

# LABORATORY TEST AWARENESS AND HEALTH LITERACY RATE AMONG THE POPULATION OF PAKISTAN: A QUESTIONNAIRE-BASED STUDY

*Original Research*

Farah Shaikh<sup>1\*</sup>, Abrar Ahmed Hasni<sup>2</sup>, Misbah Asif<sup>3</sup>, Mohammad Wasiq Waseem<sup>4</sup>, Aamir Yaqoob<sup>5</sup>, Summara Habib<sup>6</sup>, Shoaib Hasni<sup>7</sup>, Muhammad Jawad Khan<sup>8</sup>

<sup>1</sup>Research and Data Analyst, The Diabetes Centre, Islamabad, Pakistan.

<sup>2</sup>Laboratory Technologist, Aria Institute of Medical Sciences (AIMS), Quetta, Pakistan.

<sup>3</sup>Managing Director, Ibne Sena Laboratory & Diagnostic Centre Islamabad, Pakistan.

<sup>4</sup>Medical Technologist Pathology, Pulse Diagnostic Center, Pakistan.

<sup>5</sup>Faculty of Pharmacy, Ibadat International University Islamabad, Pakistan.

<sup>6</sup>Support worker, Butterfly Care Ltd, UK.

<sup>7</sup>Faculty of Anesthesia, Bashir Institute of Health Sciences, Islamabad, Pakistan.

<sup>8</sup>Laboratory Technologist, Aziz Medical Centre Islamabad, Pakistan.

**Corresponding Author:** Farah Shaikh, Research and Data Analyst, The Diabetes Centre, Islamabad, Pakistan, [drfarah.jed97@gmail.com](mailto:drfarah.jed97@gmail.com)

**Acknowledgement:** The authors gratefully acknowledge all participants who contributed their time to this study.

Conflict of Interest: None

Grant Support & Financial Support: None

## ABSTRACT

**Background:** Timely diagnosis, informed decision-making, and preventive care are critical to effective healthcare systems. These functions rely heavily on individuals' ability to understand and utilize health information, especially regarding laboratory testing. In low- and middle-income countries like Pakistan, low health literacy and limited awareness of diagnostic services continue to hinder early disease detection and management. Identifying gaps in laboratory testing awareness can inform public health strategies aimed at improving outcomes and promoting preventive care behaviors.

**Objective:** To assess the level of health literacy and awareness of laboratory testing among the literate population in Pakistan and to identify associated barriers to diagnostic utilization.

**Methods:** A retrospective cross-sectional survey was conducted from January to May 2025 using a structured online questionnaire distributed nationwide across all provinces and Islamabad. The sample included 518 literate individuals aged 16 years and above. Data were collected on demographics, awareness of diagnostic services, health status, and perceptions toward laboratory testing. Descriptive statistics were used for analysis.

**Results:** Among 518 respondents, 440 (84.9%) were aged 16–30 years, and 270 (52.1%) were female. Despite 86.7% agreeing that annual laboratory testing aids in early diagnosis, only 137 individuals (26.4%) had undergone a CBC test in the last six months. A total of 172 participants (33.2%) did not know their blood group, and 60 (11.6%) expressed disinterest in learning it. Chronic diseases were reported by 340 individuals, with specific conditions including diabetes (n=10), cardiovascular disease (n=6), cancer (n=2), and kidney disorders (n=8). Additionally, 129 respondents (25%) declined to disclose their health conditions.

**Conclusion:** The study reveals a significant gap between awareness and actual practice regarding laboratory testing in Pakistan. Targeted educational efforts and accessible diagnostic services are essential to bridge this divide and promote preventive healthcare.

**Keywords:** Awareness, Chronic Disease, Health Literacy, Laboratory Tests, Pakistan, Preventive Health, Surveys and Questionnaires.

## BACKGROUND

Low health literacy may limit awareness and utilization of laboratory tests in Pakistan

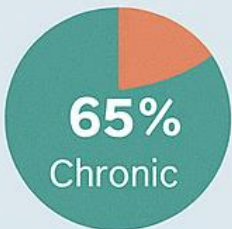


## METHODS

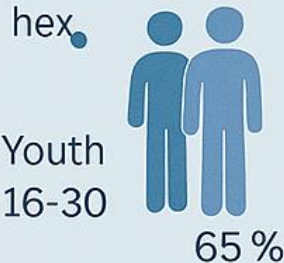
518  
online survey  
participants



## RESULTS



Believe natests  
hex.



Help diagnose  
illness early



## CONCLUSION

Findings highlight the need to improve health literacy and promote lab testing



## INTRODUCTION

The foundation of effective healthcare delivery rests on timely diagnosis, informed decision-making, and preventive measures, all of which are heavily influenced by an individual's level of health literacy. A growing body of evidence supports the link between improved health literacy and better health outcomes, particularly in facilitating access to healthcare services, adherence to treatment protocols, and utilization of preventive care (1). In the context of low- and middle-income countries such as Pakistan, where the health system is often burdened by limited resources, socioeconomic disparities, and infrastructural gaps, health literacy emerges as a critical determinant of population health. Defined as the ability to obtain, process, and understand basic health information necessary for making appropriate health decisions, health literacy in Pakistan remains notably low (2,3). This not only limits healthcare utilization but also undermines preventive strategies and timely medical interventions. A specific and often under-recognized aspect of health literacy is public awareness of laboratory testing, which plays a central role in the diagnosis, monitoring, and management of a wide array of diseases. Awareness of laboratory diagnostics can lead to early detection, especially of chronic and communicable conditions, ultimately improving individual health outcomes and reducing the strain on overburdened healthcare systems (4,5). Unfortunately, in Pakistan, awareness regarding routine and preventive diagnostic tests is considerably deficient, largely due to systemic issues such as low general literacy rates, limited health education, gender inequality, and deeply rooted cultural beliefs (6). Economic constraints further discourage the pursuit of diagnostic services, as immediate costs are often prioritized over long-term health benefits (7).

The consequences of poor diagnostic literacy are well documented. For instance, a study conducted in Quetta revealed that over 80% of participants lacked awareness regarding hepatitis B transmission and prevention, including blood testing and vaccination (8). Misconceptions surrounding laboratory testing persist not only in the general public but even among healthcare professionals, where poor adherence to universal precautions has been linked to insufficient knowledge of bloodborne pathogen transmission (9). Similarly, cultural practices in rural areas often emphasize symptomatic treatment, sidelining the role of diagnostics in preventive care (10). The issue of diagnostic illiteracy is not isolated to Pakistan. Global data suggests a widespread lack of awareness about essential health services such as palliative care and chronic disease management. For example, a review by Patel and Lyons examining public knowledge of palliative care across multiple countries including the United States, Korea, and Ireland, consistently found that the majority of individuals had poor or no understanding of palliative care services (11). A similar knowledge gap was observed in patients with chronic kidney disease (CKD), where general awareness among the public was markedly low, highlighting the urgent need for public education on disease-specific diagnostics (12).

The implications of poor laboratory test awareness are far-reaching. Individuals with limited knowledge are more likely to delay or entirely avoid essential diagnostic procedures, resulting in the late identification of diseases such as diabetes, hepatitis, and HIV (13,14). On the other hand, health-literate individuals are more likely to adhere to diagnostic recommendations and manage their conditions more effectively, as evidenced in diabetes care where understanding of tests such as HbA1c correlates with better treatment compliance (15). Addressing these challenges requires multifaceted interventions. Public health policies must prioritize the integration of health literacy programs into national education curricula, community outreach, and healthcare provider training. Technological platforms can also be leveraged to disseminate accurate, culturally sensitive information about diagnostic testing, especially in underserved regions (12). Empowering individuals with knowledge about laboratory testing is not just a clinical necessity but a public health imperative. Therefore, the objective of this study is to assess the awareness of laboratory testing and the level of health literacy among the population of Pakistan, thereby identifying critical areas for educational and policy-driven interventions aimed at improving health outcomes.

## METHODS

This study employed a retrospective cross-sectional design aimed at assessing health literacy and laboratory testing awareness among the general population of Pakistan. A total of 518 individuals were included using a non-probability convenience sampling method. Data were collected between January 2025 and May 2025 through a structured online survey disseminated via Google Forms. The survey instrument was adapted from validated constructs assessing 'patient awareness' and 'health literacy' and was designed in English to ensure clarity and consistency in data collection. Participants aged 18 years and above, residing in Pakistan, and capable of understanding English were eligible for inclusion. Individuals who declined participation, failed to complete the questionnaire, or submitted incomplete responses were excluded from analysis. The self-administered questionnaire consisted of both closed-ended and Likert scale-based items. Prior to data collection, the tool underwent a pilot test with a small sample to confirm the clarity, reliability, and comprehensibility of the questions. All participants were informed about the purpose of the study, and informed consent was obtained electronically before

proceeding with the questionnaire. Confidentiality and anonymity of responses were assured. The study protocol was reviewed and approved by the Institutional Review Board (IRB). Data were exported into IBM SPSS Statistics version 25.0 for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize demographic variables and awareness levels. Inferential statistics such as chi-square tests and independent sample t-tests were applied to explore associations between demographic variables and levels of awareness or literacy, with a p-value <0.05 considered statistically significant.

RESULTS

The study analyzed responses from a sample of 518 individuals across Pakistan. The majority of respondents (84.9%) were aged between 16 and 30 years, while only 0.6% were aged 0–15 years, 12.4% were 31–45 years, and 2.1% were 46–60 years. Gender distribution was relatively balanced, with 52.1% females and 47.9% males. In terms of education, 71.8% held a bachelor's degree, followed by 16.6% with intermediate-level education, 9.3% with MS degrees, and 1.5% with matriculation. Only 0.4% of respondents held a PhD or post-doctoral qualification each. Regarding chronic health conditions, 1.9% of participants reported having diabetes, 1.5% had kidney disease, 1.15% had cardiovascular disease, and 0.4% had cancer. Additionally, 4.1% reported other chronic diseases, and 0.41% were affected by both diabetes and kidney disease. A substantial proportion (65.5%) reported having no chronic condition, while 25% preferred not to disclose their status. Furthermore, many respondents (n=41) reported unspecified chronic illnesses beyond the defined categories, and a total of 222 chronic disease cases were reported among their family members, including conditions such as hypertension, hepatitis, depression, and tuberculosis. Only 26.4% of participants had undergone a CBC/CP test in the past six months, while 73.6% had not. Among those tested, 24 individuals reported findings such as anemia, low hemoglobin, dengue, low WBC, and platelet counts. Regarding awareness of blood grouping, 66.8% of participants had undergone blood grouping tests, yet 80.7% claimed to know their blood group. Distribution of blood groups was as follows: B+ (23.4%), O+ (20.5%), A+ (19.9%), AB+ (9.3%), O- (4.4%), A- (1.5%), B- (1.5%), AB- (0.2%), and 19.3% were unaware of their blood group. While 79.9% agreed that knowing one's blood group is important, 11.6% disagreed and 8.5% were unaware of where testing could be done.

Regarding general laboratory testing practices, 65.25% of participants had undergone some form of laboratory test in the past year, while 34.7% had not. A majority (76.3%) believed that an annual CBC test is beneficial, 16.2% were unsure, and 7.5% disagreed. About 18.7% believed frequent laboratory testing might expose them to infection, 55% rejected this myth, and 26.3% were unsure. Most respondents (86.7%) agreed that annual testing helps in early diagnosis, 8.9% were unsure, and 4.4% disagreed. Laboratory infrastructure was a concern for 29% of participants, while 50.8% were not bothered and 20.3% were indifferent. A significant majority (76.4%) preferred private laboratories, while 23.6% opted for public ones. Although 76.4% did not consider laboratory testing a waste of money, 10.6% believed it was, and 12.9% were uncertain. In terms of health literacy, 52.1% preferred consulting doctors to interpret lab results, 36.9% approached laboratory technologists, 4.1% consulted nurses, 6.6% interpreted results themselves, and 0.4% trusted non-medical individuals. Despite this, 36.3% admitted they refrained from asking questions about lab results due to discomfort, whereas 63.7% felt comfortable asking. About 22% were confident in interpreting results independently, 67.5% were somewhat confident, and 10.4% were unable to interpret results. Interestingly, 29% believed they always interpreted results correctly, 55.6% believed they interpreted them partially, and 15.4% admitted they could not. Additionally, 25.5% preferred not to receive results until reviewed by a doctor, while 54.6% were partially confident and 19.9% were confident in reading them on their own.

Table 1 Demographic distribution of the sample population by age, gender, and education

Category	Subcategory	Frequency	Percentage (%)
Age Group (Years)	0–15	3	0.6%
	16–30	440	84.9%
	31–45	64	12.4%
	46–60	11	2.1%
	Total	518	100%

Category	Subcategory	Frequency	Percentage (%)
Gender	Male	248	47.9%
	Female	270	52.1%
	Total	518	100%
Education Level	Matriculation	8	1.5%
	Intermediate	86	16.6%
	Bachelors	372	71.8%
	MS	48	9.3%
	PhD	2	0.4%
	Post-doc	2	0.4%
	Total	518	100%

Table 2 Chronic conditions among the sample population

Chronic Condition	Frequency	Percentage (%)
Diabetes	10	1.9%
Cancer	2	0.4%
Cardiovascular Disease	6	1.15%
Kidney Diseases	8	1.5%
Other Chronic Disease	21	4.1%
No Chronic Disease	340	65.54%
Prefer Not to Say	129	25%
Diabetes & Kidney Diseases	2	0.41%
Total	518	100%

Table 3 CBC and Blood Grouping Test Status among the Sample Population

Test Type	Response	Frequency	Percentage (%)
CBC Test (Last 6 Months)	Yes	137	26.4%
	No	381	73.6%
	Total	518	100%
Blood Grouping Test	Yes	346	66.8%
	No	172	33.2%
	Total	518	100%



Table 4 Awareness and Perception Regarding Laboratory Testing among the Sample Population

Question	Response	Frequency	Percentage (%)
Laboratory Testing Awareness	Yes	338	65.25%
	No	180	34.7%
	Total	518	100%
Belief That Annual Lab Tests Aid Early Diagnosis	Yes	449	86.7%
	No	23	4.4%
	Unsure	46	8.9%
	Total	518	100%

Table 5 Sample Population’s Response to Laboratory Infrastructure

Response to Laboratory Infrastructure	Frequency	Percentage (%)
Yes (Bothered)	150	29%
No (Not Bothered)	263	50.8%
Doesn’t Really Matter	105	20.3%
Total	518	100%

Table 6 Sample Population’s Perception of Laboratory Testing as a Waste of Money

Perception of Laboratory Testing as Waste of Money	Frequency	Percentage (%)
Yes	55	10.6%
No	396	76.4%
Unsure	67	12.9%

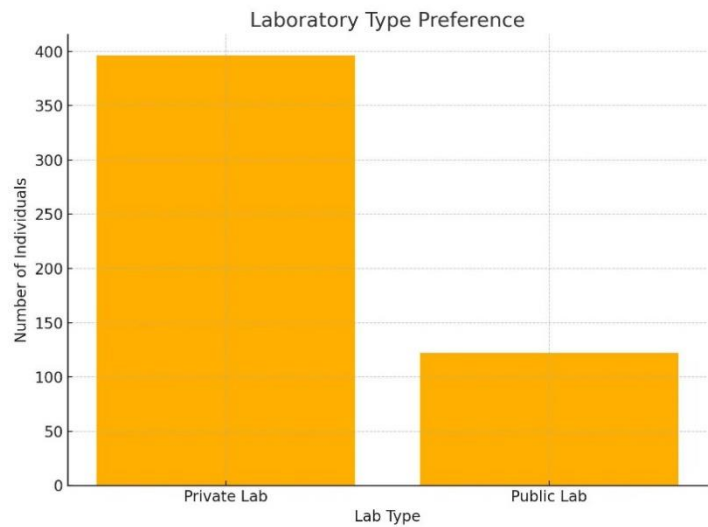


Figure 2 Laboratory Type Preference

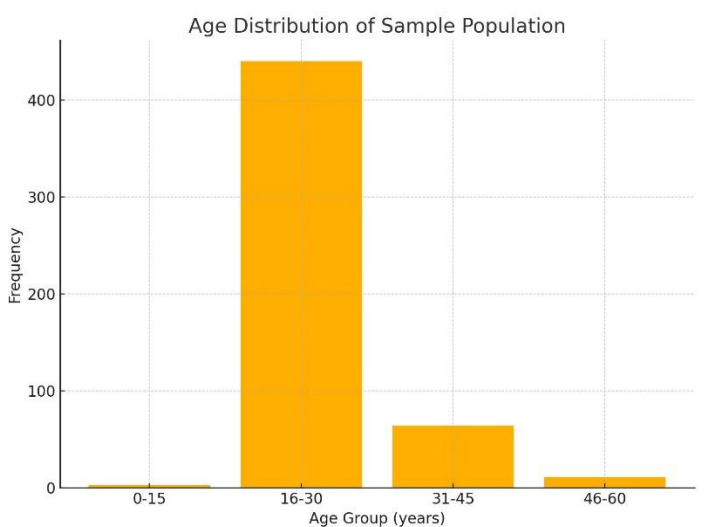


Figure 1 Age Distribution of Sample Population

Total	518	100%
-------	-----	------

DISCUSSION

Identification and promotion of awareness regarding laboratory testing play a pivotal role in public health, particularly in resource-constrained settings like Pakistan. Laboratory testing forms the foundation of modern diagnostic medicine, enabling early detection, effective disease monitoring, and timely intervention. However, these benefits remain underutilized without public awareness and proper health literacy. The current study, involving 518 participants, revealed a pronounced discrepancy between perceived importance and actual practice. While 86.7% of respondents acknowledged that regular laboratory testing facilitates early diagnosis, only 26.4% had undergone a CBC test in the past six months. This knowledge-behavior gap mirrors findings from global and local research, indicating that awareness alone is insufficient without corresponding health-seeking behaviors (14,15). The findings align with previous evidence that individuals with higher health literacy are more likely to engage in preventive health behaviors and adhere to diagnostic protocols. Internationally, significant variability in disease awareness has been documented, suggesting that symptoms or disease diagnosis often prompt engagement with the healthcare system, whereas awareness in asymptomatic individuals remains low (16). Similar patterns emerged in this study, where 34.7% had not undergone any laboratory testing in the previous year, despite understanding its significance. This emphasizes the need to move from passive knowledge to active participation in health maintenance.

Sociocultural and infrastructural factors further compound the issue. A notable proportion of respondents (29%) expressed dissatisfaction with laboratory infrastructure, and a substantial majority (76.4%) preferred private laboratories over public facilities. These preferences reflect deeper systemic challenges in public health delivery, including concerns regarding accuracy, cleanliness, staff behavior, and accessibility in public sector services (17). Misconceptions surrounding laboratory testing were also evident, with 18.7% of participants believing that repeated testing could be harmful, and 26.3% remaining uncertain. These myths, often perpetuated by misinformation and lack of health education, particularly affect communities with limited literacy. Misunderstandings about diagnostics not only delay preventive action but also foster mistrust in the healthcare system (18). Encouragingly, more than half of the participants were willing to seek clarification of their laboratory reports, primarily from physicians (52.1%) and laboratory technologists (36.9%). However, 36.3% of individuals admitted to avoiding questions due to discomfort, and only 22% felt confident in interpreting their results independently. This highlights the crucial role of healthcare provider–patient communication and the need to empower individuals through simplified and accessible diagnostic literacy tools. The reliance on healthcare professionals for interpretation underscores the complexity of laboratory findings and reinforces the importance of trained intermediaries to bridge understanding gaps. Digital health interventions, especially those tailored for low-literacy populations, can provide a scalable solution by simplifying result interpretation and reinforcing trust in diagnostics (19,20).

Economic concerns were also evident. While 76.4% of respondents did not perceive laboratory testing as a financial burden, 11% considered it a waste of money, and 12.9% were unsure. In a country where out-of-pocket health expenditures account for more than 60% of total health spending, these perceptions significantly influence care-seeking behavior. The affordability and accessibility of laboratory services must be addressed through policy interventions and innovative financing models such as subsidized services and mobile diagnostic units (21). The preference for private laboratories, despite the existence of public facilities, signals a broader trust deficit in the public health system. This reinforces the need for infrastructural improvements, enhanced quality control, and better patient experience within public laboratories (22). Public trust can be restored through accreditation systems, workforce training, and transparent quality assurance practices. Additionally, the low level of confidence in interpreting laboratory results (only 22% fully confident) points to the need for educational strategies that move beyond basic health information and instead foster critical health literacy, allowing individuals to understand and act on their health data effectively. Another important finding was that participants with family histories of chronic diseases were more inclined toward preventive screening, especially when made aware of these risks. However, formal documentation and utilization of family history in routine clinical practice remain rare in Pakistan. Integrating familial risk assessment into primary care settings could be a valuable step toward personalized preventive care. Moreover, community health workers can be instrumental in raising diagnostic awareness, especially in rural and underserved regions, by delivering culturally sensitive education in local languages.

Despite these valuable insights, the study had limitations. The use of an online, English-language questionnaire likely introduced selection bias, underrepresenting populations with low literacy, limited internet access, or non-English speakers. The cross-sectional design restricted the ability to establish causal relationships. Additionally, the overrepresentation of younger, educated participants

(84.9% aged 16–30 and 71.8% holding bachelor's degrees) may not reflect the broader population’s perspectives, especially older adults and those from lower educational backgrounds. Nevertheless, the study offers important directions for future research and policy. Health literacy must be recognized as a core component of healthcare strategy. Public-private partnerships can help improve infrastructure and subsidize testing costs, and mobile laboratory services can reach marginalized populations. Incorporating health education into national school curricula and leveraging digital platforms can also bridge the awareness-practice divide. Lastly, integrating electronic health systems with lab test reminders and personalized dashboards may reinforce health-seeking behaviors. The findings reinforce the urgent need for a comprehensive, multi-level approach to promote diagnostic literacy, dismantle structural barriers, and translate awareness into sustained preventive health behaviors in Pakistan’s population.

CONCLUSION

This study concludes that while there is a promising level of perceived awareness about the role of laboratory testing in early disease detection among the literate population of Pakistan, significant gaps remain between knowledge and practice. The findings reveal that many individuals, despite understanding the importance of diagnostic testing, do not regularly undergo such evaluations, often due to misconceptions, discomfort, or lack of motivation. Additionally, a considerable portion of the population remains unaware of basic health information, such as their blood group, which further highlights the need for targeted educational interventions. These insights emphasize the critical need for strengthening health literacy initiatives and promoting diagnostic awareness, especially among youth and individuals with chronic conditions. Promoting routine laboratory testing through accessible public health strategies can bridge the knowledge-behavior gap and ultimately improve healthcare outcomes across the nation.

Author Contribution

Author	Contribution
Farah Shaikh*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Abrar Ahmed Hasni	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Misbah Asif	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Mohammad Wasiq Waseem	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Aamir Yaqoob	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Summara Habib	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Shoaib Hasni	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Muhammad Jawad Khan	Writing - Review & Editing, Assistance with Data Curation



## REFERENCES

1. Gilreath J, Lo M, Bubalo J. Thrombopoietin Receptor Agonists (TPO-RAs): Drug Class Considerations for Pharmacists. *Drugs*. 2021;81(11):1285-305.
2. Lautz Z, Kautz-Freimuth S, Shukri A, Redaelli M, Rhiem K, Schmutzler R, et al. Predictors of knowledge and knowledge gain after decision aid use among women with BRCA1/2 pathogenic variants. *Patient Educ Couns*. 2024;124:108248.
3. Malas M, Aboalfaraj A, Alamoudi H, Kurdi A, Alahmadi T, Zawawi F. Pediatricians' knowledge and attitude toward hearing loss and newborn hearing screening programs. *Int J Pediatr Otorhinolaryngol*. 2022;161:111265.
4. Acoglu EA, Oguz MM, Sari E, Yucel H, Akcaboy M, Zorlu P, et al. Parental Attitudes and Knowledge About Lumbar Puncture in Children. *Pediatr Emerg Care*. 2021;37(7):e380-e3.
5. Coupal E, Hart K, Wong B, Rothwell E. Newborn Screening Knowledge and Attitudes Among Midwives and Out-of-Hospital-Birth Parents. *J Perinat Neonatal Nurs*. 2020;34(4):357-64.
6. Elafros MA, Belessiotis-Richards C, Birbeck GL, Bond V, Sikazwe I, Kvalsund MP. Lumbar Puncture-Related Knowledge, Attitudes, and Practices among Patients, Caregivers, Doctors, and Nurses in Zambia. *Am J Trop Med Hyg*. 2021;104(5):1925-31.
7. Kc H, Gurung A, Katuwal M, Sharma R, Parajuli SB. Knowledge, Practice and Barriers on Cervical Cancer Screening among Married Women. *J Nepal Health Res Counc*. 2023;20(3):755-60.
8. Mir ZM, Fei LYN, McKeown S, Dinchong R, Cofie N, Dalgarno N, et al. Knowledge, perceptions, attitudes, and barriers pertaining to genetic literacy among surgeons: a scoping review. *Can J Surg*. 2024;67(2):E118-e27.
9. Tarlabeleden Karaytuğ E, Boyraz S. Knowledge and attitudes of apheresis donors regarding apheresis blood donation. *Transfus Med*. 2023;33(1):39-48.
10. McCall MK, Ibikunle S, Murphy Y, Hunter K, Rosenzweig MQ. Knowledge and Attitudes About Genetic Testing Among Black and White Women with Breast Cancer. *J Racial Ethn Health Disparities*. 2021;8(5):1208-16.
11. Salehiniya H, Momenimovahed Z, Allahqoli L, Momenimovahed S, Alkatout I. Factors related to cervical cancer screening among Asian women. *Eur Rev Med Pharmacol Sci*. 2021;25(19):6109-22.
12. Deguara M, Calleja N, England K. Cervical cancer and screening: knowledge, awareness and attitudes of women in Malta. *J Prev Med Hyg*. 2020;61(4):E584-e92.
13. Srinivasan S, Won NY, Dotson WD, Wright ST, Roberts MC. Barriers and facilitators for cascade testing in genetic conditions: a systematic review. *Eur J Hum Genet*. 2020;28(12):1631-44.
14. Alghuson L, Alturki NI, Alsulayhim AS, Alsughayer LY, Akkour KM. Awareness, Knowledge, Perceptions, and Attitudes towards Familial and Inherited Cancer. *Medicina (Kaunas)*. 2022;58(10).
15. Zoltick ES, Bell M, Hickingbotham MR, Wu AC, Galbraith LN, LeBlanc JL, et al. Attitudes, knowledge, and risk perceptions of patients who received elective genomic testing as a clinical service. *Genet Med*. 2024;26(10):101200.
16. Ahmed, J., Azhar, S., ul Haq, N., Hussain, S., Stájer, A., Urbán, E., . . . Jamshed, S. (2022). Awareness of chronic kidney disease, medication, and laboratory investigation among nephrology and urology patients of Quetta, Pakistan. *International Journal of Environmental Research and Public Health*, 19(9), 5015.
17. Arif, A., Ahmad, E., Khan, F. N., & Fatima, R. (2021). Formal Education Vs Health Literacy: An Insight into Treatment Outcome of the Randomized Control Trial of MDR-TB Patients in Pakistan. *Journal of Arts & Social Sciences*, 8(1), 127-136.
18. Ashfaq, M., Ahmed, S. A., Aziz-Rizvi, R., Hasan, Z., Kirmani, S., Munim, S., . . . Furqan, A. (2023). Identifying the current status and future needs of clinical, educational, and laboratory genetics services in Pakistan: a web-based panel discussion. *Journal of Community Genetics*, 14(1), 71-80.

19. Chu, C. D., Chen, M. H., McCulloch, C. E., Powe, N. R., Estrella, M. M., Shlipak, M. G., & Tuot, D. S. (2021). Patient awareness of CKD: a systematic review and meta-analysis of patient-oriented questions and study setting. *Kidney medicine*, 3(4), 576-585. e571.
20. Mulat, A., Kassa, S., Belay, G., Emishaw, S., Yekoye, A., Bayu, H., & Kebede, S. (2020). Missed antenatal care follow-up and associated factors in Eastern Zone of Tigray, Northern Ethiopia. *African health sciences*, 20(2), 690-696.
21. Patel, P., & Lyons, L. (2020). Examining the knowledge, awareness, and perceptions of palliative care in the general public over time: a scoping literature review. *American Journal of Hospice and Palliative Medicine®*, 37(6), 481-487.
22. Stewart, E., Ercia, A., Greer, S. L., & Donnelly, P. D. (2020). Between a rock and a hard place: Comparing arms' length bodies for public involvement in healthcare across the UK. *Health Policy*, 124(4), 454-461.