

Unmet Supportive Care Needs of Lung Cancer Survival Patients at Different Cancer Stages and Treatment Phases

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Purpose: This study examined the unmet supportive care needs of lung cancer patients across different cancer stages and treatment phases, as well as the factors associated with these unmet needs.

Patients and methods: Data from 501 lung cancer patients at a cancer center in central Taiwan were analyzed to assess their unmet supportive care needs across dimensions such as health information, patient care, treatment, nutrition, psychosocial, and economic needs. Associations with sex, age, cancer stage, and treatment phase were investigated.

Results: Compared with male patients, female patients exhibited fewer unmet health information needs (aOR=0.40; p=0.021). Older patients had greater patient care needs than younger patients did (aOR=3.08, p=0.026). Patients in the in-treatment (p<0.001) and follow-up (p=0.025) phases exhibited significantly lower needs for health information than did those in the newly diagnosed phase. Similarly, patients in the treatment (aOR=0.42, p=0.006), recurrence (aOR=0.24, p=0.043), and follow-up (aOR=0.12, p=0.007) phases exhibited significantly lower needs for patient care than did those in the newly diagnosed phase. Regarding treatment needs, patients in the treatment phase also demonstrated lower needs than did those in the newly diagnosed phase (aOR=0.12, p=0.004). Patients in the treatment phase had lower nutritional needs than did those in the newly diagnosed phase (aOR=0.54, p=0.043). However, psychosocial needs were greater during the treatment (aOR=2.75, p=0.004) and recurrence phases (aOR=7.61, p=0.001).

Conclusion: The unmet needs of lung cancer patients vary based on demographic characteristics and disease-related factors. Patients in the newly diagnosed phase have significantly higher unmet needs compared to other stages. Therefore, Healthcare professionals should provide appropriate and timely individualized care to address these needs.

Keywords: unmet care needs, lung cancer, survivor, cancer stages and treatment

Introduction

Cancer remains a formidable global health challenge, claiming nearly 10 million lives in 2020 alone. Among its various forms, lung cancer is a leading cause of mortality, with 2.21 million new cases and 1.8 million deaths reported worldwide.¹

In Taiwan, lung cancer is particularly prevalent, ranking highest in both incidence and mortality rates among all cancers. In 2021, 16,880 new cases and 10,040 deaths were reported, with males (8961 cases) and females (7919 cases) affected.^{2,3} Despite a nine-year decline in standardized mortality rates, most patients are diagnosed at advanced stages, resulting in a five-year survival rate of just 35.4% for lung cancer overall.³⁻⁵ Advances in treatment, including surgery,

chemotherapy, radiation, targeted therapies, and immunotherapy, have improved outcomes but have also introduced complex care challenges.²

“Unmet needs” refer to the supportive care needs of cancer survivors that are not normally met by healthcare professionals and basic healthcare services.⁶ Several studies have indicated a significant correlation between the unmet needs of cancer patients and factors such as cancer diagnosis, cancer stage, treatment stage, sex, age, marital status, economic status, and survival time.

Advances in medical treatment technology, early diagnosis, and effective treatment have led to improved outcomes. Successful cancer treatment enables patients to resume a normal life. However, concerns and fears of cancer recurrence due to disease progression, treatment side effects, and late-stage impacts may induce psychological stress in patients or lead to limited activity, lifestyle changes, readjustments, or even alterations in personal relationships. These factors may impact both the survival process and quality of life for cancer patients, resulting in numerous unmet needs.^{7,8} After a cancer diagnosis, patients typically encounter physical, psychosocial, and lifestyle challenges.⁹

Addressing the frequent and severe unmet needs faced by lung cancer patients is more challenging than addressing these needs in patients with other types of cancer.^{10,11} Furthermore, lung cancer patients who survive five years after treatment may still experience many severe physical and psychological symptoms, including breathlessness, coughing, pain, insomnia, and fatigue. These symptoms often accompany unmet psychosocial, spiritual, and lifestyle-related needs, such as financial support, counseling, alternative complementary therapies, dietary adjustments, and exercise regimens.^{12,13}

Giuliani (2016) reported that 78% of lung cancer patients had at least one unmet need, with psychological needs (66%), and Health informational needs comprised (52%) being the most prominent.¹⁴ Similarly, Cochrane et al revealed that lung cancer patients had the most unmet needs in the health and informational domain.¹⁵

In a study by Hsieh, Chou and Guo (2018) on the five unmet informational needs related to disease, physical care, treatment, psychosocial aspects, and examinations among lung cancer patients, it was found that from initial diagnosis to the first treatment, patients had high demands for “disease-related information”, rating it very important on a scale of 1 to 5, with a score of 4.42 (± 0.79) at initial diagnosis and 3.271 (± 1.00) at a follow-up 5 months after the first treatment. The study results showed that at the time of initial diagnosis, many patients required information concerning treatment and examinations, pain, reactions to side effects, and the impact on daily life. Disease-related information needs ranked first among the five unmet needs during follow-up after the initial diagnosis of lung cancer, with more unmet needs at diagnosis than after treatment. If these informational needs related to both disease and treatment are not met, patients may experience uncertainty about their condition and treatment options, leading to distress and, in some cases, even consider discontinuing treatment.¹⁶

Kang et al found that over 60% of non-small cell lung cancer (NSCLC) patients had unmet informational needs including the desire for up-to-date, understandable, and actionable health information, as well as participation in care decisions.¹² These findings emphasize the importance of timely and accurate health communication to alleviate patient uncertainty and distress.

Nutritional guidance is another critical but often unmet need. Proper nutrition after diagnosis can mitigate treatment side effects and reduce recurrence risk, yet 1/3–2/3 of malnourished cancer patients have not received nutritional advice or guidance of any kind.^{17–20} Studies from Ireland revealed that only 39% of patients received nutritionist intervention, despite 89% considering nutrition vital to treatment.²¹

To summarize, lung cancer patients experience many symptoms and side effects impacting quality of life.^{7,8} Studies on their unmet needs are limited,²² though these are more frequent and severe than in other cancers including needs related to health information, treatment care, concerns about disease recurrence, and uncertainty about prognosis.^{10,11,14,20,23–25} Unmet needs among cancer survivors are associated with cancer diagnosis, staging, disease trajectory, and treatment.²⁶ This study examines the unmet needs of lung cancer patients at different stages and phases in Taiwan, focusing on six dimensions: health information, patient care, treatment, nutrition, psychosocial, and economic. The aim of this study was to understand the clinical and psychosocial needs of lung cancer survivors and the extent to which these needs remain unmet at various stages of cancer treatment.

Methods

Study Design and Sample

This retrospective study was based on the 2015–2017 consultation records of the Cancer Resources Center (CRC) of a medical center in central Taiwan. The CRC has oncology case managers, nutritionists, and counseling psychologists. In Taiwan, cancer patients are encouraged to seek consultations and services at the CRC. The consultation records included patient characteristics, unmet supportive care items, and the services provided by the professionals. The inclusion criteria for the study patients were (1) had a confirmed pathological biopsy-confirmed diagnosis of lung cancer, (2) were aged 20 years or older, (3) had received lung cancer treatment and agreed to participate in the present study, (4) were able to communicate in Mandarin Chinese, and (5) were patients in the outpatient department. After the exclusion of 29 patients with incomplete data, a total of 501 cancer patients were included in the study.

This study utilized medical consultation records from routine clinical practice, with all data de-identified to ensure the removal of personal identifiers. In accordance with the Taiwan Human Subjects Research Act, the Regulations on the Organization and Operation of Human Research Ethics Review Boards issued by the Ministry of Health and Welfare, and the relevant regulations of the hospital ethics committee, the potential physical, psychological, or social risks or discomforts associated with this study were no greater than those encountered in daily life or routine medical procedures. Therefore, the study met the criteria for expedited review, and the requirement for obtaining informed consent from participants was waived. This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of China Medical University Hospital (CMUH104-REC3-026), authorizing the use of the de-identified data for analysis.

Materials

The patient consultation records included basic characteristics (sex, age), treatment phase (newly diagnosed, in-treatment, relapse, follow-up, terminal care), cancer stage (stage I–IV), and unmet need items. There were six categorized unmet needs: health information, patient care, treatment, nutritional, psychosocial, and economic.

The unmet needs of health information included health education and explanations of examination procedures; the unmet needs of patient care, including pain management, the care of wounds and the side effects of chemotherapy or radiotherapy; the unmet needs of care for the discomfort associated with treatment, medical information asymmetry, and poor doctor–patient communication; unmet nutritional needs, including information and nutritionist referrals; unmet psychosocial needs, including those related to emotional support, emotional problems, and doubts about treatment or conditions; and economic needs, including the financial burden on a patient and their family.

Statistical Analysis

This study was a secondary data analysis, and IBM SPSS Statistics for Windows version 22.0 (IBM Corp, Armonk, NY, USA) was used to conduct the statistical analyses. Descriptive statistics were used to show the distribution of each variable: participants' characteristics, phase of treatment, cancer stage, and unmet need items. The chi-square test and Fisher's exact test were used to analyze the differences between participants' characteristics, treatment phases, cancer stages, and unmet needs. After considering the number of patients, Firth logistic regression analysis was used to estimate the adjusted odds ratio (aOR) and 95% confidence interval (CI) of each unmet need domain. In this study, $p < 0.05$ was considered to indicate statistical significance.

Results

The Baseline Characteristics of Lung Cancer Patients

Table 1 shows the basic characteristics of the study patients. A total of 501 lung cancer patients were included in the study. There were 267 (53.29%) male and 234 (46.71%) female participants in the study. The average age of the lung cancer patients was 62.03 years, and the standard deviation (SD) was 12.28 years. There were 284 (59.54%) patients with stage IV cancer and 75 (15.73%) with stage I and stage II cancer. More than half of the patients (74.45%) were in treatment, while 14.32% were newly diagnosed.

Table 1 Baseline Characteristics of Lung Cancer Patients and Unmet Need Reported in Six Domains

| Variable | N | % |
|----------------------------|-------------------|------------|
| Total | 501 | 100 |
| Sex | | |
| Male | 267 | 53.29 |
| Female | 234 | 46.71 |
| Age (year) (Mean \pm SD) | 62.03 \pm 12.28 | |
| ≤ 45 | 49 | 9.78 |
| 46–55 | 96 | 19.16 |
| 56–65 | 144 | 28.74 |
| >65 | 212 | 42.32 |
| Cancer stage | | |
| I | 40 | 8.39 |
| II | 35 | 7.34 |
| III | 118 | 24.74 |
| IV | 284 | 59.54 |
| Missing | 24 | |
| Treatment phase | | |
| Newly diagnosed | 65 | 14.32 |
| In-treatment | 338 | 74.45 |
| Relapse | 19 | 4.19 |
| Follow up | 27 | 5.95 |
| Terminal care | 5 | 1.1 |
| Missing | 47 | |
| Unmet need in | | |
| Health information | | |
| Yes | 50 | 9.98 |
| No | 451 | 90.02 |
| Patient care | | |
| Yes | 118 | 23.55 |
| No | 383 | 76.45 |
| Treatment | | |
| Yes | 44 | 8.78 |
| No | 457 | 91.22 |
| Nutritional | | |
| Yes | 143 | 28.54 |
| No | 358 | 71.46 |
| Psychosocial | | |
| Yes | 193 | 38.52 |
| No | 308 | 61.48 |
| Economic | | |
| Yes | 4 | 0.8 |
| No | 497 | 99.2 |

Psychosocial problems were the most prevalent unmet need (38.52%), followed by nutritional issues (28.54%), patient care (23.55%), health information (9.98%), and economic complaints (0.80%).

Table 2 presents the proportional distribution of patients in each domain concerning their basic demographic characteristics, cancer stage, and treatment phases. Male patients reported more unmet health information than female patients did (13.86% vs 5.56%, $p=0.003$); for patient care needs, 28.09% and 18.38% of the participants were male and

Table 2 Distributions of Lung Cancer Patient Needs Across the Six Domains by Sex, Age, Cancer Stage and Treatment Phase

| Variable | Health Information | | | | | Patient Care | | | | | Treatment | | | | |
|------------------------|--------------------|--------|---------------|-------|--------|---------------|-------|---------------|-------|--------|---------------|-------|---------------|-------|-------|
| | No | | Yes | | p | No | | Yes | | p | No | | Yes | | p |
| | n | % | n | % | | n | % | n | % | | n | % | n | % | |
| Total | 451 | 90.02 | 50 | 9.98 | 0.003 | 383 | 76.45 | 118 | 23.55 | 0.011 | 457 | 91.22 | 44 | 8.78 | 0.158 |
| Sex | | | | | | | | | | | | | | | |
| Male | 230 | 86.14 | 37 | 13.86 | | 192 | 71.91 | 75 | 28.09 | | 239 | 89.51 | 28 | 10.49 | |
| Female | 221 | 94.44 | 13 | 5.56 | | 191 | 81.62 | 43 | 18.38 | | 218 | 93.16 | 16 | 6.84 | |
| Age (year) | | | | | | | | | | | | | | | |
| Mean ± SD ¹ | 61.59 ± 12.23 | | 65.98 ± 12.06 | | 0.016 | 61.15 ± 12.71 | | 64.86 ± 10.30 | | <0.001 | 61.54 ± 12.30 | | 67.05 ± 10.95 | | 0.004 |
| ≤45 | 48 | 97.96 | 1 | 2.04 | 0.097 | 42 | 85.71 | 7 | 14.29 | <0.001 | 47 | 95.92 | 2 | 4.08 | 0.004 |
| 46–55 | 88 | 91.67 | 8 | 8.33 | | 83 | 86.46 | 13 | 13.54 | | 92 | 95.83 | 4 | 4.17 | |
| 56–65 | 131 | 90.97 | 13 | 9.03 | | 114 | 79.17 | 30 | 20.83 | | 136 | 94.44 | 8 | 5.56 | |
| >65 | 184 | 86.79 | 28 | 13.21 | | 144 | 67.92 | 68 | 32.08 | | 182 | 85.85 | 30 | 14.15 | |
| Cancer stage | | | | | 0.952 | | | | | 0.237 | | | | | 0.182 |
| I | 36 | 90.00 | 4 | 10.00 | | 32 | 80.00 | 8 | 20.00 | | 37 | 92.50 | 3 | 7.50 | |
| II | 32 | 91.43 | 3 | 8.57 | | 31 | 88.57 | 4 | 11.43 | | 34 | 97.14 | 1 | 2.86 | |
| III | 108 | 91.53 | 10 | 8.47 | | 86 | 72.88 | 32 | 27.12 | | 112 | 94.92 | 6 | 5.08 | |
| IV | 255 | 89.79 | 29 | 10.21 | <0.001 | 212 | 74.65 | 72 | 25.35 | 0.002 | 254 | 89.44 | 30 | 10.56 | 0.076 |
| Treatment phases | | | | | | | | | | | | | | | |
| Newly diagnosed | 43 | 66.15 | 22 | 33.85 | | 41 | 63.08 | 24 | 36.92 | | 54 | 83.08 | 11 | 16.92 | |
| In-treatment | 315 | 93.20 | 23 | 6.80 | | 258 | 76.33 | 80 | 23.67 | | 316 | 93.49 | 22 | 6.51 | |
| Relapse | 16 | 84.21 | 3 | 15.79 | | 16 | 84.21 | 3 | 15.79 | | 17 | 89.47 | 2 | 10.53 | |
| Follow up | 26 | 96.30 | 1 | 3.70 | | 25 | 92.59 | 2 | 7.41 | | 23 | 85.19 | 4 | 14.81 | |
| Terminal care | 5 | 100.00 | - | - | | 1 | 20.00 | 4 | 80.00 | | 4 | 80.00 | 1 | 20.00 | |

| Variable | Nutritional | | | | | Psychosocial | | | | | Economic | | | | |
|------------------------|---------------|-------|---------------|-------|-------|---------------|-------|---------------|-------|-------|---------------|--------|--------------|------|-------|
| | No | | Yes | | p | No | | Yes | | p | No | | Yes | | p |
| | n | % | n | % | | n | % | n | % | | n | % | n | % | |
| Total | 358 | 71.46 | 143 | 28.54 | 0.553 | 308 | 61.48 | 193 | 38.52 | 0.854 | 497 | 99.20 | 4 | 0.80 | 0.627 |
| Sex | | | | | | | | | | | | | | | |
| Male | 194 | 72.66 | 73 | 27.34 | | 163 | 61.05 | 104 | 38.95 | | 264 | 98.88 | 3 | 1.12 | |
| Female | 164 | 70.09 | 70 | 29.91 | | 145 | 61.97 | 89 | 38.03 | | 233 | 99.57 | 1 | 0.43 | |
| Age (year) | | | | | | | | | | | | | | | |
| Mean ± SD ¹ | 61.95 ± 12.31 | | 62.22 ± 12.22 | | 0.820 | 62.05 ± 12.26 | | 61.99 ± 12.33 | | 0.958 | 62.11 ± 12.27 | | 51.50 ± 9.47 | | 0.085 |
| ≤45 | 39 | 79.59 | 10 | 20.41 | 0.074 | 27 | 55.10 | 22 | 44.90 | 0.747 | 48 | 97.96 | 1 | 2.04 | 0.197 |
| 46–55 | 66 | 68.75 | 30 | 31.25 | | 61 | 63.54 | 35 | 36.46 | | 94 | 97.92 | 2 | 2.08 | |
| 56–65 | 93 | 64.58 | 51 | 35.42 | | 87 | 60.42 | 57 | 39.58 | | 143 | 99.31 | 1 | 0.69 | |
| >65 | 160 | 75.47 | 52 | 24.53 | | 133 | 62.74 | 79 | 37.26 | | 212 | 100.00 | - | - | |
| Cancer stage | | | | | 0.280 | | | | | 0.193 | | | | | - |
| I | 29 | 72.50 | 11 | 27.50 | | 28 | 70.00 | 12 | 30.00 | | 40 | 100.00 | - | - | |
| II | 20 | 57.14 | 15 | 42.86 | | 20 | 57.14 | 15 | 42.86 | | 35 | 100.00 | - | - | |
| III | 87 | 73.73 | 31 | 26.27 | | 64 | 54.24 | 54 | 45.76 | | 118 | 100.00 | - | - | |
| IV | 204 | 71.83 | 80 | 28.17 | 0.154 | 181 | 63.73 | 103 | 36.27 | 0.018 | 280 | 98.59 | 4 | 1.41 | - |
| Treatment phases | | | | | | | | | | | | | | | |
| Newly diagnosed | 39 | 60.00 | 26 | 40.00 | | 50 | 76.92 | 15 | 23.08 | | 65 | 100.00 | - | - | |
| In-treatment | 248 | 73.37 | 90 | 26.63 | | 202 | 59.76 | 136 | 40.24 | | 334 | 98.82 | 4 | 1.18 | |
| Relapse | 11 | 57.89 | 8 | 42.11 | | 7 | 36.84 | 12 | 63.16 | | 19 | 100.00 | - | - | |
| Follow up | 22 | 81.48 | 5 | 18.52 | | 17 | 62.96 | 10 | 37.04 | | 27 | 100.00 | - | - | |
| Terminal care | 4 | 80.00 | 1 | 20.00 | | 3 | 60.00 | 2 | 40.00 | | 5 | 100.00 | - | - | |

Note: ¹ Used t-test.

female, respectively ($p=0.011$). Patient age was also associated with patient care and treatment needs. Older patients were more likely to report unmet patient care than younger patients were (32.08% vs 14.29%, $p < 0.001$). Older patients also had more treatment needs than younger patients did (14.15% vs 4.08%, $p=0.004$). Unmet needs varied among the treatment phases. Greater unmet needs for health information (33.85%) and patient care (36.92%) were reported during the earlier treatment phases (ie, newly diagnosed cases), whereas nutritional needs (42.11%) and psychosocial needs (63.16%) were more common during relapse periods.

Factors Associated With Unmet Needs Among Lung Cancer Patients

Table 3 shows the factors associated with unmet needs among lung cancer patients. In terms of health information needs, compared with male patients, female patients had an aOR of 0.40 (95% CI=0.19–0.87). Patients in the in-treatment (aOR=0.14, 95% CI=0.07–0.30) and follow-up phases (aOR=0.09, 95% CI=0.01–0.74) had less need for health information than did newly diagnosed patients.

In terms of patient care needs, older patients had an aOR of 3.08 (95% CI=1.14–8.30) compared with younger patients; patients in the in-treatment (aOR=0.42, 95% CI=0.23–0.78), relapse (aOR=0.24, 95% CI=0.06–0.95) and follow-up (aOR=0.12, 95% CI=0.02–0.55) phases had significantly lower needs than did newly diagnosed patients. In terms of treatment needs, patients receiving in-treatment (aOR=0.29, 95% CI=0.12–0.67) had significantly lower needs than did newly diagnosed patients. Patients in the in-treatment (aOR=0.54, 95% CI=0.30–0.98) phase had lower levels of nutritional needs than those newly diagnosed. However, psychosocial needs were significantly greater during the in-treatment (aOR=2.75, 95% CI=1.39–5.44) and relapse (aOR=7.61, 95% CI=2.42–23.99) phases.

Discussion

The unmet needs of cancer patients vary according to factors such as sex, age, and disease stage. The results of this study revealed that the unmet needs of lung cancer patients differ with demographic factors and at different stages of cancer across six domains of supportive care needs.

The findings of this study revealed that the unmet supportive care needs of lung cancer patients are more pronounced during the new diagnosis phase than during subsequent treatment stages. This was especially true in domains such as health information, patient care, treatment, and nutrition. Hsieh, Chou and Guo (2018) investigated the information needs of lung cancer patients from the time of diagnosis to the first treatment within five months (encompassing disease-related, examination-related, treatment-related, physical care-related, and psychological needs). They found that patients exhibited greater overall information needs at initial diagnosis than during subsequent treatment phases. There was particular emphasis on the requirement for disease-related information followed by the need for information related to physical care. Similarly, a study by Matsuyama et al revealed that the need for information among patients newly diagnosed with stage II–IV cancer who were scheduled to undergo treatment focused on disease-, diagnostic testing-, treatment-, physical care-, and psychosocial-related needs. The results indicated that patients expressed greater overall information needs at initial diagnosis than at four and nine months post-diagnosis. These findings suggest that during the initial diagnosis stage, patients often seek information on different aspects, including disease-specific details, relevant diagnostic procedures, treatment modalities, and potential post-treatment effects.^{16,27}

Lin et al noted that newly diagnosed patients often lack an understanding of disease progression, diagnostic procedures, treatment modalities, treatment side effects, recovery, and follow-up care. There is clearly a need for more health information, patient care, and nutritional guidance in the early stages than in follow-up.²⁶ In Taiwan, there is a shortage of nurses, and the nurse-to-patient ratio is greater than that in most Western countries (day shift: 1:8; evening shift: 1:13–15; night shift: 1:14–16). Consequently, Taiwanese nurses may not have enough time to provide newly diagnosed patients with all the comprehensive information they need about treatment, care, and psychological support. Each case manager in the oncology case management system in Taiwan is responsible for monitoring 350 cancer patients, and the case load is overwhelming. Providing newly diagnosed patients with medical knowledge, information, and psychological support is impossible. To address the issue of nursing workforce shortages in Taiwan, the government is actively standardizing nurse-to-patient ratios across three shifts, targeting a ratio of 1:6 for day shifts, 1:9 for evening shifts, and 1:11 for night shifts. Since 2023, the Ministry of Health and Welfare has mandated hospitals to report accurate

Table 3 Firth Logistic Regression Estimated Odds Ratio of Unmet Needs Associated With Sex, Age, Cancer Stage and Treatment Phase

| Variable | Health Information | | | | Patient Care | | | | Treatment | | | |
|-----------------------|--------------------|--------|------|--------|--------------|--------|-------|-------|-------------|--------|-------|-------|
| | Adjusted OR | 95% CI | | p | Adjusted OR | 95% CI | | p | Adjusted OR | 95% CI | | p |
| Sex | | | | | | | | | | | | |
| Male (Ref.) | 1 | | | | 1 | | | | 1 | | | |
| Female | 0.40 | 0.19 | 0.87 | 0.021 | 0.76 | 0.47 | 1.23 | 0.267 | 0.74 | 0.35 | 1.58 | 0.440 |
| Age (year) | | | | | | | | | | | | |
| ≤45 (Ref) | – | | | – | 1 | | | | 1 | | | |
| 46–55 | 1 | | | | 1.08 | 0.35 | 3.28 | 0.896 | 0.68 | 0.11 | 4.07 | 0.669 |
| 56–65 | 1.17 | 0.41 | 3.33 | 0.762 | 1.97 | 0.72 | 5.44 | 0.190 | 0.96 | 0.18 | 5.07 | 0.961 |
| >65 | 1.64 | 0.63 | 4.24 | 0.308 | 3.08 | 1.14 | 8.30 | 0.026 | 2.28 | 0.48 | 10.80 | 0.298 |
| Cancer stage | | | | | | | | | | | | |
| I (Ref) | 1 | | | | 1 | | | | 1 | | | |
| II | 0.89 | 0.16 | 4.97 | 0.896 | 0.50 | 0.12 | 2.07 | 0.339 | 0.51 | 0.05 | 5.44 | 0.575 |
| III | 0.85 | 0.22 | 3.21 | 0.807 | 2.05 | 0.77 | 5.47 | 0.154 | 0.95 | 0.21 | 4.25 | 0.943 |
| IV | 1.32 | 0.39 | 4.46 | 0.661 | 1.76 | 0.69 | 4.48 | 0.239 | 2.36 | 0.61 | 9.12 | 0.213 |
| Treatment phases | | | | | | | | | | | | |
| Newly diagnosed (Ref) | 1 | | | | 1 | | | | 1 | | | |
| In-treatment | 0.14 | 0.07 | 0.30 | <0.001 | 0.42 | 0.23 | 0.78 | 0.006 | 0.29 | 0.12 | 0.67 | 0.004 |
| Relapse | 0.40 | 0.10 | 1.61 | 0.196 | 0.24 | 0.06 | 0.95 | 0.043 | 0.52 | 0.10 | 2.80 | 0.450 |
| Follow up | 0.09 | 0.01 | 0.74 | 0.025 | 0.12 | 0.02 | 0.55 | 0.007 | 0.80 | 0.19 | 3.41 | 0.763 |
| Terminal care | – | | | – | 7.69 | 0.73 | 81.49 | 0.090 | 1.34 | 0.12 | 14.85 | 0.811 |
| Variable | Nutritional | | | | Psychosocial | | | | Economic | | | |
| | Adjusted OR | 95% CI | | p | Adjusted OR | 95% CI | | p | Adjusted OR | 95% CI | | p |
| Sex | | | | | | | | | | | | |
| Male (Ref.) | 1 | | | | 1 | | | | 1 | | | |
| Female | 1.11 | 0.71 | 1.74 | 0.656 | 0.86 | 0.57 | 1.31 | 0.484 | 0.22 | 0.02 | 2.26 | 0.203 |
| Age (year) | | | | | | | | | | | | |
| ≤45 (Ref) | 1 | | | | 1 | | | | 1 | | | |
| 46–55 | 2.19 | 0.84 | 5.70 | 0.108 | 0.83 | 0.37 | 1.86 | 0.656 | 0.50 | 0.04 | 6.32 | 0.588 |
| 56–65 | 2.57 | 1.06 | 6.20 | 0.036 | 0.82 | 0.40 | 1.71 | 0.601 | 0.23 | 0.01 | 4.09 | 0.315 |
| >65 | 1.65 | 0.67 | 4.05 | 0.277 | 0.75 | 0.36 | 1.56 | 0.437 | – | | | – |
| Cancer stage | | | | | | | | | | | | |
| I (Ref) | 1 | | | | 1 | | | | – | | | – |
| II | 2.33 | 0.83 | 6.54 | 0.109 | 2.11 | 0.75 | 5.90 | 0.155 | – | | | – |
| III | 0.96 | 0.41 | 2.24 | 0.920 | 2.06 | 0.90 | 4.72 | 0.087 | – | | | – |
| IV | 0.98 | 0.44 | 2.16 | 0.959 | 1.39 | 0.64 | 3.06 | 0.408 | – | | | – |
| Treatment phases | | | | | | | | | | | | |
| Newly diagnosed (Ref) | 1 | | | | 1 | | | | – | | | – |
| In-treatment | 0.54 | 0.30 | 0.98 | 0.043 | 2.75 | 1.39 | 5.44 | 0.004 | – | | | – |
| Relapse | 1.10 | 0.38 | 3.19 | 0.864 | 7.61 | 2.42 | 23.99 | 0.001 | – | | | – |
| Follow up | 0.35 | 0.11 | 1.08 | 0.068 | 2.65 | 0.94 | 7.44 | 0.065 | – | | | – |
| Terminal care | 0.41 | 0.04 | 4.15 | 0.446 | 3.04 | 0.43 | 21.38 | 0.265 | – | | | – |

data, aiming to alleviate the workload of nursing staff and improve the quality of care. Simultaneously, the adoption of smart technologies, such as electronic health information platforms and artificial intelligence (AI)-assisted systems, effectively reduces administrative burdens, allowing nurses to focus more on patient needs. Additionally, numerous cancer-focused non-profit organizations within communities are fostering “medical-community collaboration”. By integrating hospital and community resources, these efforts aim to create seamless care models for cancer patients, enhancing primary healthcare service levels and reducing the burden on healthcare professionals. The findings of this study revealed that male patients exhibit greater levels of unmet needs in terms of health care information and patient care than female patients. Among these, the dimension of health care information needs to encompass health education, disease prevention, and explanations of diagnostic procedures. Additionally, the literature indicates a statistically significant association between gender and unmet information needs, with female cancer survivors exhibiting lower levels of unmet information needs than males. This could be attributed to females being more likely than males to actively seek medical-related information from healthcare professionals, books, and online sources.^{28,29} The findings of the present study align with those mentioned above.

Furthermore, the study revealed that patients aged 65 years and older had greater unmet patient care needs than those aged younger than 45 years. This could be attributed to younger patients having better information-seeking abilities, while older patients may have poorer health literacy regarding the disease and less information about lung cancer treatment. It can be difficult for elderly patients to gain a clear understanding of the many different lung cancer treatments currently available, such as targeted therapy, immunotherapy, or palliative care, which may contribute to the emergence of unmet care needs. Although no statistically significant differences were not observed in the unmet patient care needs of late-stage lung cancer patients, their unmet needs were 7.69 times greater than those of newly diagnosed patients. This study identified psychosocial issues (38.52%) as the most prevalent unmet need among the six dimensions, consistent with the findings of Giuliani (2016).¹⁴ This may be attributed to cancer patients experiencing anxiety and depression at all stages of the disease, coupled with uncertainties about disease progression and treatment, which can lead to many different concerns. Giuliani (2016) noted that cancer patients generally experience uncertainty about the future or fear of recurrence.¹⁴ The study revealed that the unmet psychosocial needs of lung cancer patients during treatment and recurrence were significantly greater than those at initial diagnosis. Chambers, Dunn, Scott and Ball (2021) also reported greater psychological distress in patients with advanced lung cancer than in those with other cancers.³⁰

Nutritional issues emerged as the second most prevalent unmet need among patients in this study (28.54%). In Chinese culture, there is a widespread belief in the strong correlation between cancer and diet, and almost all newly diagnosed cancer patients acknowledge the importance of nutrition in cancer treatment.³¹ Despite evidence suggesting that nutritional interventions can improve patient outcomes, in clinical practice, this need may often be overlooked.³² This can lead to increased levels of unmet nutritional needs among patients.

The low proportion of unmet economic needs reflects Taiwan’s National Health Insurance and robust social services, which reduce medical expenses and provide affordable care. About 80% of lung adenocarcinoma patients benefit from insurance-covered targeted therapies, including first-line and third-stage treatments, alleviating financial burdens. Non-profit organizations also provide financial assistance, further easing economic pressures during treatment.

This study has several limitations. First, this study relied on secondary data analysis collected from consultation records, which may limit the generalizability of the findings to the broader population of lung cancer patients in Taiwan. However, considering that this hospital treats approximately 800 lung cancer patients annually, ranking fifth in Taiwan, the results still hold important reference value. Second, subject recruitment focused on lung cancer patients who actively sought consultation services at the cancer resource center because they had unmet physical or psychological needs at new diagnosis, treatment, or post-discharge. This could lead to an underestimation of the number and proportion of unmet needs. Moreover, the limited number of patients in the recurrence and follow-up phases of this study may have constrained a comprehensive analysis of patient needs during these stages. Future research should include larger sample sizes to enhance the representativeness of the findings. Third, although the study analyzed data across six different domains of unmet needs, it did not systematically analyze individual subitems within each domain, which could have provided more detailed insights into the extent and specifics of patient unmet needs. A more detailed analysis of individual aspects within the six major dimensions of unmet needs could be pursued to offer lung cancer patients

more comprehensive and personalized services. Finally, regarding the assessment of patients' unmet needs, comparisons with other assessment tools, such as the Cancer Survivors' Unmet Needs Measure (CaSUN),¹² could be beneficial for comprehensively evaluating both unmet and met needs, as well as the severity of unmet needs, to optimize patient care and resource allocation and enhance patients' quality of life.

Conclusion

The results of this study suggest that unmet needs among lung cancer patients may vary based on demographic characteristics and disease-related factors, including sex, age, cancer stage, and treatment phase. Patients in the newly diagnosed phase have significantly higher unmet needs compared to other stages. Providing sufficient health information empowers patients to participate in medical decision-making and self-management, which is especially critical during the initial diagnosis. This phase is key for clarifying the disease and treatment plans, and targeted support can reduce anxiety, improve treatment adherence, and enhance quality of life. This study recommends prioritizing resource allocation for newly diagnosed patients by deploying additional health educators, providing nutritional guidance, and offering psychological counseling. As the disease progresses to the treatment phase or recurrence, patients' unmet psychosocial needs tend to increase compared to those at initial diagnosis. Consequently, healthcare providers need to tailor care to address the evolving needs of patients at different stages, with the aim of reducing unmet supportive care needs and enhancing the quality of medical care. Early identification of unmet needs at various stages of cancer diagnosis and treatment, coupled with the provision of appropriate information and care, can significantly improve the overall quality of life of lung cancer patients.

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Author Contributions

PY, Lee was responsible for writing the original draft, writing the review, and editing the manuscript. Yu-An. Chen was responsible for conceptualization, methodology, and validation. Tung-Han Tsai was responsible for conceptualization, methodology, and validation. Chih-Yi, Chen was responsible for data curation, formal analysis, methodology, and resources. SH, Shieh, was responsible for conceptualization, data curation, funding acquisition, methodology, writing-original draft, and writing-review & editing. All authors made a significant contribution to the work reported, whether in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report that there are no competing interests in this work.

References

1. WHO. *Cancer*. 2023; Available from: <https://www.who.int/news-room/fact-sheets/detail/cancer>. Accessed January 13, 2025.
2. Suzanne Lareau CS, Smyth R. Lung Cancer. *Am J Respir Crit Care Med*. 2021;204(12):P21–P22. doi:10.1164/rccm.20411P21
3. Welfare, H.P.A.M.o.H.a. *CANCER REGISTRY ANNUAL REPORT, 2021. TAIWAN*. 2023; Available from: https://www.hpa.gov.tw/File/Attach/17639/File_23506.pdf. Accessed January 13, 2025.
4. Wong MCS, Lao XQ, Ho K-F, et al. Incidence and mortality of lung cancer: global trends and association with socioeconomic status. *Sci Rep*. 2017;7(1):14300. doi:10.1038/s41598-017-14513-7
5. Chang YJ, Huang J-Y, Lin C-H, et al. Survival and Treatment of Lung Cancer in Taiwan between 2010 and 2016. *J Clin Med*. 2021;10(20):4675. doi:10.3390/jcm10204675
6. Lekdamrongkul P, Pongthavornkamol K, Molassiotis A, et al. Translation and psychometric testing of the Thai version of cancer survivors' unmet needs measure among cancer survivors. *Asia Pac J Oncol Nurs*. 2022;9(9):100083. doi:10.1016/j.apjon.2022.100083

7. Mayer DK, Nasso SF, Earp JA. Defining cancer survivors, their needs, and perspectives on survivorship health care in the USA. *Lancet Oncol.* 2017;18(1):e11–e18. doi:10.1016/S1470-2045(16)30573-3
8. Swisher AK, Kennedy-Rea S, Starkey A, et al. Bridging the gap: identifying and meeting the needs of lung cancer survivors. *J Public Health.* 2022;1–6.
9. Berezowska A, Passchier E, Bleiker E. Professional patient navigation in a hospital setting: a randomized controlled trial. *Support Care Cancer.* 2021;29(4):2111–2123. doi:10.1007/s00520-020-05721-5
10. Sung MR, Patel MV, Djalalov S, et al. Evolution of symptom burden of advanced lung cancer over a decade. *Clin Lung Cancer.* 2017;18(3):274–280.e6. doi:10.1016/j.clcc.2016.12.010
11. Kuon J, Vogt J, Mehnert A, et al. Symptoms and needs of patients with advanced lung cancer: early prevalence assessment. *Oncol Res Treat.* 2019;42(12):650–659. doi:10.1159/000502751
12. Kang D, Lee G, Kim S, et al. Psychometric validation of the Korean version of the cancer survivors' unmet needs (CaSUN) scale among Korean non-small cell lung cancer (NSCLC) survivors. *Cancer Res Treat.* 2022.
13. Yun Y, Shon E-J, Yang A-J, et al. Needs regarding care and factors associated with unmet needs in disease-free survivors of surgically treated lung cancer. *Ann Oncol.* 2013;24(6):1552–1559. doi:10.1093/annonc/mdt032
14. Giuliani M, Milne RA, Puts M, et al. The prevalence and nature of supportive care needs in lung cancer patients. *Current Oncol.* 2016;23(4):258–265. doi:10.3747/co.23.3012
15. Cochrane A, Woods S, Dunne S, et al. Unmet supportive care needs associated with quality of life for people with lung cancer: a systematic review of the evidence 2007–2020. *European J Cancer Care.* 2022;31(1):e13525. doi:10.1111/ecc.13525
16. Hsieh L-Y, Chou F-J, Guo S-E. Information needs of patients with lung cancer from diagnosis until first treatment follow-up. *PLoS One.* 2018;13(6):e0199515. doi:10.1371/journal.pone.0199515
17. Carruba G, Calagna ML, Campisi I, et al. Unmet nutritional and psychological needs of cancer patients: an integrated multi-professional model approach. *Diseases.* 2022;10(3):47. doi:10.3390/diseases10030047
18. Rock CL, Thomson CA, Sullivan KR, et al. American Cancer Society nutrition and physical activity guideline for cancer survivors. *Ca a Cancer J Clinicians.* 2022;72(3):230–262. doi:10.3322/caac.21719
19. Lung cancer. Available from: <https://www.who.int/news-room/fact-sheets/detail/lung-cancer>. 26, June 2023.
20. Hébuterne X, Lemarié E, Michallet M, et al. Prevalence of malnutrition and current use of nutrition support in patients with cancer. *J Parenteral Enteral Nutr.* 2014;38(2):196–204. doi:10.1177/0148607113502674
21. Sullivan ES, Rice N, Kingston E, et al. A national survey of oncology survivors examining nutrition attitudes, problems and behaviours, and access to dietetic care throughout the cancer journey. *Clin Nutr ESPEN.* 2021;41:331–339. doi:10.1016/j.clnesp.2020.10.023
22. Li J, Giris A. Supportive care needs: are patients with lung cancer a neglected population? *Psycho-Oncol.* 2006;15(6):509–516. doi:10.1002/pon.983
23. Rimmer B, Crowe L, Todd A, et al. Assessing unmet needs in advanced cancer patients: a systematic review of the development, content, and quality of available instruments. *J Cancer Survivorship.* 2022;16(5):960–975. doi:10.1007/s11764-021-01088-6
24. Al Achkar M, Marchand L, Thompson M, et al. Unmet needs and opportunities for improving care for patients with advanced lung cancer on targeted therapies: a qualitative study. *BMJ open.* 2020;10(3):e032639. doi:10.1136/bmjopen-2019-032639
25. Mullan F. Seasons of survival: reflections of a physician with cancer. *Mass Medical Soc.* 1985;313:270–273.
26. Lin Y-L, Chuang C-Y, Hsieh VC-R, et al. Unmet supportive care needs of survival patients with nasopharyngeal carcinoma. *Int J Environ Res Public Health.* 2020;17(10):3519. doi:10.3390/ijerph17103519
27. Matsuyama RK, Kuhn LA, Molisani A, et al. Cancer patients' information needs the first nine months after diagnosis. *Patient Educ Couns.* 2013;90(1):96–102. doi:10.1016/j.pec.2012.09.009
28. Stalling J, Frazier LM, Tatpati LL, et al. Gender differences in information needs among infertile couples: implications for physician counseling. *Fertil Sterility.* 2010;94(4):S223. doi:10.1016/j.fertnstert.2010.07.868
29. Willems RA, Bolman CAW, Mesters I, et al. Cancer survivors in the first year after treatment: the prevalence and correlates of unmet needs in different domains. *Psycho-Oncol.* 2016;25(1):51–57. doi:10.1002/pon.3870
30. Chambers S, Dunn J, Scott B, et al. Psychological Distress and Stigma for People with Lung Cancer: time to Act. *J Thorac Oncol.* 2021;16(10):S827–S828. doi:10.1016/j.jtho.2021.08.737
31. Ryan AM, Power DG, Daly L, et al. Cancer-associated malnutrition, cachexia and sarcopenia: the skeleton in the hospital closet 40 years later. *Proc Nutr Soc.* 2016;75(2):199–211. doi:10.1017/S002966511500419X
32. Erickson N, Sullivan ES, Kalliostra M, et al. Nutrition care is an integral part of patient-centred medical care: a European consensus. *Med Oncol.* 2023;40(4):112. doi:10.1007/s12032-023-01955-5