BELIEFS AND BEHAVIOR OF DECEIVERS IN A RANDOMIZED, CONTROLLED TRIAL OF ANTI-SMOKING ADVICE AT A PRIMARY CARE CLINIC IN KELANTAN, MALAYSIA

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Abstract. Smoking deception is often ignored, but is important in health care. In this trial it was assessed at both study entry and outcome. At study entry, 1,044 males at a primary care clinic were asked smoking status and tested for breath carbon monoxide (CO). Of self-reported non-smokers, 57/402 (14%) were actually smokers, as were 59/251 (24%) of self-reported ex-smokers. The self-reported smokers (n=387) entered a randomized, controlled trial where the intervention comprised four questions on knowledge and beliefs about smoking, standardized verbal advice against smoking, and a leaflet. At follow-up, subjects were also questioned about beliefs. Follow-up was difficult, but 191/387 (49%) attended at three or six months. Of 27 who claimed to have quit, 6 (22%) were deceivers and 21 were confirmed quitters. Cessation did not differ between intervention and control groups. Overall confirmed cessation at six months was 16/387 (4.1%). Confirmed quitters were significantly lighter smokers than deceivers and still smokers. There were non-significant trends between the outcome groups whereby deceivers had least knowledge and most lay beliefs, and quitters had most knowledge and fewest lay beliefs. The lay beliefs may prevent some smokers from quitting.

INTRODUCTION

Studies have shown the small but significant effect of physician advice in promoting smoking cessation (Silagy and Stead, 2001). Doctors are urged to tackle smoking as often as possible using the formula 'ask, advise, assist, and arrange follow-up' (Raw *et al*, 1998).

However, there is evidence that smokers do not always report their smoking accurately. This comes from two sources: firstly, from comparisons of self-reported tobacco consumption with national data on tobacco sales or tax revenue (Hatziandreu *et al*, 1989: Wald *et al*, 1988); and secondly, from biochemical tests, *eg*, expired air carbon monoxide (CO), serum thiocyanate (SCN), or urinary cotinine, compared with self-report, as reviewed by Velicer *et al* (1992). Inaccuracies of two types are shown: some smokers misrepresent themselves as ex-smokers or non-smokers; and smokers under-report the number of cigarettes they consume.

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There are several practical difficulties in assessing smoking deception. Cotinine has the best sensitivity and specificity, but CO is cheaper and more practical (Velicer *et al*,1992). The accuracy of CO is reduced, first, by diurnal variation. With a half-life of four-five hours, it is cleared from the body within 24 hours of the last cigarette (Sillett *et al*, 1978). After a cigarette CO rises, then declines, rapidly for the first five minutes, and slowly from five to 60 minutes (Woodman *et al*, 1987). This means measurements should be taken at least five minutes after the last cigarette.

A second factor is environmental exposure to CO from motor exhausts, indoor combustion, and passive smoking. In domestic rooms (Cox and Whichelow, 1985) with indoor combustion (gas, coal, wood, or paraffin), ambient CO ranged up to 42ppm. In homes with radiators or electric fires, CO was 4ppm with non-smoking residents, or up to 16ppm with smoking residents. In non-smokers breath CO is on average 1.5ppm above ambient.

There are difficulties in choosing a cut-off point. The commonest method is to pick a cut-off point that gives maximum specificity and sensitivity, as in Patrick *et al*'s review of 26 studies

(Patrick *et al*, 1994), which chose 9ppm for CO. There are two problems with this. One is that it takes self-report as the gold standard. The other is that it gives equal weight to both types of error, misclassification of smokers as non-smokers and vice versa. However, it is intrinsically unlikely that non-smokers will describe themselves as smokers.

Woodward and Tunstall-Pedoe (1992a) describe an iterative technique for deriving cut-off points independent of self-report. They compared values for CO, SCN, and cotinine using data from the Scottish Heart Health Study (Woodward *et al*, 1991; Woodward and Tunstall-Pedoe, 1992b). This mathematical technique gave a cut-off point for CO of 6ppm.

Cummings and Richard (1988) show that the optimal cut-off point varies with the prevalence of smoking in the population studied. This particularly affects tests such as CO that have substantial overlap between smokers and non-smokers. They calculated that optimum cut-offs for CO would be 14ppm where prevalence of smoking is 10%, 12ppm where prevalence is 20%, and 9ppm where prevalence is 50%. Another difficulty with these studies is that authors do not always make clear whether subjects with levels at the cut-off point are counted as smokers or non-smokers.

Some studies have assessed whether subject variables affect deception rates (Lando *et al*, 1991; Wagenknecht *et al*, 1992). Subjects describing themselves as ex-smokers are more likely to be deceivers than subjects who say they have never smoked.

The present study aimed to measure the effect of anti-smoking advice among primary care patients, which had not previously been done in Malaysia. Other variables, *eg*, cigarette consumption, stage-of-change, knowledge, and beliefs about smoking, were compared with quit rate. It has been shown that heavier smokers have lower quit rates (Lennox, 1992), and that subjects in a more advanced stage-of-change have higher quit rates (DiClemente *et al*, 1991). The relation of knowledge and beliefs about smoking to quit rate is unclear (Lennox, 1992). This study tests the hypothesis that smokers with less knowledge and more lay beliefs about safe ways to smoke would show lower quit rates.

In this study smoking deception was measured at recruitment and follow-up. At recruitment, the hypothesis was tested that deception would be higher among self-reported ex-smokers than non-smokers. At follow-up, the primary outcome measure was how many subjects were confirmed quitters, still smokers, or deceivers. These groups were compared for cigarette consumption, stage-of-change, knowledge and beliefs about smoking. This seems to be the first study to include deceivers in such a comparison. The study assesses whether deceivers resembled still smokers, or confirmed quitters, or formed a different group.

MATERIALS AND METHODS

Project setting, personnel, and sampling

The setting was the open-access outpatients clinic (KPM) attached to the teaching hospital (HUSM) of Universiti Sains Malaysia (USM) in Kota Bharu, Kelantan, in north-east Peninsular Malaysia. Subjects, enrolled by AJ, were male patients aged 10-59 years from the two nearest districts, Kota Bharu and Bachok. They were interviewed privately by a Malaysian male research assistant (RA), while waiting to see a doctor.

Sample size was planned by calculating odds ratios for various cessation rates in sample sizes varying from 100 to 400 in each arm. Studies had reported cessation rates of 5-17% in intervention subjects, and 1-11% in controls. A trial with 183 in each arm would have 80% power to detect a difference between 11% and 3% at the 5% significance level. A sample size of 400, 200 in each arm, was selected as being practical and one that might give a significant difference.

Biochemical validation

CO was measured by a Bedfont Smokerlyzer. At study entry, CO level was compared with the subjects' self-report as current smokers, ex-smokers or never-smokers. Smokers then entered the randomized, controlled trial. At follow-up, CO level was compared with their report of quitting or not.

Randomization

Using a computer-generated random allocation sequence, subjects corresponding to an even number were allocated to intervention, and odd numbers to control.

Questionnaire design

The questionnaire asked age, ethnicity, and occupation. Subjects were classified as current, ex, or never smokers on Yes/No answers to the questions: 'Do you currently smoke cigarettes, or rokok daun (local leaf cigarettes), or any other form of tobacco?' and 'Did you ever smoke cigarettes, rokok daun, or any form of tobacco?'

Current and ex-smokers were asked, 'How many cigarettes do you normally smoke per day, during the last month?' Consumption of less than one a day but at least one a week was recorded as 0.5 per day; consumption of less than one a week was recorded as 0.1 per day. CO level was measured, and then non-smokers and ex-smokers returned to the clinic waiting area.

Smokers were assessed on stage-of-change using standard questions (Prochaska and Goldstein, 1991). Then they were asked, 'In your opinion what is the effect of smoking on health?' with a Likert scale from 'very dangerous' to 'very good'. At this point the RA opened the sealed envelope containing the subject's assignment. The control subjects were invited to make comments, and then they returned to the waiting area.

The intervention comprised four extra questions, a paragraph of standardized advice, and a leaflet. The questions were:

1. 'In your opinion what number of cigarettes do you think someone can smoke and be safe?'
2. 'Do you think there are any safe ways to smoke?'
3. 'Do you think any of the following diseases are caused by smoking: heart attack, lung cancer, stroke, throat cancer, cough and breathlessness?'
4. 'Do you know what percentage of smokers will die because of smoking?'

The standardized advice was: 'On behalf of USM hospital we want to inform you that all these diseases are much more common in smokers than non-smokers. Fifty percent of smokers will die because of smoking. There is no safe way to smoke, and the only number that is safe to smoke is zero. The staff of this hospital strongly encourage you to stop smoking. Thank you.'

The leaflet (in Malay) was designed in the Department of Community Medicine under the supervision of ASG. It listed health hazards of smoking, answered common excuses for smoking, gave tips on how to stop smoking, mentioned the dangers of passive smoking and the cost of smoking, and quoted from Islamic writings against smoking. Finally the intervention subjects were invited to comment, and then they returned to the waiting area.

At three-month and six-month follow-up subjects were asked their normal daily cigarette consumption over the last three months. If they claimed to have stopped, they were asked, 'When did you stop?' 'How did you stop?' and 'Did you have any problems stopping?' CO level was recorded.

At six-month follow-up, they were also asked about lay beliefs. Interim analysis had been done on responses to 'Do you think there are any safe ways to smoke?' Three of the most common lay beliefs were presented to subjects as follows: 'Some people believe that it is safe to smoke if you do something like drinking water, eating sour fruit, or smoking after food. What is your opinion?' This provided member checking or respondent validation.

Follow-up

The RA gave subjects an appointment three months after the first interview, with the promise of five Malaysian dollars to cover transport. The RA attempted to contact defaulters by phone or letter for both a three-month and six-month follow-up appointment.

Data analysis

Textual answers to open-ended questions were translated and codified. Data were entered into Epi Info version 5. Self-reported smoking status was compared with CO level, and a cut-off was chosen to estimate rates of deception. Among smokers the correlation between number of cigarettes per day and CO level was calculated. Following the intervention the main outcome measure was rate of quitting smoking. Using CO level subjects were classified as continuing smokers, confirmed quitters, and deceivers.

RESULTS

Recruitment

Recruitment took place between 11.9.1996

and 27.11.1996. Follow-up took place from 11.12.1996 until 12.5.1997. Omissions are shown in Fig 1.

Self-reported smoking status and demographic variables

By self-report 387 (37%) were current smokers, 254 (24%) ex-smokers, and 403 (39%) non-smokers. Smoking varied with age-group: aged 10-19 years 54/296 (18%) were current smokers; aged 20-29 112/185 (61%), aged 30-39 98/198 (49%), aged 40-49 76/196 (39%), and aged 50-59 47/169 (28%). The majority of subjects were Malays, 987/1044 (94.5%), 49 (4.7%) were Chinese, and 8 (0.8%) were of other groups. Smoking did not vary with ethnicity. Omitting subjects younger than 20 years, and pensioners, the rate of smoking among manual workers was 258/472 (55%), which was significantly higher than among professional/managerial workers, 65/217 (30%), (OR 2.82; 95% CI 1.97-4.03).

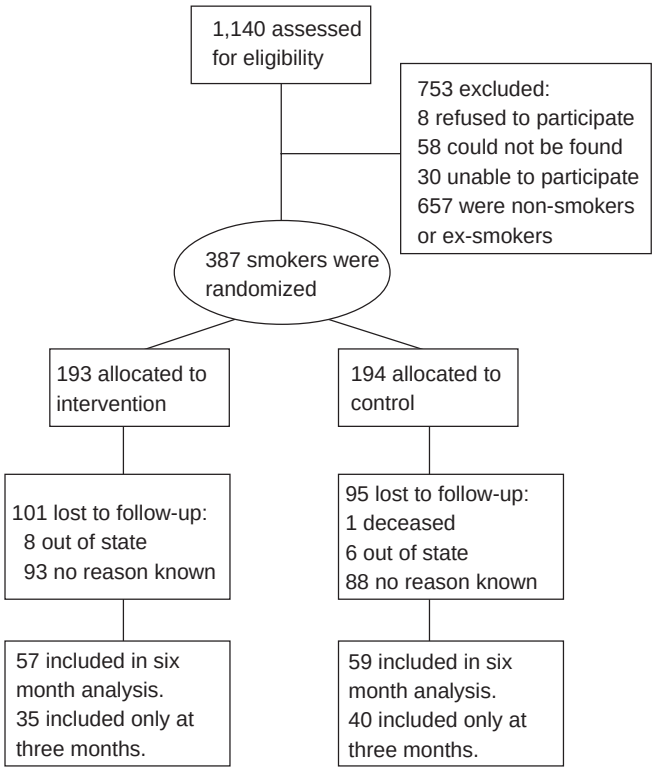

Fig 1–Flow diagram of randomized, controlled trial of anti-smoking advice given in a primary care clinic in Kelantan, Malaysia.

Self-reported smoking status compared with CO Exclusions. For this analysis, CO levels were excluded in eight subjects who had difficulty using the Smokerlyzer. Twenty-five smokers volunteered that they had not smoked in the last few days because of recent illness, *eg*, respiratory infection. With these exclusions, CO levels were compared of 358 self-reported smokers, 251 ex-smokers, and 402 non-smokers.

CO level compared with self-reported smoking status. Frequencies are illustrated in Fig 2. The CO levels in different groups were closely bunched and overlapped. Modal values were close: for non-smokers 6ppm, ex-smokers 7ppm, and smokers 9ppm. Mean values for non-smokers (6.9ppm) and ex-smokers (7.6ppm) were significantly different (p=0.000022, Mann-Whitney *U* test), while mean for smokers was 15.9ppm.

Table 1 shows the effect of different cut-offs. The chosen cut-off was 8ppm; *ie*, non-smokers and ex-smokers with CO > 8ppm were classed as deceivers. This is the highest acceptable cut-off, since 9ppm was the modal value among smokers. With this cut-off, 59/251 (24%) of self-reported ex-smokers, and 57/402 (14%) of self-reported non-smokers were deceivers.

CO level compared with cigarette consumption among smokers. This is shown for 354 subjects (data on consumption missing in 4) in Table 2. There is evidence of digit preference, in that substantial groups reported 10 or 20 cigarettes per day. The correlation between reported number of cigarettes and CO level is low, r = 0.42 (95% CI: 0.33-0.50).

Outcome allocation

Follow-up is detailed in Fig 1. Those lost to follow-up were classed as still smoking. At the latest available follow-up, 27 claimed to have quit smoking. Their CO levels separated into two groups: six in the range 11-26ppm, mean 15ppm; 21 in the range 5-8, mean 6ppm. The first six were classified as deceivers, who were actually still smoking, and the 21 as confirmed quitters.

Outcome compared to intervention

There was no difference in confirmed quit rate between intervention subjects (9/193, 4.7%;

Table 1
Numbers of subjects at recruitment, in self-reported smoking status categories, with CO less than or equal to the cut-off *vs* those above cut-off.

CO cut-off (ppm)	Smokers (%) (n = 358)	Ex-smokers (%) (n = 251)	Non-smokers (%) (n = 402)
6	18:340 (5:95)	82:169 (33:67)	185:217 (46:54)
7	36:322 (10:90)	145:106 (58:42)	283:119 (70:30)
8	61:297 (17:83)	192:59 (76:24)	345:57 (86:14)
9	92:266 (26:74)	218:33 (87:13)	378:24 (94:6)
10	110:248 (31:69)	234:17 (93:7)	391:11 (97:3)

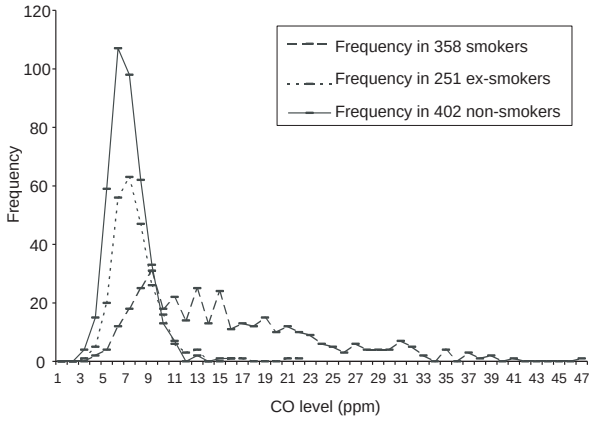

Fig 2–Frequency of CO levels in self-reported smokers, ex-smokers, and non-smokers.

95% CI 1.7-7.7%); and control subjects (12/194, 6.2%; 95% CI 2.8-9.6%). The overall confirmed quit rate among intervention and control subjects combined was 21/387 (5.3%), or, if limited to those who attended at six months, 16/387 (4.1%) (Table 3).

There is some evidence that control subjects interpreted the study as an anti-smoking intervention. When asked when and how they had stopped, 11/27 claiming to have quit volunteered that they stopped because of the study. Of these 11, four were intervention subjects and seven controls; nine were confirmed quitters and two deceivers.

Outcome compared to other variables

Table 4 summarizes the distribution of other variables with outcome. There is no difference in age and occupation between the three outcome groups.

There was a substantial and significant difference between quitters and those still smoking in the reported number of cigarettes smoked at study entry (p=0.000008, Mann-Whitney *U* test). Deceivers also smoked significantly more than quitters at study entry (p=0.0348, MWU). However, there was no difference between the smok-

Table 2
Average CO reading among self-reported current smokers reporting different levels of cigarette consumption (n = 354).

Reported consumption (cigarettes/day)	Number of subjects	Average CO (ppm)
0.1	3	11.0
0.5	14	8.0
1	14	8.6
2	23	10.9
3	24	11.8
4	6	12.7
5	24	14.6
6	13	15.7
7	12	12.8
8	5	13.0
10	80 (23%)	16.9
11	1	12.0
12	14	18.2
13	2	17.5
14	2	23.0
15	15	16.0
18	2	16.5
20	86 (24%)	19.9
25	1	32.0
30	4	15.5
40	8	22.7
50	1	28.0

Table 3
Comparison of baseline data on self-reported smokers in intervention and control groups.

	Intervention (n =193)	Control (n = 194)
Age: mean (years)	33.2	33.9
Ethnic group: Malay	187 (97%)	180 (93%)
Occupation: Professional: manual	36:127 (22%:78%)	29:131 (18%:82%)
Type of tobacco: cigarettes only	158 (82%)	158 (81%)
Number of cigarettes per day: mean	12.4	10.2
CO level: mean (ppm)	15.6	16.2
Stage of change: Precontemplation	32 (16%)	[a]24 (12%)
Contemplation	53 (28%)	51 (26%)
Preparation	108 (56%)	118 (61%)
Awareness of effect on health: dangerous	172/190 (91%)	178/194 (92%)

[a]Data on stage-of-change available for 193 control subjects.

Table 4
Comparison of subjects found at follow-up to be confirmed quitters, still smokers, or deceivers.

Variable	Quitters (n = 21)	Still smoking (n = 164)	Deceivers (n = 6)
Age: mean (years)	34.5	36.0	39.7
Occupation: Professional: manual	3:13 (19%:81%)	27:107 (20%:80%)	0:6
Number of cigarettes per day at study entry : mean	4.2	11.8	13.2
CO reading at study entry : mean (ppm)	9.0	16.0	14.6
Stage of change : preparation	17 (81%)	98 (60%)	4 (67%)
Awareness of effect on health : dangerous	21 (100%)	143 (88%)	6 (100%)
Conditions identified as caused by smoking (n=92) mean out of 5	4.00 (n = 9)	3.56 (n = 79)	3.00 (n = 4)
Beliefs at study entry (n = 92) reported any 'safe way' to smoke	5/9 (56%)	59/79 (75%)	4/4 (100%)
Beliefs at 6-month follow-up (n = 115)			
mean number held, out of 3	1.0 (n = 16)	1.5 (n = 93)	2.2 (n = 6)
supported 'Drink water'	7/16 (44%)	55/93 (59%)	5/6 (83%)
supported 'Take sour fruit'	4/16 (25%)	52/93 (56%)	5/6 (83%)
supported 'Smoke after food'	5/16 (31%)	30/93 (32%)	3/6 (50%)

ing rates at entry for smokers and deceivers (p=0.7671, MWU). Results for CO levels at study entry were similar.

On comparing stage of change, knowledge and beliefs about smoking, there are no significant differences, but there are possible trends. For stage of change, the quitters had the highest proportion in preparation. For knowledge, on the question addressed to all subjects, only those still smoking included any who regarded smoking as not dangerous.

For the other questions on knowledge and beliefs at study entry, there are data for 92 intervention subjects, and for the questions at six-month follow-up about the three lay beliefs there are data for 115 subjects. On knowledge of conditions caused by smoking, the deceivers identified fewer than those still smoking, while the quitters identified most. The beliefs reported at study entry were very varied, as described else-

where (Jackson *et al*, 2004). The proportion of subjects reporting any 'safe way' to smoke was highest among deceivers, followed by still smokers, followed by quitters. At six-month follow-up, deceivers show most support for the lay beliefs, followed by those still smoking, while quitters show least support.

DISCUSSION

There were several methodological problems in this study. The questions on smoking status were not precise enough, since Velicer *et al* (1992) specify a minimum of seven days abstinence to define ex-smokers. There were difficulties using CO levels with substantial overlap between smokers, ex-smokers, and non-smokers. Many smokers had low CO levels, possibly due to recent abstaining, as mentioned by 25 subjects, or to low cigarette consumption. Conversely, many ex-smokers and non-smokers had high CO levels, which is probably largely due to deception. Other factors, particularly environmental exposure, need further study. Background CO in the study rooms was only 1 or 2ppm. Further studies are needed on environmental exposure to CO in tropical settings.

There was no difference in quit rate between intervention and control groups. This may have been due to methodological weaknesses. Control subjects were exposed to many elements of an intervention, *eg*, questioning, CO measurement, and encouragement to attend follow-up. The only extra items for intervention subjects were four questions, a statement of advice, and a leaflet. Some control subjects interpreted the study as an anti-smoking intervention directed to themselves. This is an example of the Hawthorne effect, where participation in a study affects behavior. The sample size was too small. From the Cochrane review (Silagy and Stead, 2001), the difference between intervention and control groups should not have been expected to exceed 2.5%. To show a difference of, *eg*, 5% to 2%, would need 653 in each arm (80% power and 5% significance). With the difficulties of follow-up in this setting, sample size should be even larger.

However, the overall combined quit rate for both intervention and control subjects, of 5.3%, or strictly 4.1% at six months, is probably higher than if the subjects had not entered the study. The background rate of quitting smoking in Malaysia is not known. In Britain, the Royal College of Physicians' report on nicotine addiction (2000) estimates that among those aged 25-49 annual cessation rates between 1986 and 1996 were 2.2%. The finding that successful quitters had been lighter smokers reflects the strength of nicotine addiction.

This study highlights the importance of deception about smoking. The minimum estimate that 24% (1 in 4) of ex-smokers, and 14% (1 in 7) of non-smokers in this setting were actually smokers has serious implications. These patients cannot be reached by advice from a health professional, since they are not identified. To the slogan, 'Ask, advise, assist, and arrange follow-up' could be added, 'Don't assume'. Physicians cannot assume that patients will tell the truth about their smoking. National strategies for tackling smoking should not rely solely on smoking cessation efforts by health workers, but must use a variety of methods, *eg*, public campaigns, advertising restrictions, and taxation.

The new findings in this study concern the connections between lay beliefs, quitting, and deception. Among the three outcome groups of confirmed quitters, still smokers, and deceivers, there were non-significant trends whereby deceivers had least knowledge and most lay beliefs, while quitters had most knowledge and fewest lay beliefs. This suggests that the lay beliefs may have prevented some smokers from quitting. This may be an area for applying complexity science (Wilson and Holt, 2001). Particularly with smokers who are not motivated to quit, physicians could ask, 'Some people think smoking is not that dangerous. What do you think?' Health education campaigns should also address and correct the false beliefs held by many smokers.

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