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Perception Of Clinical Laboratories' Staff Regarding Artificial Intelligence

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Abstract:

Introduction: As Artificial Intelligence (AI) technology continues to assimilate into various industries, there is a huge scope in the healthcare industry specifically in clinical laboratories. The perspective of the laboratory professionals can give valuable insight on the ideal path to take for AI implementation. Methods: The study utilized a cross-sectional survey design and was conducted at the section of Chemical Pathology, Department of Pathology and Laboratory Medicine, the in Makkah from October- November 2022. The survey was for a duration of 2 weeks and was circulated to all working laboratory technical staff after informed consent. Results A total of 351 responses were received, of which 342 (male=146, female=196) responses were recorded after exclusion. Respondents ranged from technologists, faculty, residents, and coordinators, and were from different sections (chemical pathology, microbiology, haematology, histopathology, POCT). Out of the total 312 (91.2%) of respondents stated that they were at least somewhat familiar with AI technology. Experts in AI[1] were only 2.0% (n=7) of all respondents, but 90% (n=6) of these were < 30 years old. 76.3% (n=261) of the respondents felt the need to implement more AI technology in the laboratories, with time saving (26.1%) and improving performances of tests (17.7%) cited to be the greatest benefits of AI. Security concerns (n=144) and a fear of decreasing personal touch (n=143) were the main concerns of the respondents while the younger employees had an increased fear of losing their jobs. 76.3% were in favour of an increase in AI usage in the laboratories. Conclusion: This study highlights a favourable perspective among laboratory professionals, acknowledging the potential of AI to enhance both the efficiency and quality of laboratory practices. However, it underscores the importance of addressing their concerns in the thoughtful implementation of this emerging technology.

Introduction

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The evolution of Artificial Intelligence (AI) has led to the improvement of various industries including the healthcare industry. The integration of AI technology in healthcare is at the forefront of the current era due to the potential benefits that it can provide [1]. Within the complex ecosystem of healthcare, laboratory medicine remains the domain with the most to gain from AI integration [2, 3]. The potential to streamline laboratory processes, enhance diagnostic accuracy, and improve decision- making is huge and this possibility granted by AI can make a compelling case to invest in AI implementation [4]. AI is gaining popularity amongst clinical laboratories in many countries and Saudi Arabia, in line with the global landscape. Recent attempts at automation have increased efficiency and accuracy of lab processes and AI is expected to usher in a new wave of improvements [5, 6].

Few studies have been conducted in other countries to include employee attitudes on AI yet the knowledge, attitudes, and experiences of the workers in Saudi Arabia regarding AI remain an underexplored area [7, 8]. While the utility of AI is undeniable, and its benefits are evidently seen in present implementations in other industries, there are many differing perspectives to it. While some people accept this technology as a powerful tool that can do wonders in the laboratory environment, others show concerns for the technology. Besides advancing at a frighteningly fast pace without proper regulations, the big talking point is the fear of job displacement as employees feel threatened with being made redundant as AI technology advances. Other issues also arise from not being familiar with the technology, hence accuracy and safety might not be trusted.

Addressing these concerns would be vital in resolving the most effective integration strategy for Saudi's clinical laboratories. Before AI gets through implementation in clinical labs, there is a dire need to provide a comprehensive baseline exploration of the perceptions and insights of staff in the clinical laboratory sector across Makkah, examining their familiarity with AI, opinions on its impact, fears surrounding the increased use of AI, and recommendations for effective integration [9]. The objective of this research was to identify the knowledge gaps and establish a baseline on the attitudes and expertise of these professionals, by surveying the laboratory professionals in institutions across the country. By gathering a diverse range of opinions from different specialties and positions we can uncover the AI knowledge landscape in the clinical laboratories and utilize this to provide valuable insights for leaders of healthcare institutions and policymakers [10]. Action plans to facilitate deeper understanding of the role and proper integration of AI technology can take into account the current state of AI awareness and utilization.

Materials and Methods

A cross-sectional survey was conducted by the section of Chemical Pathology, Department of Pathology and Laboratory Medicine, at Makkah hospitals. The study was undertaken in compliance with the ethical principles for medical research involving human subjects, in accordance with the Declaration of Helsinki. A previously validated and published tool by Ardon O et al was used with some modifications according to local context [7]. The survey was filled in by two Consultant Pathologists and a senior technologist as a pilot to locally validate the questionnaire for understanding of language and content.

The survey was designed and circulated via Google Forms link to the lead Pathologists of ten major clinical laboratories across Makkah who in turn dispersed the survey amongst the employees of the labs and to other labs outside the initial ten using WhatsApp and Email. The participation was entirely voluntary and anonymized, and respondents were asked to give consent before attempting the questions. Moreover, for further convenience QR code of the survey link was also generated and hardcopy was used to ensure that people with limited access

to WhatsApp or Email can utilized the web version via direct link.

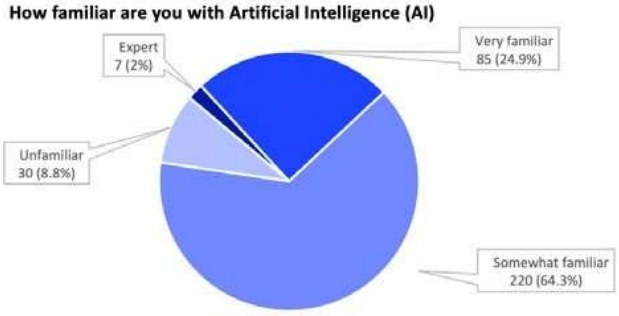
The survey consisted of three sections, first was the general information and consent; then the demographic section with eight questions, and a section with seven questions related to AI.

The sample size was calculated prior to the dissemination of the survey. An open EPI calculator at 90% confidence interval was used which yielded a sample of174. This sample size was calculated on the assumption that 20% of participants possess some knowledge and awareness of AI. However, we targeted maximum responses achieved during the defined timeframe. The survey accepted responses from October- November 2022. 353 people attempted the survey; after the inclusion/exclusion criteria was met, 342 responses from current laboratory professionals were included in the final analysis . The data was analysed to reveal the differences in the demographic groups, and associations between the groups and their AI opinions using the chi-square test of independence. The Excel (Microsoft Corporation, 2018) and Stata (Stata Corp, College Station, Tx) software were used for data collection and analysis.

Results

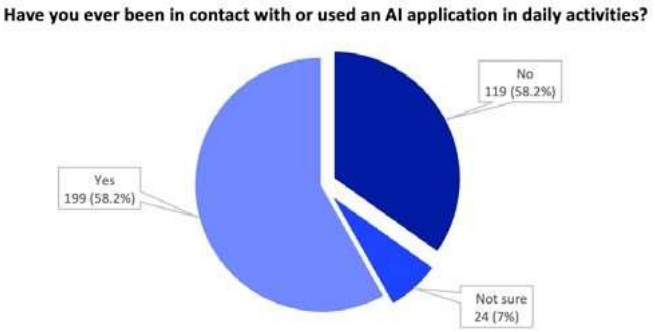
Out of the 10 clinical laboratories contacted, 9 laboratories collaborated in the project. The 342 responses came from a wide range of demographics, including those from different ages, genders, and sections. Most respondents were from the age group of 30-49 years old (n=194) while the split between male and female was 42.7% and 57.3%, respectively. Participants were from seven sections of laboratory medicine services with the highest number from Chemical Pathology (52.3%), followed by Microbiology (18.4%), Haematology (17.3%), Histopathology (6.1%), Molecular Pathology (4.1%), Point of Care Test (POCT) (0.9%) and Immunology (0.6%). The survey received responses from a multitude of positions with the greatest number coming from the technologists (31.9%), and faculty members (23.7%). Thirty eight percent of respondents had achieved FCPS, MPhil, or PHD level education, 30.4% had studied until Bachelor's, 19.9% Master's and 11.1% MBBS. Two (0.6%) of the respondents reported having completed the Diploma of Medical Laboratory Services (DMLS) degree. 46.8% of the respondents had less than 5 years of experience, and the number of respondents lowered as experience level increased.

Out of the respondents, 91.2% reported being at least somewhat familiar with AI technology (Figure 1). While experts at AI, most of these were from the less than 30 years old, indicating correlation between different age groups and the level of familiarity (p=0.016). Among various positions, lab coordinators had the highest familiarity levels. 85.7% of coordinators were experts or very familiar with AI technology. There was a significant difference between the specialities regarding their familiarity to AI (p=0.001) with Chemical Pathology and Haematology superseding other sections. There was also significant difference between genders (p<0.001). All 7 of the experts identified as male, while more females were unfamiliar or somewhat familiar with AI (80.8% females to 63.6% of males).



When asked if they have encountered any AI applications (Figure 2), the participants responded with a majority (58.2%) yes, while 34.8% had no exposure, and 7.0% were unsure if they had.

The more experienced the respondents, the more likely they were to have encounter AI technology (p=0.042).



Participants were asked for examples of AI tools that they had used (Table 1), the two main tools were ChatGPT (58.7%) and Google Bard (13.0%). Other tools reported were Quillbot, Grammarly, Scite, Perplexity, etc. Younger people were observed to utilise more AI tools (9 for <30 compared to 4 for >=50 from the list of tools acquired) and use them at a higher frequency.

Frequencies of AI tools used	**Frequency (n)**	**Percentage (%)**
ChatGPT	172	58.7
Google Bard	38	13.0
Quillbot	4	1.4
Grammarly	4	1.4
Bing	3	1.0
Copy.ai	3	1.0
Perplexity	2	0.7
Google Lens	2	0.7
SnapChat	2	0.7
Tome	2	0.7
Scite	1	0.3
Others	8	2.7
Not Reported	52	17.7
Total	**293**	**100**

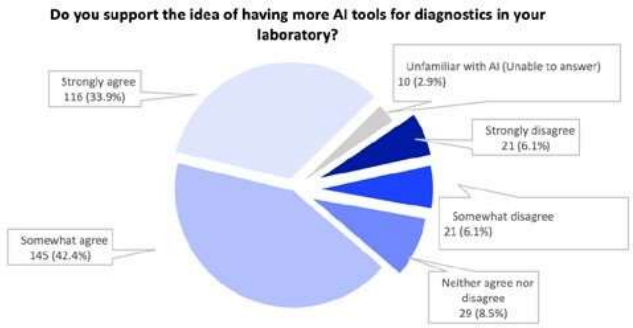
The positions with the most varied AI use were the faculty (8 tools) and technologists (7 tools). Similarly, respondents having completed their FCPS/PhD/MPhil level education reported the greatest AI use at 9 tools. There was no significant observation difference between the genders or specialties. The respondents were questioned about the proposed uses of AI (Table 2). The responses were fairly evenly distributed with time saving (26.1%) being the most useful benefit of AI, followed by increased performance of tests (17.7%) and prevention of workplace errors (16.4%). There were no significant associations between their responses and the demographics of the respondents. The respondents were questioned about the proposed uses of AI (Table 2). The responses were fairly evenly distributed with time saving (26.1%) being the most useful benefit of AI, followed by increased performance of tests (17.7%) and prevention of workplace errors (16.4%). There were no significant associations between their responses and the demographics of the respondents

If you could use AI to help you perform your job, what would you like to accomplish?	**Frequency (n)**	**Percentage (%)**
Time Saving	265	26.1
Test Performance	179	17.7
Reduce Errors	166	16.4
Drafting letters	147	14.5
Increase Objectivity	117	11.5
Reduce Repetition	117	11.5
Unfamiliar with AI	18	1.8
Others	5	0.5
Total	**1014**	**100**

The participants' main concerns about AI (Table 3) were of the security especially with regards to patient information (23.4%), and a decrease in hands-on work (23.2%). The fear of losing jobs was higher in younger professionals (20.5% for <30 vs 6.3% for >50). Similarly, job security was not as much of a concern for those with over 20 years of experience. However, more (12.5%) respondents with 20+ years' experience stated that they were unfamiliar with AI than the other respondents. Male respondents (26.4%) were more concerned about the learning curve than females (14.3%). There were no significant differences between ages, positions, or specialities.

What concerns do you have about AI?	**Frequency (n)**	**Percentage (%)**
Security concern	144	23.4
Decreased personal element	143	23.2
Big learning curve	104	16.9
Fear of losing jobs	96	15.6
Unsure of new technology capabilities	93	15.1
Unfamiliar with AI (Unable to answer)	32	5.2
Others	4	0.6
Total	**616**	**100**

Respondents were asked about their opinion on using AI technology in the laboratory setting (Figure 3). 76.3% of the respondents agreed with the use of more AI tools in the laboratory, while 12.2% disagreed. Less experienced respondents were slightly more supportive of AI technology use, while men (10.1% strongly disagree) were more hesitant to accept AI than women (2.9% strongly disagree).



When asked about the areas in which AI would be most beneficial (Table 4), the responses were distributed fairly evenly. Data analysis (20.5%) and scientific research (19.7%) were the sectors most often chosen. 17.3% respondents believed AI would benefit in education. Error detection (16.8%), results verification (14.0%), and customer care (10.9%) followed. There was no difference in the distribution of responses by gender, age, education, specialty, or position.

What areas could most benefit from AI implementation??	**Frequency (n)**	**Percentage (%)**
Data analysis	231	20.5
Scientific research	222	19.7
Education	195	17.3
Error Detection	190	16.8
Results verification and reporting	158	14.0
Customer care	123	10.9
Unfamiliar with AI (Unable to answer)	10	0.9
Total	**1129**	**100**

Discussion

A significant amount of feedback from participants (342 responses) was received for this survey, which aimed to highlight the level of expertise, knowledge, concerns, and interest among Saudi clinical laboratory staff in the field of AI and its applications in laboratory medicine. Web-based surveys have previously demonstrated advantages over traditional approaches, particularly for health social science researchers [11, 12].

Furthermore, since every person surveyed used WhatsApp or email for work-related purposes regularly, secondly the QR code availability ensured that the representativeness bias which could exist in a web-based survey could be ruled out. Most respondents supported the utility of AI-augmented diagnostic tools despite worries about job loss, and about 91.2% responded that they were somewhat familiar with AI. Respondents acknowledged that AI could boost productivity and decrease errors. Individuals with advanced degrees shown higher levels of knowledge and interaction with AI, whereas younger persons showed higher levels of familiarity with the technology.

The AI tools are starting to be used in diagnostic labs [13, 14]. The usage of AI tools reported fell under two categories, laboratory use and professional use. AI has been applied to the prediction of errors in genetic variants and phenotypes, infectious diseases, cervical cancer categorization in cytology specimens, histology, and so on [15, 16]. AI also has the potential to develop algorithms to use diagnostic tests more judiciously thus conserving the resources and time [17]. From the results, a conclusion was formed that the participants are not fully aware of more advanced AI tools that could be beneficial in research. Increase in familiarity

with tools such as Trinka and Consensus, among others, could boost the efficiency and level of research being conducted inside the clinical laboratories. Literature review revealed few surveys evaluating knowledge, attitude, and practice of AI amongst medical staff in Makkah, Saudi Arabia, but they were targeted towards physicians and students [18, 19]. However, from clinical laboratories perspective, where AI is booming globally, there was no baseline data available from the region.

Our study was different from other surveys in that we polled a large sample of laboratory workers, whereas earlier surveys were restricted to medical professionals. AI is likely to have wide-ranging implications on all members of the workforce, both technical staff and Consultant Pathologists. Therefore, it is critical to comprehend the beliefs and attitudes of non-physicians. Our results reveal that while general laboratory workers are enthusiastic about AI, they nevertheless have some of the same concerns as physicians. Data security concerns, lack of personal element and fear of losing job were the major concerns recorded. Male respondents seemed to be more wary of AI technology than females. The fear of losing job was more in the younger group i.e., less than 30 years. Moreover, it was the more experienced age group i.e., greater than 30 years that were less supportive of having more AI technology in the laboratory setting. Comparing Ardon O et al to these results, there was an overall support of AI from both studies' participants although there was a greater number of neutral laboratory professionals in the US study (30% neither agreed or disagreed). They had similar responses for the uses of AI, with time saving and reduction in errors the top 2 options in both studies. Moreover, the areas of AI implementation were also consistent with this result's findings. The main concern from the US based study was the fear of losing jobs, while the findings of this study show that it is a concern, it is less than security and human personalization. Another study conducted of labs across Italy (n=227) showed a much higher rate of AI support (95% expressed interest in learning about AI technology) although current AI knowledge was still low (15% very familiar, 5% expert). These comparisons reveal that the general situation, whether in the US, Pakistan, or a European country, is still the same with much improvement to be made in terms of AI implementation in the laboratory [20]. From future laboratory management perspective, to decrease resistance towards adoption of AI, there is a dire need to propagate that AI does not necessarily cause employment losses, much like other disruptive technologies. Instead, AI eliminates the laborious parts of work and increases efficiency in the laboratory environment [21].

The strengths of this study were a sizable sample size that included a range of job responsibilities, work settings, and educational backgrounds. Prior research has concentrated on specific tasks, like image processing, or on limited populations, such only physicians. Given the wide-ranging consequences of AI, it is critical to comprehend the opinions and attitudes of everyone who could be impacted. The successful creation and application of AI tools can be aided by this understanding. However, from limitation perspective, the results only reflect the Makkah large clinical laboratories affiliated with teaching institutes and housing all sections of Pathology, despite the high number of responses indicating a strong adherence to the questionnaire, this still represents a very small portion of the estimated more than 500 smaller clinical laboratories in Makkah. Secondly, rather than being measured, the results were self-reported. For example, rather than performing a formal examination, we asked respondents about their judgement regarding their degree of knowledge.

Finally, the survey was quite short. Because of the workforce's time demands, we were worried that a lengthy survey might result in a poor response rate. In conclusion, a positive trend towards increased familiarity with AI in this low-resource context is revealed by the survey on the attitudes, knowledge, and practises of AI among laboratory staff throughout Makkah. The highly engaged online poll demonstrated the extensive usage of different AI tools like ChatGPT, demonstrating an increasing adoption of AI technologies. But the report also points

out significant gaps,especially in the area of digital pathology, where further AI integration is desperately needed. Though it was well received, others expressed worries about possible data security risks, a perceived lack of personal touch, and the possibility of losing one's job. The results can aid proper management and strategic planning in clinical laboratories for near future in the country,the challenges can be mitigated, paving the way for increased efficiency and advancements in clinical laboratory practices through AI integration. However, thorough validations are necessary before practical adoption of AI tools in clinical laboratory practices.

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