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Performance Evaluation of Commonly Used Portable Hemoglobin Sensors in Comparison to Clinical Test Results

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Abstract. Telehealth systems in underserved countries leverage various low-cost portable medical sensors to transmit patients' vital information to remote doctors, facilitating timely diagnoses and interventions. However, the potential risks associated with inaccurate data pose considerable threats to the health of individuals. This study focuses on identifying high-quality portable hemoglobin sensors, employing the Japanese clinical pathology laboratory as a gold standard. Out of the eight sensors evaluated in this study, four were found to be highly erroneous.

Keywords. Sensor Evaluation, Portable Sensor, Hemoglobin Sensor, Telehealth

1. Introduction

The portable medical sensors play a very significant role these days in the developing world, where many clinics and diagnostic centers use these sensors [1]. This study considered the Portable Health Clinic (PHC) as a reference telehealth system that uses portable hemoglobin sensors for identifying anemia among pregnant women [2]. Therefore, it is very important to identify low-cost but high-performance sensors to ensure the quality and sustainability of the services.

2. Materials and Methods

This study collected eight hemoglobin sensors (HB1-8) for the PHC system from different countries. The experiment was conducted in a local clinic in Japan, where the blood samples were tested by these sensors as well as in the clinical pathology laboratory

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using the Automatic Analyzer (EDTA-2K). If the Normalized Root Mean Square Error (NRMSE) was less than 0.15, the result of the portable sensor was considered acceptable.

3. Results

The results of three sensors collected from Asian low-economy markets (HB-2, HB-3, and HB-6) and one from the USA market (HB-4) were very inconsistent (NRMSE > 0.15) with the clinical pathology laboratory test results [Figure 1]. The results of the other two sensors from Asian low-economy markets (HB-1 and HB-5), one from the Japanese market (HB-7), and one from the Zambian market (HB-8) were somewhat consistent (NRMSE < 0.15) with the laboratory test results.

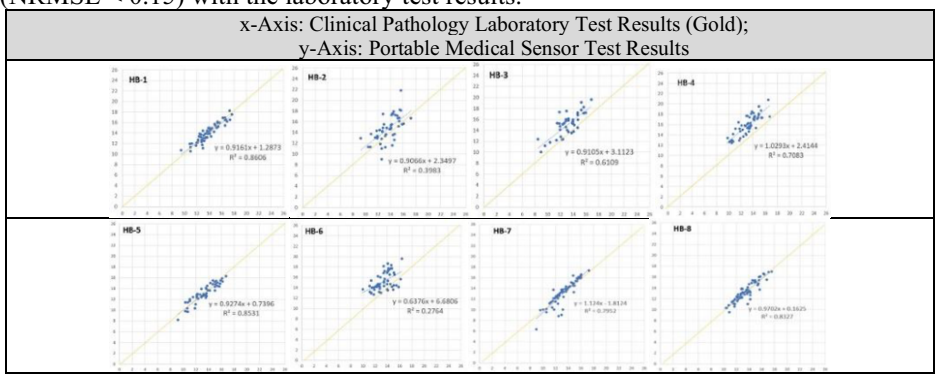

Figure 1. Test results of cholesterol sensors.

4. Discussions

The two high-performance hemoglobin sensors collected from the Asian low-economy markets were very cheap compared to the other two high-performance sensors from Japan and Zambia. This challenges the notion that a higher price tag necessarily equates to reliability. Consequently, this study advocates for the adoption of economically viable, high-performance sensors such as HB-5 or HB-1 for PHC services in low-economy developing countries.

5. Conclusions

This kind of evaluation and recommendation is very important for every sensor to be used in healthcare facilities to ensure the quality of services.

References

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