

Research Article

Health Literacy and Healthcare Seeking with Lung Cancer Symptoms among Individuals with Different Smoking Statuses: A Population-Based Study

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Objective. To estimate proportions of contacts to the general practitioner (GP) among people with specific and nonspecific lung cancer symptoms, respectively, in the Danish general population and to analyse the associations between health literacy and these contacts based on smoking status. **Methods.** A total of 67,280 randomly selected individuals aged ≥ 40 years were invited to a survey concerning symptoms and healthcare seeking. This study included lung cancer symptoms, GP contacts, smoking status, four aspects of health literacy, and socioeconomic factors. Descriptive statistics and multivariable logistic regression models were applied. **Results.** Of 22,055 respondents, 23% reported at least one specific lung cancer symptom, while 47% reported at least one nonspecific symptom. GP contacts ranged from 30% (tiredness) to 60% (shortness of breath). Individuals who currently smoke had lower odds of GP contacts. The health literacy aspect “Feeling understood and supported” increased the likelihood of GP contact, while “Having sufficient information” decreased the likelihood. Smoking status did not modify these associations. **Conclusion.** Efforts targeting individuals at risk of postponing healthcare seeking with lung cancer symptoms are needed. This study highlights aspects of health literacy that may be addressed in interventions increasing both individuals and community-based health literacy responsiveness and enhanced chances of timely healthcare seeking.

1. Introduction

Lung cancer is one of the most common cancers and is associated with high mortality [1]. During the past decades, improvements in diagnostics and treatments have decreased mortality, yet prognosis is still highly dependent on the stage of the disease at the time of diagnosis. Despite great expectations of future screening programs, most patients with lung cancer will continuously be diagnosed based on symptoms [2, 3]. Both national and international lung cancer guidelines differentiate between specific lung cancer symptoms, e.g., prolonged coughing, shortness of breath, and haemoptysis, and nonspecific lung cancer symptoms, such as tiredness and weight loss [4, 5]. In several countries,

including Denmark, general practitioners are recommended to refer patients for further clinical investigation in a fast-track cancer pathway when suspicion of lung cancer is raised [5]. However, a precondition for referral is that people seek healthcare when experiencing relevant symptoms.

Awareness of symptoms and help-seeking behaviour among people with lung cancer symptoms are influenced by several factors, such as smoking history, socioeconomic factors, age, and sex [6–9]. Common for these are that they are difficult to change. Other factors, such as fear of stigmatisation, worry about what the GP might find, and embarrassment about the symptoms, have also been described as factors important for healthcare-seeking behaviour, especially among individuals who formerly or currently smoke

[8–10]. Evidence suggests that future initiatives for enhancing awareness of healthcare seeking with cancer symptoms could benefit from a broader focus on modifiable factors as opposed to a sole focus on, e.g., smoking status, which may also add to stigmatising and increased social inequity, despite the opposite intention [3, 11–13]. This recommendation has been supported by the Danish National Health Authorities who highlights health literacy as one way to target inequity [13]. Health literacy has already been linked to several cancer-related outcomes, such as cancer screening, participation in treatment, and quality of life during treatment [14–16]. Moreover, previous studies have shown associations between socioeconomic conditions and smoking status [17–19].

Health literacy can be defined as the combination of personal competencies and situational resources needed for people to access, understand, appraise, and use information and services to make decisions about health, including the capacity to communicate, assert, and act upon these decisions [20]. Individuals with health literacy challenges have higher risk of emergency presentation of cancer [16, 21, 22] and are less likely to seek information about cancer [23], implying that they are less aware of their symptoms or less likely to perceive the symptoms as significant or as signs of potential illness [21], which could lead to postponement of healthcare seeking until the conditions become acute. Knowledge about how health literacy influences healthcare-seeking behaviour for people with lung cancer symptoms could be of importance in future interventions targeting symptom appraisal, help seeking, and social inequity in health, especially among groups at high risk of lung cancer such as individuals who currently smoke or with deprived socioeconomics. Possible intervention strategies include the development health literacy capacity at both an individual level [11, 24] and an organisational level, e.g., by reorganisations of the healthcare systems, promoting health communication and national campaigns [12, 25–27].

This population-based study aims (1) to estimate proportions of GP contacts with specific and nonspecific lung cancer symptoms and (2) to analyse the associations between health literacy and contact to general practice with lung cancer symptoms among individuals with different smoking statuses. Socioeconomics will be included in the analyses.

2. Methods

The present study is a part of a nationwide study called the Danish Symptom Cohort (DaSC). The DaSC was founded in 2012 with a large population-based survey investigating symptom experiences and healthcare-seeking behaviour in the Danish general population. Ten years later a follow-up and expansion, the Danish Symptom Cohort II (DaSC II) was conducted, which forms the basis for this study.

A total of 100,000 individuals aged 20 years or over were randomly selected by their unique personal identification number in the Civil Registration System (CRS number) [28]. Citizens with a Danish CRS number include individuals born in Denmark and immigrants. An invitation was sent to a free, personal, public digital mailbox linked to each citizen's CRS

number. Participation was voluntary, and individuals who did not wish to participate in the survey were offered the opportunity to decline online or by contacting the project group. After seven days, nonrespondents received a reminder letter in their digital mailbox encouraging them to participate. This procedure was repeated after additional seven days. Data were collected from May to July 2022.

2.1. Questionnaire. The development of the DaSC II questionnaire followed the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) guidelines [29] and was based on the original 2012 questionnaire [30]. The reporting followed the STROBE checklist for cross-sectional studies (Appendix A). An updated conceptual framework was formed by scrutinising and adjusting existing constructs, and adding new ones based on new hypotheses and themes. Inspiration for new constructs appeared from literature, clinical experiences, and interviews with a user panel consisting of twelve representatives from the general population. The final questionnaire was tested in two qualitative pilot tests evaluating feasibility, face validity, and comprehensiveness, and in a quantitative field test among 499 randomly selected Danish citizens assessing logistics, performance of the questions and scales, etc. The conceptual framework and development of the questionnaire is described in detail elsewhere [31]. The wording of the questions included in this study is shown in Appendix B.

2.1.1. Symptom Experiences. The questionnaire comprised questions regarding 44 symptoms experienced within the preceding four weeks, including specific and nonspecific cancer symptoms as well as frequent symptoms. For each reported symptom, additional questions regarding onset of the symptom and contact to the GP were asked.

In the present study, we included questionnaire data regarding eight predefined lung cancer symptoms. Specific lung cancer symptoms are defined in the Danish lung cancer guideline from 2018 as prolonged coughing (>4 weeks), shortness of breath, haemoptysis, prolonged hoarseness (>4 weeks), and changes to a familiar cough among adults older than 40 years with a relevant smoking history [5]. In addition, nonspecific symptoms such as tiredness, weight loss, and loss of appetite should also raise suspicion of lung cancer, both alone and in combination with the specific lung cancer symptom [5].

2.1.2. Health Literacy. Following the symptom domain, experiences with the healthcare system and health literacy were covered. The questions regarding health literacy arise from the internationally acknowledged and validated Health Literacy Questionnaire (HLQ) [32], which has been translated into Danish, culturally adapted, and validated [33]. The HLQ comprises 44 items across nine independent domains representing different aspects of health literacy [32, 33]. Each domain can be used alone or together with some or all the other domains. The following four domains were included in

the questionnaire: “Feeling understood and supported by healthcare providers” (“Understood and supported,” 5 items), “Having sufficient information to manage my health” (“Sufficient information,” 4 items), “Having social support for health” (“Social support,” 5 items), and “Ability to actively engage with healthcare providers” (“Actively engage,” 5 items). The selected domains were those hypothesised to have the highest impact on healthcare-seeking behaviour in a primary care setting [34]. The HLQ items cover a range of statements. For the first three domains, the respondents were asked on a four-point Likert scale whether they agreed with each item (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree), and for the last one, they were asked on a five-point Likert scale whether they found the statement difficult or easy (1 = always difficult, 2 = usually difficult, 3 = sometime difficult, 4 = usually easy, 5 = always easy).

2.1.3. Smoking Status. At the end of the questionnaire, participants were asked about individual characteristics, such as smoking status (never, former, or current).

2.1.4. Socioeconomic Factors. Socioeconomic data were obtained from Statistics Denmark by using the CRS numbers [28, 35, 36], to keep the number of questions in the comprehensive survey low, and because the Danish registers are extensive and valid [35–37]. The variables of interest were highest obtained educational level, marital status, labour market affiliation, and ethnicity. Details of the variables are described under statistical analyses. Data on vital status were obtained from the Danish Health Data Authority [38].

2.2. Statistical Analyses. Individuals who died prior to the data collection period and individuals exempted from digital mail (approximately 7%) were ineligible for study [39]. We only included respondents 40 years or older in the analyses according to the Danish lung cancer guideline [5]. Individuals who had not answered all relevant items in the survey were excluded as well as those with incomplete register data.

We constructed two overall symptom variables, e.g., *specific and nonspecific lung cancer symptoms*, respectively. Specific lung cancer symptoms were defined as having reported at least one of the symptoms: prolonged coughing, shortness of breath, haemoptysis, prolonged hoarseness, or changes to a familiar cough, while *nonspecific lung cancer symptoms* were defined as having reported at least one of the symptoms, tiredness, loss of appetite, or weight loss. Descriptive statistics were used to calculate symptom prevalence and proportions of GP contacts for the two overall variables and for each of the eight lung cancer symptoms. Furthermore, we calculated mean score and standard deviation (SD) for each of the four HLQ domains. The mean score was calculated as the sum score within each domain divided by the number of items. Higher mean scores indicate more evolved health literacy capacity within the aspect in question. No cut-off for low or high health literacy has been defined for the scale used in the present study (HLQ) [40].

Associations among sex, age, smoking status, health literacy, and contact to the GP were analysed by uni- and multivariable logistic regression models. Two multivariable models were conducted, one with adjustments for sex, age, and smoking status, and one with additional adjustment for the socioeconomic factors showing associations with health literacy in the crude analyses. To explore the interaction between smoking status and health literacy, we made sub-analyses stratified on smoking status.

The covariates included in the analyses were categorised as follows: age groups: 40–54 years, 55–69 years, and 70 years or older; smoking status: individuals who never smoked, formerly smoked, and currently smoke; marital status: single/living alone or married/living together; highest obtained educational level: low (<10 years, i.e., primary/lower secondary school), middle (10–15 years, i.e., vocational, or higher secondary school), or high (≥ 15 years, i.e., short-, medium-, or long-term higher education); labour market affiliation: working, pension, out of workforce, and disability pension; ethnicity: Danish or immigrants/descendants of immigrants.

Data analyses were conducted using STATA version 17 (StataCorp, College Station, TX, USA). All tests used a significance level of $p < 0.05$.

2.3. Ethics. The respondents were informed about the purpose and content of the study, that participation was voluntary, and that there would be no clinical follow-up. They were further instructed to contact their doctor in case of concern. Respondents had the opportunity to contact the project group by phone or e-mail if further clarification was needed. The project was approved by the Research Ethics Committee at the University of Southern Denmark (Case no. 21/29156) and by the Danish Data Protection Agency (j.no. 2011-41-6651) through the Research and Innovation Organisation (RIO), University of Southern Denmark (Project number 10.104).

3. Results

Of the 100,000 randomly selected individuals, 92,743 (92.7%) were eligible for the study and 31,415 answered the questionnaire, yielding a response rate of 33.9%. After the exclusion of individuals under 40 years of age and individuals with missing data in either the survey or registers, 22,055 respondents were included in the analyses (Figure 1).

A total of 4970 (22.5%) individuals reported at least one specific lung cancer symptom, while 46.9% of respondents reported at least one nonspecific lung cancer symptom. The most frequently reported symptoms were tiredness ($n = 10,050$ (45.6%)) and prolonged coughing ($n = 3156$ (14.3%)), while haemoptysis ($n = 57$ (0.3%)) and weight loss ($n = 418$ (1.9%)) were the least frequently reported symptoms (Table 1). Overall, 45.3% ($n = 2251$) of individuals reporting at least one specific lung cancer and 30.5% ($n = 3157$) reporting at least one nonspecific lung cancer symptom, respectively, had contacted their GP. The proportions of GP contacts ranged from 60.0% (shortness of breath ($n = 1361$))

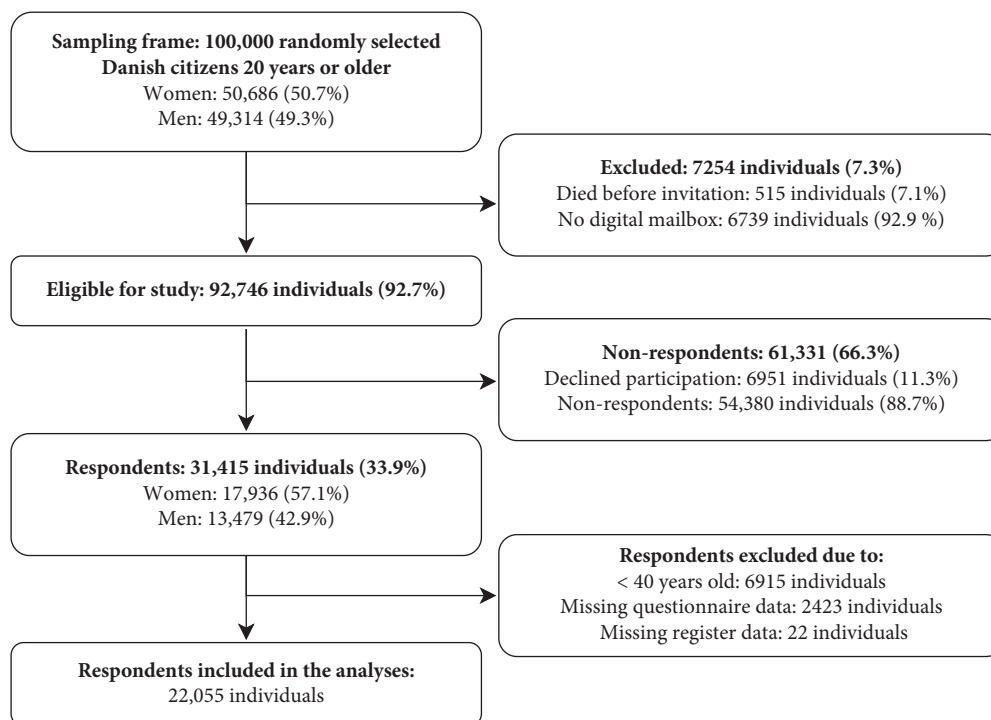


FIGURE 1: Flowchart.

to 30.1% (tiredness ($n = 3028$) and loss of appetite ($n = 357$)). Less than half of individuals with haemoptysis reported GP contact ($n = 24$ (42.2%)) (Table 1). Symptom prevalence and proportions of GP contacts with lung cancer symptoms related to socioeconomics appear in Appendix C Table S1.

Mean score for each of the four HLQ domains according to GP contact with lung cancer symptoms is shown in Table 2. Higher mean scores indicate more evolved health literacy capacity, whereas lower mean scores indicate health literacy challenges. In general, mean scores tend to be lower among individuals with no GP contacts, yet with overlapping confidence intervals.

Adjusted associations among sex, age, smoking status, health literacy, and GP contact with specific and nonspecific lung cancer symptoms are presented in Table 3. For all symptoms, men had statistically significantly lower likelihood of GP contact (ORs ranging from 0.69 to 0.79, p value < 0.05 for all except changes in a familiar cough and weight loss), while odds of GP contact increased with increasing age (ORs ranging from 1.14 to 2.26, p value < 0.05), yet not statistically significant for all symptoms. Individuals who currently smoke had lower odds of GP contact with specific lung cancer symptoms (OR: 0.72, 95% CI: 0.61–0.85) compared to individuals who have never smoked (Table 3).

In terms of the included aspects of health literacy, higher scores in “Understood and supported” increased the odds of GP contact with both specific (OR 1.41, 95% CI: 1.24–1.60) and nonspecific (OR 2.04, 95% CI: 1.85–2.26) lung cancer symptoms, while higher score for “Sufficient information” decreased the likelihood of GP contact with at least one specific (OR 0.66, 95% CI: 0.57–0.76) and nonspecific (OR 0.57, 95% CI: 0.49–0.61) lung cancer symptoms. Increasing

scores for “Social support” and “Actively engagement” were not associated with healthcare-seeking behaviour with the specific symptoms, while it decreased the odds of seeking healthcare with the nonspecific symptoms (OR 0.82, 95% CI: 0.77–0.87) (Table 3). Crude odds ratios are shown in Appendix C Tables S2–S4. Adjusting for socioeconomics did not change the direction of the associations, but some results turned insignificant (Table 3).

Stratifying the analyses on smoking status did not change either the direction or strength of the association between health literacy and contact to general practice with lung cancer symptoms (Table 4).

4. Discussion

4.1. Summary of Main Findings. One out of five participants reported at least on specific lung cancer symptom, and almost half of the 22,055 eligible participants reported at least one nonspecific lung cancer symptom with tiredness being the most dominant symptom. Proportions of GP contacts ranged from 30.1% (tiredness and loss of appetite) to 60.0% (shortness of breath). Men and younger individuals had lower odds of GP contact, and individuals who currently smoked were less likely to seek healthcare with the specific lung cancer symptoms.

For individuals reporting specific lung cancer symptoms, feeling understood and supported by healthcare providers were associated with higher likelihood of GP contact, whereas having sufficient information to manage own health was associated with lower likelihood of GP contact. Having social support for health and being able to actively engage with healthcare providers also decreased the likelihood of

TABLE 1: Symptom prevalence and proportion of contacts to the GP with specific and nonspecific lung cancer symptoms.

Total	At least one specific lung cancer symptom				Prolonged coughing				Shortness of breath				Haemoptysis				Prolonged hoarseness				Changes to a familiar cough			
	N	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)				
Total	22,055	4970 (22.5)	2251 (45.3)	3156 (14.3)	1193 (37.8)	2267 (10.3)	1361 (60.0)	57 (0.3)	24 (42.1)	811 (3.7)	276 (34.0)	275 (1.2)	100 (36.4)											
Sex																								
Women	12,209	2682 (22.0)	1283 (47.8)	1682 (13.8)	694 (41.3)	1232 (10.1)	765 (62.1)	28 (0.2)	14 (50.0)	464 (3.8)	173 (37.3)	144 (1.2)	57 (39.6)											
Men	9846	2288 (23.2)	968 (42.3)	1474 (15.0)	499 (33.9)	1035 (10.5)	596 (57.6)	29 (0.3)	10 (34.5)	347 (3.5)	103 (29.7)	131 (1.3)	43 (32.8)											
Age groups																								
40–54 years	6872	1316 (19.2)	473 (35.9)	799 (11.6)	242 (30.3)	624 (9.1)	294 (47.1)	17 (0.2)	— [§]	199 (2.9)	55 (27.6)	78 (1.1)	17 (21.8)											
55–69 years	9379	2215 (23.6)	994 (44.9)	1448 (15.4)	541 (37.4)	999 (10.7)	600 (60.1)	26 (0.3)	— [§]	360 (3.8)	123 (34.2)	128 (1.4)	53 (41.4)											
70+ years	5804	1439 (24.8)	784 (54.5)	909 (15.7)	410 (45.1)	644 (11.1)	467 (72.5)	14 (0.2)	— [§]	252 (4.3)	98 (38.9)	69 (1.2)	30 (43.5)											
Smoking status																								
Never	10572	1997 (18.9)	874 (43.8)	1279 (12.1)	477 (37.3)	807 (7.6)	465 (57.6)	18 (0.2)	— [§]	345 (3.3)	132 (38.3)	116 (1.1)	38 (32.8)											
Former	8483	2022 (23.8)	1020 (50.4)	1165 (13.7)	497 (42.7)	1041 (12.3)	666 (64.0)	28 (0.3)	— [§]	353 (4.2)	118 (33.4)	115 (1.4)	45 (39.1)											
Current	3000	951 (31.7)	357 (37.5)	712 (23.7)	219 (30.8)	419 (14.0)	230 (54.9)	11 (0.4)	— [§]	113 (3.8)	26 (23.0)	44 (1.5)	17 (38.6)											
Total	At least one nonspecific lung cancer symptom				Tiredness				Weight loss				Loss of appetite											
N	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)	Symptom experience n (%)	GP contact n (%)				
Total	20,555	10,350 (46.9)	3157 (30.5)	3028 (30.1)	418 (1.9)	175 (41.9)	1187 (5.4)	357 (30.1)																
Sex																								
Women	12,209	6007 (49.2)	1941 (32.3)	1871 (31.9)	217 (1.8)	95 (43.8)	704 (5.8)	225 (32.0)																
Men	9846	4343 (44.1)	1216 (28.0)	1157 (27.6)	201 (2.0)	80 (39.8)	483 (4.9)	132 (27.3)																
Age groups																								
40–54 years	6872	3975 (57.8)	1038 (26.1)	1012 (25.9)	128 (1.9)	47 (36.7)	426 (6.2)	97 (22.8)																
55–69 years	9379	4161 (44.4)	1274 (30.6)	1229 (30.4)	138 (1.5)	53 (38.4)	436 (4.6)	128 (29.4)																
70+ years	5804	2214 (38.1)	845 (38.2)	2108 (36.3)	787 (37.3)	152 (2.6)	75 (49.3)	325 (5.6)																
Smoking status																								
Never	10,572	4823 (45.6)	1361 (28.2)	1311 (27.8)	163 (1.5)	66 (40.5)	471 (4.5)	136 (28.9)																
Former	8483	3959 (46.7)	1303 (32.9)	1248 (32.6)	157 (1.9)	68 (43.3)	438 (5.2)	143 (32.6)																
Current	3000	1568 (52.3)	493 (31.4)	469 (31.2)	98 (3.3)	41 (41.8)	278 (9.3)	78 (28.1)																

[§]Due to Danish data legislation, reporting of number less than four is not allowed.

TABLE 2: Health literacy mean score and standard deviation (SD) among individuals with GP contact and no GP contact with their lung cancer symptom (N = 22,055).

Health literacy	At least one specific lung cancer symptom (n = 4970)		Prolonged coughing (n = 3156)		Shortness of breath (n = 2267)		Haemoptysis (n = 57)		Prolonged hoarseness (n = 811)		Changes to a familiar cough (n = 275)	
	GP contact		GP contact		GP contact		GP contact		GP contact		GP contact	
	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)
“Understood and supported”	2.90 (0.67)	2.81 (0.68)	2.91 (0.67)	2.89 (0.66)	2.78 (0.69)	2.85 (0.78)	2.79 (0.91)	2.92 (0.66)	2.79 (0.69)	2.91 (0.69)	2.68 (0.73)	2.79 (0.60)
“Sufficient information”	3.02 (0.56)	2.89 (0.60)	2.91 (0.59)	2.84 (0.60)	2.86 (0.60)	2.77 (0.74)	2.80 (0.82)	2.87 (0.63)	2.83 (0.56)	2.87 (0.56)	2.79 (0.60)	2.83 (0.68)
“Social support”	3.04 (0.59)	2.96 (0.60)	2.97 (0.59)	2.94 (0.61)	2.86 (0.64)	2.88 (0.84)	2.81 (0.79)	2.95 (0.63)	2.87 (0.59)	2.95 (0.67)	2.83 (0.68)	2.83 (0.68)
“Actively engage”	3.80 (0.87)	3.61 (0.93)	3.66 (0.92)	3.64 (0.89)	3.51 (0.95)	3.34 (1.23)	3.44 (1.24)	3.53 (0.94)	3.48 (0.92)	3.51 (0.98)	3.43 (0.95)	3.43 (0.95)
At least one nonspecific lung cancer symptom (n = 10,350)												
Health literacy	GP contact		Tiredness (n = 10,050)		Weight loss (n = 418)		Loss of appetite (n = 1187)					
	GP contact		GP contact		GP contact		GP contact		GP contact		GP contact	
	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)	Mean (SD)	No GP contact Mean (SD)
“Understood and supported”	2.90 (0.67)	2.81 (0.67)	2.91 (0.67)	2.81 (0.67)	2.96 (0.67)	2.77 (0.68)	2.95 (0.67)	2.76 (0.74)	2.95 (0.67)	2.76 (0.74)	2.95 (0.67)	2.76 (0.74)
“Sufficient information”	3.02 (0.56)	2.85 (0.60)	2.85 (0.60)	2.95 (0.55)	2.79 (0.72)	2.83 (0.59)	2.82 (0.64)	2.82 (0.62)	2.82 (0.64)	2.82 (0.62)	2.82 (0.64)	2.82 (0.62)
“Social support”	3.04 (0.59)	2.93 (0.62)	2.93 (0.62)	2.96 (0.59)	2.98 (0.66)	2.86 (0.65)	2.93 (0.67)	2.86 (0.68)	2.93 (0.67)	2.86 (0.68)	2.93 (0.67)	2.86 (0.68)
“Actively engage”	3.80 (0.87)	3.53 (0.91)	3.64 (0.88)	3.64 (0.88)	3.59 (1.01)	3.47 (1.00)	3.51 (0.98)	3.45 (0.99)	3.51 (0.98)	3.45 (0.99)	3.51 (0.98)	3.45 (0.99)

TABLE 3: Associations between sex, age, smoking status, health literacy, and contact to GP with specific and nonspecific lung cancer symptoms.

	At least one specific lung cancer symptom (n = 4970)		Prolonged coughing (n = 3156)		Shortness of breath (n = 2267)		Prolonged hoarseness (n = 811)		Changes to a familiar cough (n = 275)		At least one nonspecific lung cancer symptom (n = 10,350)		Tiredness (n = 10,050)		Weight loss (n = 418)		Loss of appetite (n = 1187)	
	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)
Sex (ref: women)																		
Men	0.76 (0.68–0.85)	0.78 (0.69–0.87)	0.69 (0.60–0.80)	0.70 (0.60–0.82)	0.79 (0.66–0.94)	0.79 (0.66–0.95)	0.69 (0.50–0.93)	0.68 (0.50–0.94)	0.73 (0.43–1.24)	0.81 (0.47–1.42)	0.75 (0.69–0.82)	0.79 (0.72–0.87)	0.75 (0.50–1.12)	0.81 (0.53–1.25)	0.71 (0.55–0.93)	0.73 (0.55–0.96)		
Age groups (ref: 40–54 years)																		
55–69 years	1.45 (1.25–1.67)	1.36 (1.17–1.59)	1.36 (1.12–1.64)	1.32 (1.08–1.61)	1.73 (1.41–2.12)	1.58 (1.27–1.96)	1.36 (0.92–2.00)	1.26 (0.84–1.89)	2.96 (1.50–5.85)	2.95 (1.42–6.12)	1.24 (1.12–1.37)	1.14 (1.02–1.26)	1.06 (0.63–1.78)	0.96 (0.53–1.72)	1.44 (1.06–1.98)	1.39 (0.99–1.95)		
70+ years	2.06 (1.76–2.41)	1.88 (1.47–2.39)	1.82 (1.48–2.24)	1.88 (1.38–2.56)	2.94 (2.30–3.75)	2.26 (1.55–3.31)	1.56 (1.03–2.36)	1.19 (0.63–2.26)	2.84 (1.31–6.12)	3.11 (1.00–9.73)	1.75 (1.56–1.97)	1.47 (1.21–1.79)	1.57 (0.94–2.63)	0.94 (0.40–2.22)	2.33 (1.67–3.24)	2.18 (1.23–3.85)		
Smoking status (ref: never smoking)																		
Former smoking	1.22 (1.08–1.39)	1.19 (1.05–1.35)	1.18 (1.00–1.39)	1.16 (0.98–1.38)	1.15 (0.95–1.40)	1.11 (0.91–1.35)	0.84 (0.61–1.15)	0.82 (0.59–1.13)	1.32 (0.75–2.34)	1.21 (0.67–2.17)	1.19 (1.08–1.30)	1.15 (1.04–1.27)	1.09 (0.69–1.73)	1.04 (0.65–1.67)	1.15 (0.85–1.54)	1.06 (0.79–1.43)		
Current smoking	0.80 (0.68–0.95)	0.72 (0.61–0.85)	0.77 (0.63–0.94)	0.69 (0.56–0.84)	0.92 (0.72–1.18)	0.83 (0.64–1.08)	0.54 (0.33–0.89)	0.50 (0.30–0.83)	2.06 (0.92–4.59)	1.67 (0.71–3.94)	1.16 (1.02–1.32)	1.03 (0.90–1.17)	1.23 (0.72–2.11)	1.22 (0.68–2.19)	1.10 (0.78–1.56)	0.92 (0.64–1.33)		
Health literacy																		
“Understood and supported”	1.48 (1.30–1.68)	1.41 (1.24–1.60)	1.44 (1.22–1.70)	1.37 (1.16–1.61)	1.44 (1.19–1.74)	1.38 (1.14–1.67)	1.42 (1.02–1.99)	1.36 (0.97–1.91)	2.25 (1.30–3.88)	2.23 (1.26–3.94)	2.17 (1.97–2.39)	1.99 (1.80–2.19)	2.01 (1.26–3.20)	1.99 (1.24–3.20)	1.95 (1.48–2.57)	1.85 (1.40–2.44)		
“Sufficient information”	0.63 (0.55–0.73)	0.66 (0.57–0.76)	0.68 (0.56–0.82)	0.70 (0.58–0.84)	0.61 (0.50–0.76)	0.63 (0.51–0.78)	0.85 (0.59–1.21)	0.90 (0.63–1.30)	0.91 (0.49–1.69)	0.88 (0.47–1.66)	0.55 (0.49–0.61)	0.57 (0.52–0.64)	0.48 (0.31–0.64)	0.52 (0.32–0.83)	0.65 (0.48–0.87)	0.67 (0.50–0.91)		
“Social support”	1.07 (0.94–1.22)	1.13 (0.98–1.29)	0.97 (0.81–1.15)	1.00 (0.84–1.20)	1.23 (1.02–1.48)	1.26 (1.04–1.53)	1.09 (0.78–1.53)	1.07 (0.76–1.52)	1.17 (0.69–1.98)	1.36 (0.77–2.40)	0.87 (0.80–0.96)	0.94 (0.85–1.03)	1.34 (0.87–2.08)	1.33 (0.84–2.09)	0.99 (0.77–1.28)	1.02 (0.79–1.33)		
“Actively engage”	0.94 (0.86–1.02)	0.96 (0.88–1.04)	0.98 (0.88–1.09)	1.00 (0.90–1.11)	0.95 (0.84–1.08)	0.98 (0.86–1.11)	0.92 (0.73–1.14)	0.93 (0.75–1.16)	0.76 (0.51–1.13)	0.76 (0.50–1.13)	0.79 (0.74–0.84)	0.83 (0.78–0.89)	0.98 (0.74–1.31)	0.99 (0.74–1.34)	0.91 (0.76–1.08)	0.94 (0.78–1.13)		

Bold: statistically significant. [†]Adjusted for sex, age, and smoking status. [‡]Adjusted for sex, age, smoking status, educational level, and ethnicity.

TABLE 4: Associations among sex, age, health literacy, and GP contact with at least one specific or nonspecific lung cancer symptoms stratified on smoking status (adjusted odds ratios (OR)).

Sex (ref. women)	At least one specific lung cancer symptom (<i>n</i> = 4974)						At least one nonspecific lung cancer symptom (<i>n</i> = 10,364)					
	Never			Former			Never			Former		
	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)	Adj. [†] OR (95% CI)	Adj. [‡] OR (95% CI)
Men	0.69 (0.57–0.83)	0.69 (0.57–0.84)	0.94 (0.79–1.13)	0.98 (0.81–1.18)	0.58 (0.44–0.76)	0.60 (0.46–0.80)	0.69 (0.60–0.80)	0.73 (0.63–0.84)	0.89 (0.78–1.02)	0.93 (0.80–1.07)	0.61 (0.49–0.77)	0.64 (0.51–0.81)
Age groups (ref. 40–54 years)												
55–69 years	1.65 (1.33–2.05)	1.61 (1.28–2.03)	1.25 (0.97–1.59)	1.09 (0.84–1.41)	1.38 (1.01–1.89)	1.40 (1.00–1.96)	1.18 (1.02–1.37)	1.07 (0.91–1.25)	1.23 (1.04–1.46)	1.14 (0.96–1.36)	1.36 (1.07–1.73)	1.28 (0.99–1.65)
70+ years	2.31 (1.82–2.93)	2.32 (1.56–3.46)	1.80 (1.39–2.33)	1.27 (0.88–1.83)	1.90 (1.27–2.86)	3.11 (1.62–5.94)	1.80 (1.52–2.13)	1.24 (0.89–1.72)	1.62 (1.35–1.95)	1.44 (1.08–1.92)	2.00 (1.41–2.84)	2.31 (1.29–4.15)
Health literacy												
“Understood and supported”	1.42 (1.17–1.73)	1.39 (1.14–1.69)	1.38 (1.12–1.70)	1.30 (1.06–1.61)	1.83 (1.38–2.44)	1.73 (1.30–2.32)	2.17 (1.88–2.50)	2.02 (1.75–2.34)	2.10 (1.79–2.46)	2.00 (1.70–2.34)	2.39 (1.88–3.04)	2.27 (1.77–2.90)
“Sufficient information”	0.68 (0.54–0.85)	0.70 (0.55–0.88)	0.66 (0.52–0.83)	0.68 (0.54–0.86)	0.53 (0.38–0.73)	0.57 (0.41–0.80)	0.60 (0.51–0.70)	0.63 (0.53–0.73)	0.53 (0.45–0.63)	0.55 (0.46–0.65)	0.47 (0.37–0.62)	0.50 (0.39–0.66)
“Social support”	1.05 (0.85–1.30)	1.08 (0.87–1.33)	1.04 (0.84–1.29)	1.12 (0.90–1.39)	1.17 (0.87–1.57)	1.28 (0.94–1.75)	0.83 (0.72–0.96)	0.88 (0.76–1.02)	0.88 (0.75–1.02)	0.92 (0.79–1.08)	0.98 (0.78–1.24)	1.12 (0.88–1.42)
“Actively engage”	0.94 (0.82–1.07)	0.95 (0.83–1.08)	0.93 (0.81–1.07)	0.96 (0.84–1.10)	0.95 (0.79–1.14)	0.96 (0.80–1.15)	0.73 (0.66–0.80)	0.75 (0.68–0.83)	0.82 (0.74–0.91)	0.84 (0.76–0.93)	0.90 (0.77–1.06)	0.92 (0.79–1.08)

Bold: statistically significant. [†]Adjusted for sex, age, and smoking status. [‡]Adjusted for sex, age, smoking status, educational level, and ethnicity

GP contact, but only for the nonspecific symptoms. Smoking status did not modify the associations between health literacy and healthcare-seeking behaviour.

4.2. Discussion of Results and Comparison with Other Literature

4.2.1. Healthcare Seeking with Lung Cancer Symptoms. Both the prevalence of lung cancer symptom and proportions of GP contacts are higher compared to the 2012 survey [6], but similar to UK studies from 2016 [7, 41]. The DaSC II was conducted shortly after the COVID-19 pandemic, and the focus on respiratory symptoms during the pandemic may have contributed to increased awareness of these symptoms. Similar tendencies have been found in the most recent results from the cancer awareness measures (CAM) in the UK [42]. However, the CAM did not show increased healthcare seeking with symptoms suspected as lung cancer symptoms, maybe because more people attributed their respiratory symptoms to COVID-19 [42, 43]. In anthropologic theories, it has been suggested that the major focus on early diagnosis of cancer, awareness of symptoms, and help seeking during the past decades have changed the semiotics in the general population [44]. A possible consequence is that more bodily sensations are perceived as symptoms of potential illness, and an increased need to explain the cause of the symptoms results in higher rates of healthcare seeking [44].

Overall, the highest proportions of healthcare seeking were found among individuals with specific lung cancer symptoms, which is in line with descriptions of the diagnostic trajectories from patients diagnosed with lung cancer in a qualitative study [45]. Individuals who smoke have the highest risk of lung cancer as cause of their symptoms, yet in line with previous studies, the present study shows that they are less likely to contact the GP with the specific symptoms [6, 7]. Thus, initiatives targeting this group are still highly relevant. A possible explanation for lower healthcare seeking among individuals who smoke could be a common knowledge of smoking causing respiratory symptoms and diseases. Therefore, respiratory symptoms among smokers, e.g., due to lung cancer or chronic respiratory diseases, may be associated with feelings of guilt and stigmatising, reducing the probability of healthcare seeking [46, 47]. Stigmatising or fear of getting a smoking-related diagnosis may also be reasons why less than half reporting haemoptysis have been in contact with their GP. Haemoptysis has the highest positive predictive value for lung cancer [48] and is associated with poorer prognosis [49]; hence, ideally it should prompt healthcare seeking to a higher degree.

4.2.2. Health Literacy and Healthcare Seeking. In the present study, individuals with higher score for the aspect feeling “Understood and supported” were more likely to seek healthcare. This implies that not feeling understood and supported may result in omitting healthcare seeking, in accordance with qualitative research describing that

previous misunderstandings or negative experiences with the healthcare system are a barrier to healthcare seeking [43, 45]. Likewise, not feeling understood and supported could be an expression of the abovementioned feelings of shame and stigmatising [50].

Increased scores of having “Sufficient information” decreased the likelihood of seeking healthcare. The ability to understand, interpret, and explain symptoms affects healthcare seeking, and it may seem unnecessary for a person to seek care with explainable symptoms [21]. Yet, individuals with health literacy challenges often make evasive explanations for their symptoms and may omit relevant healthcare seeking to a higher degree than individuals without health literacy challenges, inducing risk of delayed symptom presentation [21]. Furthermore, studies are needed to evaluate whether our results indicate a healthy pattern of healthcare utilisation based on one’s ability to evaluate symptoms oneself, or whether the results indicate a “false sense of security” in a group of individuals, who feel they have enough information, and thus omit relevant healthcare seeking resulting in delayed diagnosis.

For the nonspecific lung cancer symptoms, higher scores for having “Social support” for health and being able to “Actively engage” with healthcare providers decreased the likelihood of seeking healthcare, while it did not influence GP contacts with the specific lung cancer symptoms. This is opposite to our hypotheses and existing evidence, showing that both personal and professional relations and support are facilitators of healthcare seeking [51, 52]. To our knowledge, only a few previous studies have investigated health literacy and timely diagnosis of cancer including healthcare-seeking behaviour [16, 22], all with qualitative approaches making comparisons challenging. A quantitative study have shown associations between health literacy and diagnostic of cancer after the patients have encountered the healthcare system but does not analyse the time from first symptom experience to GP contact [53]. One explanation may be that our study population is a general, overall healthy sample, and therefore, symptoms do not necessarily imply illness or a need of medical attention. Thus, having social support or an ongoing active interaction with healthcare providers (including the GP) may indicate relevant prevention of unnecessary healthcare seeking. Further investigation of the relation between health literacy and stage at diagnosis is needed to enlighten whether individuals with strong health literacy make more adequate decisions on when and with which symptoms they seek medical attention.

4.2.3. Health Literacy and Smoking. Discordant results regarding the associations between health literacy challenges and current smoking are available in the literature [17, 18, 54]. In the DaSC II study, individuals who currently smoke have lower scores for all four HLQ domains than individuals who have never smoked [34]. Because smoking is the greatest risk factor for lung cancer and at the same time associated with stigma and blame, we aimed to explore whether health literacy as a modifiable and more neutral factor could be relevant in future interventions targeting

healthcare seeking with lung cancer symptoms [12, 13]. Overall, the present study showed that both health literacy and smoking status significantly influenced the healthcare-seeking behaviour, even after adjusting for socioeconomic factors, and that smoking did not modify the influence of health literacy. This implies that it could be beneficial to target future interventions towards stronger health literacy to reach individuals at risk of avoiding relevant healthcare seeking based on lung cancer symptoms without necessarily focusing on smoking status. Furthermore, since individuals who smoked seem to have more health literacy challenges, they may benefit even more from such interventions [34].

4.3. Strengths and Limitations. A strength of the study is the thorough development of the questionnaire following the COSMIN guidelines [29, 31]. The qualitative and quantitative pilot and field tests showed high content validity and feasibility. To enhance comparability with other studies [55], we chose to include HLQ domains, which have been translated, adapted, and validated in a Danish context [33] and used in other large population surveys [56, 57].

The large, randomly selected population-based sample is another strength. Even though the response rate of 33.9% is lower than desired, it is comparable to another large, Danish population-based study conducted during same time period [58]. More women than men answered the questionnaire, and the respondents were slightly older and had higher educational level [31]. Individuals experiencing many symptoms or GP contacts may be more prone to participate in a questionnaire about symptoms and healthcare seeking causing a risk of overestimation of symptom prevalences and GP contacts. Opposite, they may avert participation due to illness and lack of resources. Moreover, health literacy challenges have been associated with lower research participation rates [59]. Both individuals excluded due to exemption from digital mail and non-respondents may have more health literacy challenges inducing a risk of underestimation of the associations with healthcare seeking. Selection bias was sought minimised and response rates sought heightened by an easily read and understandable invitation, two pilot tests ensuring high face and content validity, and the opportunity of contacting the project group throughout the data collection period [31].

By investigating symptoms and healthcare-seeking behaviour in the general population without focusing on diagnoses, we generate knowledge about behaviour and interpretation of symptoms without the self-reported information being biased by diagnoses. This may be less biased than health behaviour recalled by patients already diagnosed with lung cancer.

Recalling symptom experiences within a time span of four weeks was assumed reasonable to reduce the risk of recall bias [60]. Symptoms that have led to healthcare seeking might be easier to recall inducing risk of slightly overestimating the proportion of GP contacts. Self-reported smoking status can be influenced by social desirability bias [61]. This was tried minimised by the large cohort, online survey, and comprehensive questionnaire providing a feeling of anonymity [62].

The HLQ is widely distributed all over the world making it possible to compare findings with existing literature and discuss health literacy challenges across different populations. Several studies have explored health literacy among patients with different diagnoses, yet few of these have focused on healthcare-seeking behaviour [34]. As the HLQ does not provide a total score or cut-off for high or low health literacy, it is able to capture that the same individual may possess both health literacy strengths and challenges [40].

4.4. Implications. The present study emphasises that despite increasing rates of healthcare-seeking behaviour among individuals with lung cancer symptoms, efforts targeting the high-risk group of individuals currently smoking are still required. This may be through health literacy interventions, yet knowledge about how to carry out such interventions in the general populations is still scarce [26, 63].

The four aspects of health literacy influenced healthcare seeking in different ways making planning of interventions and communication complex. Future studies should elaborate on these associations and could include more aspects of health literacy to ensure embracing the complexity and including all relevant dimensions. One area of attention could be reorganisation of the healthcare system to help individuals with health literacy challenges, e.g., by ensuring support and improving communication during the diagnostic process, initiated already in general practice, or if possible at community level [13, 64].

Knowledge about how health literacy influences healthcare-seeking behaviour may be of importance for GPs and other healthcare professionals in their clinical encounter with patients having health literacy challenges in primary care settings in Denmark as well as other countries with similar healthcare systems. Being aware that individuals who do not feel understood and supported are less likely to attend in general practice could result in improved communication throughout the consultations. Furthermore, this study provides knowledge about health literacy and healthcare seeking among individuals with a current and former smoking history, which could be useful in the implementation of screening programs as groups less likely to contact general practice with symptoms may also be the groups less likely to attend screening programs [16, 65, 66].

5. Conclusion

Less than half of individuals reporting at least one specific lung cancer symptom had contacted their GP about the symptom, while less than one of three had sought healthcare with the nonspecific symptoms. Individuals who currently smoked and reported health literacy challenges in terms of feeling less understood and supported by or less able to actively engage with healthcare providers were less likely to contact their GP. Surprisingly, individuals with strong health literacy in terms of having sufficient information and social support to take care of their health had lower likelihood of seeking healthcare. Smoking status did not modify the associations between health literacy and healthcare-seeking behaviour.

Data Availability

The datasets generated and analysed in the current study are not publicly available and cannot be shared due to the data protection regulations of the Danish Data Protection Agency. Access to data is strictly limited to the researchers who have obtained permission for data processing. This permission was given to the Research Unit of General Practice, Department of Public Health, University of Southern Denmark. Further inquiries can be made to the PI Dorte Jarbøl e-mail: DJarbol@health.sdu.dk

Additional Points

Code Availability. The statistical analyses were performed on the servers of Statistics Denmark, and the coding is therefore not publicly available.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

LS, SR, KB, DJ, and JS participated in the design of the study and collected the survey data. AA participated in choosing health literacy measurement tool. LS did the statistical analyses and wrote the first version of the study. All authors have contributed to the interpretation of the data and the further development of the study. All authors have read and approved the final manuscript.

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Supplementary Materials

The supplementary material comprises Appendix A–C. Appendix A: shows the STROBE list, Appendix B: shows the wordings of the questions in the DaSC II questionnaire and coding of register data, and Appendix C: includes the supplementary Tables S1–S4: Table S1: Symptom prevalence and proportions of contacts to GP with specific and nonspecific lung cancer symptoms in total and for each socioeconomic factor. Table S2: Associations among sex, age, smoking status, health literacy, and contact to GP with specific and nonspecific lung cancer symptoms (crude odds ratios). Table S3: Associations among sex, age, health literacy, and GP contact with at least one specific or nonspecific lung cancer symptoms stratified on smoking status (crude odds ratios). Table S4: Associations between socioeconomic factors and contact to GP with specific and

nonspecific lung cancer symptoms (crude odds ratios). (*Supplementary Materials*)

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