AN INTEGRATED DIGITAL SOLUTION TO IMPROVE THE GOVERNANCE AND THE MONITORING OF LOGISTICS FOR MEDICINES AND MEDICAL DEVICES

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ABSTRACT

In the last years, global healthcare is going through a consistent growth and a significant transformation of its information systems and supply chains. This evolution affects the traditional medicines and medical devices logistics and operating models and the integration of healthcare systems and healthcare information management systems. Digital solutions show to play an important role in tackle the abovementioned issues but these applications are generally focused on one or few specific aspects. The project “LIFEMED – Integrated Logistics of Medicines and Medical Devices” aims at introducing an innovative integrated platform that manages all the logistics components of medicines and medical devices and enables an improved clinical governance. In particular, together with a set of telemedicine, traceability, clinical management and transport monitoring platforms for the monitoring and management of the logistics and clinical processes, the solution will be also characterized by an evidence-based decision making system and by an effective risk management module so to strategically analyze all the gathered data. In this regard, attention must be paid in considering the wide heterogeneity of the processed data and the privacy, ethical and security implications.

KEYWORDS

Medicines, Medical Devices, Integrated Digital Solution, Clinical Governance, Traceability

1. INTRODUCTION: HEALTHCARE SCENARIO AND CHALLENGES

In the last years, global healthcare is going through a consistent growth and a significant transformation of its information systems and supply chain in order to manage the conflict between quality improvement and cost rationalisation (Ramayanam, Acharayulu, & Prasad, 2018). This need is justified by different problems that affect the traditional medicines and medical devices logistics and operating models: errors in prescription, preparation, distribution or administration of the therapy, economic inefficiencies (e.g. waste of medicines and medical devices, non-optimal and unmonitored inventory management) and lack of control and monitoring of the administered therapy (Kazemzadeh, Sepehri, & Jahantigh, 2012). Moreover, inadequate integration of healthcare systems and poor healthcare information management usually causes data loss, limiting the track & trace of the process, and leads doctors to struggle in easily access all patients' information (Wang, Kung, & Byrd, 2016). Consequently, concrete benefits require improvements on crucial aspects such as medicines and medical devices traceability, resources and stocks management, certainty of therapy administration and information availability and management (Pinna, Carrus, & Marras, 2015; Kriegel, Jehle, Dieck, & Mallory, 2013).

2. GOVERNANCE AND MONITORING OF MEDICINES AND MEDICAL DEVICES LOGISTICS WITH AN INTEGRATED DIGITAL SOLUTION

Information and Communication Technologies (ICT), thanks to the processes' digitalization that favour their standardization and automation, play a central role in the processes management and organizational evolution

applied to medicines and medical devices logistics (Gastaldi & Corso, 2012). Indeed, there are different examples of ICT solutions that proved to tackle some of the issues mentioned in the previous chapter but these applications are generally focused on one or few specific aspects (e.g. big data analysis, RFID traceability, Automated Guided Vehicles effective transportation, Internet-of-Things based secure transportation systems) (Wang et al., 2016; Chikul, Maw, & Soong, 2017; Edoh, 2017). A step forward can be made by converting these stand-alone technological solutions into interoperable and integrated information systems in order to parallel process large data volumes, manipulate and track near real time data and capture all patients' medical records (Wang et al., 2016). This will lead to a significant improvement of the clinical governance as a result of the variety, velocity, meaningfulness and high availability of the processed information. In fact, an integrated healthcare technological solution can facilitate the extraction of actionable information for a more effective and evidence-based decision making and for an advanced risk management, thus improving the quality of care, optimizing performance of services and developing personalized and secure patient care (Nepal, Ranjan, & Choo, 2015).

In this regard, the project "LIFEMED – Integrated Logistics of Medicines and Medical Devices", funded by the Italian Ministry of Education, Universities and Research (MIUR – Ministero dell'Istruzione, dell'Università e della Ricerca), aims at introducing an innovative integrated digital solution that manages all the logistics and clinical governance components of medicines and clinical devices.

3. LIFEMED INTEGRATED DIGITAL SOLUTION

The LIFEMED digital solution (Figure 1) enables primarily the monitoring and management of the logistics and clinical processes. This is obtained leveraging on specific components such as: smart transport boxes provided with sensors (e.g. temperature, vibration and light sensors) for carrying special or perishable medicines; electric vehicles equipped with on-board systems able of sending route data to a monitoring platform; telemedicine platform that will monitor patients' correct adherence to treatments at home; clinical platform for the management of medicines prescription; computerized assisted picking carts and virtual warehouses that will help in avoiding waste of medicines and in optimizing their correct administration; and portable devices with wireless RFID and barcode technologies for a better traceability of medicines and medical devices at the hospital wards, in remote outpatient clinics or at home.

Figure 1. LIFEMED integrated digital solution

Moreover, the LIFEMED solution will be also characterized by a dashboard coupled with a decision support system and by a risk management module; these two elements will together improve and strengthen the hospital clinical governance (Figure 1). In fact, thanks to the Enterprise Service Bus (ESB) software infrastructure, all the data and medical information coming from the different platforms implemented in the solution (i.e. telemedicine, traceability, clinical management and transport monitoring) will be aggregated in a common data warehouse. Here, through the dashboard, all the data can be visualized and analysed in order

to implement strategies aimed at avoiding uneconomic waste, detecting advanced warnings with their relative risk factors, reducing accident and errors and optimizing the medicines and medical devices transportation. Furthermore, the specific software model chosen for the ESB (i.e. Mirth Connect) is an open source technology that will allow the integration with the already existing hospital's clinical data, coming from the Health Information System (HIS), in order to avoid a double-input of information by the hospital staff. Finally, thanks to an API REST service (Application Programming Interface REpresentational State Transfer) supported by SQL or NoSQL database, a unique access to the data gathered by the different platforms will be created. This access will guarantee consistent, visible and easily accessible information for the patients and the healthcare workers. Indeed, the users will have a personal account accessible through a multi-channel web-based user interface where, according to the specific profiling, they could visualize the position of all the tracked elements or consult the treatments status.

4. CONCLUSIONS

The project is still ongoing and currently focused on the analysis of the as-is process and governance in the 4 involved clinical centres. The partners are also designing the new process model and the related support of the integrated information platform. In particular, they are focusing on the latest technical design (hardware and software) related to the different platforms and portable devices and on a more secure and organized management of the data warehouse. Crucial attention, indeed, must be paid in considering the wide heterogeneity of the processed data and in handling the challenge on how to ensure data confidentiality and integrity while preserving the privacy of individual patient and all the ethical, security and policies implications (Meingast, Roosta, & Sastry, 2006). Once the designing is completed, the system applications components will be integrated and, finally, the project results will be tested and monitored in the pilot centres in order to have information to define an innovative business model (Pistorio et al., 2017) for the medicines and medical devices logistics.

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