**Breaking 'Smart' New Ground: A preliminary assessment of the uptake and use of Smart Technologies in NHS Hospital Pharmacies (UK).**


## Summary

Medicines management is only one part of NHS (UK) procurement and management, but essentially a very expensive part. According to the Commercial Medicines Unit (Department of Health, 2013), NHS hospitals in England currently spend around £3.6 billion annually on pharmaceuticals, having risen from £2.2. billion in 2005. The NHS continuously strives to promote excellence in what it does and justify how it does it. In undertaking this preliminary analysis 45 pharmacy staff members contributed to an online survey. The results presented a broad mix of views on how smart technology (e.g. iPhone, iPad) could be used and if it should be used at all in this setting. The outcome of this small scale study demonstrates the lack of knowledge as to if and how such technologies could be used in hospital pharmacy and therefore present grounds for testing out the broader application of smart technology via academic and practitioner consultations.



**Track:** Operations, Logistics and Supply Chain Management (4 - Supply chain technology)

**Word Count:** 1754 (excluding references and figure)

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## Introduction

As the NHS (UK) is publicly accountable then vigilance is paid to what is spent and how it is spent: "*Today £1 of every £13 (7.7% GDP) produced by the UK economy is spent on healthcare – a level that matches most other European countries. Making sure that this investment is used as effectively as possible is a key responsibility for us all* (Department of Health, 2010). Within hospital pharmacy as part of the larger National Health Service (UK), there is a strong emphasis on contributing to the efficiency targets through reductions in waste and drug spending, as well as better practices (PharmaTimes Online, 2011). A way of improving data management to support efficiencies in medicines management is through the use of Smart Technologies in pharmacies and at ward level in hospitals.

## Smart technology in action

There are many technological solutions available to aid the management of pharmaceuticals within healthcare working as part of existing Continuous Planning Forecasting and Replenishment (CPFR), Electronic Data Management (EDI) and Vendor Managed Inventory (VMI) systems (Hammant, 1995; Danese, 2004; Landry and Philippe, 2004; Kim, 2005; Kumar *et al*. 2008; Kumar *et al.*, 2008; Mustaffa and Potter, 2009; Guimarães *et al*., 2011). These help reduce wastage whilst increasing the visibility of inventory for suppliers, reducing uncertainty, lead times, and the need for holding safety stock (Mustaffa and Potter, 2009; Dumoulin *et al*., 2012).

Information Communications Technologies (ICT) such as barcoding, QR coding and RFID tagging (Coulson-Thomas, 1997; Towill and Christopher, 2005; Parnaby and Towill, 2008; Parnaby and Towill, 2009) can be used to automate stock management and handling processes, enhance situational awareness related to who is interacting with stock and tighten security for specific high-value / controlled items. Intelligent storage solutions incorporating these technologies are currently being used within hospitals to reduce medication errors and save time through automating central pharmacy tasks and inventory management (Omnicell, 2011). Individual consignments of pharmaceuticals can also be individually tagged with smart labels which can be detected at key points in the supply chain to provide regular updates of location and condition (MacManus, 2009; Eye-for-Transport, 2011).

Further integration of smart technologies into the actual pharmaceuticals themselves in the form of 'smart pills' implanted with sensors can communicate physiological parameters such as patient heart-rate activity and blood pressure, as well as location (Hopkins, 2010) to the patient carers.

Smart technologies appear to have filtered through into various pockets of healthcare services and due to their level of efficiency and success their uptake and use appears to be spreading. In a study conducted by Buttigieg and Mamo (2012) the authors found that the use of smart technology in the community was an attractive and efficient proposition which were user-friendly and had relatively low running costs. The challenges faced with transferring these

technologies to the health care setting are the initial high cost of implementation/installation and security maintenance. That said the authors in their analysis highlighted the use of Ipad applications such as Dr Chrono, a medical record application which allows doctors to prescribe from the Ipad, interact electronically with laboratory based services, transcribe voice notes plus provides other supporting functions (dr Chrono.com, 2014). Other success application of smart technologies are reported in professional and academic journals using smart reading devices/ sensor based for studies focusing on smart pumps and smart infusions (Kennerly *et al*, 2012), smart cards for healthcare data storage, retrieval and processing (Kardas and Tunali, 2006; Mampallil, 2006), smart hospitals using RFID (Yao *et al*, 2011), online patient management (Archer et al, 2014), healthcare design (van Hoof, 2013) and targeted clinical use such as heart monitoring, breathalysing etc. (Bennett, 2012).

The use of smart technologies can also be seen as applied to medicines and pharmaceutical services. As detailed by Onzenoort *et al* (2012) research in the area of therapy compliance measurement has led to the development of microprocessor-driven systems that record the time a unit dose is removed from blister packaging. One device under development is the Smart Blister—a label imprinted with event-detection circuitry that can be affixed to standard commercial blister cards. The study took place in Holland with 115 community based patients. On the return of empty blister cards to the 20 participating community pharmacies, the stored information was scanned and downloaded for data analysis and patient counseling purposes.

Smart technologies are being applied in practice to schedule work (Hatton and Weitzel, 2013), process medication orders quicker and with more accuracy (Ray *et al*, 2013), and facilitate care for patients within their home (Traynor, 2011). Whilst there is evidence of the use of standard smart technologies such as iPad and iPhone in American pharmacies (as detailed in the previous studies) there is less reporting of such activity in UK pharmacies. As a gap in knowledge and practice has been identified, the output of this study would highlight the prevalence of knowledge and potential use of smart technologies in a small sample across the UK hospital pharmacies. The outputs of this will underpin the next steps of this study.

## Methodology

The aim of this study was to ask pharmacy professionals what opportunities they could foresee in pharmacy management for Smartphone technologies, specifically focusing on stock management and disposal. Using a purposive study sample, this question was included in a larger online survey (examining medicines recycling practice) circulated to five regional operational groups in the UK. All but one of the groups were based in mainland England. The data was collected between May 2011 and August 2012. These groups were chosen as it was convenient for the researcher (having a prior working/research relationship with some of the group members) and due to the fact that its members offered representation from a large number of NHS hospital pharmacies. An electronic survey was developed which was circulated to the group participants via the group chairperson and 45 responses were collated.

**Findings**

The results of the survey indicated that a large proportion of respondents were more or less equally split 3 ways in their view of whether smart technologies could be used in hospital pharmacy to support stock management and disposal (See Figure 1 below). 11 of the respondents felt that smart technologies could not be used at this time in pharmacy for this purpose. Some of those who fell into the Yes/No but…category also said No but then explained why this was the case. The reason given from some related to the infrastructure and processes within pharmacy prohibiting the use of such technologies rather than the technology had no purpose there at all. Almost a third of the respondents didn't know if technology of this nature could be used in supporting pharmacy services and needed to know more about the technology to ascertain its potential. *"Would need more information before answering - not sure what benefit such technologies would bring*" and "*Not aware this is an option"* were the general consensus from this cohort.

What was interesting was the group who could see the potential in using smart technologies. Those who expressed this view could foresee how it could be used to effectively manage stock allocation and management, track and trace of stock and could link to 3D barcodes and other technologies. Others appreciated the *"immense potential of these technologies*" but weren't sure how it would work in this setting. A very detailed answer indicated multiple uses in the current service; *"Could be used as means of completing ward top ups, sending orders electronically to stores. Linking all wards stock lists for quicker means of identifying stock availability on [hospital] wards. With some development could be used in conjunction with EPMA systems for more ease of access".* Only 1 respondent stated that they had something in place which they felt was commensurate with what this technology could offer to their service, the remaining respondents had no such option in place.

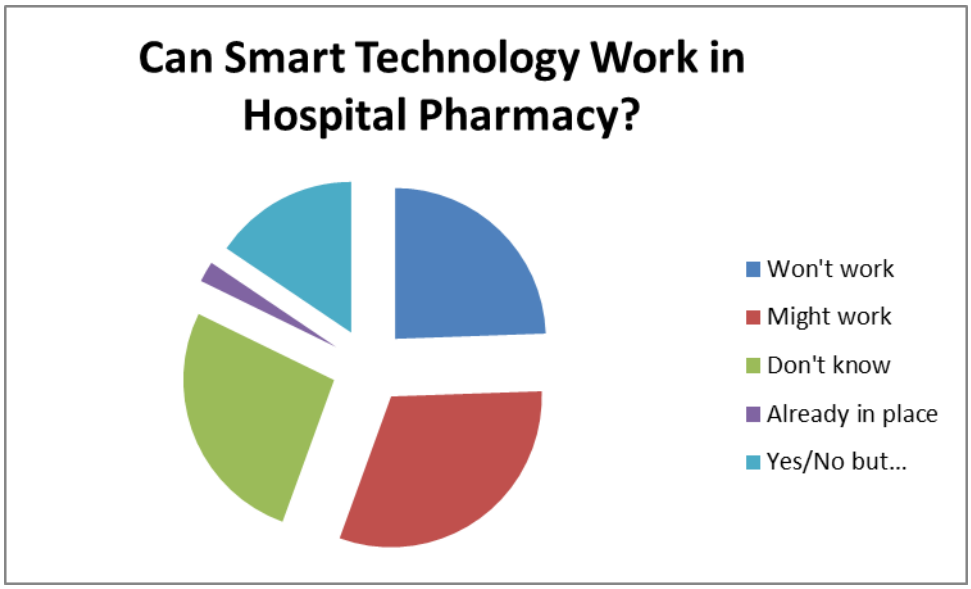

Figure 1 Respondents views from online survey.

## Conclusions and Future Research Plans

Based on the findings presented, there are potential uses for smart technologies and associated applications in the current hospital pharmacy services and some aspirational use in future pharmacy service designs. What is clear is that there is a lack of knowledge as to what these technologies offer as part of the working agenda. Respondents knew what the technologies were from a general purpose and socialising perspective but how it supported and facilitated processing data, interfacing with other agencies, ordering and managing stock etc was an unknown entity. From the literature it can be seen that our American counterparts are already using such technologies for these functions/activities.

The next steps of this study are as follows:

1. Let's chat - re-open this discussion with academic and practitioners within and external to the NHS (so we have some external comparator practice), from supply chain, IS and technological backgrounds.
2. Let's go blue sky - determine the broadest use of such technologies and raise awareness of their potential. This will allow staff the freedom to project how they can optimise the use of smart technologies in NHS pharmacies.
3. Let's update - the data collected reflects opinion in 2011/12 and focused on using smart technologies in stock management and disposal. Future work will determine the views of smart technology and its wider use in pharmacy in 2014/15
4. Let's consolidate - via professional and academic consultation within and outwith NHS pharmacy a consensus can be reached as to the way forward for this agenda.

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