VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Geletaw Sahle Tegenaw**

The public defense will take place on **Friday 1st September 2023 at 2:00pm** in room **E.0.05** (Building **E,** VUB Main Campus)

To join the digital defense, please click here
Meeting ID: 321 337 508 797
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DEVELOPING CLINICAL DECISION SUPPORT INSTRUMENTS FOR THE POINT-OF-CARE IN LOW RESOURCE SETTINGS

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Abstract of the PhD research

Clinical decision support systems (CDSSs) have been shown to assist clinical decision making in healthcare while also enabling timely and appropriate integrated care services. The clinical pathway (CP), in particular, delivers and outlines an optimal logical path and plan of care from assessment to treatment at the primary and secondary health care level. Clinical pathways are increasingly used in routine patient care to maintain care process standardization, improve patient outcomes, reduce costs, and empower local healthcare practitioners. However, these clinical decision support and/or clinical pathway systems have remained out of reach for low-resource settings (LRSs). In LRSs, following the paper-based clinical guideline is a traditional practice and the only choice utmost. The service is suboptimal and challenged to deliver accurate and adequate evidence for decision making. Furthermore, low clinical competence, limited diagnostic capabilities, high turnover and low motivation are some of the challenges that most public health facilities in developing countries are facing on a day-to-day basis.

This dissertation demonstrates and develops computer-aided point-of-care decision support instruments for identifying referral and locally treatable cases. To develop CDSSs for LRSs, the overall need for the development of clinical decision support systems was initially assessed. Then, a state-of-the-art review was conducted to investigate design approaches for executable CPs at the point-of-care, and the results show that exploring a trade-off mechanism between knowledge-based and data-driven techniques is critical for promoting data-driven decision-making approaches. Next, an algorithm for the automated and dynamic generation of CPs was developed. The key principle of our proposed algorithm is that it operates with minimal clinical input and may be updated as new information becomes available, and it dynamically maps and validates the initial knowledge-based CP based on the local context and historical evidence in order to provide a multi-criteria decision analysis. The proposed solution was then deployed on an edge device, the Raspberry Pi 4 Model B, to provide a point-of-care clinical reference, data processing, and workflow generator, as well as an interactive data visualization and clinical guidance wizard for LRS. Finally, user acceptance of the CDSS at the point-of-care in LRSs was evaluated using 22 parameters organized into six major categories, namely ease of use, system quality, information quality, decision changes, process changes, and user acceptance. A follow-up interview, on the other hand, indicated a variety of reasons for disagreement based on the neutral, disagree, and strongly disagree responses. Furthermore, the overall acceptability was simulated using partial least squares structural equation modeling, and a variety of factors impacting the acceptance of the CDSS in LRSs were examined.

In all, the key features of the CDSSs are able to provide low-cost, automated, adaptable, interactive, and applicable CPs for LRSs. A wider scale evaluation and longitudinal measurements, including CDSS usage frequency, speed of operation and impact on intervention time have not been included in the thesis work, because they require a larger deployment in daily practice.