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DIGITAL METROLOGY IN LABORATORY MEDICINE: A CALL FOR BRINGING ORDER TO CHAOS TO FACILITATE PRECISION DIAGNOSTICS

M. De Geus-Bosma [1], C. Cobbaert [1]
[1]*Leiden University Medical Center*

BACKGROUND-AIM

Laboratory medicine is faced with rapid developments in data exchange, secondary use of data and artificial intelligence (AI). Safe exchange of laboratory data requires a suitable terminology standard. NPU, LOINC and SNOMED CT are increasingly used for this purpose, but none of these terminology standards can currently accommodate safe exchange across the full spectrum of conventional laboratory data. Furthermore, rapid technological advances in, amongst others, the 'omics' area will enforce a shift towards precision diagnostics, aiming to stratify patients in order to precisely diagnose and monitor patients. These emerging technologies demand an appropriate and future-proof terminology standard.

METHODS

Given the current and future challenges in laboratory terminologies, we here present a concept for digital metrology in laboratory medicine.

RESULTS

Terminology standards used in laboratory medicine should be adjusted to the current state of science to allow safe data exchange and interpretation. Essential test information for safe data exchange and secondary use of data now and in the future entails the full spectrum of pre-pre-analysis to post-post-analysis. Major improvements needed include sufficient coding detail for the molecular form of the measurand and information on metrological traceability (calibration hierarchy). Furthermore, especially given the advances in precision diagnostics, it will become essential to indicate interrelationships between measurands. Herefore, integration with established taxonomies like UniprotKB would allow improved identification of interrelationships between measurands and linkage with scientific information for multidisciplinary data science. Hence, laboratory data can further gain in specificity and value.

CONCLUSIONS

The time has come to lay the basis for safe data exchange in the era of precision diagnostics, with a global focus. A consensus for digital metrology in laboratory medicine will be essential to move forward with health data exchange within Europe and beyond.

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STREAMLINING HIV VIRAL LOAD SAMPLE MANAGEMENT IN MUCHINGA PROVINCE: A RETROSPECTIVE STUDY ON LABORATORY INFORMATION SYSTEMS (LIS) IMPLEMENTATION

A. Maleti [2], T. Mekelani [2], M. Mapipo [4], M. Mapipo [4], P. Daka [4], L. Ngandu [3], A. Mumbi [1], P. Mwala [2], C. Mwampanja [2], S. Kanyika [2]

[1]*Provincial Health Office, Ministry Of Health, Chinsali Muchinga, Zambia*
[2]*USAID Action To HIV Epidemic Control, Chinsali Muchinga, Zambia*
[3]*USAID Action To HIV Epidemic Control, Muchinga, Zambia*
[4]*Virology Laboratory, Chinsali General Hospital, Muchinga, Zambia*

BACKGROUND-AIM

Efficient and reliable sample management is critical for delivering timely and accurate diagnostic results in healthcare systems. However, Muchinga Province in Zambia faces significant challenges in sample management due to the underutilization of Laboratory Information Systems (LIS) in some facilities. Of the 164 health facilities in the province, only 67 utilize the LIS system, while 97 remain without any electronic systems, creating substantial gaps in monitoring and managing samples. This study aims to evaluate the implementation and utilization of electronic laboratory systems (eLabs) in Muchinga Province.

METHODS

A Retrospective cross-sectional study was conducted at Chinsali General Hospital, Muchinga Province from July 2023 to March 2024. To determine LIS utilization and implementation, All HIV Viral load sample records during the study period from 164 health facilities were included in this study; of which 67 facilities utilized LIS while 97 operated without electronic systems. Descriptive statistics were used to analyze the data.

RESULTS

A total of 25,782 HIV Viral Load samples submitted revealed LIS-enabled facilities captured 18,384 (71%), while facilities without LIS accounted for only 7398 (29%). Among eLABs enabled facilities, utilization rates varied with Mpika District being the highest at 82% and Mafinga District the lowest at 12%. Additionally, Mafinga District had the highest Manual entries 659 (88%) with Mpika District having the lowest at 1337(18%).

CONCLUSIONS

The Study findings indicate the critical role of LIS in improving HIV Viral Load sample management, enhancing accuracy, and reducing turnaround times. However, substantial disparities in LIS adoption across districts highlight the need for targeted strategies to expand implementation. Strengthening LIS infrastructure and training could bridge gaps in efficiency and accountability, contributing to improved healthcare outcomes in Muchinga Province.

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AN ASSESSMENT OF THE HOSPITAL INFORMATION SYSTEM IN THE EMERGENCY DEPARTMENT: FOCUSING ON A NEW ELEMENT OF PATIENT SAFETY.

C. Mishra [2], T. Sehgal [2], N. Jamshed [1], T. Mukhopadhyay [2]
[1]*Department of Emergency Medicine, All India Institute of Medical Sciences, New Delhi*
[2]*Department of Laboratory Medicine, All India Institute of Medical Sciences, New Delhi*

BACKGROUND-AIM

The present study was conducted to assess the awareness, ease of use, and efficiency of the electronic hospital information system (HIS) in Emergency Department (ED) among emergency medicine practitioners of tertiary care hospital in north India.

METHODS

We conducted a cross-sectional study in a tertiary care hospital in India. It was composed of quantitative data obtained from a self-administered, pre-tested and structured questionnaire to document user feedback for the patient display system (PDS), laboratory information system (LIS), and radiology information system (RIS) modules of the HIS used in the ED. The HIS's usability among users was determined using a modified system usability score.

RESULTS

One hundred-three physicians in the ED responded to the survey in total. With a mean score of 83.6 (SD 12.8), the HIS was considered nearly good based on the System Usability Scale. Most participants found the HIS quicker and more accurate than paper medical records. The participants stated that the system assisted them with every aspect of patient care, including ordering laboratory tests, seeing test results, making clinical choices, and following up with patients. However, to properly assess the patients, graphs and tables must be created to enhance the user experience.

CONCLUSIONS

This study demonstrates that the information system's usability is rated close to excellent. It helped us understand physicians' understanding of the HIS for patient care in the ED. Improvements include making the system more usable by incorporating graphs and tables. The study shows how a technological solution can diminish the information gap in an ED context.

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LEVERAGING NATIONAL LAB DATA TO IDENTIFY SUSPECTED CONGENITAL ADRENAL HYPERPLASIA IN PAKISTAN: A STEP TOWARD EARLY DETECTION

R.H. Shaikh [1], Z.H. Ejaz [1], A. Sadiqa [1], M.A. Abid [1], A. Habib [1], H. Majid [1], S. Ahmed [1], I. Siddiqui [1]
[1]*The Aga Khan University Hospital*

BACKGROUND-AIM

Congenital adrenal hyperplasia (CAH) requires timely diagnosis to prevent severe complications. Analyzing large-scale laboratory datasets can identify trends in diagnostic markers like 17-hydroxyprogesterone (17-OHP). This study leverages national laboratory data on 17-OHP levels across Pakistan to assess suspected CAH prevalence and gender trends, addressing critical gaps in a setting lacking universal newborn screening, a CAH registry, and reliable prevalence data.

METHODS

A retrospective analysis of Aga Khan University Hospital's Laboratory Information System (2009–2023) was conducted, including demographics, 17-OHP levels, and location. Age-specific 17-OHP reference ranges were applied to infants (0–1 year), children (1–<18 years), and adults (≥18 years). Statistical analyses were performed using Stata 17.0, with Fisher's exact test and the Kruskal-Wallis test for significance ($p<0.05$). Annual percentage changes were calculated via JoinPoint Regression.

RESULTS

After excluding duplicates and incomplete records, 27,978 tests were analyzed, predominantly in infants (n=10,844), followed by children (n=8,830) and adults (n=8,304), with 14,673 showing elevated 17-OHP levels indicative of CAH. Positive cases were most prevalent in infants (86.9%), followed by children (49.9%) and adults (10.1%). Male infants had the highest median 17-OHP levels (250 ng/mL, IQR: 55–320 ng/mL). Trend analysis revealed a steady increase in positive 17-OHP tests in infants throughout the study period (APC: 6.85% [4.78–8.85]). In children, a decline from 2009–2020 (APC: -2.09% [-6.74 to -0.08]) was followed by a marked rise until 2023 (APC: 20.3% [4.99–41.85]). Among adults, positive tests decreased significantly from 2009–2012 (APC: -27.36% [-46.63 to -5.24]) with a subsequent stabilization. Punjab had the highest proportion of positive cases (44.6%), followed by Sindh (20.0%), and Khyber Pakhtunkhwa (19.2%).

CONCLUSIONS

This first large-scale dataset on suspected CAH in Pakistan highlights significant age and gender disparities, underscoring the need for future studies to assess the prevalence of CAH. Integrating advanced machine learning tools into laboratory systems can facilitate the implementation of newborn screening, improving outcomes for patien

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CORRELATION STUDY BETWEEN TRADITIONAL CHINESE MEDICINE PULSE DIAGNOSIS IMAGES AND THE SEVERITY OF CORONARY ARTERY LESIONS AS WELL AS LABORATORY TEST INDICATORS

Y. Yuehua [2], Z. Hanbo [2], Z. Yubo [1], F. Feixue [1]

[1]*Department of Laboratory Medicine, The Affiliated Hospital of Shaanxi University of Chinese Medicine, Deputy 2, West Road Weiyang, Qindu District , Xianyang, Shaanxi, 712000, China.*

[2]*School of Medical Technology, Shaanxi University of Traditional Chinese Medicine, Xianyang, Shaanxi 712046, China.*

BACKGROUND-AIM

Coronary heart disease (CHD) is a global health threat with inflammation as a key factor. TCM pulse diagnosis, a non-invasive method, has been used for centuries. Recent pulse digitization technology offers new insights into CHD diagnosis. However, the link between TCM pulse parameters and coronary artery lesion severity, as well as their correlation with biochemical markers, is understudied. The primary objective is to investigate the correlation between pulse diagram characteristics and the severity of the disease in patients with coronary heart disease, and to identify laboratory test indicators that may be related to pulse diagram parameters.

METHODS

Pulse samples were collected from 120 patients with coronary heart disease using a digital pulse acquisition and analysis instrument. Patients were divided into three groups based on the coronary artery lesion degree score: normal coronary artery group, non-severe coronary artery lesion group, and severe coronary artery lesion group. Concurrently, various laboratory test indicators, including blood lipids, inflammation markers, coagulation factors, and hypertension-related parameters, were collected. Binary logistic regression analysis and canonical correlation analysis were employed to identify pulse diagram indicators and laboratory test indicators that showed significant correlations.

RESULTS

Significant differences in pulse diagram parameters H1, Ass, and Ad were observed among patients with varying severities of the disease . The pulse diagram parameters (H1, H2, H3, H4, H5) were correlated with the laboratory test indicators (SII, SIRI, FIB, D-Dimer, TCHO, TG, LDL, HDL), with a correlation coefficient of 0.911. Specifically, H5 (rebound wave) was correlated with SII, SIRI, and D-Dimer.

CONCLUSIONS

There are significant differences in pulse diagram parameters among patients with different degrees of coronary artery lesions. These parameter changes can reflect the cardiovascular characteristics of patients in different groups. The correlation between pulse diagram parameters of coronary heart disease and inflammatory markers suggests that inflammation may be one of the material bases underlying the changes in pulse diagrams in coronary heart disease.

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DIGITAL LABORATORY PROJECT: A REVOLUTION IN HOSPITAL LABORATORIES SERVICES

D. Weinstein [1], R. Geler [1], S. Chagbi [1], G. Rashid [1]
[1]*Medical laboratories Devision, Meir Medical Center, Kfar Saba*

BACKGROUND-AIM

The medical laboratories at Meir Medical Center provides a wide range of laboratory services to all departments and units, while constantly striving to improve the service. Back in 2018, a "digital laboratory" system was implemented in the inpatient departments for ordering samples in an advanced computerized manner instead of using manual ordering and registration forms. The computerized ordering process replaces manual work. Over the years we have been able to add additional departments to the project, such as the Emergency Department and more.

METHODS

In order to measure the success of this significant project, in a multi-year view, we performed a wide analysis on several aspects. The measurement was carried out for departments that were included in this project from the beginning.

RESULTS

We defined key indicators relevant to the project for measuring laboratory services. In the measurement of sample rejection, an overall reduction of 36% was measured. A significant reduction was measured in rejections that stemmed from patient identification errors and treatment safety. Analysis of test execution times showed a significant improvement in the arrival time of samples to laboratory reception, so that more efficient treatment is obtained in their reception. In addition, efficient execution times were measured for a variety of routine tests, compared to the period before the project. Very successful execution times of about 45 minutes on average until release of results were measured for tests that were marked urgent in the system, and accordingly require faster execution time. In a multi-year perspective, we have also identified financial savings after implementing the project at the hospital.

CONCLUSIONS

The digital laboratory project is a revolution in laboratory services and the provision of more efficient, high-quality and advanced service to the inpatient departments. The results of the indicators we defined to measure the laboratory service indicate progress and improvement in the service in terms of reducing disqualifications, times for receiving and performing routine tests, and handling urgent tests. The data indicates a successful process implementation over the years and encourages us to continue deploying the project in more departments.