AUTOMATIC GUIDED VEHICLES (AGVs) FOR TRANSPORTATION OF FOOD AND MATERIALS IN HOSPITALS

EXECUTIVE SUMMARY

(Adapted from the report by FATIN NABILA MOKHTAR)

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Introduction

Automatic Guided Vehicles (AGVs) have been globally used in material handling for decades. The demand for mobile robots and their use in hospital had increased due to changes in demographic trends and medical cost control. For healthcare facilities, these automated systems are designed specifically for handling bulk material, pharmacy medicines, laboratories samples, central supply and transportation of food, dirty dishes, bed laundry, waste (biological, recyclable), biomedical instruments etc. Operating efficiency is gained by automating these supplies, which allows the transfer of human resources to other departments or activities.

The AGVs are electronically trolleys that automate the transport process, so the medical supplies reach from storage to “point of utilisation” requiring minimal human effort. This provides intangible long term benefits like possibility to accommodate ageing workforce, better outcomes like decreased workplace injuries, staff turn-over and medical leave rates.

The automation also offers potential benefits to healthcare facilities including efficiency improvement, patient service level increases, business activity growth adjustment, better security and comfort for staff. However, the system also challenges the healthcare facilities on several issues; investment costs compared to potential gains from operation cost reduction, a lack of flexibility in the long term, difficulty of adapting the automation system to major changes in business operations, and dependency on maintenance and informatics and programming skills.

Singapore healthcare system is at par with developed health systems and is known to employ or evaluate latest technological advances in logistics to improve efficiency. It also suffers a double whammy of tight labour market as well as ageing workforce, justifying a constant need for improvement in supply chain efficiency.2 Statistics also show that the number of hospital patients is increasing in western countries such as Denmark, which substantially increase the load of supporting logistic functions. The variety of materials and equipment that are being used in hospitals is expanding. Therefore, the AGVs maybe the appropriate solution for the handling.

Hence, this technology review was requested by Engineering Services Division of Ministry of Health, and Dietetics and Food Service Department of Hospital Tengku Ampuan Rahimah, to review the evidence related to AGVs for the above purpose.

Objective/Aim

To evaluate the efficacy, safety, cost-effectiveness and organisational issues related to AGVs for transportation of food and materials in hospitals.

Results and Conclusions

A total of two titles were identified through the Ovid interface and PubMed, and 27 titles through Google Scholar. There were four articles included in this review; a qualitative survey study, two

simulation studies and one experimental study. The studies retrieved and included in this review were conducted in Slovakia, France and Singapore.

Conclusion

There was very limited evidence to suggest AGVs have the potential to reduce labour man-hour and healthcare staff workload when compared to manual process. However, the effect was found to be less when compared to RFID alone. In terms of safety, evidence suggests that AGV was able to avoid collision with static and moving objects. The cost-analysis suggests the use of AGV alone was expensive. However, combination of AGV with RFID were found to be cost saving compared to manual process. Handling of AGV system in healthcare facilities require proper training, expertise and knowledge.

Methods

Electronic databases were searched through the Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1946 to Present EMBASE - 1996 to August 2019, Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 1946 to February 07, 2020, Ovid MEDLINE(R) and In-Process & Other Non-Indexed Citations 1946 to February 07, 2020, Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 2015 to February 07, 2020, Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily - without Revisions 2015 to February 07, 2020, Ovid MEDLINE(R) 1946 to January Week 5 2020, Ovid MEDLINE(R) without Revisions 1996 to January Week 5 2020, Ovid MEDLINE(R) Epub Ahead of Print February 07, 2020, Ovid MEDLINE(R) Daily Update February 07, 2020, Ovid MEDLINE(R) 2015 to January Week 5 2020. Searches were also run in PubMed. Google was used to search for additional web-based materials and information.

Additional articles were identified from reviewing the references of retrieved articles. Last search was conducted on 11 February 2020.