



## Motivation, acceptability and attitudes toward lung cancer screening among persons who attend a tobacco cessation program: A multicenter survey in Italy

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### ABSTRACT

This study aimed to evaluate smoking cessation (SC) motivation and the acceptability of a lung cancer screening (LCS) program with low-dose computed tomography (LDCT) among people who attend SC programs. A multicenter survey was conducted in the period January–December 2021 involving 197 people who attended group or individual SC courses in Reggio Emilia and Tuscany. Questionnaires, information sheets, and decision aids about the potential benefits and harms of LCS with LDCT were distributed at different time points during the course. The wish to protect own health (66%) was the most frequent reason given for quitting smoking, followed by cigarette dependence (40.6%) and current health problems (30.5%). Half of the participants (56%) considered periodic health checks including LDCT, as an advantageous activity. The great majority of participants were in favor of LCS (92%), with only 8% being indifferent, and no one was against these programs. Interestingly, those with sufficiently high smoking-related LC risk to be eligible for LCS and those attending the individual course were less in favor of LCS but also less concerned about the possible harms associated with LCS. The type of counseling was a significant predictor for both LCS acceptability and perceived harm of LCS. The favorable perception of LCS in people attending SC courses, despite the considerable preoccupation with potential harms, is an important finding of this study. Introducing a discussion on the benefits and harms of LCS in SC programs may prepare persons who smoke to make informed decisions on utilizing LCS.

### 1. Background

Lung cancer is the leading preventable cause of cancer deaths

worldwide (Ferlay et al., 2021). Quitting smoking is the single most important factor in decreasing the risk of developing lung cancer since 75% of cases are attributed to exposure to tobacco smoke (Cancer

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Research UK, 2022).

Smoking cessation interventions have been shown to be an effective tool in facilitating smoking cessation (Patnode et al., 2021), which in turn contributes to decreasing lung cancer, cardiovascular diseases, and other smoking-related pathologies (Reitsma et al., 2020; Duncan et al., 2019). Lung cancer screening (LCS) with low-dose CT (LDCT) is another important step in the lung cancer prevention and control continuum. Randomized controlled trials, meta-analyses, and governmental task forces confirm its association with reduced lung cancer mortality in persons who currently smoke and people who formerly smoked (National Lung Screening Trial Research Team et al., 2011; de Koning et al., 2020; Field et al., 2021; Paci et al., 2017; Pastorino et al., 2019). In the United States, LCS has been implemented based on the initial 2013 recommendations from the US Preventive Services Task Force (USPSTF) (US Preventive Services Task Force et al., 2021). Moreover, numerous scientific societies worldwide, such as the National Comprehensive Cancer Network (NCCN) and the European Society of Radiology and European Respiratory Society (ESR/ERS), recommend that people at high risk of lung cancer should undergo screening (Kauczor et al., 2015; Wood et al., 2018).

The Italian government has recently started planning targeted LCS pilot program. Accordingly, the Italian Ministry of Health funded a project to be conducted by a consortium of regional health authorities and other scientific partners. This study is a part of the project to inform health authorities about the acceptability of an LCS program with LDCT among smokers attending tobacco cessation programs.

Evaluation of the possible interactions between the primary prevention (smoking cessation) and secondary prevention (screening with LDCT) interventions is crucial because screening alone – especially in individuals with repeated negative results – could possibly lead to less concern for developing disease and reduced efforts to quit smoking (Shi and Iguchi, 2011). A positive effect of the LCS program on promoting smoking cessation is clearly recognized, especially in those with a positive result, although there is considerable heterogeneity across studies (Lococo et al., 2017; Pistelli et al., 2020; Moldovanu et al., 2021). Modeling studies show that including a smoking cessation treatment in LCS programs maximizes LC mortality reduction associated with screening (Tramontano et al., 2016; Cao et al., 2020). Meza et al show that adding even a one-time SC intervention of modest effectiveness results in a further increase in life-years gained comparable to that obtained with screening alone because SC decreases mortality from many causes, not only LC (Meza et al., 2022). Yet, less is known about whether smoking cessation programs could be a useful moment to promote and offer LCS.

Previously published KAP (Knowledge, Attitudes, and Practices) studies mainly addressed individuals at risk from the general population (Cataldo, 2016; Kellen et al., 2021). However, it is also important to assess the interests and attitudes of persons who smoke and who attend smoking cessation courses concerning LCS testing, given the number of persons who smoke who seek help to quit smoking via phone programs is increasing substantially each year in Italy (Italian Ministry of Health, 2021).

Our goals were to 1) study lung screening knowledge and attitudes of people participating in a smoking cessation program and its determinants in two regions in Italy and 2) examine the associations between smoking cessation, motivation, and the perceived benefits of quitting smoking and lung cancer screening attitudes.

## 2. Methods

### 2.1. Study design

A multicenter study was conducted surveying people attending group or individual smoking cessation programs in Reggio Emilia and Tuscany in the period January-December 2021. The eligible subjects were all consecutively recruited individuals seeking counseling in the

participating anti-smoking centers who gave their informed consent to participate in the study. There were no restrictions on age and smoking history for enrolment in the cessation course, but a sub-analysis stratified by eligibility for LCS was performed.

This study constitutes a quantitative part of a broader mixed-methods study (Luoghi di Prevenzione, 2022a). A qualitative research study was carried out in parallel with this quantitative investigation.

### 2.2. Setting

In Italy, smoking cessation services are provided by the National Health Service, through public smoking cessation clinics (*Italian CAF, Centro Antifumo*) located within local health units and university hospitals. The provincial centers of the LILT, a non-profit organization formed on an associative basis, have been offering psycho-behavioral smoking cessation programs based on national recommendations for many years and are operational in many Italian provinces (Italian Ministry of Health, 2021). LILT is CS provider for the NHS and are working in a network in both regions participating in this study. LILT clinics perform both group and individual treatments, whereas the NHS clinics (in the Tuscany Region) have individual smoking cessation treatments supported by medical treatment. Six smoking cessation centers were included in this study, five of which were in Tuscany (LILT Florence, CAF Borgo San Lorenzo, CAF Prato, and university hospitals in Pisa and Careggi) and one in the Emilia-Romagna region (LILT Reggio Emilia).

### 2.3. Smoking cessation counseling

Free-of-charge individual or group interventions are offered to people who want to quit smoking, using behavioral change techniques in combination with tailored pharmacotherapy. Individual smoking cessation counseling was offered in all the Tuscany centers, whereas a “small group” approach was adopted in Reggio Emilia (Luoghi di prevenzione., 2022b). The Trans Theoretical Model (TTM) developed by DiClemente and Prochaska (Del Rio Szupszynski et al., 2021), based on defining the stage of motivation to quit smoking, has recently been adopted by the Italian League against Cancer (LILT) and by several public health services as a helpful framework to facilitate the individual process of change.

Groups consisted of 15–20 participants. In summary, there were eight meetings in the first month and four meetings in the second month. A psychologist trained in psycho-behavioral treatment for smoking cessation in the local center had the responsibility for conducting the group treatment.

The individual intervention consisted of approximately six visits in the first three months and scheduled follow-ups at 6 and 12 months after quitting day. Pharmacological treatment options were nicotine replacement therapy (NRT), bupropion, varenicline, or cytisine, separately or in various combinations. Individual counseling was provided in an outpatient setting by a medical doctor, usually a respiratory specialist.

Both individual and group treatment sessions were preceded by an individual interview conducted by the educator with a duration of 20–30 min. During the interview, the data treatment and privacy form was delivered, the medical history sheet on smoking habits was filled in, the level of motivation was assessed, and information on the smoking cessation intervention was provided. Where possible, it was recommended that carbon monoxide (CO) levels should be measured to reinforce motivation to participate in the course.

### 2.4. Decision aids

An information sheet about LDCT and a decision aid leaflet about the potential benefits and harms of LCS with LDCT were distributed to those who agreed to participate in the study and it was explained by the

educator at the first session. The sheet also contained a visual depiction of common sources of radiation exposure compared to LDCT. The decision aid was translated from information material developed by the US Agency for Healthcare Research and Quality (Agency for Healthcare research and quality, 2022).

## 2.5. Questionnaires

Four multiple-choice questionnaires that were developed during the design phase of the study were delivered to all enrolled participants at different time points. At enrolment, participants filled out a general questionnaire about socio-demographic characteristics and smoking habits and a questionnaire about their primary reasons for quitting smoking. This questionnaire contained two parts, the first part in which participants were asked to choose the three most important reasons for quitting smoking out of the ten statements offered, and the second part in which they were asked to choose only one principal reason from the same pool of statements. They were also offered the possibility of writing additional reasons if they were not already present on the list.

The second questionnaire measured the perceived factors that would encourage or discourage participants from continuing not smoking, and it was distributed during the second or third session of the smoking cessation program. Patients were asked to choose which of nine statements described activities they considered would encourage them not to take up smoking again and which they considered would discourage them, selecting a maximum of six elements for each category.

The third questionnaire was completed between the fifth and eighth sessions. It contained two questions, with the answers graded using a five-point Likert scale. The first was a question on the overall acceptability of LCS, namely how strongly they were in favor of or against the screening process. Answers to this question were graded as “not at all in favor”, “a little in favor”, “indifferent”, “quite in favor” and “a lot in favor”. The second question evaluated the perceived risk of receiving a false positive result, performing other tests, radiation exposure, non-necessary treatment, and adverse events. Level of concern was graded as “not at all concerned”, “a little concerned”, “indifferent”, “very concerned” and “extremely concerned”.

## 2.6. Statistical analysis

Descriptive statistics were used to summarize responses. Data are presented as frequencies with percentages or medians with interquartile ranges (IQR). Overall and stratified analysis by eligibility for LCS and by type of SC counseling was performed. Given that recommended age cut-off for LCSD eligibility ranges from 55 to 74 or from 50 to 80 and for smoking history from 20 to 30 pack-years (Kauczor et al., 2015; US Preventive Services Task Force et al., 2021), in order to consider persons who would be eligible now or might be eligible, participants in our analysis were considered at sufficiently high risk for being eligible for LCS if aged  $\leq 50$  years and reported  $\geq 20$  pack-years or if aged  $> 50$  years and reported  $\geq 30$  pack-years.

The perceived LCS harm score was calculated as a sum of five perceptions about potential harms (false positive result, other tests, radiation exposure, non-necessary treatment, and adverse events). Given that single-item answers could range from zero (not at all worried) to four (considerably worried), the composite harm score could range from zero to 20, where a higher score indicated a higher level of concern.

Univariable and multivariable ordinal logistic models were built to assess the determinants of positive attitudes toward LCS. The outcome variable was categorized into three levels: very positive, positive, and indifferent or less. The independent variables were sociodemographic characteristics (age, sex, educational level, and occupation), smoking habits (cigarettes per day, pack-years, and smoking intensity), eligibility for LCS, perceived harms of LCS, main reasons for quitting smoking (health, dependence or social reason) and type of counseling (group or individual intervention). The type of counseling was not considered a

determinant in the multivariable analysis due to the issue of a fully determined outcome. However, an analysis stratified by type of counseling was performed.

Univariable and multivariable linear regression was performed to estimate determinants of preoccupation about the potential harms of LDCT. Coefficients with 95% confidence intervals were presented.

All analyses were performed using Excel and STATA16 (Stata Corporation, College Station, Texas 77,845 USA) software.

## 3. Results

### 3.1. Description of participants

There were 197 participants in the study (112 in Reggio Emilia and 85 in Tuscany), with a median age of 56 years (IQR 51–62), predominantly women with higher education (school and a university degree) (Table 1). The majority of participants (60.9%) reported heavy smoking in the past, with a median number of cigarettes smoked per day of 20 (IQR 15–30) and a median pack-year history of smoking of 38.3 (IQR 27–56). Subjects eligible for LCS were older, had a lower level of education, consumed more cigarettes per day, and attended predominantly individual courses (Supplementary Table 1).

There was a certain loss of subjects over the treatment period: 70 (35.5%) subjects did not complete the second questionnaire on motivation for quitting smoking and 84 (42.6%) did not complete the third questionnaire on acceptability and perceived risk and benefit of LCS (Table 1). Participants in the group counseling had a higher dropout rate compared to those participating in individual courses (69.1% vs 30.9%) (Supplementary Table 2). There were no substantial differences in other characteristics between participants who completed the last questionnaire and those who did not.

### 3.2. Motivation for quitting smoking

Willingness to protect their own health was the most frequent reason for quitting smoking (66%), even when participants were asked to limit their choice to only one main reason (39.4%) (Fig. 1). The patient group who were ineligible for LCS had a higher percentage of protecting their

**Table 1**  
Demographic characteristics of study participants.

	Total N = 197
Age, median (IQR)	56 (51–62)
Sex, n (%)	
Male	89 (45.2)
Female	108 (54.8)
Highest Education, n (%)	
Elementary school (five years of education)	11 (5.6)
Middle school (eight years of education)	78 (39.6)
High school (13 years of education)	77 (39.1)
University/postgraduate degree ( $\geq 16$ years of education)	31 (15.7)
Occupation, n (%)	
Unemployed	20 (10.2)
Housewife	5 (2.5)
Permanent employee	120 (60.9)
Fixed-term employee	4 (2.0)
Retired	48 (24.4)
Cigarettes-day, median (IQR)	20 (15–30)
Pack-years, median (IQR)	38.3 (27–56)
Smoking intensity, n (%)	
Light smoking (1–10 cig/day)	23 (11.7)
Moderate smoking (11–19 cig/day)	54 (27.4)
Heavy smoking ( $\geq 20$ cig/day)	120 (60.9)
Number of completed questionnaires, n (%)	
1st (Reasons for quitting smoking)	197 (100)
2nd (Activities that encourage or discourage smoking cessation)	127 (64.5)
3rd (Acceptability and perceived risks of LCS)	113 (57.4)

IQR, interquartile range; LCS, lung cancer screening; cig/day, cigarettes per day.

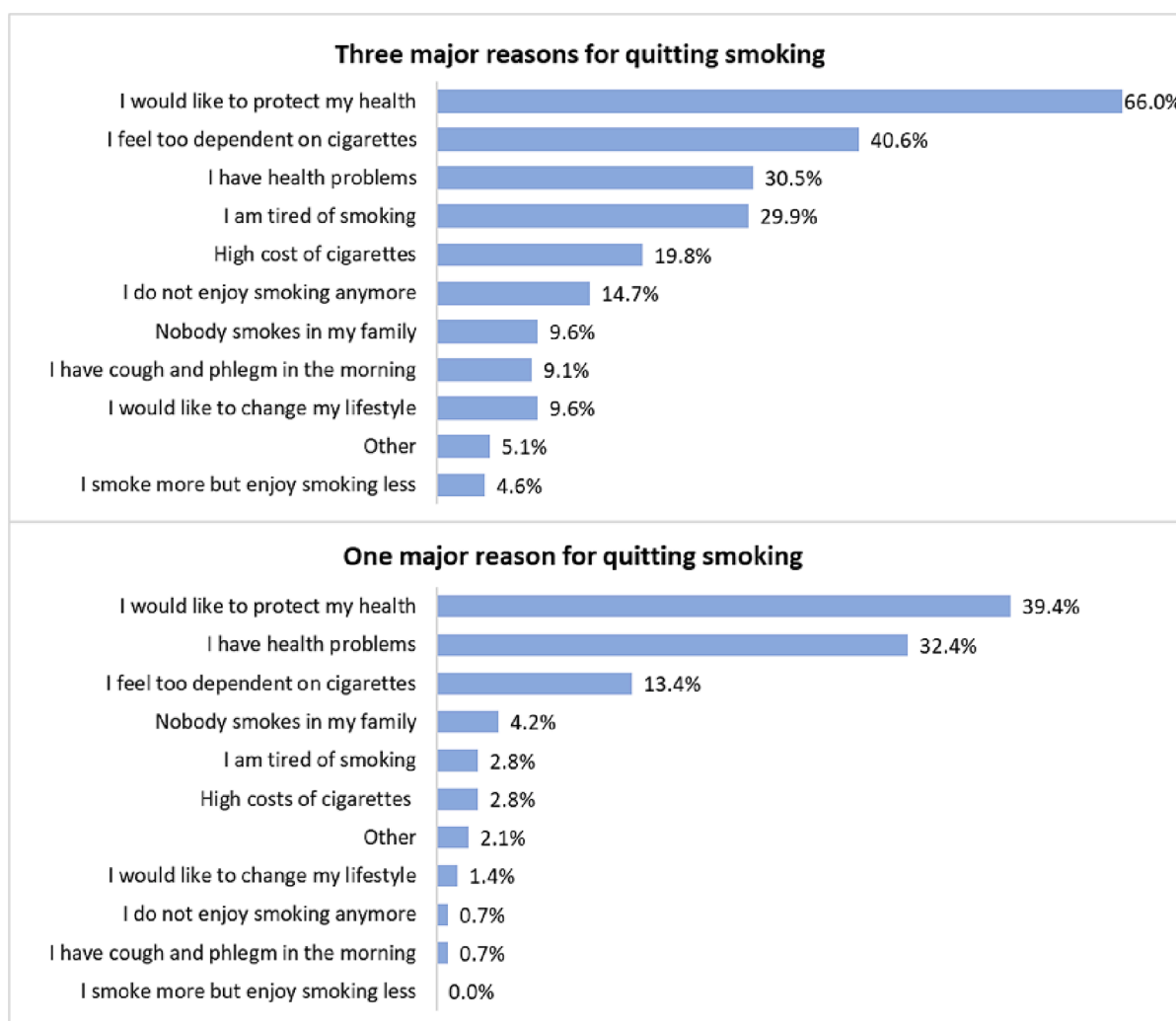


Fig. 1. Three main reasons (upper figure) and one main reason (lower figure) for quitting smoking of the participants of the smoking cessation courses.

own health as one of the main motivations to quit smoking when compared to the eligible patient group (77.4% vs 61.8%) (Supplementary Fig. 1). Inconclusive results were observed between group and individual course attendees due to discrepancies between two questionnaires on reasons for quitting smoking (Supplementary Table 2).

### 3.3. Perceived factors encouraging or discouraging smoking cessation

Activities related to group work, such as quarterly meetings with the educator and other attendees or participating in the group meetings for potential setbacks were mostly considered advantageous activities to continue not smoking, while nicotine replacement therapy (NRT) was perceived most frequently as disadvantageous activity (Fig. 2); 56% of participants indicated “periodic health check with LDCT” as an advantageous activity. This rate was higher in non-eligible participants and those attending group counseling (Supplementary Figs. 3 and 4).

### 3.4. Acceptability and perceived risks of lung cancer screening

The great majority of participants were in favor of LCS (92%), with only 8% being indifferent, and no one was against screening programs (Fig. 3). In terms of perceived risks of LCS, 69.6% of participants were afraid of adverse events of spiral TC, and almost half were concerned about unnecessary treatment (47.8%), other tests (46.6%), and receiving a false positive result (46.4%) (Fig. 4). Around a third (38.4%)

were worried about exposure to radiation. It is interesting to note that those eligible for LCS and those attending individual courses were less in favor of LCS and less concerned about the possible harms of LCS compared to ineligible patients and those attending group courses (Supplementary Fig. 5).

Results of the ordinal regression analysis (Table 2) showed that educational level and harm score were significant predictors of LCS acceptability in the univariate analysis. However, only the harm score remained a significant predictor in the multivariable analysis. The type of counseling was so strongly associated with LCS acceptability that was not entered in the multivariate model. Moreover, it had an opposite direction in group and individual counseling; while in the group SC participants increased concern about perceived harms was associated with higher LCS acceptance (OR 1.05, 95 %CI 0.88–1.25), in the individual SC group it was associated with lower acceptance of LCS (OR 0.87, 95 %CI 0.77–0.99).

Results of the linear regression analysis confirmed that smoking related-characteristics, eligibility status, and type of counseling were significant determinants of the perceived harm (Table 3). To avoid multicollinearity, only type of counseling and eligibility for LCS were considered for the multivariate model. Interestingly, only the type of counseling remained significantly associated with the harm score; participation in individual counseling was associated with decreased preoccupation about the potential harms of LDCT ( $b = -8.46$ , 95 %CI  $-10.37$  to  $-6.55$ ).



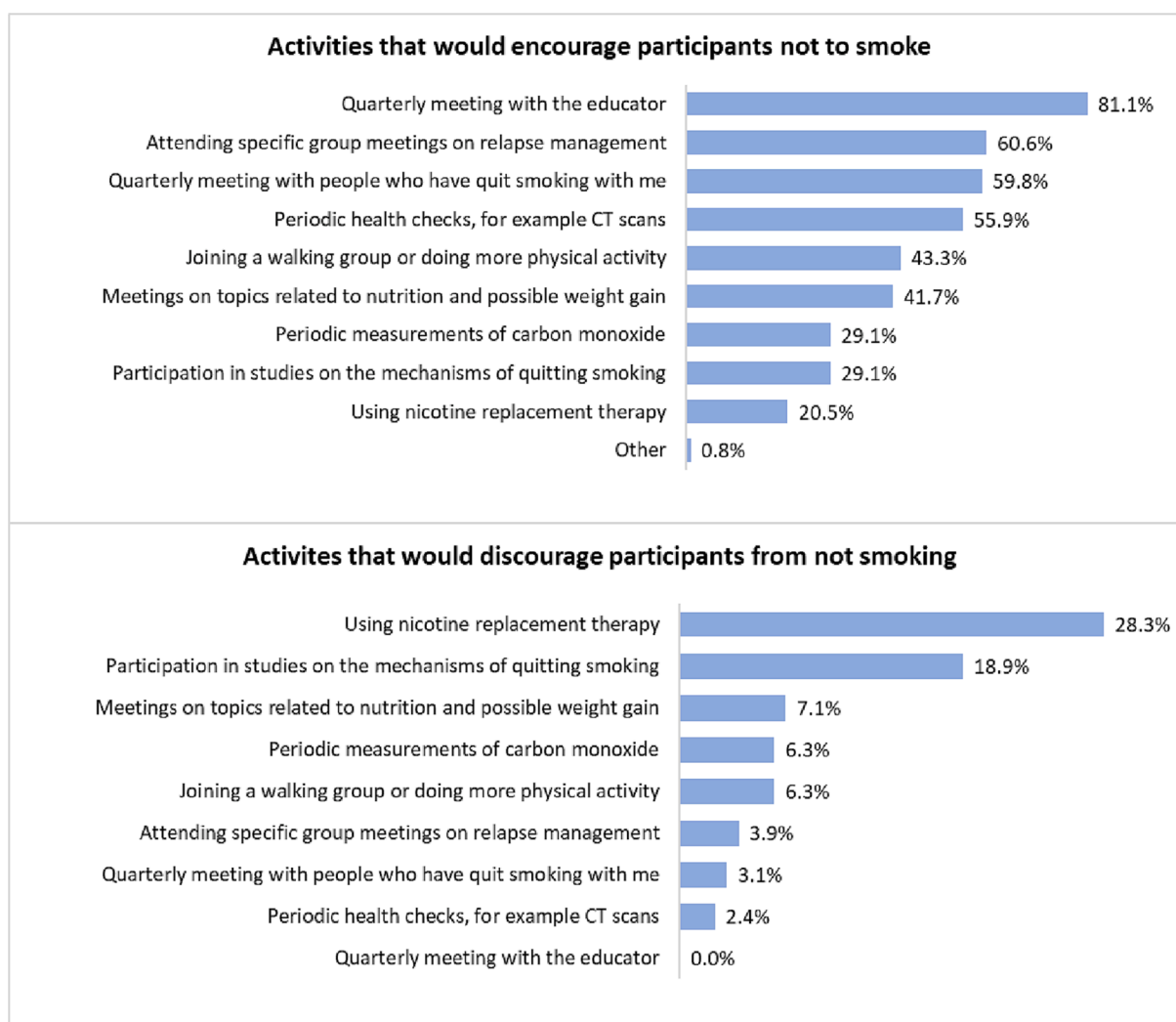


Fig. 2. Activities that would encourage (upper figure) and discourage (lower figure) participants of the smoking cessation course from not smoking.

#### 4. Discussion

We found that the principal reasons for quitting smoking were related to preserving health and feeling too addicted to cigarettes. Activities related to group meetings on various subjects were considered major factors that would encourage participants to continue not smoking, while nicotine replacement therapy was the most frequently perceived as a discouraging factor. It is important to note that periodic health check that includes LDCT, was perceived by half of participants as an advantageous activity to continue not to smoke. Moreover, almost all of the participants who completed the third questionnaire were in favor of LCS but were also very concerned about the potential harms associated with LDCT. In our study, the majority of patients worried about test results, and, interestingly, the perceived harm score was associated with greater support for LCS, being ineligible for LCS, and participation in group counseling.

Numerous studies have analyzed reasons to quit smoking in different settings and among persons who have different health conditions, and most have found – as in our study – that health benefits, economic aspects, and (to a more limited extent) family-related reasons are the most important factors (See et al., 2019; Gallus et al., 2013; Baha and Le Faou, 2010; Martins et al., 2021; Curry et al., 1997).

It is worth noting that almost all the participants who completed the smoking cessation course had a positive attitude toward LCS, despite quite significant concerns about radiation exposure and its potential

harms. Our results are in line with results from various population-based surveys in the UK (Quaife et al., 2018; Waller et al., 2016), RCTs (van den Bergh et al., 2009), and international small-scale surveys conducted on high-risk subjects (Monu et al., 2020; Bui et al., 2018; Hillyer et al., 2020). Although there are no studies that have investigated willingness to participate in an LCS program among individuals receiving smoking cessation counseling, Raz et al reported that only 18% of participants in a smoking cessation program underwent at least one LDCT despite the availability of organized LCS in the United States, and that the majority of those individuals believed that LCS can detect LC early, decreases LC mortality and decreases worry about LC (Raz et al., 2019). The so-called intention-action gap between intentions and actual health behaviors has also been well documented in other screening programs and should be borne in mind when planning a national LCS program (Vrinten et al., 2015).

In our study, most patients worried about test results, and, interestingly, the perceived harm score was associated with greater support for LCS, being ineligible for LCS, and participation in group counseling. Significant worry despite high LCS acceptability might be explained by the fact that a decision aid leaflet was provided to participants before they answered the question about LCS acceptability and harm. There is increasing evidence that strongly suggests that decision aids increase the informed choice of screening invitees without reducing the rate of screening participation (Roberto et al., 2020; Reder et al., 2017). This has also been confirmed in the context of LCS, as surveys (Raz et al.,

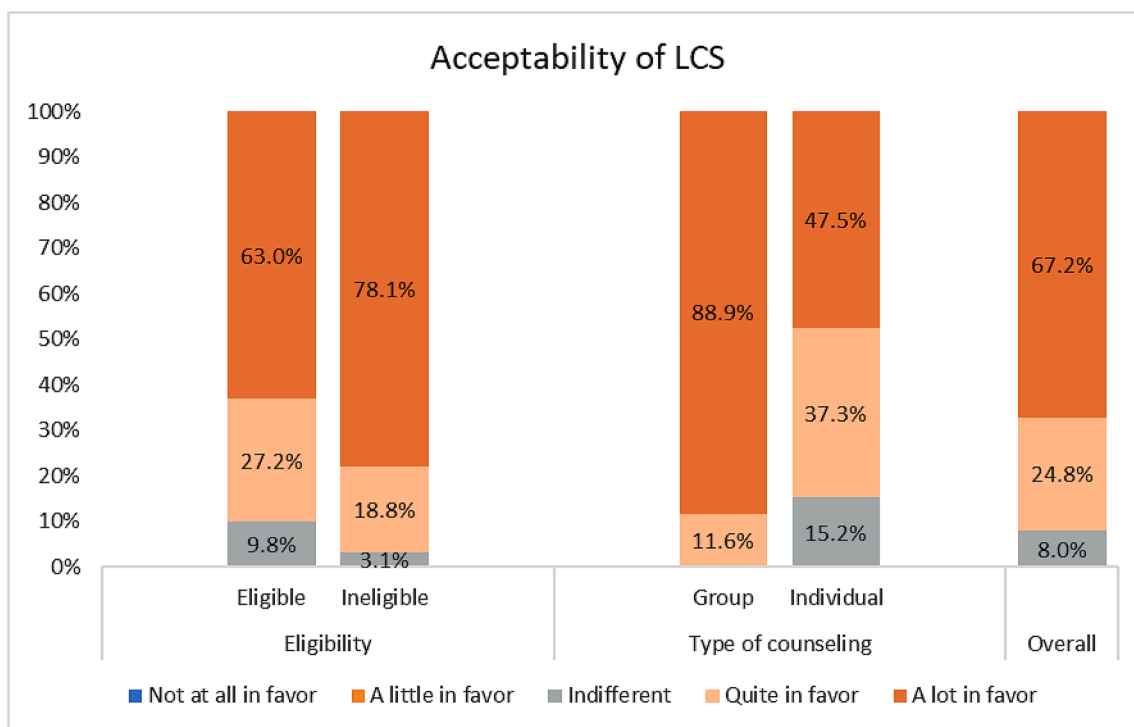


Fig. 3. Acceptability of LCS among participants of a smoking cessation course, by eligibility to LCS and type of counseling.

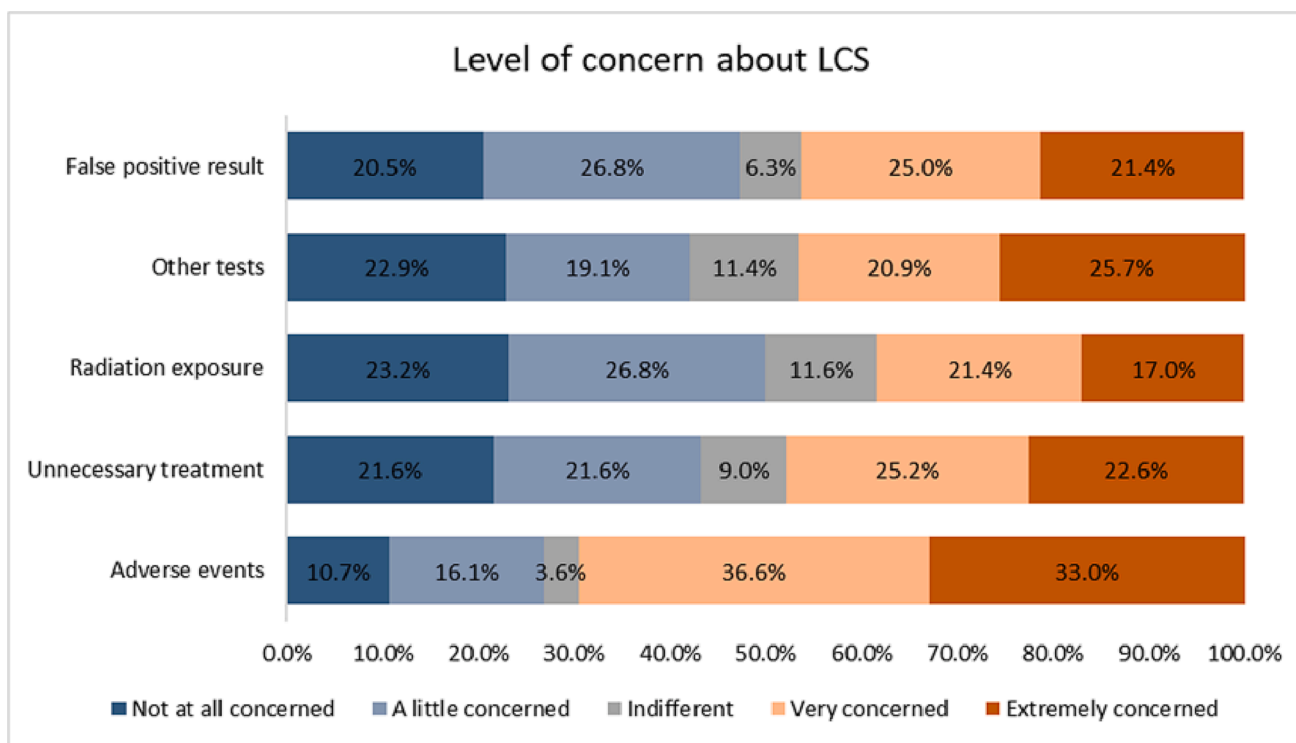


Fig. 4. Perceived risks of LCS among participants of a smoking cessation course.

2020; Volk et al., 2014), RCTs (Volk et al., 2020), and meta-analyses (Fukunaga et al., 2020) show that providing decision aids to patients leads to better preparedness when deciding about screening, and increased reports of participants feeling better informed and educated about screening choices and screening benefits and harms. Moreover, studies show that it is feasible and acceptable to incorporate an LCS

education process into group counseling on tobacco cessation (Raz et al., 2020; Volk et al., 2014), tobacco cessation lines (Fukunaga et al., 2020), or primary care settings (McDonnell et al., 2018).

Some substantial differences were observed in LCS acceptability and perceived harms between groups of eligibility and type of counseling (individual vs. group). It is interesting to note that those eligible for

**Table 2**  
Univariable and multivariable ordinal regression of predictors of LCS acceptability<sup>a</sup>.

	Univariable Overall	Multivariable Overall	Group	Individual
	OR (95 %CI)	OR (95 %CI)	OR (95 %CI)	OR (95 %CI)
Age	0.96 (0.87–1.06)			
Sex (female vs male)	0.86 (0.39–1.89)			
Education level (high vs low)	<b>2.82 (1.26–6.32)</b>	2.12 (0.91–4.92)	0.99 (0.16–6.05)	2.5 (0.81–7.42)
Occupation				
Unemployed + housewife	ref			
Employed (permanently or fix-term)	0.56 (0.14–2.18)			
Retired	0.30 (0.07–1.37)			
Cigarettes-day	0.98 (0.94–1.01)			
Pack-years	0.99 (0.98–1.01)			
Smoking intensity				
Light	ref			
Moderate	0.38 (0.07–2.03)			
Heavy	0.20 (0.04–0.93)			
Eligibility for LCS				
Not eligible	ref			
Eligible	0.46 (0.18–1.19)			
Main reason for quitting smoking				
Health	ref			
Dependence	0.68 (0.18–2.58)			
Social motives	0.84 (0.08–8.36)			
Harm score	<b>1.10 (1.03–1.18)</b>	<b>1.10 (1.01–1.17)</b>	1.05 (0.88–1.25)	<b>0.87 (0.77–0.99)</b>

<sup>a</sup> Type of counseling was excluded due to fully determined outcome.

**Table 3**  
Univariable and multivariable linear regression analysis of determinants of increased perceived harm of LDCT.

	b	SE	95 %CI	b	SE	95 %CI
Age	-0.05	0.06	-0.17 to 0.07			
Sex (female vs male)	-2.18	1.22	-4.60 to 0.24			
Education level (high vs low)	0.99	1.25	-1.48 to 3.47			
Occupation						
Unemployed + housewife	ref					
Employed (permanently or fix-term)	-0.40	1.85	-4.07 to 3.23			
Retired	0.83	2.13	-3.39 to 5.06			
Cigarettes-day	-0.13	0.06	<b>-0.25 to -0.02</b>			
Pack-years	-0.05	0.02	<b>-0.10 to -0.01</b>			
Smoking intensity						
Light	ref					
Moderate	-5.03	1.91	<b>-8.82 to -1.25</b>			
Heavy	-4.03	1.71	<b>-7.43 to -0.63</b>			
Type of counselling						
Group	ref			ref		
Individual	-8.50	0.90	<b>-10.28 to -6.72</b>	<b>-8.46</b>	<b>0.96</b>	<b>-10.37 to -6.55</b>
Elegibility						
Not eligible	ref			ref		
Eligible	-3.33	1.30	<b>-5.92 to -0.74</b>	-1.14	1.05	-2.23 to 1.94
Screening favour						
Indifferent	ref					
Somewhat in favour	-0.7	2.43	-4.89 to 4.75			
Significantly in favour	3.57	2.27	-0.92 to 8.07			
Main reason for quitting smoking						
Health	ref					
Dependence	0.42	1.72	-3.02 to 3.86			
Social motives	1.11	2.87	-4.62 to 6.85			

screening and those participating in individual counseling were less in favor of LCS while also being less concerned about potential harm. The acceptability in the group counseling was so high that probably we could not observe any variability and associations. In the individual counseling group, we observed an association with educational level and an inverse association with the harm score, suggesting that the overall positive association was simply due to confounding of the effect of type of counseling, i.e., type of counseling has substantial effect on both perceived harm and LCS acceptability. It is possible that the combination of the treatment setting (outpatient setting in individual courses and non-clinical setting in group courses) and the educator’s approach in individual or group work might have accounted for some of the differences in LCS acceptability and harm as well as perceived discouraging

factors.

This study has some limitations. The relatively small sample size is a significant limitation in terms of the general application of the findings, but it is nonetheless a multicenter study including two large Italian regions. Moreover, the participants in our study were mostly females and those with high educational levels, which do not represent the tobacco-using population of Italy, and it is rather representative of patients seeking to stop smoking. In fact, in Italy in 2021, male tobacco users (22.9%) were more represented than female tobacco users (15.3%), and they were mostly with lower education degrees (no education or with elementary school) (28.7%) than with university degree (18.2%) (Ministry of Health, 2022). Attitudes and willingness to participate in LCS were not assessed at baseline, namely before the information sheet

and decision aid were explained and the smoking cessation program was completed, so effectiveness could not be assessed. Furthermore, the distribution of the most important questionnaire about LCS acceptability at the end of the course led to selection bias and overestimation of potential willingness to participate in LCS, since only those individuals who were more determined completed the SC course. However, by informing participants early during the SC course about LCS risks and benefits, we were able to ascertain that they are aware of this while answering the questions about LCS acceptability. In this way, an informed decision could be made, although this limits the generalizability of results to people at high risk of cancer who are motivated to stop smoking and are aware of the screening risks and benefits. Another potential limitation is the lack of assessment as to whether some participants had undergone LDTC in the past.

The main strength of the study is that it provides a useful insight into attitudes towards smoking cessation and screening intention in different types of organizational settings of smoking cessation programs and within different strata of lung cancer risk. Given that the majority of ineligible participants are below the lower age eligibility threshold, they might be eligible in the future and their perceptions about the harms and benefits of LCS are important to address. This may have significant practical implications on the planning of national LCS programs, especially on recruitment and communication strategies, and may provide reassurance for participants without increasing their concerns and potential anxiety, which can happen with such programs.

## 5. Conclusion

High acceptance rates and favorable perception of LCS in both high-risk and low-risk persons attending smoking cessation courses, despite significant concerns about potential harms, is an important finding of this study. Discussing the provision of decision aids about LCS during smoking cessation programs could be a useful addition to raising awareness and educating people who are trying to quit smoking about the benefits and harms associated with LCS. Efforts are needed to find the most appropriate ways to adapt LCS education and decision aids to various cessation treatment modalities.

## Ethical approval

The study was approved by the local ethics committee of the coordinating center (February 3, 2020; ASMN 2020/0013503). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

## Informed consent

Informed consent was obtained from all individual participants included in this study.

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## CRediT authorship contribution statement

**Olivera Djuric:** Conceptualization, Methodology, Data curation, Formal analysis, Validation, Writing – original draft. **Paolo Giorgi Rossi:** Conceptualization, Methodology, Validation. **Elena Camelia Ivanciu:** Data curation, Formal analysis, Validation. **Salvatore**

**Cardellicchio:** Conceptualization, Investigation, Supervision. **Chiara Cresci:** Investigation, Supervision. **Laura Carozzi:** Investigation, Supervision. **Francesco Pistelli:** Investigation, Supervision. **Valentina Bessi:** Investigation. **Patrizia Gai:** Conceptualization, Investigation, Supervision. **Valentina Galli:** Conceptualization, Investigation, Supervision. **Giacomo Lavacchini:** Conceptualization, Investigation, Supervision. **Claudia Bricci:** Conceptualization, Investigation, Supervision. **Giuseppe Gorini:** Conceptualization, Methodology, Validation. **Sandra Bosi:** Conceptualization, Methodology, Validation. **Eugenio Paci:** Conceptualization, Methodology, Validation.

## 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.

## Data availability

Data will be made available on request.

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**Appendix A. Supplementary data** Supplementary Table 1. Participants’ characteristics by eligibility for lung cancer screening and type of smoking cessation counseling. Supplementary Table 2. Participants’ characteristics by adherence to LC counseling. Supplementary Figure 1. Principal reasons for the continuation of smoking cessation, by eligibility for LCS. Supplementary Figure 2. Principal reasons for the continuation of smoking cessation, by type of SC counseling. Supplementary Figure 3. Activities that would encourage or discourage remaining a non-smoker, by eligibility for LCS. Supplementary Figure 4. Activities that would encourage or discourage remaining a non-smoker, by type of SC counseling. Supplementary Figure 5. Acceptability and perceived harms of LCS by eligibility for LCS and type of SC counseling.

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