Association between self-reported motivation to quit smoking with effectiveness of smoking cessation intervention among patients hospitalized for acute coronary syndromes in Switzerland

Inge Worni-Schudel a, Vasilis Tzalis b, Julian Jakob a, b, Kali Tal a, Lauriane Gilgien-Dénéréaz c, Baris Gencer d, Christian M. Matter e, Thomas Felix Lüscher f, g, Stephan Windecker h, François Mach i, Jean-Paul Humair j, Nicolas Rodondi k, l, David Nanchen l, Reto Auer a, c, *

a Institute of Primary Health Care (BIHAM), University of Bern, Switzerland
b Department of Paeidiatrics, University Hospital Bern (Inselspital Bern), Switzerland
c Center for Primary Care and Public Health (Unisante), University of Lausanne, Lausanne, Switzerland
d Cardiology Division, Geneva University Hospitals, Geneva, Switzerland
e Department of Cardiology, University Hospital Zurich, Zurich, Switzerland
f Center for Molecular Cardiology, University of Zurich, Switzerland
g Royal Brompton and Harefield Hospitals and Imperial College, London, United Kingdom
h Cardiology, University Hospital Bern (Inselspital, Bern), Switzerland
i Faculty of Medicine, Division of Primary Care Medicine, Geneva University Hospitals, Geneva, Switzerland
j Department of General Internal Medicine, Inselspital, Bern University Hospital, University of Bern, Bern, Switzerland

ARTICLE INFO

Keywords:
Motivation to quit
Motivational interviewing
Smoking cessation
Opt-in versus Opt-out
Prevention

ABSTRACT

Guidelines recommend brief smoking cessation interventions for hospitalized smokers reporting low motivation-to-quit. However, an intensive smoking cessation intervention may improve smoking cessation for these smokers. We conducted a secondary analysis of a pre-post interventional study that tested the efficacy of a proactive approach systematically offering intensive smoking cessation intervention to all hospitalized smokers with acute coronary syndrome (ACS) compared to a reactive approach offering it only to smokers willing to quit.

We analyzed data from one study site in Switzerland, which recorded motivation-to-quit smoking at study inclusion between 08.2009 and 02.2012. The primary outcome was smoking cessation at 1- and 5-year. We tested for interaction by participant’s motivation-to-quit score (low vs. high motivation), and calculated multivariable adjusted risk ratios (RR), stratified by motivation score.

We obtained motivation scores for 230 smokers. Follow-up was 94% (217/230) at 1-year and 68% (156/230) at 5-year. Among participants with low motivation to quit, 19% of smokers in the reactive phase had quit at 1 year compared to 50% of smokers in the proactive phase (multivariable adjusted RR = 2.85, 95%CI:0.91-8.91). Among highly motivated smokers, rates did not differ between phases: 48% vs. 49% (multivariable adjusted RR = 1.02, 95%CI:0.75-1.39, p-value for interaction between motivation-to-quit categories = 0.10). At 5-year follow-up, the point estimates were similar.

While our study has limitations inherent to the study design and sample size, we found that a proactive approach to offer systematic smoking cessation counseling for smokers with ACS reporting low motivation to quit was associated with higher smoking cessation rates at 1 year.

1. Introduction

Effective smoking cessation counseling is an essential component of secondary preventive care after acute coronary syndromes (ACS).

Guidelines recommend that healthcare providers ask patients if they smoke, assess their readiness to quit, assist smokers willing to quit with counseling, and arrange a follow-up contact (the “5A’s”) (Fiore et al., 2012), but recommend only minimal intervention if smokers are not
ready to quit. Recommended smoking cessation interventions are usually reactive, offered as an ‘opt-in’ approach (Richter and Ellerbeck, 2015), but the effectiveness of the opt-in approach has been recently challenged (Aveyard et al., 2012; Richter and Ellerbeck, 2015). Some have questioned the opt-in approach because it does not align with the proactive approach of interventions to treat other cardiovascular risk factors such as diabetes, dyslipidaemia and hypertension (Richter and Ellerbeck, 2015). In these interventions, treatment is offered systematically and patients can refuse (opt-out) (Fasu et al., 2017). An opt-out approach to smoking cessation would offer counseling to all smokers, whether or not they are ready to quit.

There is evidence suggesting that opt-out interventions for smoking cessation counseling are more effective than opt-in interventions for smokers in the outpatient setting (Aveyard et al., 2012; Fu et al., 2016; Fu et al., 2014; Japuntich et al., 2020; Pisinger et al., 2005b; Richter and Ellerbeck, 2015), but there is less evidence for its efficacy among hospitalized smokers (Fasu et al., 2017). We already conducted a pre-post interventional study that tested the acceptance and efficacy of a proactive, opt-out intervention based on motivational interviewing (MI), a non-judgmental, patient-centered counseling approach, with promising results (Auer et al., 2016). MI guides smokers through the process of behaviour change rather than solely offering smokers advice and recommendations based on their stated motivation (Codern-Bovi et al., 2014; Lindson-Hawley et al., 2015, 2011; Miller and Rollnick, 2012).

In our study, we systematically offered MI-based intensive smoking cessation intervention to all smokers hospitalized for ACS in the proactive, opt-out, phase and compared it to a reactive, opt-in, phase where we only offered smokers a smoking cessation intervention when their healthcare provider requested one (Auer et al., 2016). The proactive approach yielded promising smoking cessation outcomes, but the differences between phases were not statistically significant. One of our four study sites recorded motivation to quit at study inclusion during the proactive and the reactive phases of the study. Thus, we tested the hypothesis whether a proactive approach of systematically offering smoking cessation intervention to all smokers, regardless of self-reported motivation-to-quit, benefited smokers who state they are not motivated-to-quit more than a reactive approach.

We set out to determine whether a higher proportion of smokers with low motivation-to-quit received an intensive MI-based smoking cessation intervention and quit smoking at 1- and 5-years follow-up when they were included during the proactive phase than those included during the reactive phase.

2. Materials and methods

We report data from participants enrolled in the study site of Lausanne, Switzerland; one of the four study sites of the Special Program University Medicine-Acute Coronary Syndrome (SPUM-ACS) prospective cohort study (NTC 01000701, clinicaltrials.gov).

We defined current smoking as smoking one cigarette or more per day during the month before hospitalization. Participants were included consecutively in the reactive phase (08/2009 to 10/2010) or in the proactive phase (11/2010 to 02/2012). In the proactive phase, a resident physician trained in MI systematically approached all included smokers and asked permission to discuss their smoking habits (Auer et al., 2016). In the reactive phase, clinicians in charge could request dedicated smoking cessation counseling based on their assessment of a patient’s needs. At study entry, before any dedicated smoking cessation intervention, study nurses asked all participants: “On a scale from 1 (not motivated at all) to 10 (maximal motivation), what is your motivation to stop smoking?” Our primary outcome was self-reported 7-day smoking abstinence at the in-person 1-year follow-up and 5-years phone follow-up, assessed by a single question. Smoking abstinence was validated by expired CO level at 1-year follow-up. Carbon monoxide levels of 10 ppm or were identifying participants as current smokers. Secondary outcomes were delivery of smoking cessation intervention, time spent in counseling, and prescription of nicotine replacement therapy (NRT) at discharge.

We computed risk ratios (RR) with 95% confidence intervals (CI) for smoking cessation outcomes at 1- and 5-year follow-up. To determine whether the initial motivation to quit smoking modified the effect of the intervention, we tested for interaction by dichotomous motivation score on smoking cessation rates at 1 year. Due to limited sample size, we used the alpha level of 0.10 to determine significant interaction. We stratified analyses on smoking cessation outcomes by participants’ self-reported motivation-to-quit score at baseline (low motivation [1–5] and high motivation [6–10]). The cut-off for low vs high motivation was decided based on clinical judgment and arbitrarily set at the mean of the visual analog scale (1–5 and 6–10). Since we did not plan these analyses when we set up the trial, and therefore did not register our hypothesis or the cut-offs in a repository beforehand, cut-off should be considered a post-hoc decision and results considered exploratory.

We fitted multivariable adjusted generalized linear models following a negative binomial distribution, adjusted for demographic (age, sex, education), baseline smoking intensity (cigarettes per day), and for type of ACS. We excluded participants lost to follow-up from main analyses but performed sensitivity analysis including them as continuous smokers. Analyses were performed using STATA 17.0 (StataCorp, Texas, USA).

3. Results

Between August 2009 and February 2012, 616 participants admitted for ACS were included in the study; of these, 245 were smokers (Auer et al., 2016). We obtained motivation scores at baseline for 230 participants. At one year, 217/230 (94%) of these participants were available for follow-up; 8 (3.5%) had died, 5 (2%) were lost to follow-up. At 5 years, 156/230 (68%) were available for follow-up; 23 (10%) had died, 47 (20) were lost to follow-up (see flow diagram in online Appendix). Median age was 55 years; 22% were women. Sex, education, and cigarettes smoked per day were equally distributed across categories (Table 1). People were younger in the high motivation group than in the low motivation group (p = 0.014).

Among those with low motivation, 14% (N = 4) participants received a smoking cessation counseling intervention in the reactive phase and 78% (N = 14) in the proactive phase. NRT prescriptions increased more in those with low motivation than in those with high motivation to quit between reactive and proactive phases (Table 2). The median duration of counseling was 45 min in reactive phase and 50 in the proactive phase and did not differ by motivation-to-quit categories (Table 2). We found a significant interaction between motivation-to-quit score and study phases on smoking cessation at 1 year (p for interaction = 0.10). In stratified analyses by motivation to-quit-score, we found that 1-year smoking cessation rates were 19% in the reactive phase compared to 50% in the proactive phase among participants with low motivation-to-quit at baseline, multivariable adjusted RR = 2.85 (95%CI: 0.91–8.91). Among participants with high motivation-to-quit score, 48% of smokers included in the reactive phase were abstinent at 1-year follow-up compared to 49% of smokers included in the proactive phase (multivariable adjusted RR = 1.02, 95%CI: 0.75–1.39).

At 5-years follow-up, the point estimate was lower, but tended towards the same direction: Among participants with low motivation at baseline, 5-year smoking cessation rates were 28% in the reactive phase and 55% in the proactive phase (multivariable adjusted RR 2.98, 95%CI: 0.76–11.7). Smoking cessation rates of highly motivated patients were 51% in the reactive phase compared to 55% in the proactive phase (multivariable adjusted RR 1.07, 95%CI: 0.76–1.51). In sensitivity analyses including participants lost to follow-up as continuous smokers, results remained virtually unchanged at 1-year and at 5-years follow-up.
intervention was similar across groups with different motivation to quit. When smokers received MI-based counseling, the duration of the intervention varied significantly among smokers with low motivation-to-quit as compared to those with high motivation. Smokers with low motivation-to-quit appeared to benefit as much from the intervention as smokers with high motivation-to-quit. This finding supports the use of intensive MI smoking cessation counseling to benefit all smokers hospitalized for ACS regardless of baseline motivation.

4. Discussion

In this secondary analysis of a before-after trial, we found that self-reported motivation-to-quit at baseline modified the effect of a proactive MI-based smoking cessation intervention offered to all smokers hospitalized for ACS, regardless of baseline motivation to quit. The proportion of smokers with low motivation-to-quit who received an intensive smoking cessation intervention increased substantially, from 14% to 78% between the reactive and proactive phases. When smokers received MI-based counseling, the duration of the intervention was similar across groups with different motivation to quit (45 min vs 50 min), suggesting smokers with low motivation to quit are still open to receiving intensive MI smoking cessation counseling. The proactive approach of offering MI-based smoking cessation intervention was associated with increased smoking cessation at 1 year among the smokers with low motivation-to-quit (18% vs 50%), suggesting smokers with low motivation-to-quit appeared to benefit as much from the intervention as smokers with high motivation-to-quit. These findings challenge current recommendations to offer intensive smoking cessation counseling only to hospitalized smokers motivated-to-quit.

Our findings align with studies in the outpatient setting, where proactive approaches that delivered telephone-based smoking cessation counseling increased smoking cessation rates (Fu et al., 2016; Fu et al., 2014; Japuntich et al., 2020). Similarly, a RCT among smokers in the general population of Denmark showed that smokers at all motivational stages who said they had not planned to quit still accepted intensive smoking cessation counseling when systematically offered (Pisinger et al., 2005b), and this counseling raised smoking cessation rates (Pisinger et al., 2005a).

Our results suggest that proactive counseling benefits inpatient smokers who are not ready to quit, and can still be delivered to those who are not ready to quit. We know of no study specifically designed to test the effectiveness of proactive counseling for smokers who are not ready to quit. The authors do not present stratified analyses based on readiness to quit, so we do not know whether those states were not ready to quit benefited as much as those who were ready to quit. Therefore, future research should investigate whether proactive counseling can be delivered to all smokers hospitalized for ACS, regardless of their readiness to quit.

Table 1

| Variable                        | All (N=230) | Low motivation | Risk ratio (95% CI) | Multivariable adjusted** Risk ratio (95% CI) | High motivation | Risk ratio (95% CI) | Multivariable adjusted** Risk ratio (95% CI) |
|---------------------------------|-------------|----------------|---------------------|---------------------------------------------|-----------------|---------------------|---------------------------------------------|
| Reactive Phase (Group A)       |             |                |                     |                                             | Proactive Phase (Group B) |                |                                            |                                            |
| Discharge                      |             |                |                     |                                             | 14% (4/29)       | **78% (14/18)      | **5.64 (2.20–14.48)                          | **–**                                      |
|Duration, min., (IQR)           |             |                |                     |                                             | 45 (45–45)       | 50 (38–60)        | **–**                                      | **–**                                      |
| Discharged                     |             |                |                     |                                             | **19% (5/26)     | **50% (8/16)      | **2.85 (1.03–6.57)                          | **1.73–3.73**                             |
| Discharge at year 1, n (%)***  |             |                |                     |                                             | 25% (23/91)      | 49% (44/89)       | **1.04**                                   | **1.02**                                  |
| Discharge at year 5, n (%)**** |             |                |                     |                                             | 51% (33/65)      | 55% (34/62)       | **1.08**                                   | **1.07**                                  |

*Participants included in the reactive phase from 08/2009 to 10/2010 and the proactive phase from 11/2010 to 02/2012.

** Multivariable adjusted general linear models following a negative binomial distribution adjusted for sex, age, ACS type (STEMI/NSTEMI), education (University grade/High school grade/Apprenticeship or lower) and baseline cigarettes smoked per day. Three participants with missing data on education were excluded from multivariable analysis, but sensitivity analysis including them using multiple imputation showed similar results.

*** Follow-up outcome data for 94% (217/230) of included participants; 8 died within first year, and 5 were lost to follow-up. They were excluded from the analyses (see online supplement with flow-chart).

**** Follow-up outcome data for 68% (156/230) of included participants; 23 died within 5 years, 47 were lost to follow-up and 4 had a missing smoking status. They were excluded from analyses (see online supplement with flow-chart).
much or more from the intervention than those who stated they were ready to quit. In contrast, a subsequent RCT only including smokers “willing to make a serious attempt to quit smoking” after ACS, thereby excluding smokers with low motivation-to-quit, showed no benefit of the smoking cessation intervention (Sivarajan Froelicher et al., 2004). These findings highlight the need to consider the motivation to quit of included participants in smoking cessation intervention in future research.

Our study has limitations. Since we did not pre-specify stratified analyses by motivation-to-quit when we set up our clinical trial, our results should be considered exploratory in nature. Our conclusions are also limited because we were underpowered to detect meaningful changes in these stratified analyses. The multivariable adjusted RR = 2.85 (95%CI: 0.91–8.91) is also consistent with no effect or a negative effect of proactive counselling. Also, the before-after design may have introduced selection bias over time even though patients hospitalized with ACS were consecutively recruited (Auer et al., 2016). Adequately powered RCTs needed to further test our hypothesis (Fasercu et al., 2017). The follow-up rate was high at one year. The 5-year analyses should be interpreted carefully since we cannot exclude the possibility of informative censoring of participants. Furthermore, our data set was limited to patients hospitalized at a single site in Switzerland with ACS, whose smoking cessation rates are high compared to other health conditions. Future studies should test this hypothesis within a broader range of health conditions and settings.

Our exploratory findings challenge current recommendations to allocate high intensity smoking cessation counseling only to those who state they are motivated to quit (Fiore et al., 2012). We found that of the steering/executive group of trials funded by Abbott, Amgen, BMS, Bayer, Boston Scientific, Biotronik, Cardinal Health, Cardio Valve, CSL Behring, Daichi Sankyo, Edwards Life sciences, Johnson & Johnson, Medtronic, Querbet, Polares, Sanoﬁ, Terumo, Sinomed. S.W. reports research and educational grants to the institution from Abbott, Amgen, BMS, Bayer, Boston Scientific, Biotronik, Cardinal Health, Cardio Valve, CSL Behring, Daichi Sankyo, Edwards Life sciences, Johnson & Johnson, Medtronic, Querbet, Polares, Sanoﬁ, Terumo, Sinomed.

S.W. serves as unpaid advisory board member and/or unpaid member of the steering/executive group of trials funded by Abbott, Abiomed, Amgen, Astra Zeneca, BMS, Boston Scientiﬁc, Biotronik, Cardiovalve, Edwards Life sciences, Med Alliance, Medtronic, Novartis, Polares, Sinomed, V-Wave and Xelis, but has not received personal payments by pharmaceutical companies or device manufacturers. He is also member of the steering/executive committee group of several investigated-initiated trials that receive funding by industry without impact on his personal remuneration. S.W. is an unpaid member of the Pfizer Research Award selection committee in Switzerland.

CRediT authorship contribution statement

Inge Worni-Schudel: Conceptualization, Formal analysis, Investigation, Writing – original draft, Visualization. Vasilis Tzalis: Investigation, Writing – review & editing. Julian Jakob: Formal analysis, Data curation, Writing – review & editing, Visualization. Kali Tal: Conceptualization, Investigation, Writing – review & editing. Lauriane Gilgien-Danereaz: Writing – review & editing, Formal analysis. Baris Gencer: Data curation, Writing – review & editing, Funding acquisition. Christian M. Matter: Writing – review & editing, Project administration, Funding acquisition. Thomas Felix Lüscher: Resources, Writing – review & editing, Project administration, Funding acquisition. Stephan Windenacker: Writing – review & editing, Funding acquisition. François Mach: Writing – review & editing, Funding acquisition. Jean-Paul Humair: Conceptualization, Writing – review & editing. Nicolas Rodondi: Conceptualization, Resources, Writing – review & editing, Supervision, Project administration, Funding acquisition. David Nanchen: Resources, Writing – review & editing, Supervision, Project administration, Funding acquisition. Reto Auer: Conceptualization, Formal analysis, Investigation, Resources, Writing – original draft, Visualization, Supervision, Project administration, Funding acquisition.

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.

Acknowledgements

The SPUM ACS registry was supported by a grant of the Swiss National Research Foundation (Special Programme University Medicine; SPUM 33CM30-124112 to T.F.L, S.W., F.M., C.M.M., 32473B_163271 to F.M., D.N., C.M.M., N.R., G.B.E., 310030_165990 to C. M. M, a research grant from the Swiss Tobacco Prevention Fund (FPT 10.000046), a research grant from the Department of University Medicine and Community Care (DUMSC) of the University of Lausanne, Switzerland and unrestricted grants-in-aid by AstraZeneca (Zug Switzerland), Eli Lilly, (Indianapolis, USA), Merck Sharp and Dome (MSD, Lucerne, Switzerland), Roche Diagnostics (Rotkreuz, Switzerland) and Medtronic (Tolochenaz, Switzerland) and the Foundation for Cardiovascular Research – Zurich Heart House, Zurich. The founding organizations had no role in the design and conduct of the study; collection, management, analysis and interpretation of the data; preparation, review or approval of the manuscript; and decision to submit the manuscript for publication.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2021.101583.

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