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Knowledge, Attitudes and Practices regarding Lung Cancer and Lung Cancer Screening in Greece: A Cross-sectional Study

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Abstract

This study aimed to investigate the knowledge, attitudes and practices of Greek general population regarding lung cancer (LC) and LC screening and the factors that may influence these aspects. A nationwide cross-sectional survey was conducted. The total mean (SD) knowledge score was 4.1 (1.7) over a maximum score of 8 68.1% of participants correctly mentioned low-dose computed tomography (LDCT) as screening method for LC and 87.7% believed that LC screening should be a priority for the state and should be provided for free to all citizens (91.1%) 80.0% mentioned that they would be willing to undergo LDCT screening if recommended by their physician, or if they received a state-issued text message. Higher total knowledge scores were significantly associated with greater probability of willingness to undergo LDCT. These findings underline the need to implement public health interventions towards increasing community awareness regarding benefits of screening and early diagnosis of LC.

Keywords: Lung cancer; Perceptions; Awareness; Screening

Introduction

Lung neoplasms represent the most common cause of cancer incidence and mortality globally [1]. Approximately 21 million new cases were diagnosed in 2018 [2], accounting for 11.5% of all newly diagnosed cancer patients, while the projected number of the lung cancer (LC)-related deaths is expected to reach the striking 3 million by 2035 [3]. According to estimates, 6,690 men and 1,660 women died from LC in Greece in 2018, placing it first in the list of cancer-related malignancies among Greek men and second among Greek women (after breast cancer) [4]. Moreover, the humanistic consequences are devastating for patients and their caregivers, whereas there is a substantial financial burden for the healthcare system, as well [3]. Indeed, a recent European study concluded that LC patients' mortality rates are higher than those of other cancers, leading to significant costs and productivity losses [5].

There is a strong relationship between LC prognosis and advanced stages at the time of diagnosis, with only about 20% of the cases being amenable to surgery [6,7]. Unfortunately, apart from the most “alarming” symptoms, such as hemoptysis, most patients experience non-specific warning signs (persistent cough, dyspnea, etc), resulting in being diagnosed at later, potentially incurable stages [8]. In addition, the delays in seeking medical consultation have been linked with false patients’ perceptions, such as that they are invulnerable, or that LC cannot be diagnosed in a timely manner and there are no effective treatment strategies [8-10].

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However, several recent advances in the field of LC have gained momentum and are eventually changing the diagnostic and treatment landscape. Regarding screening low-dose computed tomography (LDCT) as well as new therapeutic options with targeted therapies, surgical techniques, and radiotherapy, at early and locally advanced stages of the disease, have been associated with significantly better outcomes for patients [11-14].

In light of the above, the public's lack of knowledge concerning LC may have a significant impact on patient practices, leading to late diagnosis and poor prognosis. Recently, a growing number of studies have been conducted to assess the general population's knowledge, and perceptions in order to highlight the need for the design and implementation of awareness campaigns on LC [15-17].

To the best of our knowledge and despite that epidemiological data indicate that LC is a major public health problem, this is the first study to address such issues in Greece. To be more specific, the aim of this work was to describe the knowledge, attitudes and practices of the Greek general population regarding LC with a focus on LC screening, as well as the factors that may influence these aspects.

Materials and Methods

Study design, population, and data collection

A nationwide cross-sectional survey was conducted between March 22, 2023, and April 24, 2023, using a mixed methodology for data collection: computer-assisted telephone interviewing (CATI) and computer-assisted web interviewing (CAWI).

The sample size vey was calculated at 1,000 people, assuming that at a confidence interval of 99%, 50% of the respondents will have a satisfactory level of knowledge about LC and LC screening, with a margin of error of ± 5%. To ensure a nationally representative sample of the urban/rural population according to the Greek census 2011 (www.statistics.gr), a proportionate stratified by region random sampling procedure was used to recruit participants 45% of the total target sample size was met by CATI and the other 55% by CAWI For CATI, a random-digit dialed (RDD) sample of 7,836 landline-telephone households was conducted, 52.81% of whom were excluded due to unavailability (no answer, busy, etc). The remaining 47.19% (3,698) led to handled calls. Out of those 2,647 (71.6%) refused to participate in this survey, 366 (9.9%) did not meet the age criterion, 121 (3.3%) reached businesses/commercial spaces instead of households, 94 (2.5%) communications were not possible, and 20 (0.5%) were on a meeting. To complete 550 interviews with the CAWI method, 2,803 invitations were sent to adults (Response Rate: 20%).

To ensure the external validity and the greater generalizability of the study, survey weights were used to adjust for differences in age, gender, and region distribution between the survey sample and country population as obtained from the census 2011 (www.statistics.gr).

During the telephone or online interview, all participants were informed about the purpose of the study and asked for their consent. Participants were able to withdraw their consent at any time during the interview process and their participation was voluntary Anonymized data were collected. The study protocol was approved by the University of Peloponnese Ethics Committee, and the study was conducted in accordance with the Helsinki Declaration [18].

Data collection

The telephone and online interviews were conducted using a structured questionnaire (average duration: 15 minutes). The questionnaire was developed based on previous similar studies [15,17,19] (Supplementary Material) and was reviewed by 8 independent health care professionals with extensive experience in LC, to assess content validity. A pilot sample of 19 adults was used to assess the face validity of the questionnaire, after which, two questions were revised to enhance their comprehensibility for respondents. The responses gathered during the pre-test study were not included in the final analysis.

The final version consisted of 58 questions divided into six sections as follows: 1) demographics 2) smoking status; 3) individual/family history of LC; 4) knowledge about LC and LC screening (8 questions); 5) attitudes toward LC and LC screening (13 questions); and 6) practices toward LC and LC screening (8 questions).

To measure knowledge, a total knowledge score ranging from zero (0) to eight (8) was calculated, assigning one (1) point to each correct answer. The answers considered correct per question are presented in the Supplementary Material. A higher score indicates better knowledge of LC and LC screening. Prior to calculation, the internal consistency of score was assessed using the statistic Kuder-Richardson (0 73). Pack years were calculated by multiplying the number of packs of cigarettes smoked per day with the number of years of active smoking [20].

Statistical analysis

The linearization-based variance estimators were used to consider survey weights in computing sampling standard errors. Quantitative variables' normality was assessed using the Kolmogorov-Smirnov criterion and graphically using the histograms and Q-Q plots. For normally distributed quantitative variables, means and standard deviations (SD) were presented, whereas for skewed variables medians and interquartile ranges (IQR) were calculated. Counts and percentages were used for qualitative variables. Univariate linear and logistic regression models were performed to assess the association between participants' socio-demographic

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characteristics, smoking habits and family history with total knowledge score and attitudes questions, respectively. Characteristics found to be significantly associated with total score and attitudes questions at univariate level, were entered at multivariate models to identify the factors independently associated with participants' knowledge and attitudes. A nominal significance level of p-value=0.05 was set for all statistical analyses. All statistical calculations were performed using STATA software.

Results

Baseline characteristics

Participants' sociodemographic characteristics, smoking status and history of LC are presented in Table 1. The majority were female (51.4%), married or in a civil partnership (58.4%), and had graduated from Technological or Higher Educational Institutions (46.4%). The mean age of the sample was 48.7 (± 17 4) years, while 20.6% were obese and 33.4% were overweight. Only 6.3% of participants were healthcare professionals.

Of the total participants, 45.5% were current and 36.0% were ex-smokers, while 41.7% mentioned they are passive smokers. The median (IQR) number of pack years was 10.0 (2.5, 20.0). Concerning LC history, 15.2% reported a positive family history for LC, while 42.7% reported a personal or family history for other malignancies [Table 1].

Table 1: Baseline characteristics of participants (N=1,000).

Baseline characteristics	N (%)
Gender	
Male	486 (48.6%)
Female	514 (51.4%)
Age	
18 - 29	177 (17.7%)
30 - 39	183 (18.3%)
40 - 49	177 (17.7%)
50 - 59	156 (15.6%)
60 - 69	127 (12.7%)
70+	180 (18.0%)
Residence	
Athens	314 (31.4%)
Thessaloniki	102 (10.2%)
Urban area (over 10.000 inhabitants)	428 (42.8%)
Semi-urban area (2.000 - 10.000 inhabitants)	71 (7.1%)
Rural area (up to 2,000 inhabitants)	85 (8.5%)
Marital status	
Unmarried	217 (21.7%)
In cohabitation	90 (9.0%)
Married - civil partnership	584 (58.4%)
Divorced - In dimension	58 (5.8%)
Widower/s	47 (4.7%)
Professional status	
Freelancer/self-employed	148 (14.8%)
Employee	416 (41.7%)
Unemployed	73 (7.3%)
Retired person	247 (24.7%)
Student/student	57 (5.7%)
Household	52 (5.2%)
Other	4 (0.4%)
Educational status	
Primary school	42 (4.2%)
Secondary school	40 (4.0%)
High school	241 (24.1%)
Technical/vocational high school	71 (7.1%)
TEI/HEI	464 (46.4%)
Postgraduate degree	110 (11.0%)
PhD	19 (1.9%)
Postdoctoral degree	11 (1.1%)
Other	3 (0.3%)
Are you a healthcare professional?	
Yes	63 (6.3%)
No	932 (93.7%)
If YES, what is your professional status?	
Doctor	13 (20.6%)
Nurse	21 (33.3%)
Other	29 (46.0%)
Individual net monthly income (in EUR)	
<800	327 (36.6%)
801-1,200	304 (34.1%)
1201-1,600	153 (17.2%)
1601-2,000	63 (7.1%)
>2,000	46 (5.1%)
BMI Status	
Normal	460 (46.0%)
Overweight	334 (33.4%)
Obese	206 (20.6%)
Which of the following categories do you belong to regarding your smoking status?	
Current Smoker	455 (45.5%)
Ex-smoker	360 (36.0%)
Non-smoker	185 (18.5%)
Do you work/live in an environment with smokers (passive smokers)?	
Yes	417 (41.7%)
No	583 (58.3%)
Do you work or live in an environment exposed to smoke, dust, or fumes?	
Yes	266 (26.6%)
No	734 (73.4%)
Do you have a family history of lung cancer?	
Yes	152 (15.2%)
No	842 (84.2%)
I prefer not to answer	5 (0.5%)
Do you have a personal or family history of another form of cancer?	
Yes	427 (42.7%)
No	570 (57.0%)
I prefer not to answer	3 (0.3%)
Baseline characteristics	
BMI (Mean ± SD***)***	26.2 (5.0)

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Age (years, Mean ± SD***)***	48.7 (17.4)
Height (in meters, Mean ± SD***)***	1.7 (0.1)
Weight (in Kg, Mean ± SD***)***	76.8 (16.7)
Pack years (Median (IQR))	10.0 (2.5, 20.0)
Approximately how long ago did you stop smoking? (Median (IQR))	7.0 (3.0, 5.0)

TEI: Technological Educational Institute; HEI: Higher Educational Institute; BMI: Body Mass Index

Knowledge regarding lung cancer and lung cancer screening

Descriptive statistics regarding knowledge questions are presented in Table 2. The total mean knowledge score was 4.1 (± 1.7). A significant percentage of participants (86.5%) knew what "smoking is risk factor for LC" meant. Almost half of them (53.2%) correctly mentioned all the risk factors for LC, with active smoking and passive smoking being among the most recognized risk factors (90.9% and 80.9%, respectively). The three most mentioned LC symptoms were cough that worsens or persists (76.2%), shortness of breath (72.5%) and hemoptysis (68.6%), while only 1 out of 4 participants (24.4%) provided an overall correct answer regarding LC symptoms. Less than 30% of participants responded correctly about LC being the leading cause of death from cancer in Greece. 80.7% of the participants were found to know what screening was, with 30.3% being aware of all the methods for LC screening, and 68.1% correctly reporting LDCT as an LC screening method.

Table 2: Descriptive statistics of questions regarding knowledge (N=1,000).

Question	N (%)
Which of the following are risk factors for lung cancer? (Select as many of the following as apply)	
Active Smoking	909 (90.9%)
Passive Smoke	809 (80.9%)
Family History of Lung Cancer	738 (73.8%)
Workplace exposure to substances such as asbestos, arsenic, and diesel exhaust fumes	768 (76.8%)
All of the above*	532 (53.2%)
None of the above	7 (0.7%)
What do we mean when we say that smoking is a risk factor for lung cancer? N (%)	
All those who smoke at some point will develop cancer	88 (8.8%)
Those who smoke is more likely to develop lung cancer than those who do not smoke*	865 (86.5%)
I do not know	46 (4.6%)
Symptoms of lung cancer include (Select as many of the following as apply)	
Cough that worsens or does not retreat	762 (76.2%)
Chest pain	558 (55.8%)
Shortness of breath	725 (72.5%)
Hemoptysis	686 (68.6%)
Fatigue	607 (60.7%)
Weight loss without a known origin	593 (59.3%)
All of the above belong*	244 (24.4%)
None of the above belong	1 (0.1%)
Lung cancer is the leading cause of death from cancer in Greece N (%)	
Yes*	298 (29.8%)
No	287 (28.7%)
I do not know	415 (41.5%)
Screening is defined as the use of laboratory or imaging tests in a population without obvious signs or symptoms of the disease being investigated, with the aim of detecting the disease at an early stage when treatment is most effective: N (%)	
Yes*	807 (80.7%)
No	62 (6.2%)
I do not know	131 (13.1%)

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Is it possible that the findings of a LDCT may indicate that you have lung cancer when you do not? N (%)	
Yes*	449 (44.9%)
No	279 (27.9%)
I do not know	271 (27.1%)
Is it possible that the findings of a LDCT may not indicate that you have lung cancer when you do? N (%)	
Yes*	606 (60.6%)
No	170 (17.0%)
I do not know	224 (22.4%)
Methods of lung cancer screening include (Select as many of the following as apply)	
Sputum cytology	390 (39.0%)
Chest x-ray	708 (70.8%)
LDCT	681 (68.1%)
All of the above belong*	303 (30.3%)
None of the above belong	8 (0.8%)
	Mean ± SD
Total knowledge score	4.1 (1.7)

* Correct answer; LDCT: Low-dose computed tomography

Table 3 shows that age, marital status, number of children, current smoking status, working or living in an environment with smokers, and family history of LC were statistically significantly associated with knowledge score in the univariate models. However, the multivariate model showed that only age (p-value=0.024), current smoking status (p-value<0.001) and LC family history (p-value=0.004) remained statistically significant. More specifically, older participants, ex- and non-smokers, as well as those with LC family history were found to have higher level of knowledge.

Table 3: Factors associated with total knowledge score: Results from univariate and multivariate linear models.

Total knowledge score	Univariate Models Coefficient (95% CI)	p-value	Multivariate Model Coefficient (95% CI)	p-value
Baseline			3.64 (3.28, 4.01)	
Sex				
Male *	4.08 (3.93, 4.23)	0.601		
Female	0.06 (-0.15, 0.26)			
Age (years)				
18-29 *	3.58 (3.33, 3.82)	**< 0.001**		**0.024**
30-39	0.28 (-0.07, 0.62)		0.22 (-0.13, 0.58)	
40-49	0.65 (0.30, 0.99)		0.52 (0.15, 0.89)	
50-59	0.67 (0.32, 1.03)		0.52 (0.12, 0.91)	
60-69	0.82 (0.44, 1.19)		0.62 (0.21, 1.04)	
70+	0.86 (0.52, 1.20)		0.57 (0.18, 0.97)	
The area in which household I have now called belongs to which of the categories I am about to read to you in terms of population?				
Athens *	4.10 (3.92, 4.29)	0.073		
Thessaloniki	0.14 (-0.23, 0.52)			
Urban area (over 10,000 inhabitants)	-0.14 (-0.38, 0.11)			
Semi-urban area (2,000 - 10,000 inhabitants)	0.25 (-0.18, 0.68)			
Rural area (up to 2,000 inhabitants)	0.33 (-0.07, 0.73)			

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Marital status				
Unmarried *	3.79 (3.57, 4.01)			
In cohabitation/Married - civil partnership	0.41 (0.16, 0.66)	**0.005**	0.14 (-0.14, 0.43)	0.581
Divorced - In dimension/Widower	0.45 (0.06, 0.84)		0.06 (-0.36, 0.49)	
Professional status				
Workers *	4.08 (3.94, 4.21)	0.505		
Non-workers	0.07 (-0.14, 0.28)			
Educational status				
Primary/Secondary/High/Technical-vocational high school *	4.02 (3.86, 4.19)			
TEI/HEI	0.19 (-0.03, 0.42)	0.155		
Postgraduate studies	-0.04 (-0.36, 0.28)			
Individual net monthly income (in EUR)				
<800 *	3.96 (3.78, 4.14)			
801-1,200	0.20 (-0.06, 0.47)	0.099		
>1,200	0.28 (0.01, 0.56)			
BMI Status				
Normal *	3.99 (3.84, 4.14)	0.107		
Overweight	0.25 (0.01, 0.48)			
Obese	0.16 (-0.11, 0.44)			
Which of the following categories do you belong to regarding your smoking status?				
Current Smoker *	3.83 (3.68, 3.98)			
Ex-smoker	0.39 (0.16, 0.62)	**< 0.001**	0.38 (0.15, 0.61)	**< 0.001**
Non-smoker	0.73 (0.45, 1.01)		0.56 (0.27, 0.86)	
Pack years				
Baseline *	3.93 (3.78, 4.07)	0.086		
10-Pack-year Increase	0.05 (-0.01, 0.10)			
Do you work/live in an environment with smokers (passive smoker)?				
Yes *	3.86 (3.71, 4.03)	**< 0.001**		0.181
No	0.41 (0.20, 0.61)		0.15 (-0.07, 0.37)	
Do you work or live in an environment exposed to smoke, dust, or fumes?				
Yes *	3.95 (3.74, 4.15)	0.069		
No	0.42 (-0.02, 0.45)			
Do you have a family history of lung cancer?				
Yes *	4.43 (4.17, 4.69)	**0.009**		**0.004**
No	-0.38 (-0.67, -0.10)		-0.42 (-0.70, -0.14)	

*Reference; TEI: Technological Educational Institute; HEI: Higher Educational Institute; BMI: Body Mass Index; CI: Confidence Interval

Attitudes regarding lung cancer and lung cancer screening

Descriptive statistics regarding attitudes toward LC and LC screening are presented in Table 4. Approximately 72% of participants (71.9%) mentioned that they disagree/strongly disagree that cough alone wouldn't activate them to seek medical advice since they believed that they would waste the physician's time. Most of the participants agreed/strongly agreed that LC can be detected before the first symptoms

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appear through proper screening (75.7%); in addition, 77.9% believed that seeking immediate medical consultation upon the appearance of symptoms is associated with longer survival, in case of LC diagnosis. A strong majority (87.7%) believed that LC screening should be a priority for the state, and it should be offered for free to all citizens (91.1%). Only 22.2% concurred that LC screening should only be recommended for smokers and/or ex-smokers over the age of 50 (and not for all adults over this age), whereas 47.6% believed that screening costs affect the LDCT participation rate. Finally, it seems that almost 70% support that it is a great need for educating the general public about what screening is, when it is used, which are the benefits and/or risks and who, where and when someone can be subjected to screening.

Practices regarding lung cancer and lung cancer screening

Practices toward LC screening are presented in Table 5. Only 13.3% of participants mentioned that they have been subjected to LC screening in the past, with the most used screening method being the chest x-ray. 84.2% were willing to undergo LDCT screening if recommended by their doctor, and 81.7% would do so if they received a telephone text message letting them know that they are eligible to be subjected to LDCT free of charge. Only 68% of participants mentioned that a physician has recommended them to undergo screening with LDCT over the past 18 months and among them only 47.1% mentioned that they did. Finally, 79.0% stated that they would not be afraid to be subjected to LDCT due to exposure to radiation.

Table 4: Descriptive statistics of questions regarding attitudes (N=1,000).

Question	I agree / I strongly agree N (%)	Neutral N (%)	I disagree / I strongly disagree N (%)
I would not want to know if I had lung cancer	392 (39.2%)	233 (23.3%)	375 (37.5%)
I believe that, if I consult my doctor immediately when the first symptoms appear, I may live longer if I am diagnosed	779 (77.9%)	152 (15.2%)	69 (6.9%)
In the event that I only had a cough, I would not visit my doctor because I would be concerned about wasting his time	126 (12.6%)	155 (15.5%)	719 (71.9%)
I believe that lung cancer can be detected before the first symptoms appear through proper screening	757 (75.7%)	205 (20.5%)	39 (3.9%)
I would be so concerned about what might be discovered at a lung cancer screening that I would prefer not to go	181 (18.1%)	155 (15.5%)	664 (66.4%)
It makes sense to undergo lung cancer screening because it will impact whether and how long you will live	721 (72.1%)	182 (18.2%)	97 (9.7%)
I believe that LDCT without findings suggesting lung cancer can help reduce the worry and anxiety associated with the development of lung cancer	767 (76.7%)	157 (15.7%)	77 (7.7%)
I believe that lung cancer screening should be a priority for the state	877 (87.7%)	101 (10.1%)	21 (2.1%)
I believe that lung cancer screening should only be recommended for smokers and/or ex-smokers over the age of 50 and not for all adults over the age of 50	222 (22.2%)	174 (17.4%)	604 (60.4%)
I believe that screening costs play an important role in my decision to have a LDCT	476 (47.6%)	208 (20.8%)	316 (31.6%)
I believe that lung cancer screening should be offered free of charge to all citizens	911 (91.1%)	76 (7.6%)	13 (1.3%)
I believe there is a general need to inform citizens about the following (select as many as you want): (Select as many of the following as apply)			
What screening is	833 (83.3%)		
Conditions for which screening is used	865 (86.5%)		
Pros and cons of screening	833 (83.3%)		
Who, where and when can undergo screening	818 (81.8%)		
All of the above	695 (69.5%)		
None of the above	24 (2.4%)		

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LDCT: Low-dose computed tomograph

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Table 5: Descriptive statistics of questions regarding practices (N=1,000).

Question	N (%)
I have undergone screening for lung cancer before	
Yes	133 (13.3%)
No	867 (86.7%)
If yes, with which method? (N=131)	
Sputum cytology	12 (9.1%)
Chest x-ray	105 (80.3%)
LDCT	65 (49.3%)
Other	6 (4.6%)
I do not recall	2 (1.7%)
I would be willing to undergo LDCT screening for lung cancer if my doctor recommended it	
Yes	842 (84.2%)
No	158 (15.8%)
I would be willing to undergo lung cancer screening using LDCT scan if the state sent me a message suggesting that I do it and it was free	
Yes	817 (81.7%)
No	183 (18.3%)
I would be afraid to have a LDCT because of my exposure to radiation	
Yes	210 (21.0%)
No	790 (79.0%)
During the past 18 months, has your doctor recommended that you undergo lung cancer screening with LDCT?	
Yes	68 (6.8%)
No	932 (93.2%)
If yes, did you undergo it? (N=68)	
Yes	32 (47.1%)
No	34 (50.0%)
I do not recall	2 (2.9%)
During the past 18 months, have you undergone pre-symptomatic screening for any other form of cancer, such as...	
Breast cancer-mammography (only for women) (N=513)	213 (41.5%)
Cervical cancer- Pap test or HPV test (only for women) (N=513)	235 (45.9%)
Prostate cancer-PSA (only for men) (N=487)	117 (23.9%)
Colorectal cancer - Colonoscopy	89 (8.9%)
Other	2 (0.2%)
No, I have not undergone	559 (55.9%)
I do not recall	14 (1.4%)
LDCT: Low-dose computed tomography; HPV: Human Papillomavirus; PSA: Prostate Specific Antigen	

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Table 6 presents significant associations between practice questions and participants' sociodemographic characteristics, as well as attitude questions and the total knowledge score. Multivariate logistic regression revealed that participants with LC family history (p=0.008), those with more pack-years (p=0.014) and those believing that screening might impact how long they will live (p=0.031), were more likely to have been subjected to screening for LC in the past. Moreover, participants with higher total knowledge score (p=0.004), those believing that LC screening might prolong their life (p=0.002), those believing that seeking medical advice immediately after the first symptoms might prolong their life (p=0.001), and those believing that LC screening should be offered free of charge (p=0.027), were more likely to undergo LDCT if recommended by their doctor. Similar results were found for the question assessing the willingness of the general population to undergo LDCT if they receive a state-issued text message.

Table 6a: Factors associated with selected practices towards lung cancer screening.

F1. I have undergone screening for lung cancer before	Univariate Models OR (95% CI)	p-value	Multivariate Model OR (95% CI)	p-value
Sex				
Female vs. Male	1.07 (0.74, 1.54)	0.710		
Age (years)				
30-39 vs. 18-29	0.81 (0.40, 1.66)	**0.001**	0.63 (0.29, 1.37)	0.580
40-49 vs. 18-29	0.97 (0.49, 1.94)		0.67 (0.31, 1.45)	
50-59 vs. 18-29	1.28 (0.65, 2.51)		0.84 (0.37, 1.88)	
60-69 vs. 18-29	1.85 (0.95, 3.62)		1.01 (0.42, 2.43)	
70+ vs. 18-29	2.53 (1.39, 4.61)		1.31 (0.54, 3.15)	
The area in which household I have now called belongs to which of the categories I am about to read to you in terms of population?				
Thessaloniki vs. Athens	1.33 (0.72, 2.44)	0.154		
Urban area (over 10,000 inhabitants) vs. Athens	0.99 (0.65, 1.52)			
Semi-urban area (2,000 - 10,000 inhabitants) vs. Athens	0.28 (0.08, 0.95)			
Rural area (up to 2,000 inhabitants) vs. Athens	1.35 (0.71, 2.59)			
Marital status				
In cohabitation/Married - civil partnership vs. Unmarried	2.03 (1.19, 3.49)	**0.028**	1.53 (0.80, 2.90)	0.310
Divorced - In dimension/Widower vs. Unmarried	2.23 (1.09, 4.58)		1.11 (0.45, 2.71)	
Professional status				
Non-workers vs. Workers	1.47 (1.02, 2.11)	**0.040**	1.15 (0.67, 1.98)	0.604
Educational status				
TEI/HEI vs. Primary/Secondary/High/Technical-vocational high school	1.24 (0.83, 1.84)	0.502		
Postgraduate studies vs. Primary/Secondary/High/Technical-vocational high school	0.99 (0.55, 1.78)			
Individual net monthly income (in EUR)				
801-1,200 vs. <800	1.41 (0.87, 2.27)	0.064		
>1,200 vs. <800	1.77 (1.10, 2.85)			
BMI Status				
Overweight vs. Normal	1.41 (0.92, 2.14)	0.125		
Obese vs. Normal	1.56 (0.97, 2.49)			
Which of the following categories do you belong to regarding your smoking status?				
Ex-smoker vs. Current Smoker	1.18 (0.80, 1.76)	0.242		
Non-smoker vs. Current Smoker	0.73 (0.42, 1.27)			

Citation: Georgia Kourlaba, Christos Triantafyllou, Dimitra Ioanna Lampropoulou, Ifigenia Faropoulou, George Gounelas, Maria Gamvrouli, Sofia Zyga, Nikos Rikos, Pavlos Myrianthefs. Knowledge, Attitudes and Practices regarding Lung Cancer and Lung Cancer Screening in Greece: A Cross-sectional Study. Archives of Clinical and Biomedical Research. 8 (2024): 357-372.

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Pack years (10-pack years)	1.16 (1.07, 1.25)	**< 0.001**	1.12 (1.02, 1.22)	**0.014**
Do you work/live in an environment with smokers (passive smoker)?				
No vs. Yes	1.00 (0.69, 1.44)	0.981		
Do you work or live in an environment exposed to smoke, dust, or fumes?				
No vs. Yes	0.70 (0.47, 1.03)	0.070		
Do you have a family history of lung cancer?				
No vs. Yes	0.55 (0.35, 0.85)	**0.008**	0.50 (0.30, 0.84)	**0.008**
Total knowledge score (1-Point)	1.14 (1.02, 1.28)	**0.020**	1.08 (0.94, 1.23)	0.291
I believe that, if I consult my doctor immediately when the first symptoms appear, I may live longer if I am diagnosed				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	1.98 (1.17, 3.34)	**0.010**	1.37 (0.75, 2.48)	0.302
I believe that lung cancer can be detected before the first symptoms appear through proper screening				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	2.13 (1.28, 3.55)	**0.004**	1.39 (0.77, 2.50)	0.270
I would be so concerned about what might be discovered at a lung cancer screening that I would prefer not to go				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	1.47 (0.95, 2.27)	0.085		
It makes sense to undergo lung cancer screening because it will impact whether and how long you will live				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	2.23 (1.37, 3.63)	**0.001**	1.88 (1.06, 3.33)	**0.031**
I believe that LDCT without findings suggesting lung cancer can help reduce the worry and anxiety associated with the development of lung cancer				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	1.39 (0.88, 2.21)	0.162		
I believe that lung cancer screening should only be recommended for smokers and/or ex-smokers over the age of 50 and not for all adults over the age of 50				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	1.16 (0.76, 1.77)	0.503		
I believe that lung cancer screening should be offered free of charge to all citizens				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	1.51 (0.73, 3.12)	0.272		
I believe that lung cancer screening should be a priority for the state				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	0.97 (0.56, 1.68)	0.905		

Table 6b: Factors associated with selected practices towards lung cancer screening.

F2. I would be willing to undergo LDCT screening for lung cancer if my doctor recommended it	Univariate Models OR (95% CI)	p-value	Multivariate Model OR (95% CI)	p-value
Sex				
Female vs. Male	0.96 (0.68, 1.34)	0.791		
Age (years)				
30-39 vs. 18-29	1.19 (0.69, 2.05)	0.226		
40-49 vs. 18-29	1.28 (0.74, 2.23)			
50-59 vs. 18-29	2.01 (1.07, 3.80)			
60-69 vs. 18-29	1.61 (0.85, 3.06)			
70+ vs. 18-29	1.01 (0.59, 1.71)			

Citation: Georgia Kourlaba, Christos Triantafyllou, Dimitra Ioanna Lampropoulou, Ifigenia Faropoulou, George Gounelas, Maria Gamvrouli, Sofia Zyga, Nikos Rikos, Pavlos Myrianthefs. Knowledge, Attitudes and Practices regarding Lung Cancer and Lung Cancer Screening in Greece: A Cross-sectional Study. Archives of Clinical and Biomedical Research. 8 (2024): 357-372.

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The area in which household I have now called belongs to which of the categories I am about to read to you in terms of population?				
Thessaloniki vs. Athens	1.72 (0.86, 3.43)	0.427		
Urban area (over 10,000 inhabitants) vs. Athens	1.01 (0.69, 1.49)			
Semi-urban area (2,000 - 10,000 inhabitants) vs. Athens	1.07 (0.53, 2.15)			
Rural area (up to 2,000 inhabitants) vs. Athens	1.58 (0.76, 3.27)			
Marital status				
In cohabitation/Married - civil partnership vs. Unmarried	2.07 (1.40, 3.04)	**0.001**	1.32 (0.84, 2.09)	0.336
Divorced - In dimension/Widower vs. Unmarried	1.44 (0.79, 2.60)		0.95 (0.48, 1.87)	
Professional status				
Non-workers vs. Workers	0.69 (0.49, 0.97)	**0.031**	0.60 (0.40, 0.89)	**0.011**
Educational status				
TEI/HEI vs. Primary/Secondary/High/Technical-vocational high school	1.18 (0.81, 1.71)	0.361		
Postgraduate studies vs. Primary/Secondary/High/Technical-vocational high school	0.84 (0.51, 1.37)			
Individual net monthly income (in EUR)				
801-1,200 vs. <800	1.16 (0.77, 1.77)	0.410		
>1,200 vs. <800	1.36 (0.86, 2.13)			
BMI Status				
Overweight vs. Normal	1.04 (0.70, 1.54)	0.643		
Obese vs. Normal	0.84 (0.54, 1.30)			
Which of the following categories do you belong to regarding your smoking status?				
Ex-smoker vs. Current Smoker	1.02 (0.70, 1.49)	0.647		
Non-smoker vs. Current Smoker	1.25 (0.77, 2.04)			
Pack years (10-pack years)	0.98 (0.91, 1.06)	0.671		
Do you work/live in an environment with smokers (passive smoker)?				
No vs. Yes	1.27 (0.91, 1.79)	0.163		
Do you work or live in an environment exposed to smoke, dust, or fumes?				
No vs. Yes	1.26 (0.87, 1.82)	0.230		
Do you have a family history of lung cancer?				
No vs. Yes	0.97 (0.60, 1.57)	0.910		
Total knowledge score (1-Point)	1.48 (1.33, 1.65)	**< 0.001**	1.20 (1.06, 1.36)	**0.004**
I believe that, if I consult my doctor immediately when the first symptoms appear, I may live longer if I am diagnosed				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	3.68 (2.57, 5.28)	**< 0.001**	2.06 (1.32, 3.20)	**0.001**
I believe that lung cancer can be detected before the first symptoms appear through proper screening				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	3.51 (2.46, 5.01)	**< 0.001**	1.40 (0.89, 2.22)	0.145
I would be so concerned about what might be discovered at a lung cancer screening that I would prefer not to go				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	0.30 (0.21, 0.44)	**< 0.001**	0.29 (0.19, 0.45)	**< 0.001**

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It makes sense to undergo lung cancer screening because it will impact whether and how long you will live				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	3.62 (2.55, 5.14)	**< 0.001**	1.93 (1.26, 2.95)	**0.002**
I believe that LDCT without findings suggesting lung cancer can help reduce the worry and anxiety associated with the development of lung cancer				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	3.08 (2.16, 4.41)	**< 0.001**	1.31 (0.83, 2.08)	0.252
I believe that lung cancer screening should only be recommended for smokers and/or ex-smokers over the age of 50 and not for all adults over the age of 50				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	0.62 (0.42, 0.91)	**0.014**	0.70 (0.45, 1.07)	0.098
I believe that lung cancer screening should be offered free of charge to all citizens				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	6.64 (4.20, 10.50)	**< 0.001**	2.09 (1.09, 4.00)	**0.027**
I believe that lung cancer screening should be a priority for the state				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	5.66 (3.75, 8.53)	**< 0.001**	1.64 (0.90, 2.96)	0.104

Table 6c: Factors associated with selected practices towards lung cancer screening.

F3. I would be willing to undergo lung cancer screening using LDCT scan if the state sent me a message suggesting that I do it and it was free	**Univariate Models OR (95% CI)**	**p-value**	**Multivariate Model OR (95% CI)**	**p-value**
Sex				
Female vs. Male	0.99 (0.72, 1.37)	0.957		
Age (years)				
30-39 vs. 18-29	0.62 (0.35, 1.08)	**0.032**	0.51 (0.27, 0.97)	**0.003**
40-49 vs. 18-29	0.63 (0.36, 1.11)		0.36 (0.19, 0.70)	
50-59 vs. 18-29	1.04 (0.55, 1.97)		0.62 (0.30, 1.25)	
60-69 vs. 18-29	0.75 (0.40, 1.42)		0.45 (0.22, 0.91)	
70+ vs. 18-29	0.46 (0.26, 0.79)		0.27 (0.14, 0.53)	
The area in which household I have now called belongs to which of the categories I am about to read to you in terms of population?				
Thessaloniki vs. Athens	1.35 (0.73, 2.51)	0.907		
Urban area (over 10,000 inhabitants) vs. Athens	1.02 (0.70, 1.48)			
Semi-urban area (2,000 - 10,000 inhabitants) vs. Athens	1.00 (0.52, 1.92)			
Rural area (up to 2,000 inhabitants) vs. Athens	1.06 (0.57, 1.98)			
Marital status				
In cohabitation/Married - civil partnership vs. Unmarried	1.29 (0.88, 1.89)	0.361		
Divorced - In dimension/Widower vs. Unmarried	1.03 (0.58, 1.84)			
Professional status				
Non-workers vs. Workers	0.64 (0.47, 0.89)	**0.007**	0.75 (0.48, 1.17)	0.205
Educational status				
TEI/HEI vs. Primary/Secondary/High/Technical-vocational high school	1.49 (1.05, 2.11)	0.074		
Postgraduate studies vs. Primary/Secondary/High/Technical-vocational high school	1.08 (0.67, 1.73)			

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Individual net monthly income (in EUR)				
801-1,200 vs. <800	1.02 (0.69, 1.52)	0.228		
>1,200 vs. <800	1.43 (0.92, 2.20)			
BMI Status				
Overweight vs. Normal	1.39 (0.95, 2.02)	0.184		
Obese vs. Normal	0.98 (0.65, 1.48)			
Which of the following categories do you belong to regarding your smoking status?				
Ex-smoker vs. Current Smoker	0.87 (0.61, 1.25)	0.678		
Non-smoker vs. Current Smoker	0.85 (0.55, 1.32)			
Pack years (10-pack years)	0.96 (0.89, 1.03)	0.246		
Do you work/live in an environment with smokers (passive smoker)?				
No vs. Yes	1.04 (0.75, 1.44)	0.805		
Do you work or live in an environment exposed to smoke, dust, or fumes?				
No vs. Yes	1.11 (0.78, 1.59)	0.572		
Do you have a family history of lung cancer?				
No vs. Yes	0.98 (0.63, 1.53)	0.925		
Total knowledge score (1-Point)	1.43 (1.29, 1.58)	**< 0.001**	1.26 (1.12, 1.41)	**< 0.001**
I believe that, if I consult my doctor immediately when the first symptoms appear, I may live longer if I am diagnosed				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	2.67 (1.89, 3.78)	**< 0.001**	1.39 (0.91, 2.14)	0.128
I believe that lung cancer can be detected before the first symptoms appear through proper screening				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	3.04 (2.17, 4.27)	**< 0.001**	1.32 (0.77, 2.03)	0.199
I would be so concerned about what might be discovered at a lung cancer screening that I would prefer not to go				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	0.61 (0.41, 0.89)	**< 0.001**	0.57 (0.37, 0.88)	**0.011**
It makes sense to undergo lung cancer screening because it will impact whether and how long you will live				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	3.47 (2.49, 4.84)	**< 0.001**	2.10 (1.42, 3.12)	**< 0.001**
I believe that LDCT without findings suggesting lung cancer can help reduce the worry and anxiety associated with the development of lung cancer				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	2.78 (1.97, 3.91)	**< 0.001**	1.36 (0.89, 2.08)	0.153
I believe that lung cancer screening should only be recommended for smokers and/or ex-smokers over the age of 50 and not for all adults over the age of 50				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	0.69 (0.48, 1.002)	0.051		
I believe that lung cancer screening should be offered free of charge to all citizens				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	3.78 (2.40, 5.97)	**< 0.001**	1.05 (0.54, 2.06)	0.889
I believe that lung cancer screening should be a priority for the state				
I agree/I strongly agree Vs. I strongly disagree/I disagree/Neutral	5.27 (3.53, 7.88)	**< 0.001**	2.51 (1.42, 4.42)	**0.002**

TEI: Technological Educational Institute; HEI: Higher Educational Institute; BMI: Body Mass Index; LDCT: Low-dose computed tomography; OR: Odds Ratio; CI: Confidence Interval

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Discussion

The objective of this work was to present the knowledge, attitudes and practices of the general population in Greece regarding LC and LC screening, as well as the parameters that may influence these aspects. To the best of our knowledge, this is the first study conducted in Greece aiming to assess general population's knowledge, attitudes and practices.

Our research revealed that although most participants acknowledged active and passive smoking as risk factors for LC, only 53.2% identified all of the risk factors. Our results are partially in line with those from other studies that evaluated the knowledge of risk factors associated with LC [21-24]. Based on existing literature, active smoking has been a highly recognized risk factor [21-24] as opposed to passive, which has been identified by less than 50% of responders [23]. Our results (80.9% of participants identified passive smoking as a risk factor) indicate that Greek adults may be more conscious about the impact of passive smoking in lung physiology, compared to other populations.

Moreover, in the current study, cough that worsens or persists, shortness of breath and hemoptysis were the three most recognized symptoms, while only 1 out of 4 participants were found to identify the symptoms overall. Regarding screening, although a high percentage of general population seems to know what screening is and almost 70% of them correctly mention LDCT as a screening tool for LC, it seems that general population is not familiar with the concepts of "false positive" and "false negative".

The average total knowledge score pertaining to LC and LC screening was 4.1 out of 8, suggesting a moderate level of knowledge among participants. Indeed, this finding indicates a significant gap in community awareness, consistent with previous studies that have reported a similar deficiency in understanding [16,17,19]. An integrated interpretation of this finding reveals that the current public health campaigns and education systems may not be sufficiently effective in disseminating this critical information [25,26]. This highlights the need for more competent education strategies and health policy initiatives to improve overall alertness, thereby promoting better preventative and screening practices among the population at risk [27,28]. More importantly, our study revealed a general willingness of public population to learn more about LC screening procedures, an attitude that should be considered by health policy makers in order to promote relevant health campaigns.

Furthermore, another interesting finding was that younger people, current smokers as well as those without LC family history had poor knowledge. This aligns with prior research showing that family history of disease can influence health-related knowledge, since individuals with a positive family history tend to be more familiar with the disease's risk factors and consequences [29]. In addition, the fact that current smokers have lower level of knowledge, in combination with the high percentage of current smokers (45.8%) in our sample raises potential concerns about the future incidence of LC in our country and highlights the importance of preventative measures such as LC screening [30]. Besides, it also underlines the necessity to tailor public health measures in order to address this high-risk group's specific needs and misconceptions, enhancing their understanding of the relationship between smoking and LC and promoting LC screening practices [31,32].

Interestingly, a significant number of participants believed that LC screening should be a priority for the state, and it should be offered free of charge. This observation demonstrates the expectation of Greek population for the inclusion of LC screening in public health services.

As for participants' practices regarding LC screening, a small percentage reported having already been subjected to LC screening (13.3%), while it seems that more than 80.0% are willing to undergo LDCT if recommended by their doctor, or if they received a telephone text message letting them know that they are eligible for LDCT for free Last, we found that the total knowledge score of the participants was statistically significantly associated with willingness to undergo LDCT screening for LC if recommended by a doctor, and if suggested by a state-issued message, supporting that knowledge is strongly associated with the adoption of better prevention practices Similar trends have been previously reported, showing that physician's recommendation greatly influences patients' decisions about LDCT in the context of screening, with better knowledge acting as an auxiliary factor [33]. Comparable results were found with state-issued messages, where higher knowledge scores have been linked with a greater likelihood of acting upon health information disseminated by trusted authorities [34,35]. These findings together stress the necessity to promote knowledge about LC and LC screening, in order to facilitate informed decision-making among general population.

The strength of this study lies in its design. In previous knowledge, attitudes and practices (KAP) studies, data were collected using paper-based or online self-reported questionnaires, a method that often excludes vulnerable groups, such as the illiterate and rural populations with no access to the internet or online health information resources. In contrast, our survey employed a mixed-method-approach for data collection, utilizing both CATI and CAWI, ensuring a randomly selected sample with greater generalizability in terms of age, gender, and area of residence. Moreover, to the best of our knowledge, this is the first study conducted in European population, indicating that there is significant need

to increase public awareness towards LC and LC screening even in developed countries.

Despite the strengths of this study, several limitations must be acknowledged. First and foremost, telephone and web-based surveys typically have a lower response rate than face-to-face interviews, which can affect the sample's representativeness. However, by using weights, we ensured representation in terms of age and gender. Furthermore, this type of survey may suffer from lower response quality compared to face-to-face interviews due to potential reporting bias.

Conclusions

In conclusion, the study reveals considerable awareness and positive attitudes towards LC screening among the Greek population, yet gaps in knowledge, influenced by various demographic factors. Moreover, the importance of knowledge in the general population's willingness to adopt better prevention strategies was revealed. These findings illustrate the need for development and implementation of public health interventions to increase community awareness regarding the risk factors, symptoms and benefits of screening and early detection of LC, as well as policy measures to make LC screening more accessible.

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