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Uptake and efficacy of a systematic intensive smoking cessation intervention using motivational interviewing for smokers hospitalised for an acute coronary syndrome: a multicentre before–after study with parallel group comparisons

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ABSTRACT

Objectives: To compare the efficacy of a proactive approach with a reactive approach to offer intensive smoking cessation intervention using motivational interviewing (MI).

Design: Before–after comparison in 2 academic hospitals with parallel comparisons in 2 control hospitals.

Setting: Academic hospitals in Switzerland.

Participants: Smokers hospitalised for an acute coronary syndrome (ACS).

Intervention: In the intervention hospitals during the intervention phase, a resident physician trained in MI systematically offered counselling to all smokers admitted for ACS, followed by 4 telephone counselling sessions over 2 months by a nurse trained in MI. In the observation phase, the in-hospital intervention was offered only to patients whose clinicians requested a smoking cessation intervention. In the control hospitals, no intensive smoking cessation intervention was offered.

Primary and secondary outcomes: The primary outcome was 1 week smoking abstinence (point prevalence) at 12 months. Secondary outcomes were the number of smokers who received the in-hospital smoking cessation intervention and the duration of the intervention.

Results: In the intervention centres during the intervention phase, 87% of smokers (N=193/225) received a smoking cessation intervention compared to 22% in the observational phase (p<0.001). Median duration of counselling was 50 min. During the intervention phase, 78% received a phone follow-up for a median total duration of 42 min in 4 sessions. Prescription of nicotine replacement therapy at discharge increased from 18% to 58% in the intervention phase (risk ratio (RR): 3.3 (95% CI 2.4 to 4.3; p≤0.001). Smoking cessation at 12-month increased from 43% to 51% comparing the observation and intervention phases (RR=1.20, 95% CI 0.98 to 1.46; p=0.08; 97% with outcome assessment). In the control hospitals, the RR for quitting was 1.02 (95% CI 0.84 to 1.25; p=0.8, 92% with outcome assessment).

Conclusions: A proactive strategy offering intensive smoking cessation intervention based on MI to all smokers hospitalised for ACS significantly increases the uptake of smoking cessation counselling and might increase smoking abstinence at 12 months.

Strengths and limitations of this study

- Four university centres were involved with two centres serving as a parallel comparison.
- Smoking cessation outcome assessed after 12 months in 97% of participants in the intervention centres.
- The weaker before–after design with parallel comparisons limits causal inference of the potential effects of the intervention.
- There were significant differences in attendance rates to cardiac rehabilitation and length of stay between the observation and intervention phase, limiting the interpretation of the findings.
- Participants received phone counselling after their hospital stay in the intervention phase, but not in the observation phase, thereby inherently limiting the interpretation of the comparison between a proactive and a reactive approach of offering a smoking cessation intervention on smoking cessation rates at 12 months.

INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death in adults in the USA and in

Europe and smoking is the leading cause of CVD.[1] Smokers who quit after a myocardial infarction can expect a 36% reduction in CVD mortality over 2 years compared with continuing smokers.[2 3] In a meta-analysis of randomised controlled trials (RCTs) of smokers hospitalised for a CVD diagnosis, smoking cessation interventions started in the hospital and sustained in the ambulatory setting for at least 1 month after discharge, increased smoking cessation rates by more than 40%.[4 5]

While the effectiveness of smoking cessation counselling interventions and their components has been extensively studied, the optimal delivery of smoking cessation interventions has been less studied.[6 7] Current guidelines promote the use of the 5A's for the delivery of smoking cessation interventions where healthcare providers *assist* smokers willing to make a quit attempt after having *assessed* their 'readiness to quit'.[8 9] However, past negative experiences with healthcare workers, where smokers felt to be negatively judged because of their behaviour, may impact their willingness to explore their habit with a counsellor.[10–12] The Clinical Practice Guideline for Treating Tobacco Use and Dependence recommends the use of motivational interviewing (MI) with smokers who express low motivation to quit.[13] MI is a collaborative, person-centred guidance to elicit and strengthen motivation to change; MI could allow approach all smokers, regardless of their self-reported motivation to quit smoking.[14 15] While a recent study showed promising results on increasing the uptake of smoking cessation interventions when systematically identifying and assisting hospitalised smokers, 30% declined consent to participate in the study and an additional 30% of those offered behavioural support refused it.[16]

Our primary aim was to test the efficacy of a proactive approach compared with a reactive approach to offer intensive smoking cessation intervention using MI to smokers hospitalised for an acute coronary syndrome (ACS) in two sites in a before–after comparison. We also aimed at making a parallel comparison of the smoking cessation rates of smokers hospitalised in these intervention sites to the quit rates of smokers hospitalised in two other sites without intensive smoking cessation intervention throughout the study duration.

MATERIALS AND METHODS

Study population

The study population comprised smoking participants to the SPUM ACS (Special Program University Medicine - Acute coronary Syndrome) cohort study; a national cohort of patients with ACS conducted in four academic hospitals in Switzerland and registered at clinicaltrials.gov (NCT 01000701 and NCT 01075867).[17–19] Inclusion criteria were patients aged 18 years or older presenting with the principal diagnosis of ST segment-elevation myocardial infarction (STEMI), non-STEMI (NSTEMI) or unstable angina (UA), actively smoking at the time of inclusion and willing to participate in a clinical study including a follow-up examination at 12 months. Active smoking was defined as smoking one cigarette or more per day during the month preceding the hospital stay. Exclusion criteria were index revascularisation with coronary artery bypass graft, severe physical disability, inability to give consent (dementia), impossibility of returning for a follow-up clinical visit at 12 months and <1 year of life expectancy for non-cardiac reasons. Patients were followed at 12 months for assessment of smoking cessation outcomes (figure 1). The observation phase was from August 2009 to October 2010 and the intervention phase from November 2010 to February 2012. The study includes two intervention sites (A and B) and two control sites (C and D). There are five major academic medical centres in Switzerland and four participated in the prospective cohort study of patients with ACS.[17–19] The two intervention sites were chosen based on the existence of a team providing smoking cessation interventions to hospitalised smokers before the start of the study on a reactive basis. There was no random allocation of study sites into control and intervention sites. Detailed documentation of the flow of participants from the arrival to the emergency room for suspected ACS to the inclusion in the clinical follow-up study was performed in study site A (see online supplementary appendix).

Study design

The study design is a multicentre before–after study with parallel group comparisons. We made two comparisons for smoking cessation outcomes at 12 months follow-up and process outcomes: a before–after comparison between observation and intervention phases in intervention sites A and B; a parallel group comparison between intervention (A and B) and control (C and D) sites in both observation and intervention phases.

Study protocol and interventions

During the observation phase at the intervention sites (study sites A and B), the standard practice in place was that patients received information about the possibility of a dedicated smoking cessation intervention and clinicians in charge of patients could request a specialised smoking cessation intervention for hospitalised smokers through a simple phone call and after patient's agreement.[20 21] We called this approach a 'reactive approach' to delivering smoking cessation interventions. In the intervention phase, a resident physician trained in MI identified all smokers included in the clinical follow-up study and systematically approached them to get permission to discuss their smoking habit. We called this approach a 'systematic approach' to delivering smoking cessation interventions. There was no restriction on the duration of the interview and residents ended the discussion once they felt an increase in the resistance of the patients, if they were interrupted by competing care to patients or if patients specifically asked the interview to end. Multiple MI sessions were allowed during the

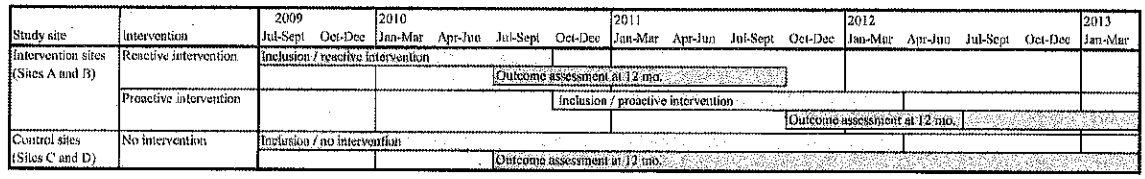

Figure 1 Study design. Before–after intervention with parallel group comparisons: we compared the 7 days point smoking prevalence at 12 months follow-up between participants included in the reactive versus the proactive intervention phases in intervention sites (A and B). We also compared the 7 days point smoking prevalence at 12 months follow-up between participants included during the same period in observation sites (C and D).

hospital stay and at the end of each session, the resident systematically offered the possibility of additional consultations during the hospital stay provided the logistics were possible. While the in-hospital counselling intervention was the same in the observation and in the intervention phase, residents also systematically suggested to patients to be contacted by a study nurse after their hospital stay for four ambulatory telephone contacts during the intervention phase, which was not done in the observation phase. Study nurses systematically contacted by phone each patient at 2 days, 1 week, 1 month and 2 months after discharge from the acute care hospital.[4] Whenever possible, the nurse tried to meet all counselled smokers for a brief face-to-face encounter before discharge. In addition to training in tobacco cessation counselling and prescription of nicotine replacement therapy (NRT),[21] residents were trained in MI during four sessions of 4 hours each over 1 month separated by 1 week before the intervention phase. To allow residents to adapt the interview to the patient's needs, we did not develop a detailed manual for directing the MI.[22] To minimise interference with the intervention, most data were collected during the inclusion of patients before the residents approached patients. If not already prescribed by the health care provider (HCP) in the ward, the resident offered NRT and brochures on smoking cessation. Residents provided the HCP in charge of the patient with a brief summary of the intervention and recommendations for NRT and sent a medical report to the patient's primary care provider. Study nurses followed the same training in MI as the residents. NRT, which is not reimbursed in Switzerland, was available free of charge during the hospital stay, but were at the patients' charge in ambulatory care. In the control study sites (C and D), there was no dedicated smoking cessation intervention throughout the study duration and participants received minimal smoking cessation advice by hospital clinicians in charge of their care.

Covariates

Current smoking status, age of smoking initiation and daily cigarettes consumption were assessed for all patients throughout the study duration in all sites during the inclusion process in the clinical study. In the intervention sites during the intervention phase, patients were given a questionnaire to be filled during the hospital stay.

Administrative (length of stay, discharge home or direct transfer to a peripheral hospital or to cardiovascular rehabilitation (CR)), demographic (age, sex, race, education), medical (type of ACS (NSTEMI/UA and STEMI); previous coronary health disease (CHD)) data and processes of care were collected during the inclusion in the clinical follow-up study and completed after discharge. Attendance rate to CR and type of CR (ambulatory vs hospital) were assessed from administrative data available at discharge and from self-report during the ambulatory follow-up visit at 1 year. In Switzerland, healthcare providers' organise CR during the hospital stay or provide patients with information to benefit from CR. Thus patients could be directly addressed to an inpatient CR facility or attend ambulatory CR in the outpatient setting. Quality indicators were based on cardiological guidelines and included systematic collection of reason for non-prescription for preventive medication.[17]

Outcomes

The primary outcome for smoking cessation was 1 week smoking abstinence (point prevalence) at 12 months. At the time of inclusion, patients were informed that they would be asked about their smoking status during a visit at 12 months. Self-reported smoking cessation was biochemically confirmed by exhaled carbon monoxide levels (Micro Smokerlyzer; Bedfont Scientific) at the 1-year follow-up visit in all sites.[23] Patients who did not return at 12 months were contacted either by phone or mail. We classified those with carbon monoxide levels of at least 10 ppm as current smokers. Secondary process outcomes were: the number of patients who received smoking cessation counselling, NRT at discharge and follow-up as well as the duration and number of interventions during the hospitalisation and follow-up.

Statistical analysis

Frequencies, means with SDs and medians with IQRs were used when appropriate, as were χ^2 tests, Fisher's exact test, Wilcoxon rank-sum test and analysis of variance (ANOVA) for bivariate analyses. The primary analysis examined the point estimate and 95% CI of the risk ratio (RR) for smoking cessation at 12 months between both phases in the intervention sites and using an intention-to-treat approach. The sample size calculation was based on an expected 10% absolute increase in

smoking abstinence at 12 months in the two intervention centres. The 10% difference was based on a summary estimate of 11 previous RCTs identified in a systematic review and meta-analysis which included smokers hospitalised with CHD and tested the effect of a high-intensity intervention with phone follow-up.[5 24–36] The summary quit rate over all these studies in the intervention groups was 45% and 31% in the control groups, thus an absolute risk difference (ARD) of 14%. Using an α-level of 0.05 and a power of 80%, and given the potential increase in abstinence due to the intervention in some smokers in the observation phase, we estimated that 400 patients had to be included in the intervention sites (A and B) over the entire study period to detect a 10% absolute difference in quit rates. Secondary analyses were a comparison of the smoking cessation rates at 12 months between both phases in the control study sites (C and D; figure 2). The study was not powered to detect a significant difference between intervention and control sites over the observation and intervention phases. We also conducted stratified analyses by attendance to CR and education status (with or without university degree). We further tested the association between the presence and duration of counselling between phases using logistic regression models and Poisson logistic regression models. Statistical significance was set at 0.05. All analyses were performed using STATA V.12 (StataCorp, College Station, Texas, USA).

RESULTS

Study population

Between August 2009 and February 2012, 616 patients admitted for ACS were included in the clinical follow-up study in site A, and 510 in site B. A total of 458 (40%) were current smokers and included in the subsequent analyses (figure 2 and online supplementary appendix figure 1). At 12 months follow-up, smoking status was assessed in 97% while 15 participants had died (figure 2 and online supplementary appendix figure 1). In the study sites C and D, 192 smokers were included in the observation phase and 244 in the intervention phase (figure 2 and online supplementary appendix table 1). At 1 year follow-up, smoking status was obtained for 92% while 12 participants died.

Mean age of participants included in the intervention sites (study sites A and B) in the intervention phase was 55 years, 20% were women and 52% had been hospitalised for STEMI (table 1). There were no significant differences in baseline characteristics between participants in observation and intervention phases, except for the longer stay of patients directly discharged home.

Process outcomes

In the intervention sites (study sites A and B), 22% of patients received intensive smoking cessation counselling during the observation phase compared to 87% in the intervention phase (figure 2 and table 2). Among the 13% who did not receive counselling in the intervention phase, 10% (n=24) were transferred to another facility or discharged home before the counsellor could approach them; 2% (N=4) completely refused to discuss with counsellor and 1% (N=2) had a major language barrier. The median duration of the intervention during the hospital stay was 50 min and did not significantly vary between both phases. During the intervention phase, 78% received a phone follow-up (90% of those receiving in-hospital counselling) for a total median duration of 42 min in four sessions. Prescription of NRT at

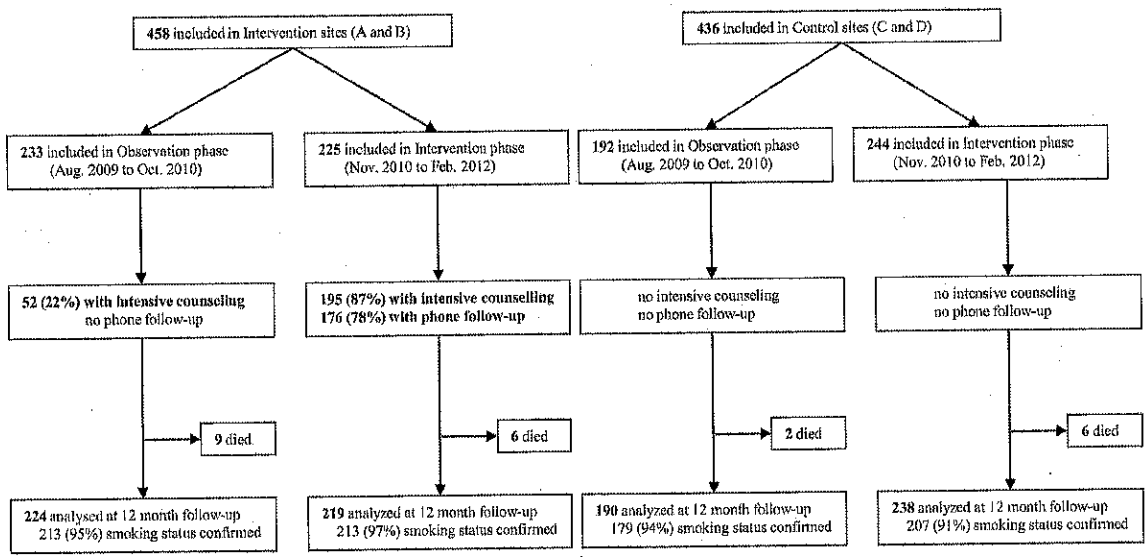

Figure 2 Flow chart of participants included in the intervention sites (A and B) and control sites (C and D) during observation phase (August 2009–October 2010) and intervention phase (November 2010–February 2012). Intensive smoking cessation counselling was offered during the observation phase in the observation on request and systematically during the intervention phase. Phone follow-up was only offered in the intervention phase in the intervention sites (see Materials and methods section).

Table 1 Baseline characteristics of participants hospitalised for an acute coronary syndrome in two academic hospitals (intervention sites, study sites A and B) in Switzerland in the observation phase (August 2009–October 2010) and intervention phase (November 2010–February 2012)

	Intervention sites (A and B)		
	Observation phase n=233	Intervention phase n=225	p Value
Demographic variables			
Age, years (mean±SD)	57±11	55±11	0.06
Female, n (%)	46 (20)	45 (20)	0.9
Education, less than university degree, n (%)*	203 (88)	185 (83)	0.1
Living alone	68 (29)	55 (24)	0.3
Working status, employed, n (%)	136 (59)	143 (64)	0.3
Previous CHD, n (%)	46 (20)	37 (16)	0.3
Smoking variables			
Cigarettes per day (median, Q1, Q3)	20 (10, 25)	20 (10, 25)	0.5
Age at smoking start (mean±SD)	19±6	18±6	0.6
Clinical variables			
ACS-type:			
STEMI (vs NSTEMI/UA), n (%)	121 (52)	116 (52)	0.9
Hospital stay			
Length of stay, median (Q1, Q3), in days			
For patients directly discharged home	5 (3,6)	5 (4,7)	0.04
For patients transferred to peripheral hospital	1 (0.5, 1)	1 (0.5, 2)	0.3
Treatment at discharge			
Destination at discharge, n (%)			
Home	148 (64)	138 1)	
Direct transfer to cardiac rehabilitation	47 (20)	39 (17)	0.3
Transfer to peripheral hospital	36 (16)	47 (21)	
Prescription of all recommended drug therapy at discharge†	222 (95)	216 (96)	0.6
Attendance to cardiovascular rehabilitation assessed at discharge and 12 months follow-up (n, %)‡	136 (58)	163 (73)	<0.01
Ambulatory vs stationary§	74 (56)	109 (67)	0.05

*Six participants with missing information on education status or who refused to disclose their education status.
†Concomitant prescription at discharge unless contraindicated or not indicated for aspirin, clopidogrel/prasugrel or ticagrelor if percutaneous coronary intervention (PCI) - stent treatment, β-blocker, statin, angiotensin-converting-enzyme inhibitor (ACEI) if LVEF ≤40%. When participants transferred to peripheral hospital, β-blocker and ACEI/angiotensin receptor II antagonist (ATII) coded as not applicable.
‡Both ambulatory and stationary cardiovascular rehabilitation are covered after an ACS in Switzerland. Attendance rate computed using data on direct referral to in-patient CR and on self-reported attendance at 1 year follow-up in order to capture information on those directly transferred to a stationary CR and those attending CR in the ambulatory setting.
§Three participants with missing information on type of CR.
CHD, coronary heart disease; CR, cardiac rehabilitation; LVEF, left ventricular ejection fraction; n, number of participants; NSTEMI, non-ST segment elevation myocardial infarction; Q1, first quartile; Q3, third quartile; STEMI, ST segment elevation myocardial infarction.

discharge increased significantly from 18% to 58% in the intervention phase (RR: 3.3 (95% CI 2.4 to 4.3; p≤0.001). Of those who received phone follow-ups in the intervention phase, 67% were prescribed NRT at discharge, but only 41% were still taking NRT at the first phone follow-up 2 days after discharge.

In the intervention sites, the proportion reporting having attendedCR significantly increased during the intervention phase in the intervention sites from 58% to 73% (p<0.01). The proportion attending ambulatory CR compared to hospital-based CR increased from 55% in the observation phase to 67% in the intervention phase.

Smoking abstinence at 12 months

In the intervention sites, validated 12 months smoking abstinence increased from 43% during the observation phase to 51% in the intervention phase (RR 1.20; 95% CI 0.98 to 1.46, p=0.08; ARD 8%, table 3). In the control sites, 47% quit smoking in the observation phase compared to 48% in the intervention phase (RR: 1.02 (95% CI 0.84 to 1.25; p=0.8; absolute risk reduction (ARR) 1%).

In exploratory stratified analyses comparing cessation rates in intervention sites between both phases, the apparent benefit was mostly seen in those not attending CR and those without university degree (table 3).

DISCUSSION

In this multicentre study involving smokers hospitalised for an ACS, a systematic smoking cessation intervention sharply increased the number of patients exposed to MI and NRT. The median duration of counselling during the hospital stay was 50 min and did not vary between phases. Comparing observation with intervention phases, the smoking abstinence at 1 year increased from 43% to 51% (8% absolute difference in abstinence,

Table 2 Process outcomes in intervention sites (study sites A and B) comparing smokers hospitalised in the observation phase (August 2009–October 2010) and intervention phase (November 2010–February 2012)

	Observation phase N=233	Intervention phase N=225	Risk ratio (95% CI) or coefficient*	p Value†
Received intensive counselling during hospital stay (n, %)	52 (22)	193 (87)‡	3.9 (3.0 to 5.0)	<0.001
Duration of in-hospital counselling per participant in minutes (median, Q1, Q3)	45 (45, 48)	50 (35, 60)	2.6 (−3.7 to 8.7)	0.4
Number of in-hospital counselling sessions (median, min, max)	1 (1,2)	1 (1, 3)	0.15 (−0.15 to 0.45)	0.3
Received phone follow-up (n, %)	NA	175 (78)	–	–
Duration of each phone follow-up in min (median, Q1, Q3)	NA	11 (8, 17)	–	–
Total duration of phone follow-up in min (median, Q1, Q3)	NA	42 (30, 61)	–	–
Number of phone follow-ups (median, Q1, Q3)	NA	4 (3, 4)	–	–
Prescribed nicotine replacement therapy at discharge (n, %)	42 (18)	132 (59)	3.3 (2.4 to 4.3)	<0.001

*Risk ratio and 95% CI calculated for dichotomous outcomes. Coefficients for duration of counselling obtained by linear regression. For number of counselling sessions, coefficient obtained by Poisson logistic regression model.
†p Value calculated by χ^2 for dichotomous outcomes (eg, proportion receiving counselling) and linear regression for duration of encounters.
‡Of the 13% who did not receive an intervention, 24 (11%) were transferred to another facility or discharged home before the counsellor could approach them, 2% (n=4) completely refused to discuss with counsellor, 1% (n=2) were in a confused state.
CHD, coronary heart disease; CR, cardiac rehabilitation; LVEF, left ventricular ejection fraction; min, minutes; n, number of participants; NA, not-applicable; NSTEMI, non-ST segment elevation myocardial infarction; Q1, first quartile; Q3, third quartile; STEMI, ST segment elevation myocardial infarction.

Table 3 Smoking cessation outcomes at 12 months follow-up comparing participants in observation phase (August 2009 to October 2010) and intervention phase (November 2010 to February 2012) at four university sites in Switzerland. Seven-day point prevalence abstinence, validated by exhaled carbon monoxide*

	N total for analysis	Per cent of quit in obs. phase/interv. phase	Risk ratio (95% CI)	Absolute risk difference (%)	p Value
Main outcome					
Intervention sites (study sites A and B) (n=458)	443	42.0/50.2	1.20 (0.98 to 1.47)	8.3	0.08
Control sites (study sites C and D) (n=436)	428	46.8/47.8	1.02 (0.84 to 1.25)	1.1	0.8
Secondary analyses for participants in intervention sites (study sites A and B) (n=440)					
Cardiac rehabilitation					
With cardiac rehabilitation	296	51.5/53.7	1.04 (0.84 to 1.30)	2.2	0.7
No cardiac rehabilitation	143	29.5/43.6	1.48 (0.95 to 2.30)	14.1	0.09
Education status					
University degree	64	59.3/51.3	0.87 (0.56 to 1.34)	−7.9	0.5
No university degree	371	40.7/50.8	1.24 (1.0 to 1.6)	10.1	0.05

*Participants lost to follow-up or who withdrew consent (n=11, 97% follow-up rate) considered as smokers for these analyses. Participants who died (n=15) during follow-up excluded from these analyses. Validated smoking cessation by carbon monoxide (CO) in 68% of quitters in intervention sites and 40% of quitters in control sites. Two participants reported having quit during last 7 days despite a CO level of more than 10 ppm considered as smokers.
N, number of participants.

p=0.08). At sites without dedicated in-hospital smoking cessation intervention during the entire study period, no difference in smoking abstinence was observed. In subgroup analyses, the benefit of the systematic intervention appeared limited to smokers not attending CR and those with lower education level.

Murray *et al*[16] recently tested the effectiveness of systematically providing support to all identified smokers in a RCT randomising medical wards in one medical centre in the UK. The systematic identification permitted to increase the offer of behavioural support from 46% to 100% of smokers and the acceptance of behavioural support from 29% to 70% of smokers. However, of the 1072 smokers identified in ward, 30% declined consent to participate in the study and an additional 30% of those offered behavioural support refused it. In our study, detailed analysis of the flow of participants until inclusion in the clinical study showed that 4% refused to enter the clinical follow-up study, followed by 2% who completely refused to open the discussion

with the resident approaching them to start a motivational interview. The benefits of counselling all smokers regardless of their motivation to quit using MI had also previously been tested in a rigorously performed RCT in 1996–1997.[29] Of the 164 smokers with acute myocardial infarction, 8 (5%) refused to participate in the smoking cessation intervention including follow-up at 6 months. The smoking cessation rate at 1 year was 34% in the observation group and 55% in the intervention group (p<0.005). However, the study was performed in a single study site and the rate attending CR was not provided and is expectedly lower than the rate in our population, thus limiting the comparison.

The sharp increase in uptake of the smoking cessation intervention highlights the effect of changes in the choice architecture described in behavioural economic theories. Setting the default option from an *opt-in* to an *opt-out* has been shown to be a powerful driver of uptake in interventions.[37 38] In the context of our study, the systematic offer of a smoking cessation intervention is similar to an *opt-out* policy where patients ask not to have the intervention compared to the *opt-in* policy where patients or their caregivers specifically have to request a smoking cessation intervention.

In our study, the rate discharged to CR in the intervention sites increased from 58% to 73% between the observation and intervention phases. Given that CR includes smoking cessation counselling and support, it could be considered a follow-up intervention as recommended by guidelines and might be explained by a higher attendance rate to CR.[4] However, in stratified analyses by attendance to CR, the benefit of the systematic smoking cessation intervention was mostly apparent among participants not attending CR. The systematic approach might permit to counsel those most at risk of lack of follow-up in the ambulatory care. The high attendance rate to CR overall in our study might explain the negative findings on smoking cessation rates over follow-up[39–42] Overall, attendance rates in the USA range from 14% to up to 55%.[39–42] We based our sample size estimation on previous studies on smoking cessation after ACS where attendance rates to CR were expectedly lower. Unfortunately, we are unable to compare the attendance rates in our study to previous smoking cessation studies because previous studies included in the Cochrane systematic review and to the recent study by Murray *et al*[16] have not reported on rates of ambulatory CR.[5 24–36] Future studies should also better describe the concomitant interventions in the ambulatory care in order to facilitate the interpretation and translation of findings into clinical practice.

Our findings challenge the recommendation of allocating high intensity counselling only to those 'willing to make a quit attempt' recommended in smoking cessation guidelines based on the 5A's framework.[9] According to MI, motivation occurs in the interpersonal context, which depends on the style used by counsellors with smokers and may influence the acceptance rates of the intervention.[14] A previous rigorously performed RCT including only those willing to make a serious quit attempt was unable to show a benefit on smoking cessation.[27]

We found that the systematic smoking cessation intervention led to an increase in NRT prescriptions at discharge comparing the observation and intervention phase at the intervention study sites. However, the high cost of NRT after discharge, given that NRTs are not covered by healthcare insurance companies in the ambulatory setting in Switzerland, might explain the lower rate of participants still taking NRT at the phone follow-up. Future studies should test the effect of removing potential financial barriers for using NRT after the hospital stay on smoking cessation outcomes.

Our study has certain limitations. The weaker before–after design with parallel group comparisons does limit the causal inferences from our results. Participants received phone counselling after their hospital stay in the intervention phase, but not in the observation phase. A systematic review on the benefits of smoking cessation intervention for hospitalised smokers suggested that only interventions including a follow-up intervention in the ambulatory setting have shown an effect on smoking cessation outcomes at 12 months. This strongly limits the comparison of smoking cessation rates between the observation and intervention phase as the smoking cessation increase could be due to either phone follow-up or a proactive versus reactive approach of offering smoking cessation intervention. We urge for careful interpretation of the results given differences in covariates between participants included in the observation phase and intervention phase (table 1). In the participants included in the intervention sites, we found a significant increase in length of stay in addition to the previously discussed increase in attendance rates to CR between the observation and intervention phase. Smoking cessation rates at 12 months were based on self-report. We validated the 1 week smoking abstinence by measuring the exhaled carbon monoxide whenever possible.[23] However, misclassification of the smoking cessation outcome is still possible. Rates of referral to CR were based on information at discharge and self-report at 1 year follow-up. The reliability of self-reported CR referral has been validated in patients after an ACS in Canada and used recently to report on enrolment rate to CR in the USA.[42 43] Exploratory subgroup analyses on the differential effect of education level and attendance to CR should be carefully interpreted, as these analyses were defined a posteriori. Patients were included in four high-quality academic hospitals and results may not apply to different settings. The MI sessions were not recorded and the quality of interactions can therefore not be directly assessed. We did not develop a detailed manual for directing the MI. A prior meta-analysis suggested that clinical trials in which MI was delivered without a manual had showed better treatment outcomes.[22]

CONCLUSIONS

In summary, we found that a systematic smoking cessation intervention using MI for smokers hospitalised for an ACS compared to a reactive strategy relying on busy healthcare providers to contact a specialised smoking cessation consultation permitted to sharply increase the number of patients counselled. In exploratory subgroup analyses of data collected in one study centre, patients with lower education level and not attending CR appeared to be more likely to benefit from the intervention. Comparison of smoking cessation rates at 12 months between the observation and intervention phases are limited by the study design and showed a trend towards an increase in smoking cessation rates. Future studies should evaluate the benefit of systematically exposing smokers to a smoking cessation intervention based on MI.

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Contributors RA, BG, RT, CMM, TFL, SW, FM, JC, J-PH, NR were involved in conception or design of the work or the acquisition. RA, BG, DN, RT, JC, J-PH, NR were involved in analysis or interpretation of data for the work. RA, BG, RT, J-PH, NR drafted the work. DN, CMM, TFL, SW, FM, JC were involved in revising it critically for important intellectual content. RA, BG, RT, DN, CMM, TFL, SW, FM, JC, J-PH, NR contributed to the final approval of the version to be published. RA, BG, RT, DN, CMM, TFL, SW, FM, JC, J-PH, NR were involved in agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors do meet the ICMJE criteria for authorship.

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Competing interests The following authors have the following conflicts. TFL reports receiving research grants to the institution from Abbott, Biosensors, Biotronik, Boston Scientific and Medtronic, and consultant payments from AstraZeneca, Boehringer Ingelheim, Bayer, Merck and Pfizer. CMM reports receiving grants from MSD, Eli Lilly, AstraZeneca and Bayer; expert testimony from MSD; payment for lectures from MSD, AstraZeneca and Roche; and having patents from Mabimmune, CH. SW reports receiving research contracts to the institution from Abbott, Biotronik, Boston Scientific, Biosensors, Cordis, Medtronic and St. Jude Medical and speaker fees from Abbott, Biotronik, Boston Scientific, Biosensors, Medtronic, Eli Lilly and Astra Zeneca. All other authors have declared that they have no competing interests.

Patient consent Obtained.

Ethics approval The study protocol was approved by the institutional review board of all participating centres; namely, the Ethics Committee on Clinical Research of the University of Lausanne, the Ethics Committee of the Department for Internal Medicine and Community Medicine of the University Hospital of Geneva, the Cantonal Ethics Committee (KEK) of the Canton of Bern, and the Cantonal Ethics Committee (KEK) of the Canton of Zurich. All patients provided written, informed consent.

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