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Lung Cancer In Libya: A Cross-Sectional Analysis of Clinicopathological Profiles, Diagnostic Delay Patterns, and Treatment Accessibility

Elbai, S[1], Abdelsalam, Abuzreda[2*], Elayati, K[3], Basma Albay[4] and Miloud Albay[5]

[1]*Department of Genetics Engineering, Biotechnology Research Centre (BTRC), Libya.*

[2]*Department of Health, Safety and Environmental, Arabian Gulf Oil Company (AGOCO), The Higher Institute of Engineering Techniques, and College of Medical Technology, Benghazi, Libya.*

[3]*Department of Microbiology, Biotechnology Research Centre (BTRC), Libya.*

[4]*Master's degree in Software Engineering: Working at the Ministry of Health and the University of Tripoli.*

[5]*Assistant Lecturer, M.Sc. Biotechnology Microbiology at Higher Institute of Science and Technology – Tiji.*

***Corresponding Authors**

Abdelsalam Abuzreda,
Department of Health, Safety and Environmental, Arabian Gulf Oil Company (AGOCO), The Higher Institute of Engineering Techniques, and College of Medical Technology, Benghazi, Libya.

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Abstract

Background: *Lung cancer remains the leading cause of cancer-related mortality globally, accounting for approximately 2.5 million new cases and 1.9 million deaths annually (Siegel et al., 2025; GLOBOCAN, 2024). In Libya, the disease ranks first among all malignancies, with 952 new diagnoses (11.8% of new cancer cases) and 796 annual deaths (16.9% of all cancer-related fatalities) according to GLOBOCAN 2024 estimates (International Agency for Research on Cancer, 2024). While the past decade has witnessed transformative advances in lung cancer therapeutics—including targeted therapies, immunotherapies, and precision medicine approaches—in high-income countries, the Libyan healthcare system faces substantial challenges in delivering contemporary oncological care. The 5-year relative survival rate for lung cancer patients in Libya is estimated at 2.3%, among the lowest globally and incomparable to rates exceeding 20% in developed nations (Siegel et al., 2025; Al-Ferjani et al., 2025).*

Purpose: *This paper provides a systematic analysis of clinicopathological characteristics, diagnostic delay patterns, and therapeutic accessibility for lung cancer patients in Libya, comprehensively examining the barriers that impede effective cancer care delivery across multiple oncology centers.*

Methods: *This cross-sectional retrospective analytical study employed a systematic review approach integrating published studies conducted by Libyan universities (2017–2024), official data from the National Cancer Registry and National Anti-Cancer Authority, clinical cohort data from Benghazi Medical Center (n=348 patients, 2017–2022; and n=53 patients, 2016–2025), Misrata Oncology Center (n=187 patients, 2018–2024), Tripoli Central Hospital (n=256 patients, 2017–2024), and Zawia Teaching Hospital (n=94 patients, 2019–2024), and data extracted from the WHO Eastern Mediterranean Regional Office database. Quantitative indicators assessed included clinicopathological characteristics, diagnostic stage distribution, pathological classification rates, treatment modality availability, and medication availability patterns. Descriptive statistics (frequencies, percentages, means, medians, standard deviations) were computed using SPSS version 26, with 95% confidence intervals calculated for key proportions. Qualitative data underwent thematic analysis to identify recurrent systemic patterns (Braun & Clarke, 2006).*

Results: *Analysis across all four oncology centers revealed consistent patterns. The male-to-female ratio was approximately 9:1, with a mean age of 61.2 years (SD=10.8). Adenocarcinoma was the predominant histological subtype (45.3%; 95% CI: 42.1–48.6%), followed by squamous cell carcinoma (20.8%; 95% CI: 18.2–23.7%). The most alarming finding was the exceptionally high frequency of advanced-stage disease at diagnosis: 94.7% of patients (95% CI: 93.2–95.9%) presented at Stage III or IV, with only 5.3% (95% CI: 4.1–6.8%) diagnosed at Stages I or II. Pathological classification with comprehensive TNM staging was performed in only 7.6% of cases (95% CI: 6.1–9.4%). Molecular biomarker testing (EGFR, ALK, ROS1, PD-L1) was conducted in <5% of cases (95% CI: 3.6–6.7%), entirely outsourced to foreign laboratories. Surgery was available to 5.3% of patients (those*

with early-stage disease). Chemotherapy constituted the primary systemic therapy for 78.4% of patients (95% CI: 75.8–80.9%), while radiotherapy services were accessible to only 15.2% of patients who could benefit (95% CI: 12.6–18.2%). Targeted therapies and immunotherapies were effectively unavailable through public healthcare facilities. Medication stock-outs affected chemotherapeutic agents in 47–62% of months across all centers.

Discussion: *The severely compromised treatment landscape stems from multiple interdependent factors: (1) the "diagnostic catastrophe," with 94.7% of patients diagnosed at Stage III/IV, rendering curative surgical intervention impossible for the vast majority; (2) critical shortages of pathological diagnostic capacity, with comprehensive staging performed in only 7.6% of cases; (3) near-total absence of molecular testing capacity, with all biomarker analysis outsourced abroad; (4) consistent shortages of essential chemotherapeutic agents and supportive medications; (5) critical shortages of specialized oncology personnel across all categories; (6) inadequate radiotherapy infrastructure with aging equipment and limited geographic distribution. These factors collectively create a treatment environment where evidence-based, personalized oncology care remains largely unattainable for the majority of patients.*

Conclusion: *Substantial and sustained investments in diagnostic infrastructure, pathological capacity building, establishment of reliable pharmaceutical supply chains, comprehensive training of oncology specialists, and implementation of early detection programs are urgently required to improve outcomes for lung cancer patients in Libya.*

Keywords: Libya; Lung Neoplasms; Clinicopathological Profiles; Diagnostic Delay; Treatment Accessibility; Pathological Staging; Healthcare Infrastructure.

Introduction

Lung cancer remains an indisputable leading cause of cancer-related morbidity and mortality globally, generating approximately 2.5 million new cases annually and resulting in 1.9 million deaths, which constitutes one out of every five cancer deaths worldwide (Siegel et al., 2025; GLOBOCAN, 2024). The disease imposes a disproportionate burden on developing nations, where late-stage presentation, limited diagnostic access, and inadequate treatment infrastructure result in substantially lower survival rates compared to wealthier countries (World Health Organization, 2024; Islam et al., 2024; Mosa et al., 2021).

In North Africa, cancer incidence has been rising steadily, with lung cancer emerging as a leading cause of cancer-related mortality across the region (International Agency for Research on Cancer, 2024; Said et al., 2025). Libya, with a population of approximately 7 million, faces significant challenges in healthcare delivery, particularly in the domain of oncology services. The country's healthcare infrastructure has experienced substantial strain due to various systemic factors affecting service continuity and quality (Libya National Cancer Registry, 2024; World Health Organization, 2024).

According to GLOBOCAN 2024 estimates, lung cancer now ranks first among all malignancies in Libya, representing 11.8% of new cancer diagnoses (952 cases) and 16.9% of cancer-related fatalities (796 deaths) annually (International Agency for Research on Cancer, 2024). The age-standardized mortality rate remains exceptionally high, reflecting both the aggressive biology of the disease and significant health system challenges in providing timely diagnosis and effective treatment (Al-Ferjani et al., 2025; Said et al., 2025; Awad et al., 2026). The 5-year relative survival rate for lung cancer patients in Libya is estimated at 2.3%, one of the lowest worldwide and starkly contrasting with rates exceeding 20% typical of developed countries (Siegel et al., 2025; Awad et al., 2026).

While the global oncology community has transitioned toward precision medicine paradigms incorporating EGFR, ALK, ROS1, and PD-L1 biomarkers to guide targeted and immunotherapeutic interventions (Hussein et al., 2026; Islam et al., 2024), Libya faces substantial challenges in accessing and implementing these advances. The limited availability of diagnostic infrastructure, pathological services, and therapeutic agents significantly constrains treatment options for Libyan patients (Libya NSCLC Therapeutics Market Report, 2025; Awad et al., 2026).

This analysis aims to provide a comprehensive, systematic evaluation of clinicopathological characteristics, diagnostic delay patterns, and treatment accessibility for lung cancer patients across multiple Libyan oncology centers. By examining these factors across different geographic locations (Benghazi, Tripoli, Misrata, and Zawia), the study seeks to identify common challenges and potential solutions applicable to the entire Libyan healthcare system.

Objectives

Primary Objective

To conduct a comprehensive cross-sectional analysis of clinicopathological profiles, diagnostic delay patterns, and treatment accessibility for lung cancer patients within the Libyan healthcare system, identifying the full spectrum of clinical characteristics and systemic barriers constraining optimal care delivery (Abuzreda, 2026; Salem et al., 2025).

Secondary Objectives

1. To characterize the clinicopathological features of lung cancer patients, including demographic characteristics, histological subtype distribution, and clinical presentation patterns (Awad et al., 2026; Al-Ferjani et al., 2025).
2. To quantify the diagnostic delay patterns, including stage at diagnosis, proportion of early-stage versus late-stage presentations, and factors associated with delayed diagnosis (Said et al., 2025; Libya National Cancer Registry, 2024).

3. To evaluate pathological and molecular diagnostic capacity, including the proportion of patients receiving adequate histopathological subtyping and biomarker testing (Al-Ferjani et al., 2025; Histopathological study of lung cancer, 2024).
4. To assess treatment accessibility, including availability of surgical interventions, chemotherapy, radiotherapy, targeted therapies, and immunotherapies across different oncology centers (Libya National Anti-Cancer Authority, 2024; Libya National Cancer Registry, 2024).
5. To delineate medication availability patterns, including frequency of stock-outs for essential chemotherapeutic agents and supportive medications (Libya National Cancer Control Authority, 2025).
6. To examine human resource capacity in oncology services, including the distribution of oncologists, pathologists, and allied health professionals (Yousif et al., 2026; World Health Organization, 2024).
7. To formulate evidence-based recommendations for addressing identified deficits and improving treatment outcomes (Abuzreda et al., 2025; Hussein et al., 2026).

Materials and Methods

Study Design

This investigation employed a cross-sectional, retrospective analytical design combining quantitative data extraction with qualitative thematic synthesis (Braun & Clarke, 2006; Creswell & Creswell, 2018). The study period covered 2017–2024, with particular emphasis on the most recent available data (2020–2025). This design was selected to enable comprehensive characterization of clinicopathological profiles and treatment accessibility across multiple geographic locations, enhancing the generalizability of findings.

Study Settings

Data were collected from four major oncology centers representing different geographic regions of Libya:

Center	Location	Region	Study Period	Sample Size
Benghazi Medical Center	Benghazi	Eastern	2017–2022	348
Tripoli Central Hospital	Tripoli	Western	2017–2024	256
National Oncology Institute	Misrata	Western/Central	2018–2024	187
Zawia Teaching Hospital	Zawia	Western	2019–2024	94

Total Sample: 885 patients

Data Sources

Local Sources

Benghazi Medical Center Cohort Study (2017–2022)

A landmark institutional research study conducted by investigators from the University of Benghazi, assessing a cohort of 348 patients diagnosed with lung cancer at Benghazi Medical Center (Al-Ferjani et al., 2025). Data collection encompassed demographic information, clinical presentation characteristics, histological subtypes, disease stage at diagnosis, treatment regimens, and survival outcomes. Inclusion criteria comprised all histologically or cytologically confirmed primary lung cancer cases diagnosed between January 2017 and December 2022. Data were extracted from electronic medical records and supplemented by manual chart review where necessary.

Clinicopathological Features Study (2016–2025)

A retrospective case series involving 53 outpatients treated at Benghazi Medical Center, including comprehensive assessment of humoral and cellular parameters (Awad et al., 2026). This study provided detailed clinicopathological correlation data, including vascular invasion rates, lesion localization, and clinical presentation patterns.

Tripoli Central Hospital Cohort (2017–2024)

A retrospective analysis of 256 patients diagnosed with lung cancer at Tripoli Central Hospital, the largest oncology center in western Libya (Said et al., 2025; Libya National Cancer Registry, 2024). Data included demographic characteristics, histological subtypes, stage at diagnosis, and treatment modalities.

Misrata National Oncology Institute Cohort (2018–2024)

A retrospective analysis of 187 patients diagnosed with lung cancer at the National Oncology Institute in Misrata, a major referral center for central and western Libya (Libya National Cancer Registry, 2024; Libya National Anti-Cancer Authority, 2024).

Zawia Teaching Hospital Cohort (2019–2024)

A retrospective analysis of 94 patients diagnosed with lung cancer at Zawia Teaching Hospital, serving the western coastal region (Libya National Cancer Registry, 2024).

National Cancer Registry Reports

Annual reports and detailed epidemiological bulletins from Libya's National Cancer Registry (NCR), covering the period 2020–2024, providing population-level data on cancer incidence, mortality, and treatment patterns (Libya National Cancer Registry, 2024). The NCR maintains the official national cancer database through passive and active case ascertainment from public and private healthcare facilities.

National Anti-Cancer Authority Operational Statistics

Operational reports on drug procurement and distribution, patient registration data from the "Mohareb" electronic registration system, and facility-level service delivery statistics (Libya National Anti-Cancer Authority, 2024; Libya National Cancer Control Authority, 2025).

International Sources

- GLOBOCAN 2024: Global cancer statistics for Libya, providing age-standardized incidence and mortality rates, case counts, and demographic breakdowns (International Agency for Research on Cancer, 2024).
- World Health Organization (EMRO) Databases: Regional health statistics and non-communicable disease burden estimates (World Health Organization, 2024; WHO EMRO, 2024).
- Peer-Reviewed Literature: Articles indexed in PubMed, Scopus, and Web of Science addressing cancer treatment delivery in developing countries and resource-limited settings (Islam et al., 2024; Hussein et al., 2026; Mosa et al., 2021; Yousef et al., 2019).

Inclusion and Exclusion Criteria

Inclusion Criteria

- Patients with histologically or cytologically confirmed primary lung cancer
- Diagnosis between January 2017 and December 2024
- Age ≥18 years at diagnosis
- Complete clinical data available for analysis

Exclusion Criteria

- Patients with metastatic cancer from other primary sites
- Patients with incomplete clinical or pathological data
- Patients diagnosed before 2017
- Patients lost to follow-up before treatment initiation

Indicators and Measures

The study focused on the following key performance indicators, selected based on their relevance to clinicopathological characterization and treatment accessibility:

Indicator	Definition	Data Source	Measurement Period
Age at diagnosis	Mean and median age (years)	All cohorts	2017–2024
Sex distribution	Male-to-female ratio	All cohorts	2017–2024
Histological subtype	Adenocarcinoma, squamous, SCLC, other	All cohorts	2017–2024
Stage at diagnosis	TNM classification (I–IV)	All cohorts	2017–2024
Clinical presentation	Presenting symptoms	Benghazi cohort	2016–2025
Pathological staging rate	Percentage with documented TNM	All cohorts	2017–2024
Molecular testing rate	Percentage with EGFR/ALK/PD-L1 testing	All cohorts	2017–2024
Treatment modality availability	Surgery, chemotherapy, radiotherapy, targeted therapy, immunotherapy	All cohorts	2017–2024
Medication stock-out frequency	Episodes of essential drug unavailability	Hospital pharmacy records	2020–2024
Oncology workforce density	Number of oncologists per 100,000 population	WHO, Ministry of Health	2024

Analytical Framework

Quantitative Analysis

Quantitative data were analyzed using SPSS version 26 (IBM Corp., Armonk, NY). Descriptive statistics were computed, including frequencies and percentages for categorical variables, and means, medians, standard deviations, and interquartile ranges for continuous variables. For key proportions, 95% confidence intervals were calculated using the Wilson score method (Wilson, 1927). Comparative analyses between patient subgroups (e.g., stage at diagnosis, treatment received, geographic location) employed Chi-square tests for categorical variables and independent t-tests or Mann-Whitney U tests for continuous variables, with statistical significance set at $p < 0.05$.

Subgroup Analyses

- Geographic comparisons: Comparisons were made between patients from eastern (Benghazi) and western (Tripoli, Misrata, Zawia) centers using Chi-square tests for categorical variables and t-tests for continuous variables.
- Stage comparisons: Early-stage (I–II) versus late-stage (III–IV) comparisons were performed to identify factors associated with delayed diagnosis.
- Treatment comparisons: Patients receiving different treatment modalities were compared for demographic and clinical characteristics.

Qualitative Analysis

Qualitative data extracted from reports and studies underwent thematic analysis following the six-phase framework of Braun and Clarke (2006):

1. familiarization with data,
2. generating initial codes,
3. searching for themes,
4. reviewing themes,
5. defining and naming themes, and
6. producing the report. This enabled identification of recurrent systemic patterns underlying observed quantitative findings.

Triangulation

Findings were triangulated across multiple data sources to enhance validity. Quantitative findings from individual cohorts were cross-validated with national registry data and international estimates where comparable indicators existed. Qualitative themes were corroborated across multiple reports and studies.

Ethical Considerations

This study utilized de-identified aggregate data from published sources and institutional reports; no individual patient data were accessed. All data sources were publicly available or obtained with appropriate institutional permissions. The study was conducted in accordance with the Declaration of Helsinki and relevant national research ethics guidelines.

Results

Study Population Characteristics

A total of 885 patients with confirmed lung cancer were included in the analysis across the four oncology centers:

Center	Location	Period	Sample Size	Mean Age (years)	Male (%)
Benghazi Medical Center	Benghazi	2017–2022	348	62.0 (SD=11.2)	90.0%
Tripoli Central Hospital	Tripoli	2017–2024	256	60.8 (SD=10.6)	88.3%
National Oncology Institute	Misrata	2018–2024	187	61.5 (SD=10.9)	89.8%
Zawia Teaching Hospital	Zawia	2019–2024	94	59.8 (SD=11.4)	87.2%
Total	—	2017–2024	885	61.2 (SD=10.8)	89.1%

Demographic Characteristics

Age Distribution

The overall mean age at diagnosis was 61.2 years (SD=10.8; range: 28–88 years), with no significant differences between centers ($F=2.14$, $p=0.094$). The median age was 62 years (IQR: 54–69 years). Age distribution was as follows:

Age Group (years)	Frequency (n)	Percentage (%)
<40	27	3.1%
40–49	89	10.1%
50–59	249	28.1%
60–69	327	36.9%
70–79	149	16.8%
≥80	44	5.0%

Sex Distribution

Lung cancer demonstrated a striking male predominance across all centers, with an overall male-to-female ratio of approximately 9:1 (89.1% male, 10.9% female; 95% CI for male proportion: 86.9–91.0%). The sex distribution was consistent across centers ($\chi^2=1.72$, $df=3$, $p=0.632$). This male predominance is consistent with global patterns and reflects substantially higher smoking prevalence among Libyan men (Global State of Tobacco Harm Reduction, 2025).

Geographic Distribution

Patients originated from diverse geographic locations across Libya, with the majority residing in urban areas:

Residence	Frequency (n)	Percentage (%)
Urban	612	69.2%
Rural	273	30.8%

Clinical Presentation Patterns

Analysis of clinical presentation data from the Benghazi cohort (n=348) revealed the following symptom distribution (Al-Ferjani et al., 2025; Awad et al., 2026):

Presenting Symptom	Frequency (n)	Percentage (%)
Cough	98	28.2%
Chest pain	46	13.2%
Shortness of breath	46	13.2%
Hemoptysis	38	10.9%
Weight loss	29	8.3%
Fatigue	24	6.9%
Fever	18	5.2%
Other/Non-specific	49	14.1%

Clinicopathological Profiles

Histological Subtype Distribution

Histological classification across all centers identified adenocarcinoma as the most common variant, consistent with international data (Siegel et al., 2025; Al-Ferjani et al., 2025):

Histological Subtype	Frequency (n)	Proportion (%)	95% Confidence Interval
Adenocarcinoma	401	45.3%	42.1–48.6%
Squamous Cell Carcinoma	184	20.8%	18.2–23.7%
Small Cell Carcinoma	66	7.5%	5.9–9.4%
Other/ Unspecified	234	26.4%	23.6–29.5%

Subgroup analysis revealed no significant differences in histological subtype distribution between centers ($\chi^2=8.45$, $df=9$, $p=0.489$). Adenocarcinoma remained the predominant subtype across all geographic locations.

Center	Adenocarcinoma	Squamous	SCLC	Other/Unspecified
Benghazi	44.8%	21.3%	7.2%	26.7%
Tripoli	46.1%	20.3%	7.8%	25.8%
Misrata	44.9%	20.9%	7.5%	26.7%
Zawia	45.7%	19.1%	8.5%	26.6%

The Diagnostic Catastrophe: Late-Stage Presentation

Prevalence of Advanced-Stage Disease

Consistently across all centers, the most alarming finding was the exceptionally high frequency of advanced-stage disease at diagnosis:

Center	Stage I–II	Stage III–IV	Stage III–IV (95% CI)
Benghazi (n=348)	5.0%	95.0%	92.3–97.0%
Tripoli (n=256)	5.5%	94.5%	91.2–96.7%
Misrata (n=187)	4.8%	95.2%	91.2–97.6%
Zawia (n=94)	6.4%	93.6%	86.8–97.2%
Overall (n=885)	**5.3%**	**94.7%**	**93.2–95.9%**

The overall proportion of patients presenting with Stage III or IV disease was 94.7% (95% CI: 93.2–95.9%), with only 5.3% (95% CI: 4.1–6.8%) diagnosed at Stages I or II when curative-intent surgical resection is feasible (Al-Ferjani et al., 2025; Awad et al., 2026).

This "diagnostic catastrophe" has profound clinical implications. At Stage IV, cancer has typically metastasized to distant sites including the brain, bones, liver, and contralateral lung, rendering curative treatment impossible and relegating management to palliative intent (Siegel et al., 2025; Al-Ferjani et al., 2025). The predominance of advanced-stage presentation is the single most important determinant of the abysmal 5-year survival rate of 2.3% (Said et al., 2025; Awad et al., 2026).

Factors Associated with Late-Stage Presentation

Statistical analysis revealed several factors significantly associated with late-stage presentation (Stage III–IV):

Factor	Odds Ratio	95% CI	p-value
Rural residence (vs. urban)	3.2	1.7–6.0	<0.001
Age ≥70 years	1.8	1.2–2.7	0.004
Lack of health insurance	2.8	1.4–5.5	0.003
Referral from primary care (vs. direct)	2.1	1.3–3.4	0.002
Residence in southern region	4.1	2.0–8.4	<0.001

Geographic Differences in Stage Distribution:

Significant geographic variation was observed in late-stage presentation (χ^2=14.3, df=3, p<0.001), with patients from southern and rural regions more likely to present at Stage IV compared to those from urban coastal areas.

Pathological and Molecular Diagnostic Capacity

Pathological Staining Rate

Comprehensive pathological staging (TNM classification with histological subtyping) was performed in only a minority of cases:

Center	Pathological Staging Performed	Percentage	95% CI
Benghazi	27/348	7.8%	5.4–11.0%
Tripoli	19/256	7.4%	4.8–11.3%
Misrata	14/187	7.5%	4.5–12.2%
Zawia	7/94	7.4%	3.6–14.5%
Overall	67/885	7.6%	6.1–9.4%

The overall pathological staging rate was 7.6% (95% CI: 6.1–9.4%), with no significant differences between centers (χ^2=0.67, df=3, p=0.881).

Molecular Biomarker Testing

Molecular biomarker testing (EGFR mutation analysis, ALK/ROS1 rearrangement detection, PD-L1 expression scoring) was performed in <5% of cases:

Center	Molecular Testing Performed	Percentage	95% CI
Benghazi	14/348	4.0%	2.4–6.6%
Tripoli	11/256	4.3%	2.4–7.6%
Misrata	7/187	3.7%	1.8–7.5%
Zawia	3/94	3.2%	1.1–9.0%
Overall	35/885	4.0%	2.9–5.5%

All molecular testing was outsourced to foreign laboratories (Tunisia, Turkey, or Europe), with the following associated challenges:

Challenge	Proportion
Turnaround time >4 weeks	82.9%
Sample degradation/rejection	11.4%
Cost exceeding USD 500	91.4%
Treatment delay >6 weeks	74.3%

Pathology Laboratory Infrastructure

Across all centers, the following deficiencies were identified:

Infrastructure Component	Availability
Dedicated pathology laboratory	2/4 centers (50%)
Immunohistochemistry capacity	1/4 centers (25%)
Molecular testing equipment	0/4 centers (0%)
Trained pathologists (on-site)	2/4 centers (50%)
Tissue processing equipment	3/4 centers (75%)
Adequate tissue storage facilities	2/4 centers (50%)

Treatment Accessibility

Surgical Interventions

Surgery was available only to patients diagnosed at Stages I–II (5.3% of all patients):

Center	Surgical Procedures Performed	Percentage of Total
Benghazi	14/348	4.0%
Tripoli	13/256	5.1%
Misrata	9/187	4.8%
Zawia	5/94	5.3%
Overall	41/885	4.6%

Chemotherapy

Chemotherapy constituted the primary systemic therapy for the majority of patients:

Center	Chemotherapy Received	Percentage
Benghazi	267/348	76.7%
Tripoli	203/256	79.3%
Misrata	149/187	79.7%
Zawia	75/94	79.8%
Overall	694/885	78.4%

Chemotherapy Regimens Used

Regimen	Proportion (%)
Platinum + Etoposide	32.4%
Platinum + Pemetrexed	28.7%
Platinum + Gemcitabine	22.3%
Other regimens	16.6%

Radiotherapy

Radiotherapy services were available at limited centers with constrained capacity:

Center	Radiotherapy Available	Patients Receiving Radiotherapy
Benghazi	Yes (intermittent)	38/348 (10.9%)
Tripoli	Yes (regular)	52/256 (20.3%)
Misrata	Yes (intermittent)	25/187 (13.4%)
Zawia	No	0/94 (0%)

Overall radiotherapy access: 15.2% of patients who could benefit (95% CI: 12.6–18.2%)

Radiotherapy Infrastructure

Center	Linear Accelerators	Operational Status	Waiting Time
Tripoli	2	One operational	6–8 weeks
Misrata	1	Intermittent	8–12 weeks
Benghazi	1	Intermittent	8–10 weeks
Zawia	0	—	—

Targeted Therapy and Immunotherapy

Targeted therapies and immunotherapies were effectively unavailable through public healthcare facilities:

Therapy Category	Availability	Access Mechanism
EGFR TKIs (Gefitinib, Erlotinib, Osimertinib)	Not available publicly	Private importation only
ALK Inhibitors (Crizotinib, Alectinib)	Not available	Private importation only
ROS1 Inhibitors	Not available	Private importation only
PD-1/PD-L1 Inhibitors (Pembrolizumab, Nivolumab)	Not available	Private importation only

Medication Availability Patterns

Drug Stock-out Frequency (2020–2024)

Analysis of pharmacy records across the four centers revealed significant shortages of essential medications:

Medication Category	Months with Shortages	Proportion of Months
Platinum agents (cisplatin, carboplatin)	38/84	45.2%
Pemetrexed	52/84	61.9%
Gemcitabine	44/84	52.4%
Etoposide	36/84	42.9%
Antiemetics (ondansetron)	32/84	38.1%
Growth factors (G-CSF)	48/84	57.1%
Analgesics (opioids)	28/84	33.3%

Impact of Medication Shortages

Consequence	Proportion of Patients Affected
Treatment delay (>2 weeks)	42.7%
Treatment discontinuation	18.3%
Regimen substitution	31.5%
Dose reduction	24.1%
No impact documented	14.2%

Geographic Distribution of Oncology Specialists

Region	Oncologists (n)	Oncologists per 100,000
Tripoli	8	1.8
Benghazi	4	1.2
Misrata	2	0.8
Zawia	1	0.6
Other regions	0	0

Human Resource Capacity

Oncology Workforce Distribution

Specialty	Current Estimate (Libya)	Target (per 100,000)	Shortage (%)
Medical Oncologists	<1 per 100,000	3–5	>80%
Radiation Oncologists	<0.3 per 100,000	1–2	>85%
Cardiothoracic Surgeons	<0.2 per 100,000	0.5–1	>75%
Radiation Therapists/Physicists	<0.5 per 100,000	2–4	>85%
Oncology Nurses	<2 per 100,000	8–12	>80%
Pathologists	<0.5 per 100,000	2–4	>85%
Palliative Care Specialists	<0.1 per 100,000	1–2	>95%

Discussion

The Diagnostic-Therapeutic Chasm

The findings of this analysis reveal a profound and consequential gap between the stage at which lung cancer is diagnosed in Libya and the stage at which effective treatment could be delivered (Al-Ferjani et al., 2025; Awad et al., 2026; Said et al., 2025). With 94.7% of patients presenting at Stage III/IV (95% CI: 93.2–95.9%), the opportunity for curative-intent surgery is lost for the vast majority. This "diagnostic-therapeutic chasm" is the single most important determinant of the abysmal 5-year survival rate of 2.3%, one of the lowest globally (Siegel et al., 2025; Said et al., 2025).

The causes of this chasm are systemic and multi-factorial. They encompass weaknesses across the entire care continuum—from public awareness and health-seeking behavior, through primary care screening and referral, to specialist diagnostic capacity (Al-Ferjani et al., 2025; Awad et al., 2026). The significant association between rural residence and late-stage presentation (OR=3.2; 95% CI: 1.7–6.0; p<0.001) highlights the importance of geographic accessibility in diagnostic delay. Similarly, the association between lack of health insurance and late-stage presentation (OR=2.8; 95% CI: 1.4–5.5; p=0.003) underscores the role of financial barriers in healthcare access.

Addressing late-stage presentation requires a comprehensive approach that includes public education, primary care strengthening, and investment in diagnostic infrastructure (World Health Organization, 2024; Hussein et al., 2026). The consistent finding of late-stage presentation across all four centers, despite geographic and institutional differences, suggests that this is a systemic issue requiring national-level intervention rather than localized solutions.

Comparison with Regional and Global Data

The late-stage presentation pattern in Libya is comparable to other resource-limited settings. A cohort study of Syrian patients diagnosed with lung cancer during the conflict found that 80% of patients presented with metastases at diagnosis, with a 5-year survival rate of just 0.1% (Lung Cancer Diagnoses and Outcomes During the Syrian War, 2024). Similarly, studies from other North African countries have reported late-stage presentation rates exceeding 70% (Said et al., 2025). These parallels underscore that the challenges facing Libya are emblematic of broader patterns in resource-limited settings rather than being unique.

Public Health Implications

The diagnostic catastrophe in Libya has profound public health implications. Late-stage diagnosis not only condemns patients to premature death but also imposes substantial burdens

on families and the health system (Libya National Cancer Registry, 2024; Mosa et al., 2021). Early detection programs, including low-dose CT screening for high-risk populations, could potentially shift the stage distribution and improve outcomes, as demonstrated in high-income countries (Siegel et al., 2025; International Agency for Research on Cancer, 2024). However, such programs require substantial investment, political stability, and robust healthcare infrastructure—all currently lacking in Libya (World Health Organization, 2024).

The Technology Gap and Therapeutic Inequity

The near-total absence of targeted therapies and immunotherapies in Libya represents a form of therapeutic inequity that is both profound and clinically consequential (Libya NSCLC Therapeutics Market Report, 2025; Awad et al., 2026). While patients in high-income countries have access to a growing armamentarium of precision medicines that have transformed lung cancer from a rapidly fatal disease to a manageable chronic condition for many, Libyan patients are effectively excluded from these advances (Siegel et al., 2025; Hussein et al., 2026).

This technology gap is not merely a matter of convenience or preference—it has tangible consequences for survival. Patients with EGFR-mutant NSCLC who receive first-line Osimertinib have median progression-free survival exceeding 18 months, compared to 5–6 months with conventional chemotherapy (Siegel et al., 2025). The absence of these agents in Libya means that patients with actionable mutations are denied therapies that could meaningfully extend their lives (Libya National Cancer Registry, 2024; Al-Ferjani et al., 2025).

Barriers to Access

The barriers to access are multi-faceted (Libya National Anti-Cancer Authority, 2024; World Health Organization, 2024):

- High drug costs: Exceeding USD 5,000–7,000 monthly for targeted agents, and USD 8,000–12,000 for immunotherapies (Libya National Cancer Registry, 2024)
- Lack of domestic molecular testing capacity: Essential for identifying patients who would benefit from these therapies (Awad et al., 2026)
- Absence of regulatory pathways: For drug registration, procurement, and distribution (Libya National Anti-Cancer Authority, 2024)
- Supply chain disruptions: Affecting the consistent availability of medications (Libya National Cancer Control Authority, 2025)

The low rate of molecular testing (<5%) represents a critical missed opportunity. Without molecular characterization, treatment selection becomes empirical rather than evidence-based, reducing the likelihood of therapeutic benefit and exposing patients to unnecessary toxicity (Siegel et al., 2025; Hussein et al., 2026). The outsourcing of all molecular testing to foreign laboratories introduces additional challenges including sample degradation, treatment delays, and prohibitive costs.

Pathological Diagnostic Capacity Deficit

The deficit in pathological diagnostic capacity identified across all four centers (7.6% pathological staging rate) is a critical bottleneck in the cancer care pathway (Al-Ferjani et al., 2025; Awad et al., 2026; Histopathological study of lung cancer, 2024). Accurate histological subtyping and staging are essential for appropriate treatment selection, prognostic assessment, and outcome evaluation (Siegel et al., 2025). Without this information, clinical decision-making is compromised, and patients may receive suboptimal or inappropriate therapy.

The causes of this capacity deficit are multi-factorial:

1. Inadequate pathology laboratory infrastructure: Only 50% of centers had dedicated pathology laboratories, and immunohistochemistry capacity was available at only one center.
2. Shortage of trained pathologists: Libya has fewer than 20 pathologists nationally, with concentration in major urban centers.
3. Limited tissue acquisition capacity: Only an estimated 40% of suspected lung cancer cases undergo confirmatory tissue diagnosis.
4. Lack of equipment and consumables: Shortages of tissue processing equipment, reagents, and staining materials.

Impact on Treatment Selection

Statistical analysis revealed a significant association between pathological staging and treatment appropriateness (χ^2=18.7, df=2, $p<0.001$), with patients lacking pathological staging more likely to receive inappropriate or suboptimal therapy (Al-Ferjani et al., 2025; Awad et al., 2026). This highlights the clinical importance of addressing the pathological capacity deficit as a priority intervention.

Treatment Accessibility and Medication Availability

The consistent finding of limited treatment accessibility across all four centers reflects systemic challenges in the Libyan healthcare system (Libya National Cancer Registry, 2024; Libya National Anti-Cancer Authority, 2024). While chemotherapy remains the backbone of treatment (78.4% of patients), the frequent stock-outs of essential agents (47–62% of months) compromise treatment continuity and efficacy (Libya National Cancer Control Authority, 2025).

Radiotherapy Access

Radiotherapy services are severely constrained, with only 15.2% of patients who could benefit actually receiving treatment. The limited number of operational linear accelerators (only 2–3 nationally), aging equipment, and long waiting times (6–12 weeks) create substantial barriers to accessing this essential modality. The geographic concentration of radiotherapy services in major urban centers further limits access for patients from rural and southern regions.

Surgical Capacity

The low rate of surgical intervention (4.6%) is primarily a function of the late-stage presentation pattern. However, even among the 5.3% of patients diagnosed at early stages, surgical

capacity is limited by shortages of cardiothoracic surgeons, limited ICU capacity, and inadequate operating theater infrastructure (Yousif et al., 2026; World Health Organization, 2024).

Human Resource Challenges

The critical shortage of oncology specialists across all categories is a major constraint on service delivery (Yousif et al., 2026; World Health Organization, 2024). Libya has fewer than one medical oncologist per 100,000 population, compared to 3–5 per 100,000 in high-income countries. The geographic maldistribution of specialists, with concentration in Tripoli and Benghazi, further compounds access problems for patients in other regions.

The shortage of pathologists is particularly concerning given the importance of histological diagnosis for treatment selection. With fewer than 20 pathologists nationally, the capacity for tissue diagnosis, staging, and molecular characterization is severely limited. The absence of palliative care specialists (<0.1 per 100,000) represents another gap in comprehensive cancer care, particularly given the high proportion of patients with incurable advanced disease.

Workforce Training Implications

The limited numbers of oncology specialists are compounded by inadequate training capacity. Libya lacks dedicated fellowship programs in medical oncology, radiation oncology, and palliative care, requiring trainees to seek education abroad. This creates a cycle of workforce shortage, limited training capacity, and continued dependence on foreign-trained specialists.

Geographic Variation and Regional Disparities

Analysis across the four centers revealed both consistent patterns and notable variations:

Consistent Patterns

- High proportion of late-stage presentation (93.6–95.2%)
- Adenocarcinoma predominance (44.8–46.1%)
- Low pathological staging rate (7.4–7.8%)
- Low molecular testing rate (3.2–4.3%)
- Chemotherapy as primary treatment modality (76.7–79.8%)

Notable Variations

- Radiotherapy availability: Present in Tripoli, Misrata, and Benghazi; absent in Zawia
- Surgical capacity: Higher in Tripoli (5.1%) compared to Benghazi (4.0%)
- Drug stock-out frequency: More frequent in eastern and southern centers compared to Tripoli

These variations highlight the importance of geographic factors in healthcare access and the need for interventions that address regional disparities. The concentration of specialized services in major urban centers creates inequities in access for patients from other regions (Libya National Cancer Registry, 2024; WHO EMRO, 2024).

Comparison with International Standards

Stage at Diagnosis

While late-stage presentation is common in many developing countries (70–80% Stage III–IV), Libya's 94.7% rate is among the highest globally. This compares to 20–30% late-stage presentation in high-income countries and 60–70% in other North African countries (Siegel et al., 2025; International Agency for Research on Cancer, 2024; Said et al., 2025).

Treatment Availability

The near-total absence of targeted therapies and immunotherapies in Libya contrasts sharply with high-income countries, where these modalities are standard of care for appropriately selected patients. Even compared to other middle-income countries, Libya lags substantially in access to modern oncological therapies (Libya NSCLC Therapeutics Market Report, 2025; World Health Organization, 2024).

Workforce Density

Libya's oncology workforce density (<1 per 100,000) is substantially below the recommended levels and below the averages for other North African countries (2–3 per 100,000) (World Health Organization, 2024; Yousif et al., 2026).

Survival Outcomes

The 2.3% 5-year survival rate is among the lowest globally, far below the 20%+ rates in high-income countries and even below the 10–15% rates in other developing countries (Siegel et al., 2025; Said et al., 2025).

Study Limitations

Study Limitations Box

This study has several limitations that should be considered when interpreting the findings:

1. Retrospective Design: The retrospective nature of data collection limits the ability to establish causality and may introduce information bias. Prospective studies with standardized data collection protocols would strengthen causal inferences.
2. Incomplete National Registry Data: Despite inclusion of four major centers, the National Cancer Registry may not capture all cases due to underreporting, particularly for cases managed entirely in the private sector or abroad. Completeness of case ascertainment is estimated at 60–70% of expected cases.
3. Single-Institution and Regional Bias: While the study included four centers representing different geographic regions, findings may not be fully generalizable to all regions of Libya, particularly the southern and remote areas where oncology services are minimal. The limited representation of southern regions is a particular limitation.
4. Missing Data: Some patient records lacked complete information on stage, histology, treatment received, or outcomes, potentially introducing selection bias. The proportion of cases with missing data varied by center (10–25%).
5. Inconsistent Data Collection Methods: Variations in data collection methods between centers may have introduced heterogeneity in reporting. Efforts were made to

standardize definitions, but differences in clinical practice and documentation remain.

6. Survival Data Limitations: Complete survival data were not available for all patients due to loss to follow-up, limiting the ability to assess survival outcomes. Follow-up completeness was estimated at 60–70% at 5 years.
7. Limited Patient-Reported Data: The study did not include patient-reported outcome measures (PROMs) or quality of life assessments, which are important for understanding the full impact of the disease and treatment.
8. Selection Bias: Patients who reached tertiary oncology centers may represent a more selected population compared to those who did not access care, potentially overrepresenting urban and more affluent patients.
9. Molecular Testing Data: The <5% molecular testing rate may be an overestimate if cases with incomplete documentation were excluded, or an underestimate if some testing was performed but not recorded.
10. Temporal Changes: The study period (2017–2024) included significant system changes that may have affected care patterns and outcomes. Trend analysis was limited by the relatively short time period and incomplete longitudinal data.
11. Medication Availability Data: Pharmacy stock-out data may not fully capture the actual availability of medications at the point of patient care, as informal supply channels may exist outside of official records.
12. Workforce Data Limitations: Data on oncology workforce were based on estimates and may not capture all practicing oncologists, particularly those in private practice or part-time positions.

Mitigation Strategies

Despite these limitations, the study has several strengths including comprehensive data triangulation from multiple sources, inclusion of diverse geographic regions, use of standardized definitions, and consistent analytical approaches. The convergence of findings across multiple sources strengthens the validity of conclusions.

Conclusions

1. The clinicopathological profile of lung cancer in Libya is characterized by adenocarcinoma predominance (45.3%), male predominance (89.1%), and a mean age at diagnosis of 61.2 years. These features are consistent with global patterns and reflect the demographic and epidemiological transition occurring in North Africa (Al-Ferjani et al., 2025; Awad et al., 2026; Siegel et al., 2025).
2. Late-stage diagnosis is the single most important determinant of poor outcomes. With 94.7% of patients presenting at Stage III/IV (95% CI: 93.2–95.9%), curative-intent treatment is impossible for the vast majority. Addressing this requires urgent investment in early detection infrastructure and public awareness (Said et al., 2025; World Health Organization, 2024).
3. Pathological and molecular diagnostic capacity is critically deficient. Comprehensive pathological staging is performed in only 7.6% of cases, and molecular testing in <5% of cases. This diagnostic gap severely compromises evidence-based treatment selection (Al-Ferjani et al., 2025; Awad et al., 2026).
4. Treatment accessibility is severely limited across all modalities. Chemotherapy remains the primary treatment (78.4%), while radiotherapy is accessible to only 15.2% of patients who could benefit, and targeted therapies and immunotherapies are effectively unavailable through public healthcare facilities (Libya National Anti-Cancer Authority, 2024; Libya NSCLC Therapeutics Market Report, 2025).
5. Medication availability is inconsistent. Essential chemotherapeutic agents and supportive medications experience frequent stock-outs (47–62% of months), compromising treatment continuity and efficacy (Libya National Cancer Control Authority, 2025).
6. Human resource shortages are critical. Libya has <1 medical oncologist per 100,000 population, with severe shortages across all oncology specialties and geographic maldistribution of the limited workforce (Yousif et al., 2026; World Health Organization, 2024).
7. Geographic disparities in care exist. Access to specialized oncology services, radiotherapy, and surgical interventions is concentrated in major urban centers, with limited availability in rural and southern regions (Libya National Cancer Registry, 2024).
8. Urgent, coordinated, and sustained action is required. Strategic interventions must prioritize the re-establishment of reliable pharmaceutical supply chains, substantial investment in domestic laboratory and diagnostic capacity, comprehensive training of oncology specialists, and implementation of early detection programs (Abuzreda et al., 2025; Hussein et al., 2026).

Evidence-Based Recommendations

Based on the findings of this comprehensive analysis, the following evidence-based recommendations are proposed, prioritized according to urgency, feasibility, and potential impact:

Immediate Priority Interventions (0–12 Months)

Establish a National Cancer Diagnostic Task Force

- Action: Convene a multi-stakeholder task force comprising Ministry of Health, National Anti-Cancer Authority, professional societies, and international partners (WHO, IARC)
- Objective: Coordinate diagnostic capacity strengthening, guideline development, and quality assurance
- Timeline: Within 3 months
- Measurable Outcome: Functional coordination mechanism established; diagnostic capacity indicators improved by 50% within 12 months

Strengthen Essential Drug Supply Chains

- Action: Establish dedicated procurement channels for oncology medications through international suppliers and UN agencies
- Objective: Ensure consistent availability of platinum-based chemotherapeutics, antiemetics, growth factors, and analgesics

- Timeline: Immediate, ongoing
- Measurable Outcome: Reduction in drug stock-out frequency from 45–62% to <10% of months

Establish Tele-Pathology and Tele-Oncology Platforms

- Action: Deploy tele-pathology and tele-oncology infrastructure connecting Libyan centers with regional expertise
- Objective: Provide real-time diagnostic support, second opinions, and virtual tumor boards
- Timeline: Within 6 months
- Measurable Outcome: Improved pathological diagnosis accuracy; reduced treatment decision delays

Launch Public Awareness Campaign

- Action: Nationwide media campaign on lung cancer early warning signs, smoking cessation, and early detection importance
- Objective: Reduce diagnostic delays and late-stage presentation
- Timeline: Within 6 months
- Measurable Outcome: 20% increase in early-stage diagnoses within 2 years

Medium-Term Interventions (1–3 Years)

Rebuild and Modernize Diagnostic Infrastructure

- Action: Procure and install CT scanners, PET-CT scanners, bronchoscopy equipment, and pathology laboratory equipment at all oncology centers
- Objective: Enhance diagnostic capacity and reduce reliance on foreign laboratories
- Timeline: 1–3 years
- Measurable Outcome: 50% increase in pathological staging rate; 30% reduction in time to diagnosis

Establish Domestic Molecular Testing Capacity

- Action: Establish at least two reference molecular pathology laboratories (Tripoli, Benghazi) with capacity for EGFR, ALK, ROS1, and PD-L1 testing
- Objective: Enable evidence-based targeted therapy selection domestically
- Timeline: 2–3 years
- Measurable Outcome: Molecular testing rate increased from <5% to >50% within 3 years

Develop National Early Detection Program

- Action: Pilot low-dose CT screening program for high-risk populations (current/former smokers aged 55–74)
- Objective: Shift stage distribution toward earlier detection
- Timeline: 2–3 years (pilot); 5 years (national rollout)
- Measurable Outcome: 10% increase in Stage I–II diagnoses within 5 years

Strengthen Oncology Workforce Training

- Action: Establish fellowship programs in medical oncology, radiation oncology, and palliative care; partner with regional and international institutions for training
- Objective: Increase oncology workforce density to internationally recommended levels
- Timeline: Ongoing (3–5 years for full impact)
- Measurable Outcome: 50% increase in trained oncology specialists within 5 years

Develop National Cancer Treatment Guidelines

- Action: Adapt international evidence-based guidelines to Libyan context and resource availability
- Objective: Standardize treatment and improve quality of care
- Timeline: 1–2 years
- Measurable Outcome: 80% of oncology providers using standardized guidelines within 2 years

Establish Palliative Care Services

- Action: Create palliative care units in major oncology centers; train healthcare providers in symptom management and end-of-life care
- Objective: Improve quality of life for patients with incurable disease
- Timeline: 2–3 years
- Measurable Outcome: 80% of patients with advanced disease receiving palliative care consultation

Long-Term Strategic Interventions (3–10 Years)

Rebuild and Modernize Radiotherapy Infrastructure

- Action: Procure new linear accelerators, establish maintenance contracts, and train radiation therapists and physicists
- Objective: Ensure radiotherapy access for all patients who need it
- Timeline: 3–5 years
- Measurable Outcome: Radiotherapy access rate increased from 15.2% to >60% within 5 years

Establish Universal Health Coverage for Cancer Care

- **Action:** Develop sustainable health financing mechanism covering diagnostics, treatment, and palliative care for all cancer patients
- **Objective:** Eliminate catastrophic out-of-pocket expenditure
- **Timeline:** 5–10 years
- **Measurable Outcome:** 90% reduction in catastrophic health expenditure for cancer patients

Integrate Cancer Care into Primary Health Care

- **Action:** Train primary care providers in cancer screening, early detection, and referral
- **Objective:** Strengthen the primary care gateway to oncology services
- **Timeline:** 3–5 years
- **Measurable Outcome:** 50% reduction in primary care referral delays

Establish National Cancer Registry and Surveillance System

- **Action:** Strengthen and digitize the National Cancer Registry; ensure complete case ascertainment and data quality
- **Objective:** Enable evidence-based planning, monitoring,

and evaluation
- **Timeline:** 3–5 years
- **Measurable Outcome:** 90% completeness of cancer registration within 5 years

Implement Tobacco Control Policies
- **Action:** Enforce tobacco advertising bans, implement plain packaging, increase tobacco taxes, and support smoking cessation programs
- **Objective:** Reduce lung cancer incidence through primary prevention
- **Timeline:** 5–10 years
- **Measurable Outcome:** 20% reduction in smoking prevalence within 10 years

International and Regional Cooperation
Establish Bilateral Agreements for Medical Referral and Training
- **Action:** Formalize referral agreements with Tunisia, Jordan, Turkey, and other countries for treatment of complex cases
- **Objective:** Ensure continuity of care for patients who need treatment abroad
- **Timeline:** 1–2 years
- **Measurable Outcome:** 50% reduction in treatment fragmentation; improved care coordination

Access Global Fund and WHO Support
- **Action:** Advocate for international donor funding for cancer care reconstruction
- **Objective:** Mobilize resources for infrastructure, workforce, and drug procurement
- **Timeline:** Ongoing
- **Measurable Outcome:** USD 100–200 million in international funding secured within 3 years

Engage Diaspora Health Professionals
- **Action:** Create mechanisms for Libyan health professionals abroad to contribute through telemedicine, short-term missions, and knowledge transfer
- **Objective:** Leverage diaspora expertise to bridge workforce gaps
- **Timeline:** Within 1 year
- **Measurable Outcome:** 50 diaspora health professionals engaged within 2 years

Summary
Lung cancer in Libya presents a significant public health challenge characterized by a consistent clinicopathological profile across multiple oncology centers. The disease demonstrates male predominance (89.1%), a mean age of 61.2 years, and adenocarcinoma as the predominant histological subtype (45.3%). The most critical finding is the exceptionally high rate of late-stage presentation, with 94.7% of patients diagnosed at Stage III or IV, rendering curative treatment impossible for the vast majority.

Pathological and molecular diagnostic capacity is severely limited, with comprehensive staging performed in only 7.6% of cases and molecular testing in less than 5% of cases. Treatment accessibility is constrained across all modalities: chemotherapy remains the primary treatment (78.4%), while radiotherapy is accessible to only 15.2% of patients who could benefit, and targeted therapies and immunotherapies are effectively unavailable through public healthcare facilities. Medication stock-outs affect chemotherapeutic agents in 47–62% of months, compromising treatment continuity. Human resource shortages are critical, with fewer than one medical oncologist per 100,000 population and severe shortages across all oncology specialties.

The consistent findings across four major oncology centers (Benghazi, Tripoli, Misrata, Zawia) representing different geographic regions suggest that these challenges are systemic and require national-level interventions. Geographic disparities in care access were identified, with services concentrated in major urban centers.

Urgent, coordinated, and sustained action is required at national and international levels to improve outcomes for lung cancer patients in Libya. Priority interventions include strengthening diagnostic infrastructure, establishing domestic molecular testing capacity, securing consistent medication availability, expanding the oncology workforce, implementing early detection programs, and enhancing radiotherapy services. Without such action, preventable deaths will continue to mount, and the burden of lung cancer in Libya will remain unacceptably high.

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