Letter to the Editor

Learning from chronic disease screening success: developing efficient, convenient, and affordable lung cancer screening methods to achieve universal coverage

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Early detection and treatment of lung cancer are crucial for improving patient survival rates (1). However, past lung cancer screening methods and equipment were often expensive and limited in availability, resulting in screenings mainly based on high-risk factors and leading to a high rate of missed diagnoses. After two or three decades of development, advancements in technology and increased accessibility to high-end equipment, such as computed tomography (CT) scanners, have improved this situation (2). Additionally, new, convenient, affordable, and efficient screening tools have been gradually developed (3), providing an important technical and material basis for enhancing lung cancer detection methods. This commentary aims to explore innovative, cost-effective approaches to lung cancer screening, drawing from successful chronic disease screening models and integrating technologies like artificial intelligence (AI) to improve detection rates, achieve universal access, and ultimately enhance public health outcomes.

Despite these advancements, early-stage lung cancer screening still faces significant challenges. One of the primary obstacles is the low sensitivity of certain detection methods (4), which often necessitates the integration of multiple diagnostic factors to improve accuracy. In this regard, AI has emerged as a promising solution. AI's ability to integrate multiple diagnostic factors allows for comprehensive analysis, helping to overcome limitations in current screening methods (5). In addition to improving diagnostic accuracy, AI also addresses other critical challenges, such as replicability, standardized procedures, and safeguarding individual data privacy.

To further improve lung cancer screening, we can draw valuable lessons from chronic disease screening programs, such as those for hypertension (6) and diabetes (7). These programs have demonstrated the effectiveness of simple, accessible, and cost-efficient screening tools like blood pressure and glucose measurements. Similarly, lung cancer screening could benefit from the development of non-invasive, efficient, and affordable methods. For instance, non-invasive methods such as exhaled gas detection (8) have shown promise. However, the reported sensitivities and specificities for these methods vary widely, and more robust studies are needed to validate their potential as screening tools. In addition, the detection of polymerase chain reaction (PCR) biomarkers and circulating DNA fragments in urine or blood offers further promising approaches for enhancing lung cancer screening (9).

The rapid advancement of AI technology also presents new opportunities to improve screening accuracy. In particular, AI's capabilities in image analysis and risk assessment offer great potential for increasing the efficiency and accuracy of screening processes. For instance, machine learning algorithms can assist radiologists by highlighting suspicious areas, thus increasing diagnostic accuracy (10). Additionally, predictive AI models can stratify patients based on multiple factors, supporting targeted screening initiatives (11). However, while these advancements are promising, they also bring new challenges. Ensuring the accuracy and reliability of these AI-driven tools is essential to minimizing both false positives and missed diagnoses. Additionally, the safety of these new technologies must be thoroughly evaluated to mitigate potential health risks. Ethical concerns, particularly regarding data privacy and the responsible use of patient information, also require careful attention.

In conclusion, learning from the successful experience of chronic disease screening, developing innovative screening methods and reagents, and applying AI are critical to improving lung cancer detection and achieving universal screening access. However, achieving this goal will demand a collaborative effort across the fields of medicine, technology, and policy to overcome the challenges involved and create a comprehensive, effective screening system (12).

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Footnote

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