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Letter to the Editors

# Exploring radio frequency identification (RFID) in healthcare: Promises fulfilled or forsaken?

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Dear editors,

The primary challenges faced by healthcare professionals involve mitigating the repercussions of adverse events and enhancing patient safety. An adverse event is defined as any complication arising during a patient's hospital stay that is unrelated to the underlying disease or reason for hospitalization. These events can have severe consequences for the patient, their family, and the healthcare system at large. The concept of traceability holds significant benefits for addressing these challenges. Traceability refers to the identification of all information related to a product from its origin to delivery and/or consumption. In the realm of health services, this translates to the precise identification of the patient, the drug administered, and the patient/drug relationship. This meticulous identification can substantially reduce the incidence of adverse events, thereby enhancing overall safety. The healthcare sector is presently grappling with the dual challenges of improving patient safety and reducing operational costs, often stemming from human and systematic errors. Radio Frequency Identification (RFID) technology has been gaining prominence across various industries, with healthcare witnessing substantial growth. Applications like Real-Time Locating Systems (RTLS) for patient tracking, medical staff, and asset tracking were poised to contribute significantly to the rapid expansion of the RFID industry [1].

The identification process involves reading an RFID tag attached to an asset or person without physical contact. Data collection and transfer occur through radio waves, enabling efficient, automatic, and real-time capture without human intervention. Unlike traditional barcode scanning, RFID readers can simultaneously read multiple tags from a greater distance, eliminating the need for proximity [2].

RFID technology, either independently or in conjunction with other technologies, is being explored as a viable solution to address public health hazards and improve overall management, such as reducing medical errors [3] and Adverse Drug Events (ADEs) [4], preventing and controlling infections [5], monitoring vital signs remotely and in real-time [6], as well as monitoring medical instruments and adherence of patients [7]. Especially, RFID has assumed a crucial role in assuring patient identification. Several pilots have been designed and tested for this purpose, such as at the Meyer Children's Hospital in Florence (Italy) for tracking and identifying patients in an Intensive Care Unit (ICU) [8], at the Emergency Department of Hospital A Coruna (Spain) for traceability and proper identification of patients

and prescribed medication [9], or at the Virxe da Xunqueira Hospital (Spain) for tracking hospitalizations, care plans, vital monitoring, prescriptions, and drug administration [10]. The risk analysis performed after the adoption of the RFID technology shows a dramatic improvement with a strong reduction of the overall risk priority index [11].

Despite the significant potential of RFID technology in healthcare, there are notable barriers to its widespread implementation. Implementation costs and the imperative to enhance data security pose challenges, particularly in hospital or public medical facility settings. The critical issue of data security demands meticulous attention to safeguard privacy and sensitive information. Additionally, electromagnetic interference (EMI) presents another obstacle, occurring when electromagnetic waves from one electronic device disrupt the operation of another, leading to undesired responses [12,13].

Actually, RFID technology paved the way for the Internet of Things (IoT) ecosystem, which can currently benefit from less critical technologies in terms of EMI which still offer good performances of traceability, longevity, and cost-effectiveness (e.g., Bluetooth Low Energy beacons), in conjunction with an ever-expanding framework that integrates software, hardware, physical objects, and computing devices to communicate, collect, and exchange data. The IoT is easing the interactions between humans and a variety of physical and virtual things, providing affordable and efficient solutions for RTLS, patient and asset tracking, as well as helping perform a correct link between patients and their medications. Moreover, IoT has forced the adoption of standardized protocols (e.g., the Message Queuing Telemetry Transport – MQTT) and ontologies [14] for exchanging data among different actors, improving interoperability, efficiency, scalability, compatibility, security, and ease of maintenance.

The adoption of IoT technologies in healthcare is a considerable topic which is also particularly relevant within the European Union (EU). For instance, OHIO is an ongoing project that received funding from the EU's Horizon 2020 research and innovation action programme, via the ODIN – Open Call issued and executed under the ODIN project (GA 101017331), focused on the enhancement of hospital safety, productivity, and quality through the implementation of an IoT framework based on BLE beacons, providing an informative system able to empower the management of hospital facilities in terms of clinical engineering, evidence-based maintenance, logistics, and disaster preparedness [15].

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