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MINISTRY OF HEALTH & PREVENTION

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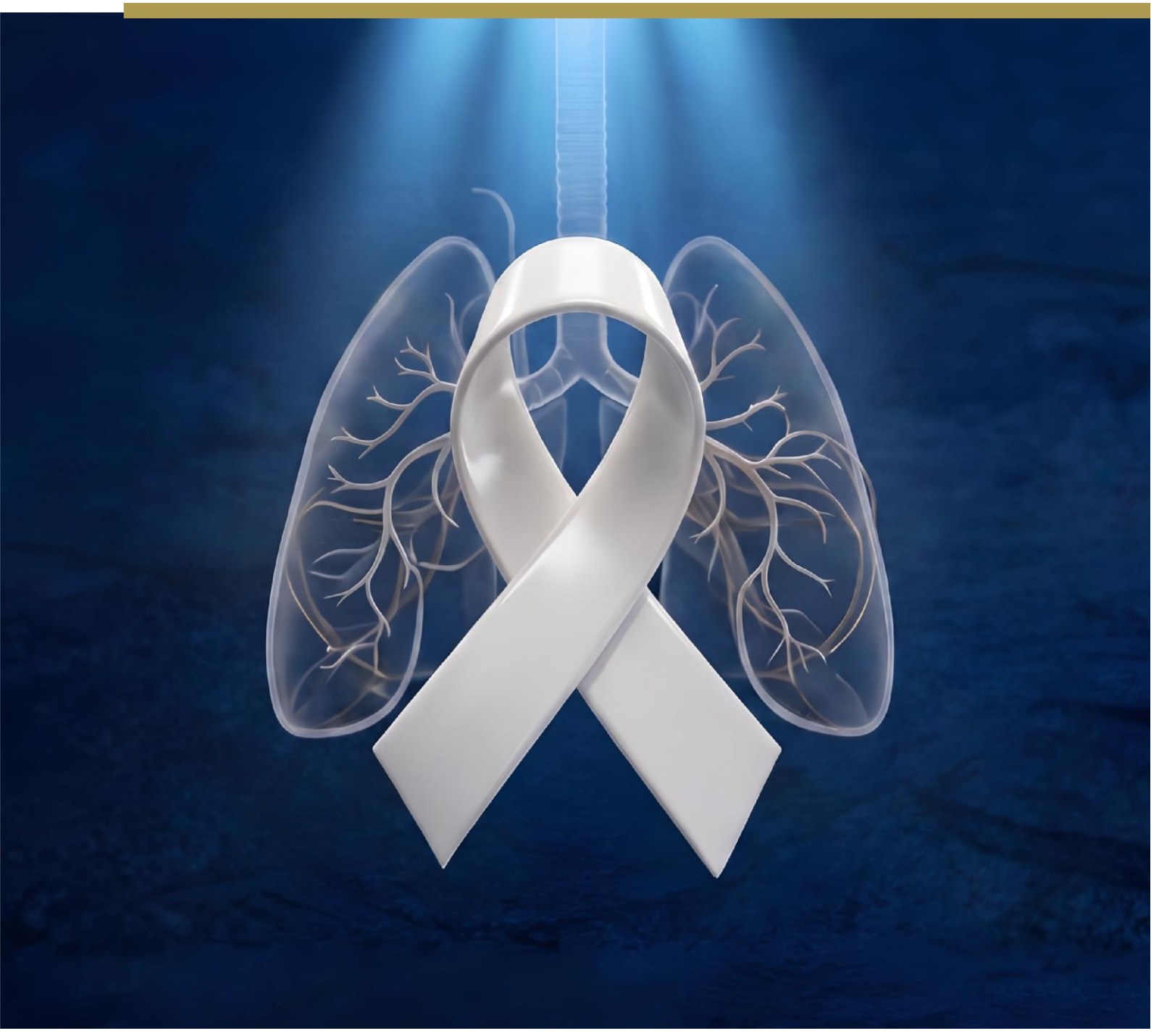
وزارة الصحة ووقاية المجتمع

THE UAE NATIONAL GUIDELINE FOR

LUNG CANCER
SCREENING AND DIAGNOSIS

1ST EDITION 2025



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ABBREVIATIONS & DEFINITIONS

Term	Full Form
Airway Nodules:	• Endotracheal or endobronchial abnormalities that are segmental or more proximal are classified as Lung-RADS 4A. • Subsegmental and/or multiple tubular endobronchial abnormalities favor an infectious or inflammatory process. • If no underlying obstructive soft tissue nodule is identified, these findings may be classified as: ◦ Lung RADS 0 (likely infectious or inflammatory; additional imaging recommended), or ◦ Lung RADS 2 (benign appearance or behavior). • The presence of air in segmental or more proximal airway abnormalities often Retained secretions; if no underlying soft tissue nodule is identified, these findings may be classified as Lung-RADS 2. • Segmental or more proximal airway nodules that persist on 3-month follow-up CT are upgraded to Lung-RADS 4B with management recommendation for further clinical evaluation (typically bronchoscopy).
Atypical Pulmonary Cysts:	• Thin-walled Cyst: Unilocular with uniform wall thickness < 2 mm. Thin-walled cysts are considered benign and are not classified or managed in Lung-RADS. • Thick-walled Cyst: Unilocular with uniform wall thickness, asymmetric wall thickening, or nodular wall thickening ≥ 2 mm (cystic component is the dominant feature); manage as an atypical pulmonary cyst. • Multilocular Cyst: Thick or thin-walled cyst with internal septations. Manage as an atypical pulmonary cyst. • Cavitary Nodule: Wall thickening is the dominant feature; manage as a solid nodule (total mean diameter). • Cyst with an Associated Nodule: Any cyst with adjacent internal (endophytic) or external (exophytic) nodule (solid, part-solid, or ground glass). Management is based upon Lung-RADS criteria for the most concerning feature. • Growth: > 1.5 mm increase in nodule size (mean diameter), wall thickness, and/or size of the cystic component (mean diameter) occurring within a 12-month interval. • Fluid-containing cysts may represent an infectious process and are not classified in Lung-RADS unless other concerning features are identified. • Multiple cysts may indicate an alternative diagnosis such as Langerhans cell histiocytosis (LCH) or lymphangioleiomyomatosis (LAM) and are not classified in Lung-RADS unless other concerning features are identified. [1]
Category 4B:	• Management is predicated on clinical evaluation (comorbidities), patient preference, and risk of malignancy. Radiologists are encouraged to use the McWilliams, et al Assessment Tool when making recommendations. [2]

Term	Full Form
Category 4X:	Category 3 or 4 nodules with additional imaging findings that increase the suspicion of lung cancer, such as spiculation, lymphadenopathy, frank metastatic disease, a GGN that doubles in size in 1 year, etc. 4X is a distinct Lung-RADS category; X should not be used as a modifier. [2]
Dokha	is a tobacco product, consisting of dried and ground tobacco leaves that have been flavored with herbs and spices. Its high nicotine content, which can be up to five times that of a normal cigarette. It's categorized into "cold" (light), "warm" (medium), and "hot" (strong) blends.
Exam Modifier:	An S modifier may be added to Lung-RADS categories 0-4 for clinically significant or potentially clinically significant findings unrelated to lung cancer. • Management should adhere to available ACR Incidental Findings management recommendations (3). The ACR Lung Cancer Screening CT Incidental Findings Quick Reference Guide summarizes common findings and management (4). • Findings that are already known and have been or are in the process of clinical evaluation DO NOT require an S-modifier. Any evidence of a concerning change in a known significant or potentially significant finding that is unexpected warrants renewed use of the S-modifier.
False-Positive Result:	Positive screening with a completed negative work-up or follow-up of at least 12 months with no diagnosis of lung cancer.
False-Positive Result:	Positive screening with a completed negative work-up or follow-up of at least 12 months with no diagnosis of lung cancer.
False-Negative Result:	Negative screening associated with diagnosis of lung cancer in less than 12 months of baseline examination.
Growth definition:	Growth is defined as either: An increase in mean nodule diameter of >1.5 mm, or A minimum increase of ≥25% in nodule volume, when volumetric assessment is used. **Note:** When volumetric software isn't an option, it's best to rely on diameter-based assessments. However, if you have both diameter and volume data at your disposal, you should prioritize volumetric growth assessments for Lung RADS categorization.
LDCT:	low dose chest CT; GGN: ground glass nodule
Lung-RADS Category:	Each exam should be coded 0-4 based on the nodule with the highest degree of suspicion.
Lung-RADS Management:	The timing of follow-up imaging is from the date of the exam being interpreted. For example, 12-month screening LDCT for Lung-RADS 2 is from the date of the current exam. Also note that management of 4A lesions follows a stepped approach based upon follow-up stability or decrease in size.

Term	Full Form
Lung Cancer Diagnosis:	Once a patient is diagnosed with lung cancer, further management (including additional imaging such as PET/Diagnostic CT) may be performed for purposes of lung cancer staging; this is no longer considered screening.
Multi-Disciplinary Team:	A team responsible for individualized and evidence-based management of candidates with positive lung cancer screening results. It consists of radiologists, pulmonologists, thoracic surgeons, oncologists, pathologists, family physicians and nurses.
Medwakh (the pipe):	An Arabian smoking pipe, often traditionally 6 inches long, but can vary in size. The bowl is notably smaller than that of traditional Western pipes because the tobacco is more concentrated, requiring only a small amount for each smoke.
Nodule Measurement:	To calculate the nodule's mean diameter, measure both the long and short axis to one decimal point in mm, and report mean nodule diameter to one decimal point. The long and short axis measurements may be in any plane to reflect the true size of the nodule.
Practice Audit Definitions:	A negative screen is defined as categories 1 and 2; a positive screen is defined as categories 3 and 4. A negative screen does not mean that an individual does not have lung cancer.
Prior Exams:	If waiting on prior exams (either a prior screening or diagnostic CT), the Lung-RADS 0 category is temporary until the comparison study is available and a new Lung-RADS category is assigned.
Size Thresholds:	Apply to nodules at first detection and that enlarge, reaching a higher size category. When a nodule crosses a new size threshold for other Lung-RADS categories, even if not meeting the definition of growth, the nodule should be reclassified based on size and managed accordingly.
Slow Growing Non-Solid (Ground Glass) Nodules:	A ground glass nodule (GGN) that demonstrates growth over multiple screening exams but does not meet the > 1.5 mm increase in size for any 12-month interval may be classified as a Lung-RADS 2 until the nodule meets finding criteria of another category, such as developing a solid component (then manage per part solid nodule criteria).
Slow Growing Solid or Part Solid Nodules:	A solid or part-solid nodule that demonstrates growth over multiple screening exams but does not meet the > 1.5 mm threshold increase in size for any 12-month interval is suspicious and may be classified as a Lung- RADS 4B. Slow growing nodules may not have increased metabolic activity on PET/CT; therefore, biopsy, if feasible, or surgical evaluation may be the most appropriate management recommendation. Monitor for transformation to part-solid; consider biopsy if >30 mm persistent.

Term	Full Form
Suspected Infectious or Inflammatory Findings:	• lung-RADS 0 with 1–3-month follow-up LDCT may be recommended for pulmonary findings suggesting an indeterminate infectious or inflammatory process. Such findings may include segmental or lobar consolidation, multiple new nodules (more than six), large solid nodules (≥ 8 mm) appearing in a short interval, and new nodules in certain clinical contexts (e.g. immunocompromised patient). At 1–3-month follow-up, a new Lung-RADS classification and management recommendation should be provided based on the most suspicious nodule. • New solid or part solid nodules with imaging features more concerning for malignancy than an infectious or inflammatory process meeting Lung-RADS 4B size criteria may be classified as such with appropriate diagnostic and/or clinical evaluation. • Some findings indicatives of an infectious or infectious process may not warrant short-term follow-up (e.g. tree-in-bud nodules or new < 3 cm ground glass nodules). These nodules may be evaluated using existing size criteria with a Lung-RADS classification and management recommendation based on the most suspicious finding.
Shisha:	Also known as hookah, narghile, or waterpipe is a method of inhaling flavored tobacco smoke that has been passed through a water basin. Tobacco, typically mixed with molasses and flavorings, is heated by charcoal, creating smoke that passes through a water bowl, down a hose, and into the mouth.



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EXECUTIVE SUMMARY:

Lung cancer continues to be one of the top causes of cancer-related deaths around the globe, and it presents an increasing public health challenge in the United Arab Emirates (UAE). While the national incidence rate is lower compared to many high-income countries, a significant number of lung cancer cases in the UAE are still diagnosed at advanced stages, leading to less favorable survival rates. Research shows that implementing structured low-dose computed tomography (LDCT) screening for carefully chosen high-risk individuals can facilitate earlier detection, lower lung cancer-specific mortality rates, and enhance overall outcomes, especially when paired with effective tobacco cessation programs and comprehensive care from multidisciplinary teams. This guideline aims to create a national, standardized approach for lung cancer screening, reporting, diagnostic evaluation, and follow-up in the UAE. It aligns with internationally recognized evidence-based standards, particularly the ACR Lung-RADS® v2022 system, while also considering the unique epidemiology, population demographics, and healthcare delivery systems specific to the UAE.

Screening Eligibility

Lung cancer screening with LDCT is recommended for adults who don't have symptoms but are at a higher risk of developing lung cancer, as long as they meet the eligibility criteria outlined in this guideline. Here are the core eligibility criteria:

- Adults aged between 50 and 80 years
- A smoking history of at least 20 pack-years
- Current smokers or those who have quit within the last 15 years

We may also consider additional factors for individuals who have:

- Significant exposure to certain occupational or environmental hazards (like asbestos or radon)
- Chronic lung conditions such as COPD or pulmonary fibrosis
- A strong family history of lung cancer

It's important to note that routine screening for non-smokers is not recommended. Screening for never-smokers or those who
have previously undergone lung cancer treatment might be considered, but only on a case-by-case basis after a thorough review by a multidisciplinary team (MDT). This should include documentation of shared decision-making and an assessment of the individual's suitability for curative treatment.

Screening should be stopped when:

- The person turns 81 years old
- The individual has not smoked for more than 15 years
- Life expectancy is less than 10 years, or the person is either unwilling or unfit for curative treatment.

Reporting and Key Lung-RADS Thresholds

When it comes to reporting and understanding Key Lung RADS Thresholds, all screening LDCT exams need to be interpreted and reported using the ACR Lung RADS® assessment categories. This ensures that we have a consistent approach to classification and management recommendations.
Here are some key principles to keep in mind:

- Classification hinges on identifying the most suspicious nodule.
- Nodule size should be reported as the mean diameter in millimeters, and if possible, volumetric assessments should be included.
- Growth is defined in two ways:
  - *A more than 1.5 mm increase in mean diameter, or*
  - *A 25% or greater increase in volume when using volumetric software.*

Now, let's highlight some important categories:

- Lung RADS 1–2 (Negative/Benign): This calls for annual LDCT screening.
- Lung RADS 3 (Probably benign): Here, a short-interval follow-up LDCT is recommended.
- Lung RADS 4A–4B (Suspicious/Very suspicious): This requires a diagnostic evaluation, a review by a multidisciplinary team, and possibly a PET/CT scan, biopsy, or surgical assessment.
- Lung RADS 4X: This category indicates additional concerning features that need quick evaluation.
- Category S modifier: This is used for significant non-lung cancer findings.

For slow-growing nodules, atypical pulmonary cysts, airway nodules, and suspected infectious or inflammatory findings, management follows specific criteria outlined in this guideline. Decisions on escalation are based on persistence, growth, and risk features.

Management Timelines and Follow Up

Timely communication, diagnostic assessment, and management are essential to the effectiveness of a lung cancer screening program. This guideline establishes standardized national timelines to minimize delays and ensure quality of care.

Key Performance Indicators (KPI Targets)

For screening programs to participate, they need to meet and regularly audit the following essential performance targets:

- Communicating screening LDCT results to individuals: ≤ 15 working days
- Referring patients for diagnostic lung assessments when abnormal LDCT findings are present: ≤ 15 working days from the report
- The time from a positive screening result (Lung-RADS 4) to a definitive management decision: ≤ 31 days in at least 95% of cases
- Compliance with these timelines: Audited annually at both facility and program levels

These indicators serve as vital benchmarks for program accreditation, ensuring quality assurance and fostering continuous improvement.

Multidisciplinary Team (MDT) Requirements

Taking a multidisciplinary team approach is key to ensuring safe and effective lung cancer screening and diagnosis. An MDT review is essential for:

- All Lung-RADS 4A, 4B, and 4X screening results
- Persistent or complex nodules (like airway nodules or atypical cysts)
- Eligibility exceptions (such as never-smokers or those who have survived prior lung cancer)
- Decisions about invasive diagnostics or treatments aimed at curing the disease
- At the very least, the MDT should consist of:
- Radiologists who specialize in thoracic imaging
- Pulmonologists
- Thoracic surgeons
- Medical and/or radiation oncologists
- Pathologists
- Representatives from nursing or care coordination

It's crucial that MDT decisions are well-documented, clearly communicated to both patients and referring physicians, and incorporated into personalized care plans.

WORD FROM THE ASSISTANT UNDERSECRETARY OF PUBLIC HEALTH

Lung cancer is one of the leading causes of cancer-related mortalities worldwide. It is expected that the incidence of lung cancer will significantly increase in the next decade.

Given the recognized risk factors for lung cancer, such as smoking and air pollution continue to contribute to this growing burden, However, preventative measures such as tobacco control and environmental interventions—can play a critical role in reducing the incidence and improving outcomes. Additionally, earlier detection of lung cancer is essential for decreasing mortality and improving survival rates.

In the United Arab Emirates (UAE), lung cancer is not as common as in other parts of the world. However, the incidence of lung cancer is increasing, and most cases are diagnosed at late stages.

Smoking patterns and the unique young population of the UAE could lead to an increasing number of lung cancer in the coming years.

The UAE government has made tremendous commitments to reducing the health burden of smoking-associated disease through legislation. Tobacco control is one of the most important priorities for health authorities in the UAE.

The UAE introduced an excise tax at a rate of 72% on tobacco products in 2017 and regulations for electronic nicotine products in 2019 to curb smoking, combat diseases, and prevent the spread of electronic cigarettes and analog products in the markets and outlets in the country [5].

According to the National Health Survey 2018, the prevalence of tobacco use has been reduced from 11% in 2010 to 9% in 2018.

The UAE aims to improve air quality by setting national pollution standards, promoting clean energy and green economy initiatives, enhancing sustainable transport, and leveraging smart technologies for effective air quality monitoring.

The UAE and the 2031 Agenda for Sustainable Development, which underpins the national sustainable development pillars, recognize the importance of prevention and “seek to reduce cancer and lifestyle-related diseases in order to ensure longer, healthier lives for citizens and residents” [6].

Two of the national key performance indicators are the prevalence of smoking and the rate of deaths from cancer. This underlines the commitment of the UAE to reducing cancer mortality and increase quality of life by promoting preventative measures, technology-driven approach.

This guideline aims to review the current state of lung cancer within the UAE, highlight opportunities for early detection, and recommend evidence-based strategies to reduce both the incidence and mortality of lung cancer. Through continued collaboration, policy implementation, and public health innovation, we strive to protect and enhance the well-being of all citizens and non-citizens

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WORD FROM THE HEAD OF THE NONCOMMUNICABLE DISEASE AND MENTAL HEALTH SECTION

Global:

- Lung cancer is the most common cancer type and the most common cause of cancer death in the world. The enormous burden of lung cancer obscures the fact that most cases are avoidable. According to WHO the principal risk factor for developing lung cancer remains tobacco smoking, which is responsible for approximately 85% of all cases, Other common causes include exposure to contaminants such as second-hand tobacco smoke, outdoor and indoor air pollution.
- Lung cancer is the leading cause of cancer-related deaths worldwide, accounting for the highest mortality rates among both men and women. Smoking is the leading cause of lung cancer, responsible for approximately 85% of all cases. [7]
- In 2022, 20 million patients were diagnosed with cancer, and there were 9.7 million deaths, according to WHO. A total of 53.5 million patients were alive 5 years following a cancer diagnosis. Additionally, 1 in 5 people will develop cancer, including 1 in 9 men and 1 in 12 women dying from cancer. [7]
- By 2050, 35 million cancer diagnoses are expected, which is a 77% increase from 20 million in 2022. The increase in cancer burden is occurring from increased risk factors such as socioeconomic development, tobacco, alcohol use, and obesity. [8]

Gulf:

In the Arab Gulf Cooperation Council (GCC) countries, which include Bahrain, Kuwait, Qatar, Saudi Arabia, Oman, and the

UAE, the incidence of lung cancer is significantly lower than in Europe, North America, and some Asian countries.

Lung cancer was identified as the seventh most common cancer among men and women in the GCC, with an average number of 505 cases annually, which accounts for 4.6% of total cancer cases each year [9]

National:

- In the United Arab Emirates, cancer is considered the third leading cause of death among noncommunicable diseases after cardiovascular diseases and injuries, as cancer caused 12.4% of the total deaths in 2023. [10] (Fig 2)
- An estimated age-standardized cancer mortality rate of 30.37 deaths per 100,000 for both genders, 34.8 deaths per 100,000 females and 28.6 deaths per 100,000 males, 2023.[10]

- Lung cancer ranked eighth among females and males. There were 230 lung cancer cases accounting to 3.2 % from all Newly diagnosed invasive cancer cases in 2023. Lung cancer affected 1.7% females and 5.1% males. [10] (Table 1) It is a generally poor prognosis, with an overall 5-year survival rate of 20.5%, since about 80% of lung cancer is diagnosed at an advanced stage where there are fewer treatment options available with 5-year survival rate being 0% to 10% for patients with stage IV. However, early-stage lung cancer has a better prognosis and is more amenable to treatment. It is important to detect lung cancer at an early stage to offer effective treatment options.
- Comprehensive primary prevention strategies—including the implementation of robust tobacco control policies and the mitigation of environmental risk exposures—are essential in reducing the incidence of lung cancer and associated mortality.
- This guideline aims to support healthcare professionals in the early detection of lung cancer, thereby facilitating prompt and evidence-based interventions to improve patient outcomes and overall disease management.

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INTRODUCTION:

01 UAE Cancer Registry

National Cancer Registry systematically collects, stores, summarizes, analyses, and distributes information about cancer patients who are newly diagnosed in UAE. It provides information on cancer patterns and trends over time as well as monitors cancer incidence in UAE.

The Cancer Registry is a part of the National Diseases Registry, and it comes under the auspices of the Statistics and Research Center.

UAE National Cancer Registry will produce a report about the cancer incidence on an annual basis, and as incidence data are accumulated over the years, the registry will eventually be able to produce certain trends which would help in studying the distribution of such conditions in different regions of the country.

In the cancer report (table 1,2,3), we have used the UAE Resident Population for 2023 as estimated by Federal Competitiveness and Statistics Centre (FCSC) to compute the crude and age standardized incidence rates, and mortality rates to describe various indicators where 'rates' were calculated.

02 Cancer incidence rate:

The 10th Annual Report for 2023, present the data on newly diagnosed cancer cases among both Emirati and Non-Emirati populations within the UAE. This report includes both malignant and in-situ cancers, as these are the cancer behaviours that are reportable to the UAE National Cancer Registry (UAE-NCR).

It is important to note that benign and borderline malignancies are not reportable in the UAE-NCR for the year 2023.

This distinction ensures that the registry focuses on cancers with the potential for malignancy, which are more relevant for epidemiological monitoring, treatment strategies, and public health interventions. (Table 2, 3)

03 Top malignant primary sites among all UAE population, 2021 -2023

Table 1: present the data on newly diagnosed cancer cases among both Emirati and Non-Emirati populations within the UAE. This Table includes both malignant and in-situ cancers, as these are the cancer behaviour that are reportable to the UAE National Cancer Registry (UAE-NCR). It is important to note that benign and borderline malignancies are not reportable in the UAE-NCR for the year 2023. This distinction ensures that the registry focuses on cancers with the potential for malignancy, which are more relevant for epidemiological monitoring, treatment strategies, and public health interventions.

Table 1: Top 10 malignant primary sites among all UAE population,2021, 2023. [11]

Primary site ICD-10	2021 (%)	Primary site ICD-10	2023 (%)
C50 Breast	20.3%	C50 Breast	20.5%
C73 Thyroid	10.6%	C73 Thyroid	11.2%
C18-C21 Colorectal	9.5%	C18-C21 Colorectal	8.3%
C91-C95 Leukemia	5.4%	C44 Skin (Carcinoma)	4.7%
C44 Skin (Carcinoma)	4.9%	C61 Prostate	4.6%
C61 Prostate	4.5%	C82-C86, C88 and C96 non-Hodgkin lymphoma	4.6%
C34 Bronchus and Lung	4.1%	C91-C95 Leukemia	4.6%
C82-C85, C96 non-Hodgkin lymphoma	4.1%	C34 Bronchus and Lung	3.2%
C54-C55 Uterus	3.1%	C54-C55 Uterus	3.0%
C00-C14 Lip, Oral cavity & pharynx	2.7%	C00-C14 Lip, Oral cavity & pharynx	2.8%

• Between January and December 2023, the total number of breast cancer cases reported to the UAE National Cancer Registry among UAE population was 1456, representing 20.5% of all malignant cases

• Between January and December 2021, the total number of breast cancer cases reported to the UAE National Cancer Registry among UAE population was 1139, representing 20.3% of all Invasive cancer cases (malignant)

Table 2: Top 10 malignant primary sites among females, 2021, 2023: Breast cancer and Thyroid cancer in females have shown the fastest increase in incidence over the past decade across UAE. The incidence of colorectal cancer in females has been observed to decreased markedly in 2023. [11]

2021		2023	
Primary site ICD-10	(%)	Primary site ICD-10	(%)
C50 Breast	36.9%	C50 Breast	36.6%
C73 Thyroid	13.8%	C73 Thyroid	14.4%
C18-C21 Colorectal	7.0%	C18-C21 Colorectal	5.7%
C54-C55 Uterus	5.7%	C54-C55 Uterus	5.4%
C53 Cervix uteri	4.6%	C53 Cervix uteri	3.7%
C44 Skin (Carcinoma)	3.6%	C44 Skin (Carcinoma)	3.4%
C56 Ovary	3.5%	C82-C86, C88 and C96 non-Hodgkin lymphoma	3.2%
C91-C95 Leukemia	3.1%	C56 Ovary	3.2%
C82-C85, C96 non-Hodgkin lymphoma	2.8%	C91-C95 Leukemia	2.8%
C34 Bronchus and Lung	2.3%	C34 Bronchus and Lung	1.7%

Table 3: Top 10 malignant primary sites among males 2021, 2023. [11]

2021		2023	
Primary site ICD-10	**(%)**	**Primary site ICD-10**	**(%)**
C18-C21 Colorectal	12.5%	C18-C21 Colorectal	11.5%
C61 Prostate	9.8%	C61 Prostate	10.3%
C91-C95 Leukemia	8.2%	C73 Thyroid	7.2%
C73 Thyroid	6.8%	C91-C95 Leukemia	6.8%
C44 Skin (Carcinoma)	6.4%	C44 Skin (Carcinoma)	6.3%
C34 Bronchus and Lung	6.3%	C82-C86, C88 and C96 non-Hodgkin lymphoma	6.3%
C82-C85, C96 non-Hodgkin lymphoma	5.6%	C34 Bronchus and Lung	5.1%
C00-C14 Lip, Oral cavity & pharynx	4.6%	C00-C14 Lip, Oral cavity & pharynx	4.6%
C64-C65 Kidney & Renal pelvis	4.2%	C64-C65 Kidney & Renal pelvis	4.5%
C67 Urinary bladder	4.0%	C16 Stomach	3.3%

MORTALITY ACCORDING TO THE PRIMARY SITE:

Tabe 4: Colon cancer was the leading cause of cancer deaths in 2021, with an estimated average of 112 colon cancer deaths which are representing 11.49% of all cancer deaths, 5.85% of cancer deaths in men and 5.64% in women. Lung cancer was the second most common cause of cancer death in both sexes, with an estimated average of 96 (9.85%) deaths, 6.87% of cancer deaths in males and 2.97% of cancer deaths in females. Breast cancer was the third common cause of Cancer death, with an estimated average of 94 (9.64%) deaths, 9.54% of cancer deaths in females.

Leukemia was the fourth common cause of cancer death, with an estimated average of 48 (4.92%) deaths, 1.74% of cancer deaths in females and 3.18% in males. Stomach cancer was the fifth common cause of cancer death, with an estimated average of 42 (4.31%) deaths, 1.23% of cancer deaths in females and 3.08% in males. Cervix Uteri and Rectum cancer was the 6th common cause of cancer death, with an estimated average of 13 (1.33%) deaths.

Table 4: Distribution of malignant cancer deaths by type of cancer in UAE, 2021. [12]

Underlying cause of death	Female	Male	Total	(%)
C18 - C21 Malignant Neoplasm of Colorectal	55	57	112	11.4%
C33 - C34 Malignant Neoplasm of Trachea, bronchus & Lung	29	67	96	9.85%
C50 - C50 Malignant Neoplasm of Breast	93	1	94	9.64%
C91 - C95 Leukemia	17	31	48	4.92%
C16 - C16 Malignant Neoplasm of Stomach	12	30	42	4.31%
C53 Malignant Neoplasm of Cervix Uteri	13	0	13	1.33%
C18-C21 Malignant Neoplasm of Rectum	7	6	13	1.33%

Tabe 5: showing the number of deaths in 2023 and their corresponding percentages for each cancer type. Colorectal cancer is the leading cause of cancer-related death, accounting for 10.6% of all cancer deaths in the UAE. A total of 152 deaths were reported, with 65 females and 87 males. This indicates a higher number of deaths among males compared to females. Breast cancer follows as the second most common cause of cancer death, contributing to 10.0% of total cancer-related deaths.

There were 143 deaths, with 142 females and only 1 male. Lung cancer is the third most common cause, with 127 deaths (representing 8.9% of the total). Of these, 31 were females and 96 were males, suggesting a higher incidence of lung cancer deaths in males.

Pancreatic cancer caused 98 deaths (representing 6.8% of all cancer deaths), with 44 females and 54 males.

This indicates a relatively higher mortality in males. Stomach cancer resulted in 72 deaths (5.0% of the total), with 34 females and 38 males. The number of deaths is fairly balanced between genders, though slightly more common in males.

Leukemia contributed to 71 deaths (5.0% of total cancer deaths), with 27 females and 44 males, again showing a higher mortality in males. Cervical cancer caused 20 deaths (1.4% of the total), and all deaths occurred in females, as this cancer affects only women.

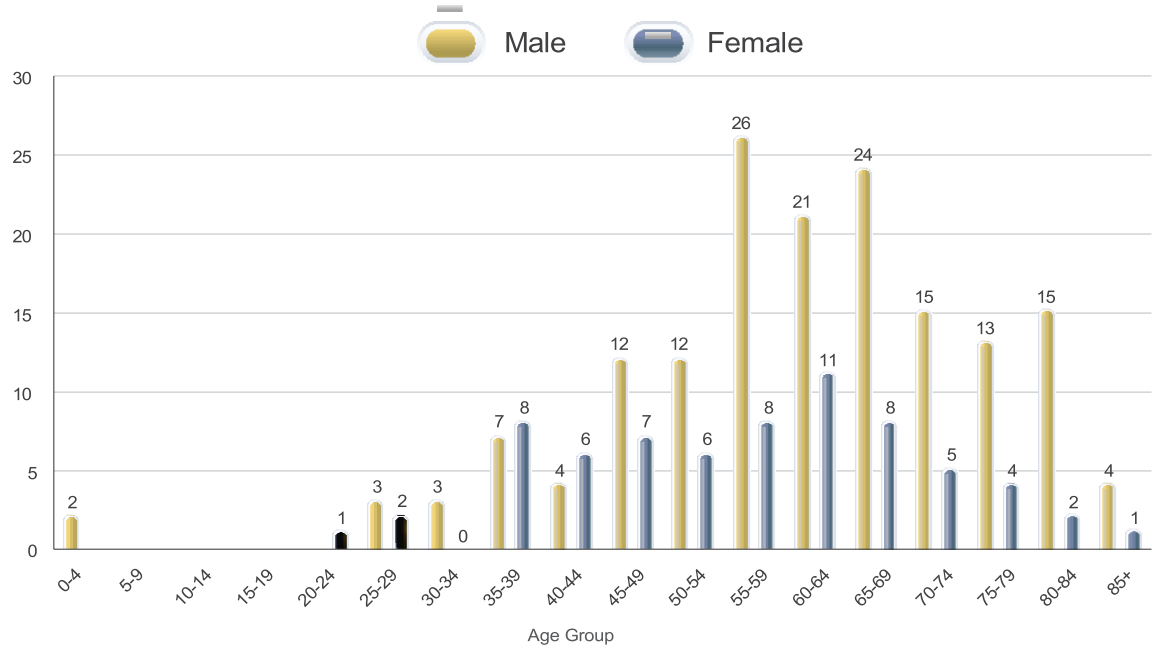
Table 5: Distribution of malignant cancer deaths by type of cancer in UAE, 2023. [13]

Underlying cause of death	Female	Male	Total	(%)
C18 - C21 Malignant Neoplasm of Colorectal	65	87	152	10.6%
C50 - C50 Malignant Neoplasm of Breast	142	1	143	10.0%
C33 - C34 Malignant Neoplasm of Trachea, bronchus & Lung	31	96	127	8.9%
C25 Pancreas	44	54	98	6.8%
C16 - C16 Malignant Neoplasm of Stomach	34	38	72	5.0%
C91 - C95 Leukemia	27	44	71	5.0%
C53 Malignant Neoplasm of Cervix Uteri	20	0	20	1.4%

BRONCHUS & LUNG CANCER INCIDENCE IN UAE – 2023

The distribution of bronchus and lung cancer cases and their ASIR in the UAE for the year 2023. Understanding the patterns of incidence across different age groups and genders are essential to support public health planning, early detection efforts, and targeted interventions for lung cancer control within the UAE.
Detailed insights presented in the accompanying figures below.

Figure 3: summarizes the distribution of bronchus and lung cancer cases by age group and gender in the UAE for the year 2023. [14]



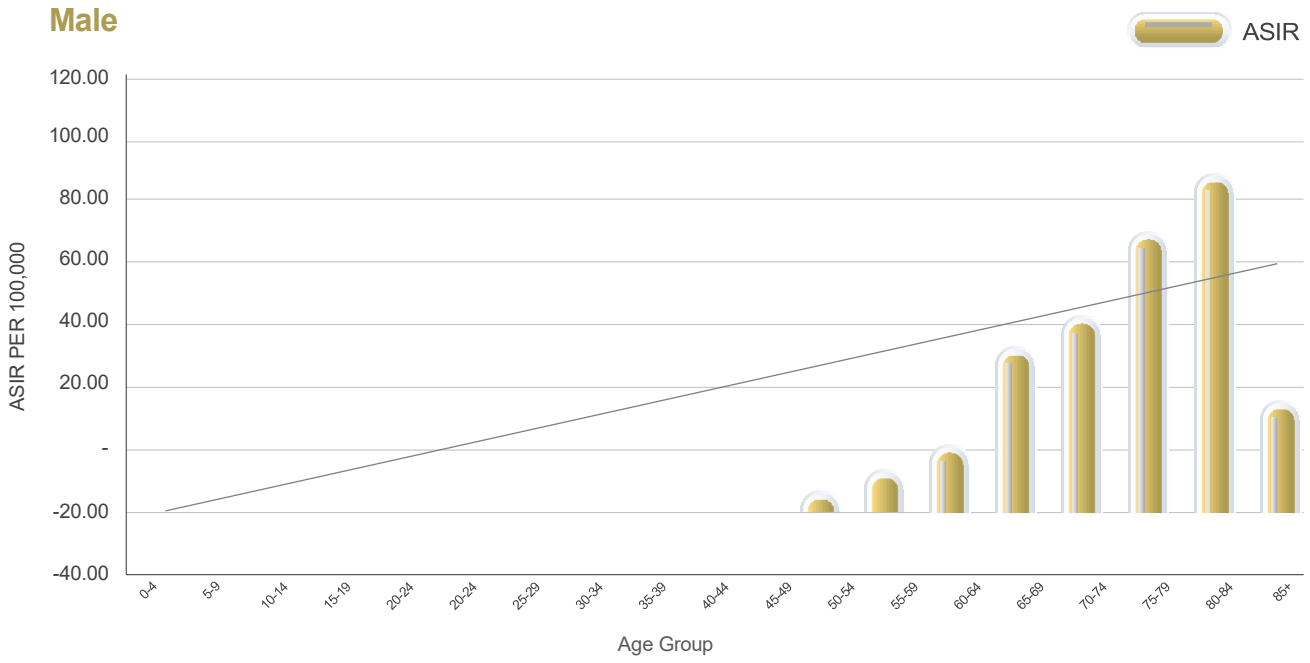
AGE DISTRIBUTION:

Lung cancer cases among males increase progressively with age, peaking notably in the 55-59 age group (26 cases), followed closely by the 65-69 (24 cases) and 60-64 (21 cases) age groups. After this peak, there is a gradual decline in cases among the older age groups.

GENDER DIFFERENCES:

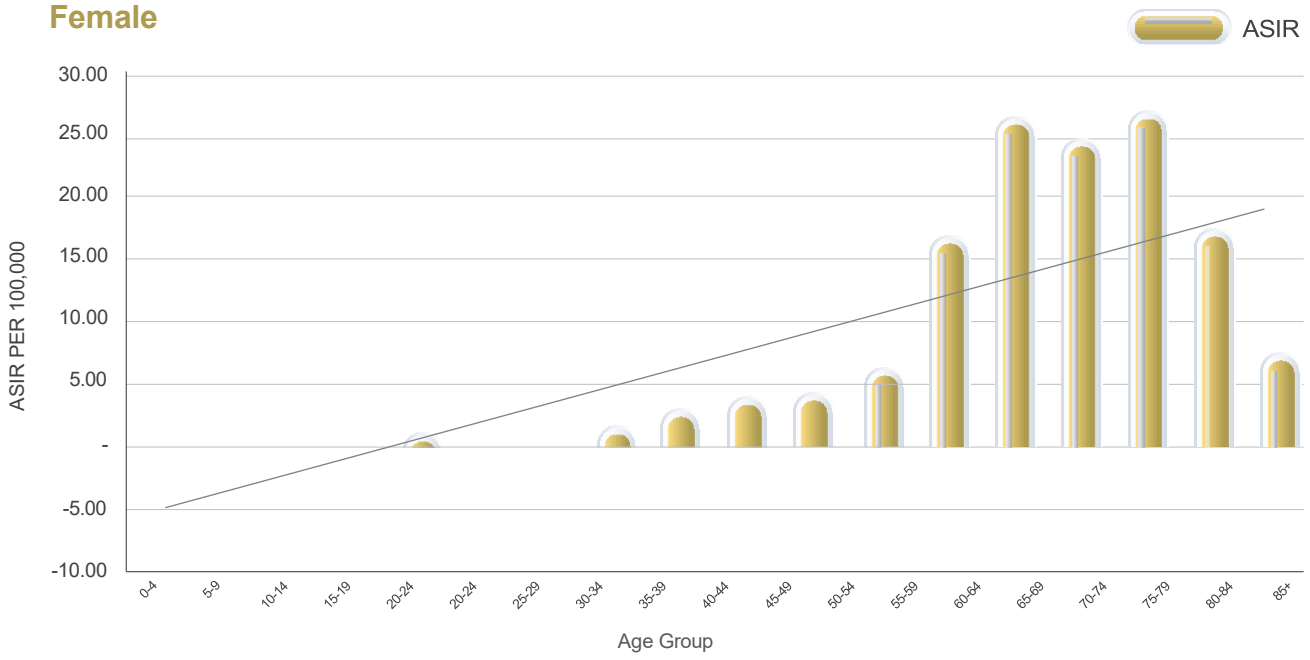
There is a clear predominance of lung cancer cases in males (161 cases) compared to females (69 cases). This aligns with global patterns, likely reflecting higher exposure to risk factors such as smoking and occupational hazards among males.

Figure 4: Distribution of ASIR for female bronchus and lung cancer cases in the UAE for the year 2023. [15]



The ASIR for male bronchus and lung cancer in the UAE demonstrate a clear, progressive increase starting from middle age, with minimal incidence before age 45.
The rates rise sharply from age 55 onward, peaking in the 80-84 age group and then declining slightly in the 85+ group.
The ASIR data clearly indicate that lung cancer screening in the UAE should focus on middle-aged to elderly males with established risk factors. This targeted approach promises to improve early detection rates and reduce mortality in the UAE. Integrating these efforts with prevention and awareness programs is essential for effective lung cancer control.

Figure 5: Distribution of ASIR for female bronchus and lung cancer cases in the UAE for the year 2023. [16]



Although lung cancer incidence in females is lower than in males, the data show a marked increase in risk from middle age onwards. Implementing targeted screening for females with significant risk factors can improve early detection and reduce mortality. Integrating these efforts with prevention and awareness programs are essential for effective lung cancer control.

PURPOSE:

1.1 To set out the best Clinical Care Standards and frequency for lung cancer screening as per international evidence-based guidelines.

1.2 To set out the case definition, eligibility criteria and data reporting requirement for lung cancer screening.

1.3 To ensure the population receives quality and safe care and timely referral for diagnosis and/or treatment where appropriate.

SCOPE:

This guideline applies to all healthcare providers (facilities and professionals) in the United Arab Emirates, participating in lung cancer screening program, assessment and diagnosis services.

DEFINITIONS:

1: Lung Cancer Screening: means the process for the early detection of lung cancer. It includes recruitment of individuals at a high risk of developing lung cancer, counselling of these individuals and then performing a low dose computed tomography scan screening followed by a discussion by a privileged healthcare professional.

1.1 Lung Cancer Screening services.

1.2 Lung Cancer assessment and follow up.

2: LDCT Scan: A procedure that uses low-dose computer tomography (LDCT) radiation to make a series of very detailed pictures of areas inside the body in a spiral path. The procedure is also called a low-dose helical CT scan.

3: Case Mix: Refer to all includes males and females aged 50-80 years determined eligible for lung cancer screening services, in accordance with the criteria detailed in this guideline.

4: Have a 20 pack-year smoking history and currently smoke or have quit within the past 15 years. (See below for definition of pack-year.)
4.1. Pack-Year: A way to measure the amount a candidate has smoked over a specific period.

4.2. Is a way of calculating how much a person has smoked in their lifetime. One pack-year is the equivalent of smoking an average of 20 cigarettes—1 pack—per day for a year.

5: People with a history of lung cancer. If you were treated for lung cancer more than five years ago, you may consider lung cancer screening.

6: People with other risk factors for lung cancer. People who have other risk factors for lung cancer may include those with chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, family history of lung cancer, radon exposure and occupational exposure of silica, cadmium, asbestos, arsenic, beryllium, chromium, diesel fumes, and nickel

INCLUSION / EXCLUSION CRITERIA FOR LUNG CANCER SCREENING:

Inclusion criteria:

4.1.1 : Aged 50 -80 years with:

- 20 Pack-year history of smoking, and/or tobacco cessation <15 years.
- 20 Pack-year history of tobacco use, and/or tobacco cessation <15 years and one additional risk factor.
- 20 Year history of tobacco product used such as cigarette, water pipe (shisha) and/or dokha, medwakh, E cigarette and/or all other forms of smoked tobacco use

4.1.2 : Recruitment-

- Eligible candidates for lung cancer screening might be recruited through one of the following:
- Opportunistic recruitment.
- Smoking cessation clinic
- Online subscription: booking a screening appointment in specific healthcare facilities licensed to provide lung cancer screening.

Exclusion Criteria:

- Metallic implants or devices in the chest or back, such as pacemakers or Harrington fixation rods.
- Personal history of lung cancer.
- Requirement for home oxygen supplementation.
- Unexplained weight loss of more than 5% of body weight within 6 to 12 months prior to eligibility assessment. [18-19]
- Pneumonia or acute respiratory infection treated with antibiotics in the last 12 weeks.
- Chest CT examination in the 12 months prior to eligibility assessment.
- Patients deemed unfit for curative surgery due to comorbidities (e.g., severe COPD, assessed via multidisciplinary review
- patients who are symptomatic with signs and symptoms suggestive of lung cancer - need diagnostic testing and will not go with screening test

LUNG CANCER SCREENING

1. Lung cancer screening Center should follow the national Lung Cancer Screening Pathway:
Physician in lung cancer screening facility should obtain and document Informed consent from eligible candidate to participate in lung cancer screening program.

2. All eligible candidates:

- Enrolled in a screening program should receive smoking cessation interventions.
- Must be provided with (oral and written) education and information regarding benefits, risk and limitations of lung cancer screening, about the screening test, the incidental findings and associated procedures and expected time frames to receive results.
- Adequate attention must be given to the level of literacy, diversity, and linguistic requirements of different populations.

3. In case of negative results, the candidate should:

3.1. Have the next lung cancer screening appointment scheduled as per the screening criteria. (fig 1)
3.2. Be encouraged to continue following up with the tobacco cessation clinic/Center.

4. In case of positive results:

4.1. The screening results should be assessed and discussed by a multi-disciplinary team prior to referral of the candidate to a treatment facility. (Refer to appendix 4) for the roles and responsibilities of the multidisciplinary team
4.2. The candidate must be referred to a treatment facility for further diagnostic testing and confirmation

PAYMENT FOR SCREENING AND FOLLOW UP OF LUNG CANCER

Eligibility for reimbursement under the Health Insurance Scheme must be in accordance with local insurance laws for each Emirate.

CLINICAL SERVICES SPECIFICATIONS

All licensed healthcare facilities providing lung cancer screening services must:

1. Follow The national lung cancer screening guideline developed in 2025 which is established based on evidence-based best practices recommended by national cancer committee. (according to references)
2. Adhere lung cancer screening and diagnosis care pathways (per Figure1)
3. Written orders for lung cancer LDCT screenings must be appropriately documented in the beneficiary's medical record, and must contain the following information:
    - Date of birth.
    - Current smoking status, and for former smokers, the number of years since quitting smoking.
    - Actual pack–year smoking history (number).
    - A statement that the beneficiary is asymptomatic (no signs or symptoms of lung cancer).
4. Adhere to the timeline's performance for referral in accordance. (Figure 1)
5. The timing of screening appointments for adults seeking the service is not delayed beyond 15 working days
6. Refer adults with screen detected abnormalities for further lung assessment or treatment.

All health care providers Participating in lung Cancer Screening & Diagnosis Must:

1. Have knowledge of the principles of lung cancer screening, assessment, and diagnosis.
2. Physicians must conduct lung cancer risk assessments. Detailed history, such as that described in (Figure 1), must be evaluated and completed, each time an adult's visits for screening. The purpose of this is to identify risk status, as per risk categories specified in (Appendix 3) and referral to appropriate screening tests.
3. Participate in continuing medical education and take part in any recognized external quality assessment schemes concerning radiologists and technologists; to allocate At least 20 CME hours annually on CT imaging, with 40% focused on lung screening
4. Inform all individuals of the procedures and expect the time frame to be screened and to receive results.
5. Follow up and timely referral of adults with abnormal results to further assessment or treatment.
6. Ensure that the outcome of screening for lung cancer is reviewed by a multi-disciplinary team involving a full range of specially trained professionals including a radiologist, surgeon, nurse counselor and medical oncologist/radiotherapist the expected time frame

Tobacco cessation counselling and intervention

1. Screening should not be viewed as an alternative to tobacco cessation: Candidates currently using tobacco should be informed of their continuing risk of developing lung cancer.
2. Candidates currently using tobacco that are willing to participate in lung cancer screening should receive tobacco cessation
intervention parallel with lung cancer screening.
3. Healthcare providers should increase attention to all forms of tobacco use including shisha, medwakh, cigarettes, E-cigarettes, vape and others.

LDCT requirements

1. Only Licensed radiologic technologists under radiologist supervision are allowed to perform LDCT Scan with Specify dose (<1 mSv) and Annual calibration per IAEA standards.
2. Where delays are likely to occur due to limited availability of same sex licensed professionals at the employing facility, or where there are no female technologists, that the provider communicates this to the patient and refers/recommends that the patient seeks screening services from another provider
3. Establish and maintain a record of LDCT outcomes, audit program to follow up positive LDCT assessments and with the interpreting physician's notes.
4. Adults with abnormal LDCT Scan, who require further assessment and diagnosis must be recalled/referred to Diagnostic lung Assessment within 15 working days of screening LDCT.
5. Early recall rate must be recorded, monitored and audited
   - 5.1 : Assessment and diagnostic work up of screen detected abnormality is best achieved using the assessment tools:
     - 5.1.1 : Imaging; usually diagnostic CT scan, PET scan and fitness assessment
     - 5.1.2 : Clinical examination
     - 5.1.3 : Cytology and histopathology
6. Results of assessments must be evaluated and considered by a multidisciplinary team (MDT). Particular attention must be given to addressing radiology-pathology correlation.

Artificial intelligence (AI) and lung cancer screening program [16-17]

Artificial intelligence (AI) can play a key role in screening program

- Artificial intelligence (AI) has the potential to significantly enhance lung cancer screening programs. However, it's crucial that any AI systems used in this context are thoroughly validated, receive approval from the appropriate regulatory bodies, and are implemented in line with the governance policies of the institution.
- AI outputs should serve as supportive tools for decision-making and should never replace the expertise of a radiologist.
- The ultimate responsibility for interpreting images and classifying them according to Lung RADS lies with the reporting radiologist.
- Additionally, any AI-assisted findings that play a significant role in clinical decision-making should be clearly documented in the radiology report.

▪ It may have a role in each process of the lung cancer screening workflow

In screening program, the radiologists will have a high workload using CT techniques to evaluate, characterize, and detect lung nodules

AI could help radiologists to reduce the amount of work and increase the sensitivity of screening keeping false positive rates low

The deep learning reconstruction (DLR) is a new reconstruction method that improves the accuracy of measuring lung nodule sizes in low-dose CT scans and to reduce radiation exposure

computer-aided diagnostic (CAD) systems reduce observational errors and false-negative rates and provide a second opinion in imaging interpretation finalized to diagnosis

CAD systems may assist in differentiating between malignant and benign tumours, contributing to more accurate diagnoses.

- ▪ CAD systems contain different general components such:
- Data collection: Radiological images used by the CAD system are gathered in the data-collecting process.
- pre-processing: improves the image quality for the succeeding steps by removing noise, artefacts, and other unnecessary information from the images
- lung segmentation: each lung nodule is separated from the lung parenchyma then distinguishing between benign and malignant nodules.

▪ convolutional neural network–based CAD system for detecting and longitudinally tracking ground-glass nodules achieved less variation in volume measurement in comparison with radiologists' manual segmentations

Several mathematic models are used to estimate the probability of malignancy based on clinical and standard radiographic predictors. These include the PanCan model (also known as the Brock model), Veterans Affairs model, and Mayo Clinic model.

Validated and approved Artificial Intelligence (AI) algorithms have been proposed to ensure documentation of important findings in the radiologist's report and to workflow

Reporting screening LDCT

1. Double reading of screening LDCT is mandatory. LDCT must be interpreted by two independent radiologists
2. In case of discordant opinions between two radiologists, either consensus or preferably arbitration using a third expert screening radiologist can be carried out.
3. The final assessment must be reported using the FDA-approved LDCT Imaging, Reporting and Data System Lung -RADS Assessment Categories (as described in Table 4)
4. One final report to be issued.
5. Must be used by radiologists containing at least the following information:
   - 5.1 : Interpreting physicians' names
   - 5.2 : Date of examination
   - 5.3 : Patient identification
   - 5.4 : Reason for examination
   - 5.5 : Description of significant imaging lesions: characteristics of the lesion; location; and size (maximum diameter in mm).
   - 5.6 : Final Assessment RADS categories
   - 5.7 : Detailed recommendations should be included in the report.

Screening Outcomes

1. All adults must be informed about the results of screening within 3 weeks (15 working days) from the date of screening LDCT.
2. Adults with screening LDCT of Normal/Benign (lung RADS), are discharged and Screening frequency will follow recommendation specified (in figure 1)
3. IF adults require further assessment for abnormal screening LDCT (lung RADS), referral must be to a Diagnostic lung Assessment Unit within 15 days of screening LDCT result.
4. At the end of the screening, Adults must be provided with one final written LDCT report.
5. It is the responsibility of the radiologist/referring physician (at the screening or assessment facilities) to inform adults regarding her screening and assessment results. Also, send feedback to the referring physician at the primary healthcare clinic

Figure 1: Lung Cancer Screening Pathway

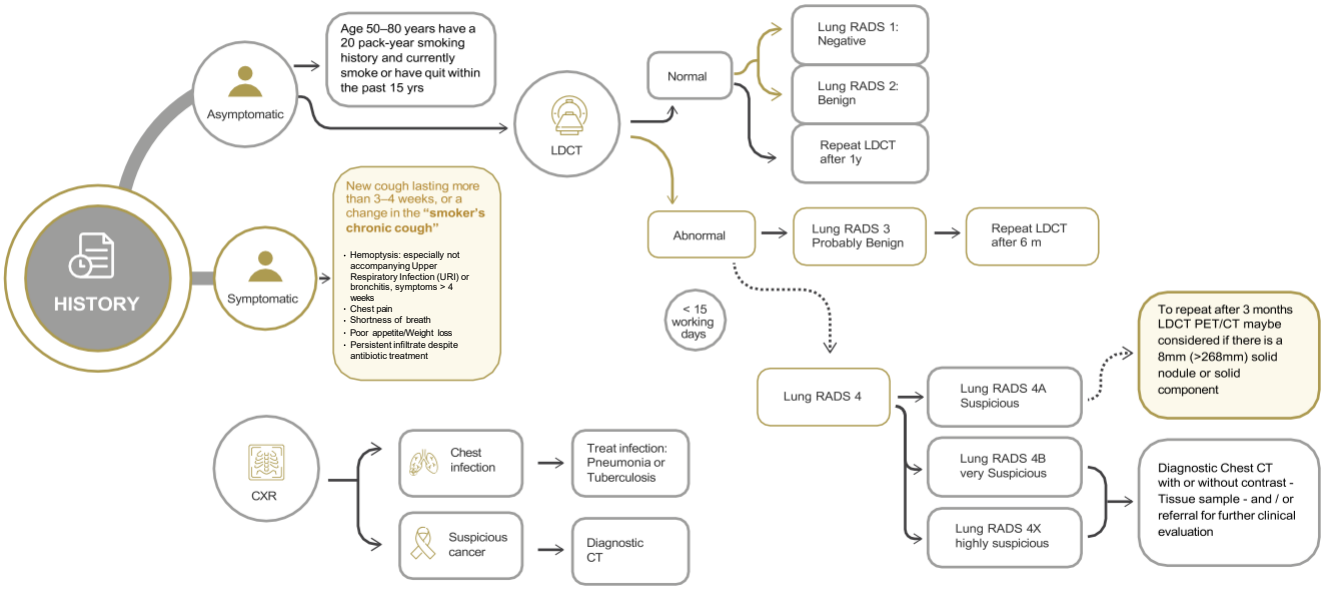
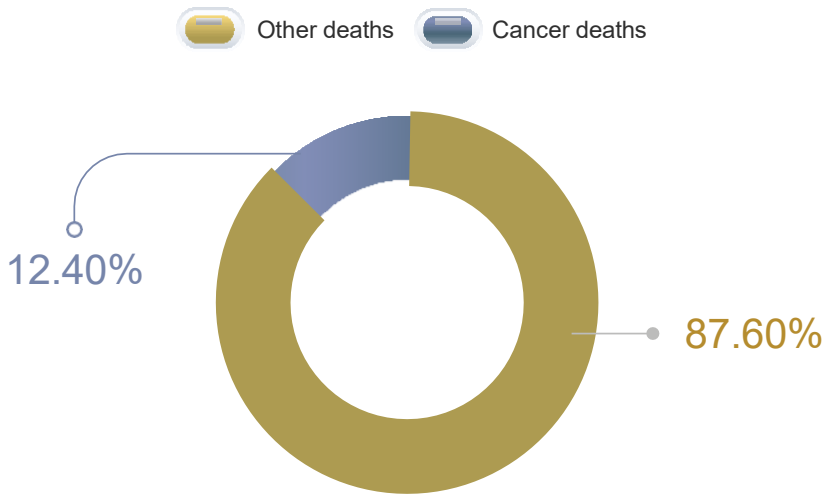


Figure 2: Percentage of reported cancer deaths among UAE population, 2023



Demonstrates the percentage of cancer deaths from total number of deaths (all causes) among UAE population in 2023, which represents 12.4% of all deaths regardless of nationality, type of cancer or gender.

APPENDIX 1: REQUIREMENT FOR LUNG SCREENING & DIAGNOSIS SERVICES

REQUIREMENT FOR LUNG SCREENING UNIT

1. General

1.1 Assign a screening program director/coordinator who will be in charge of overall performance, quality assurance
of the unit and will be responsible for submitting data on screening visits and outcomes to MOHAP.
1.2 Be able to perform risk assessments, physical examinations and screen LDCT.
1.3 Monitor data and feedback of results, Keep a formal record of LDCT result, assessment processes and outcomes.
1.4 Annual audit of >90% compliance with 15-day result turnaround
1.5 1 radiologist per 500 screens

2. Referral, assessment, and feedback

2.1 Referral
2.1.1 At the end of the screening, the screening unit must provide the individuals with a written report with clear instructions on follow-up plan and next steps, including referral for treatment or next screening dates. Also, send feedback to the referring physician at the primary or ambulatory healthcare clinic.
2.1.2 It is the sole responsibility of the referring physician (in the case of LDCT) to inform the individuals with their results and next steps.
2.1.3 The time between completion of a screening test and receipt of results by the participant must be less than 15 working days (acceptable standard > 90% within 15 days).
2.1.4 Screening with LDCT:

- In case of normal results, negative or benign in (lung RADS), individuals must be re-invited for screening in accordance with the frequencies specified (table 4)
- In case of benign must be repeated in accordance (table 4)
- Probably Benign and Suspicious must be monitored and audited and repeated in accordance (table 5)
- The time interval between a positive LDCT (very suspicious) and definitive management must be monitored not more than 31 days . (Acceptable standard ≥ 95% of cases must be no more than 31 days).
- Compliance with these timelines must be audited annually

APPENDIX 2: WHEN SHOULD SCREENING BE STOPPED

Turns 81 years old,
Once a person has not smoked for 15 years
OR develops a health problem that substantially limits life expectancy or if life expectancy <10 years or the ability or willingness to have curative lung surgery

APPENDIX 3: ADULT AT INCREASED RISK

Adults are considered at higher risk of developing lung cancer if they have one or more of the following criteria:

1. General

1. Smoking tobacco

The risk of developing lung cancer increases with how long smoked, age of started smoking and the number of cigarettes smoke each day.

The risk is higher if have other risk factors. Pipes, cigars, herbal cigarettes, chewing tobacco, low-tar cigarettes, vape and low-nicotine cigarettes also cause cancer and are not considered safe.

2. Second-hand smoke

Second-hand smoke is what smokers exhale and what rises from a burning cigarette, pipe or cigar. It is also called environmental tobacco smoke (ETS). Breathing in second-hand smoke is called involuntary or passive smoking.

No amount of exposure to second-hand smoke is safe. It contains the same chemicals as smoke that is actively inhaled. People exposed to second-hand smoke have a higher risk for lung cancer. Second-hand smoke is a main risk factor for lung cancer among non-smokers.

3. Radon

Radon is a colourless, odourless, tasteless gas that comes from the natural breakdown of uranium in rocks and soil. In the outdoors, radon gas is diluted by fresh air, so it is not usually a concern. But radon can seep into buildings through dirt floors or cracks in the foundations. It may reach unsafe levels in enclosed, poorly ventilated spaces. Breathing in radon gas can damage cells that line the lungs.

Radon exposure increases the risk for lung cancer. Radon is the leading cause of lung cancer in non-smokers and the second leading cause of lung cancer in smokers.

The risk of developing lung cancer depends on how much radon you are exposed to and how long you are exposed to it .

4. Asbestos

Asbestos is the name of a group of minerals that occur naturally. It can be separated into long, thin fibres that are very fine. When someone breathes in these fibres, they can get trapped in the lungs.

Asbestos has been widely used in building materials and many industries. People who have the highest risk of asbestos exposure include:

- workers in asbestos mines
- automotive industry workers, including brake and clutch repair workers
- shipyard workers
- cement plant workers
- plumbing and heating tradespeople
- construction workers, painters, carpenters and electricians Studies show that smokers who are exposed to asbestos have an even greater risk of developing lung cancer.

5. Occupational exposure to certain chemicals

Certain chemicals are carcinogens, which means that they cause cancer

These chemicals can cause lung cancer in people who are exposed to them at work. In general, the risk of developing lung cancer is even higher for smokers who are exposed to these chemicals.

Occupational exposure to the following chemicals increases the risk for lung cancer:

- arsenic and inorganic arsenic compounds
- beryllium and beryllium compounds
- cadmium and cadmium compounds
- chemicals used in rubber manufacturing, iron and steel founding and painting
- chloromethyl ethers and bis(chloromethyl) ether
- chromium (VI) compounds
- diesel engine exhaust
- mustard gas

- radioactive ores such as uranium and plutonium
- silica dust and crystalline silica
- some nickel compounds
- some types of polycyclic aromatic hydrocarbons (PAHs)
- bitumen used in roofing
- cobalt-tungsten carbide
- welding fumes

Some industries use many chemicals, so it is difficult for researchers to know which ones increase the risk for lung cancer. People who work in the following industries have the highest risk for lung cancer:

- rubber manufacturing
- iron and steel founding
- coal gasification
- coke production
- chimney sweeping
- commercial painting
- roofing and paving
- industries that use the Acheson process to create silicon carbide

6. Outdoor air pollution

Air pollution is chemicals, particles and other materials in the air in amounts that could damage the environment or harm the health or comfort of people, animals and plants. The types of pollutants in the air vary from place to place depending on sources of emissions in the area. Emissions can also move in from other regions.

There is strong evidence that exposure to outdoor air pollution causes lung cancer. The more air pollution you are exposed to, the greater your risk of developing lung cancer.

Research shows that the different components of outdoor air pollution cause cancer. These components include diesel engine exhaust, benzene, particulate matter and some PAHs

7. Personal or family history of lung cancer

People who had lung cancer have a higher risk of developing lung cancer again. You may also have a slightly higher risk for lung cancer if you have a first-degree relative (a brother, sister, child or parent) who had lung cancer. The increased risk could be due to several factors, such as shared behaviors (like smoking) or living in the same place where there are carcinogens (like radon).

8. Personal history of lung disease

Certain lung diseases or conditions can scar the lungs and increase the risk for lung cancer. Examples of these conditions include:

- chronic obstructive pulmonary disease (COPD), which is long-term damage to the lungs that is often caused by smoking
- emphysema and chronic bronchitis, which are types of COPD
- tuberculosis (TB)
- lung infection caused by Chlamydophila pneumoniae

9. Exposure to radiation

People who were treated with radiation therapy to the chest for certain cancers, such as Hodgkin lymphoma or breast cancer, have a higher risk for lung cancer. These people have an even higher risk if they smoke.

People who were exposed to ionizing radiation during atomic bomb explosions or nuclear accidents have a greater risk of developing lung cancer.

10. Arsenic in drinking water

Arsenic can get into drinking water from natural sources in the soil or from certain types of industries, such as mining. While experts don't completely understand how arsenic causes changes to cells, studies from many different parts of the world show that high levels of arsenic in drinking water increase the risk for lung cancer. The risk is even greater in people who smoke.

11. HIV

HIV infection can suppress the immune system. People with HIV have a higher risk of developing many types of cancer, including lung cancer.

12. Organ Transplant

People who have an organ transplant take drugs to suppress their immune system, having a suppressed immune system increases their risk of developing lung cancer.

13. Pollutants from cooking and heating

Some types of cooking and heating can release pollutants that increase the risk for lung cancer. The levels of these pollutants can be very high in spaces that have poor air flow.

Burning coal indoors for cooking and heating is most strongly linked to lung cancer. Burning wood and other fuels, such as dung or grass, and frying foods in oil at high temperatures can also increase the risk for lung cancer.

14. Lupus

Systemic lupus erythematosus (SLE) is an autoimmune disease. People with lupus have a higher risk for lung cancer

15. Occupational exposure to certain chemicals

Researchers are trying to find out if the following chemicals increase the risk for lung cancer:

- Bitumen used in paving
- Dioxin used in pesticides
- Strong chemical acid mists
- Fibrous silicon carbide

16. Genetic mutations

Research shows that some families have a strong history of lung cancer, which may mean that they have a mutation in a certain gene that may cause lung cancer. Researchers are trying to find out if a specific gene or genes may increase the risk for lung cancer. Studies are also trying to find very small changes in genes (called genetic polymorphisms) that may increase the risk for lung cancer or make people, especially non-smokers, more sensitive to known risks for lung cancer.

17. Smoking cannabis

The evidence suggesting a link between long-term smoking of cannabis (marijuana) and cancer is not as strong or as comprehensive as the evidence linking smoking tobacco and cancer. Some studies found that long-term recreational smoking of cannabis can increase the risk for lung cancer.

APPENDIX4: RULE AND RESPONSIBILITY OF MULTIDISCIPLINARY TEAM

Radiologists: Have documented training in diagnostic radiology and radiation safety.

- Involvement in the supervision and interpretation of at least 300 chest computed tomography acquisitions in the past 3 years.
- Direct supervision LDCT screening process.
- Reporting the results of LDCT scans for lung cancer screening.
- Take full responsibility for the quality of the LDCT report.
- Ensure minimum radiation exposure to screening participants

Oncologists (Medical and Surgical oncologist): Participate in diagnosis, developing follow up and treatment plan.

Oversee and report results of ancillary molecular studies (FISH, PCR, and next-generation sequencing [NGS]), with documented competency

Pulmonologists: Evaluate lung nodules.

Perform bronchoscopy, image guided biopsy, Endobronchial Ultrasound (EBUS) services.

Pathologist:

- **Provide specialized expertise in cytopathology and pulmonary pathology for accurate interpretation of cytology specimens, small biopsies, and surgical resections.**
- **Perform and interpret lung cancer biomarker testing, including immunohistochemistry (e.g., ALK, ROS1, EGFR, and PD-L1), with demonstrated and documented competency in PD-L1 scoring and reporting to ensure accuracy and reproducibility in guiding immunotherapy decisions.**
- **Oversee and report results of ancillary molecular studies (FISH, PCR, and next-generation sequencing [NGS]), with documented competency in molecular data interpretation and integration into diagnostic reports. All ancillary studies must be validated and performed in an accredited laboratory to meet quality and regulatory standards.**
- **To report at least 50 lung cancer cases annually**
- **Ensure double reporting of all lung cancer diagnoses to maintain diagnostic accuracy and quality assurance.**
- **Adhere to internationally recognized standards, such as the Royal College of Pathologists (UK) datasets and the College of American Pathologists (CAP) Cancer Protocols, for consistent and comprehensive reporting.**
- **Contribute to the systematic collection of standardized data, supporting:**
    - Development of national and institutional screening programs
    - Establishment of tumour registries
    - Research initiatives and translational studies
    - Participation in audits and clinical trials
    - Ongoing service evaluation and quality improvement

Nurse Navigators:

- Coordinate care across different specialists and ensure all necessary tests are completed.
- They communicate a patient's needs to other healthcare professionals and ensure the patient receives the best possible care.
- They help patients find community resources, support services, and financial or insurance assistance.
- They act as a central point of contact for patients, helping them "hold the patient's hand" through a complex system.

APPENDIX 5: LUNG CANCER SCREENING PATHWAY SUMMARY

Step 1:

Patient invitation & Initial assessment (Identifying individuals meet eligibility criteria)

1. People aged 50 to 80 with a physician record including a history of smoking will be invited for an initial assessment.
2. The initial assessment will use Lung Cancer Screening Eligibility involve the participant answering questions to determine if they are at a high risk of lung cancer.
3. Use Brock model (or PanCan model) is a validated tool that calculates the probability of malignancy in lung nodules found on CT scans, particularly in screening programs. It uses patient data (age, sex, family history, emphysema) and nodule characteristics (size, density, location, count, spiculation) to estimate risk, often used alongside the Herder model to guide management.
    - It estimates the probability that a solid pulmonary nodule is malignant, usually over a 2–4-year period.
    - The full model includes nine factors: age, sex, family history of lung cancer, emphysema, nodule diameter, density (solid, part-solid, ground-glass), location (upper lobe), count, and spiculation.
4. The Herder model is a clinical prediction tool used to estimate the risk of malignancy in solid pulmonary nodules (8–30 mm) by incorporating PET-CT findings, specifically FDG uptake, alongside patient and nodule characteristics. It is typically applied after a Brock risk assessment of 10%, with management guidelines suggesting surveillance for <10% risk, and investigation for >70% risk
5. To register an appointment of shared decision-making (as in Figure 1)

Step 2:

Shared decision-making visit

1. Provider will discuss the benefit, potentially risks of screening procedure with eligible individual
2. To offer smoking cessation education and referral to smoking cessation clinics
3. Request the low dose CT scan of the lungs.
4. To document aforementioned information in the electronic system

Step 3:

Low dose CT scan

1. A low dose CT scan helps to check for changes in the lungs that may be lung cancer.
2. Using (Artificial Intelligence) AI to analyse the CT findings and classify the lung cancer risk depending on Lung RADS Recommendation

Step 4:

Outcome and follow up

The final result will be shared with referring physician

Second outpatient clinical visit (OPD or E-clinic) will be booked to inform the patient about the screening report and further management.

1. If individual has suspected lung cancer (Lung RADS 4), he will be referred for multidisciplinary thoracic oncology team to decide the required diagnostic test (oncologist referee him)
2. If individual has classified as (Lung RADS 1,2, or 3), he may be invited to screening more regularly, follow up appointment will be confirmed as required. (as Fig 1)
3. If other abnormalities are found (clinically significant findings unrelated to lung cancer) (Lung RADS S), patient will be referred as appropriate to the specific finding

Table 6: LUNG -RADS®V 2022 ASSESSMENT CATEGORIES

American College of Radiology™

Release Date: November 2022

Lung-RADS	Category Descriptor	Findings	Management
0	**Incomplete Estimated Population Prevalence: ~ 1%**	Prior chest CT examination being located for comparison (see summary 9)	Comparison to prior chest CT
		Part or all of lungs cannot be evaluated	Additional lung cancer screening CT imaging needed
		Findings suggestive of an inflammatory or infectious process	1–3-month LDCT
1	**Negative Estimated Population Prevalence: 39%**	**No lung nodules OR**	12-month screening LDCT
		Nodule with benign features: Complete, central, popcorn, or concentric ring calcifications **OR** Fat-containing	
2	**Benign - Based on imaging features or indolent behavior Estimated Population Prevalence: 45%**	**Juxtapleural nodule:** < 10 mm (524 mm3) mean diameter at baseline or new **AND** Solid; smooth margins; and oval, lentiform, or triangular shape	
		Solid nodule: < 6 mm (< 113 mm3) at baseline OR New < 4 mm (< 34 mm³)	
		Part solid nodule: < 6 mm total mean diameter (< 113 mm) at baseline	
		Nonsolid nodule (GGN): < 30 mm (< 14,137 mm³) at baseline, new, or growing OR ≥ 30 mm (≥ 14,137 mm³) stable or slowly growing (see summary 7)	
		Airway nodule, subsegmental - at baseline, new, or stable (see note 11)	
		Category 3 lesion that is stable or decreased in size at 6-month follow-up CT OR Category 4B lesion proven to be benign in etiology following appropriate diagnostic workup	

Lung-RADS	Category Descriptor	Findings	Management
3	**Probably Benign - Based on imaging features or behavior** **Estimated Population Prevalence: 9%**	**Solid nodule:** ≥ 6 to < 8 mm (≥ 113 to < 268 mm³) at baseline OR New 4 mm to < 6 mm (34 to < 113 mm³)	6-month LDCT
		Part solid nodule: ≥ 6 mm total mean diameter (≥ 113 mm³) with solid component < 6 mm (< 113 mm³) at baseline OR New < 6 mm total mean diameter (< 113 mm³)	
		Nonsolid nodule (GGN): ≥ 30 mm (≥ 14,137 mm) at baseline or new	
		Atypical pulmonary cyst: (see note 12) Growing cystic component (mean diameter) of a thick-walled cyst	
		Category 4A lesion that is stable or decreased in size at 3-month follow-up CT (excluding airway nodules)	
4A	**Suspicious Estimated Population Prevalence: 4%**	**Solid nodule:** ≥ 8 to < 15 mm (≥ 268 to < 1,767 mm³) at baseline OR Growing < 8 mm (< 268 mm³) OR New 6 to < 8 mm (113 to < 268 mm³)	3-month LDCT. PET/CT may be considered if there is a ≥ 8 mm (≥ 268 mm³) solid nodule or solid component
		Part solid nodule: ≥ 6 mm total mean diameter (≥ 113 mm³) with solid component ≥ 6 mm to < 8 mm (≥ 113 to < 268 mm³) at baseline OR New or growing< 4 mm (< 34 mm³) solid component	
		Airway nodule, segmental or more proximal - at baseline (see note 11)	
		Atypical pulmonary cyst: (see note 12) Thick-walled cyst OR Multilocular cyst at baseline OR Thin- or thick-walled cyst that becomes multilocular	

Lung-RADS	Category Descriptor	Findings	Management
4B	**Very Suspicious Estimated Population Prevalence: 2%**	**Airway nodule,** segmental or more proximal - stable or growing (see summary 11)	Referral for further clinical evaluation
		solid nodule: ≥ 15 mm (≥ 1767 mm³) at baseline OR New or growing ≥ 8 mm (≥ 268 mm³)	Diagnostic chest CT with or without contrast. PET/CT may be considered if there is a ≥ 8 mm (≥ 268 mm³) solid nodule or solid component. tissue sampling. and/or referral for further clinical evaluation Management depends on clinical evaluation, patient preference, and the probability of malignancy (see summary 13)
		Part solid nodule: Solid component ≥ 8 mm (≥ 268 mm³) at baseline OR New or growing ≥ 4 mm (≥ 34 mm) solid component	
		Atypical pulmonary cyst: (see note 12) Thick-walled cyst with growing wall thickness/ nodularity OR Growing multilocular cyst (mean diameter) OR Multilocular cyst with increased loculation or new/ increased opacity (nodular, ground glass, or consolidation)	
		Slow growing solid or part solid nodule that demonstrates growth over multiple screening exams (see summary 8)	
4X	**Estimated Population Prevalence: < 1%**	Category 3 or 4 nodules with additional features or imaging findings that increase suspicion for lung cancer (see summary 14)	
S	**Significant or Potentially Significant Estimated Population Prevalence: 10%**	**Modifier:** May add to category 0-4 for clinically significant or potentially clinically significant findings unrelated to lung cancer (see summary 15)	As appropriate to the specific finding

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