the messages’ content, for example one practice nurse stated that it contained “knowledge that a practice nurse already has” (P10). Other participants perceived this as affirmation that they were on the right track in how they provided SCC. A respiratory nurse (P2) stated that the messages helped to “remember [SCC] knowledge better”, and that the messages repeated knowledge that she had acquired during a recent SCC training, such that it did not “disappear under a layer of dust”. Two participants suggested that the messages could be improved by tailoring to knowledge level (P17, gynecologist; P24, midwife).

**Summary-sheet.** When asked about their evaluation of the guideline, many participants instead explained their views on the summary-sheet, suggesting that they considered this a substitute for the guideline. In line with this, a pediatrician (P28) stated that

**Table 3**  
Explaining changes in knowledge (tested and self-reported) and satisfaction between T1 and T2 by baseline variables (N = 228): Linear regression analyses.

Predictor variables (T1)	$\Delta$ Knowledge (tested)		$\Delta$ Knowledge (self-reported)		$\Delta$ Satisfaction	
	Univariable	Multivariable	Univariable	Multivariable	Univariable	Multivariable
<i>Participant characteristics</i>						
Age	0.07		-0.12*	-0.01	0.11*	-0.04
Gender (male)	0.05		0.09		-0.01	
Profession						
PN (ref.)	0		0		0	
Gynecologist	0.06		0.09		0.09	
Midwife	0.12		0.06		-0.06	
Pediatrician	0.16		0.06		0.04	
RN	0.09		0.07		-0.02	
Years worked	0.07		-0.03		-0.07	
SCC training	-0.11*	-0.01	-0.19**	-0.37	-0.17*	0.00
Smoking status						
Never (ref.)	0		0	0	0	
Ex-smoker	-0.05		-0.03	0.03	-0.06	
Current	0.02		-0.16*	-0.16*	-0.10	
<i>Patient characteristics</i>						
% smoker	-0.09		0.02		0.03	
<i>Psychosocial determinants</i>						
Agreement content	-0.09		-0.20**	-0.10	-0.15*	-0.01
Attitude	-0.04		-0.16*	0.07	-0.20**	-0.06
Motivation	0.04		-0.22**	-0.17	-0.22**	-0.09
Self-efficacy	-0.20**	-0.20**	-0.10		-0.08	
Skills	-0.07		-0.29**	-0.17*	-0.23**	-0.10
Role identity	0.01		-0.06		-0.07	
Outcome expectations	-0.08		-0.05		-0.07	
Descriptive norms	0.03		-0.05		-0.03	
Injunctive norms	-0.04		-0.09		0.00	
Social support	-0.10		-0.15*	-0.03	-0.18**	-0.06
<i>Barriers</i>						
Guideline adaptability	-0.10		0.02		0.09	
Guideline complexity	-0.03		0.05		0.07	
Time	0.02		0.04		0.02	
Materials	-0.04		0.07		0.02	
Patient reimbursement	-0.06		-0.01		0.03	
Referral possibilities	-0.06		0.05		0.09	
Training	0.04		0.19**	0.03	0.20**	0.09

Note. Values reported in the table are  $\beta$  values. PN = practice nurse; RN = respiratory nurse; SCC = smoking cessation care. Multivariable model for tested knowledge  $R^2 = 0.04$ ,  $p = .01$ ; self-reported knowledge  $R^2 = 0.14$ ,  $p < .001$ ; satisfaction  $R^2 = 0.09$ ,  $p = .01$ .

\*\*\* $p < .001$ .

\* $p < .10$ .

\* $p < .05$ .

\*\* $p < .01$ .

compared to the guideline “such a sheet is much easier in daily practice”. Most participants thought that the summary-sheet was practical and useful, although some found it “slightly too concise” (P4, practice nurse). Several participants had placed a printed summary-sheet in their consultation room, and checked it before or during consultations. Some participants had also adapted their SCC practice based on information on the summary-sheet, such as one respiratory nurse (P6) who had changed which pharmacotherapy she prescribed.

#### 4. Discussion

This mixed-method study evaluated text-messages and summary-sheets as tools to improve the implementation of a SCC guideline among gynecologists, midwives, pediatricians, practice nurses and respiratory nurses. Although the use of guideline summaries is well established,<sup>33</sup> this is the first study we know of that evaluated text-messages to improve guideline implementation. The study focused on a specific guideline (i.e., the revised Dutch tobacco dependence treatment guideline), but results are relevant for implementation of SCC guidelines more generally as the Dutch guideline is quite similar to other national SCC guidelines.<sup>13</sup>

Results showed that text-messages and summary-sheets are useful tools to improve SCC guideline implementation. However, as self-report instruments were used to determine implementation success, results have to be interpreted with caution. Additional observational studies are needed to verify the results of this study, but finding resources to perform such a study remains problematic. Employing a Participatory Action Research (PAR) approach might be an option to reduce social desirability bias,<sup>49</sup> and perform iterative cycles of evaluation to inform implementation strategy refinement per HCP group.

The messages had good reach and participants evaluated both the text-messages and summary-sheets positively. Multivariable regression analyses showed that positive outcome expectations of SCC were related to positive evaluations of both text-message and summary-sheet feasibility. In addition, lower self-efficacy and tested knowledge at baseline were related to more positive evaluations of the messages. Being an ex-smoker (vs. never-smoker) and perceiving the guideline as adaptable to one's working context were related to more positive evaluations of the summary-sheets. Interestingly, based on the univariable regression analyses for feasibility of text-messages and summary-sheets, it appeared that the summary-sheets were evaluated more positively by participants who were more proficient at providing SCC,

whereas the text-messages were more useful for those with less SCC expertise. This suggests that text-messages were too simple for experienced participants, whereas the information on the summary-sheets was more useful for those who could integrate it into their existing expertise on SCC.<sup>37</sup>

With regard to guideline implementation outcomes, results showed significant improvements over time in tested knowledge (assessed through statements about the guideline's content) and self-reported knowledge about SCC, as well as satisfaction. Provision of quit-advice showed an improvement among pediatricians only. This may be related to the fact that pediatricians scored lowest on providing quit-advice at baseline, and had greatest room for improvement. Notably, knowledge and intentions decreased in some groups when text-messages were no longer sent. Continuation of text-messages, possibly at lower frequency, may be beneficial for maintaining effects. Moreover, future research should further elucidate whether tailoring of implementation strategies to the individual HCP may lead to implementation improvement. Tailoring might be facilitated by, for instance, theory informed behavior change,<sup>50</sup> which provides opportunity to match individual determinants with behavior change techniques and evidence-based implementation strategies (as mentioned in the taxonomy by Powell et al.<sup>51</sup> If and to what extent this theory-based establishment of tailored based implementation strategies can improve implementation outcomes should be further elucidated.

Changes in tested and self-reported SCC knowledge over time could be explained by baseline variables. Specifically, multivariable regression analyses showed that participants with lower self-efficacy at baseline showed stronger improvements in tested knowledge. Improvements in self-reported knowledge were stronger in those who did not smoke themselves (vs. current smokers) and had lower skills at baseline. Similarly, in a recent randomized controlled trial practice nurses with lower self-efficacy appeared to benefit most from an e-learning program for SCC in terms of improved guideline adherence.<sup>37</sup>

Never-smokers showed stronger increases in self-reported SCC knowledge than current smokers. Univariable results furthermore showed that ex-smokers were more positive about the summary-sheets than never-smokers, but this was not found in the multivariable model. Associations between HCPs' own smoking status and their responses to implementation strategies have not been studied, but a Canadian study showed that GPs who smoked were more interested in learning about counseling methods than ex-smokers and never-smokers.<sup>52</sup> In contrast, a small-scale Italian study among oncologists found no significant difference in willingness to follow SCC training between former, current and never-smokers.<sup>53</sup> Studies into the effect of HCPs' smoking behavior on SCC provision more generally have shown mixed results. Several studies showed that HCPs who smoke are less likely to provide quit-advice or counsel smokers in quitting,<sup>12,46,49,54,55</sup> but other studies did not find this.<sup>15,53,56,57</sup> A Turkish study found that smoking HCPs were less likely to promote smoking cessation only when confounders were not controlled for.<sup>58</sup>

This study has limitations. First, this was an observational (pre-post) study, and results might be subject to history or maturation bias. Moreover, retest effect might have been present, possibly inflating scores on knowledge in the second and third measurement in time. Given that text messages had not been used to improve SCC implementation before, we opted for a pragmatic study design. Based on the positive results of this study, it would be beneficial to conduct a randomized controlled study to examine causality. Second, outcomes were based on self-report, except for tested knowledge, which may be associated with social desirability or recall bias. However, other methods such as videotaping interactions with patients were not possible within the current study design (and also have disadvantages). Third, as is common in

implementation research, it is likely that HCPs who were more interested in the topic were more inclined to participate. We have tried to minimize this risk by recruiting participants through different means. Still, selective attrition may have reduced generalizability to some extent. Finally, although we found effects of the HCP's own smoking status, future studies with more current smokers can shed more light on the role of own smoking behavior.

## 5. Conclusion

SCC guidelines should be accompanied by specific implementation materials. This study shows that a combination of text-messages and summary-sheets can be a promising addition to existing guideline implementation options. Results suggest that text-messages may be more useful for HCPs with less knowledge, whereas HCPs with more knowledge may benefit more from summary-sheets. The current implementation strategy may be more beneficial for certain HCPs, contexts, or guidelines than others. Text-messages may also be more beneficial if tailored to individual HCPs in addition to HCP group, in line with results from research into eHealth and mHealth more generally.<sup>59</sup> Effective implementation strategies can lead to better implementation of SCC guidelines, such that more smokers receive high-quality care and might quit smoking successfully. A hybrid type III randomized controlled trial<sup>60</sup> can provide insight into both the implementation behavior of HCPs and the effect of the intervention on patient outcomes. Such a trial is necessary to evaluate if and to which extent positive, significant change can be achieved at the patient level by optimizing the SCC guideline implementation integrity of HCPs.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgement

The authors would like to thank Douglas Kim for his contribution to data collection and qualitative analyses.

## Funding Statement

This work was supported by Partnership Stop met Roken and STIVORO.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ceh.2019.08.001>.

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