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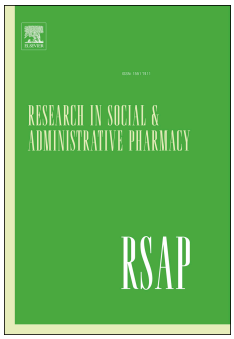

A qualitative case study of ehealth and digital literacy experiences of pharmacy staff

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Original Paper

A qualitative case study of ehealth and digital literacy experiences of pharmacy staff in North East Scotland

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ABSTRACT

Background: eHealth's many forms are benchmarked by the World Health Organization. Scotland is considered an advanced adopter of ehealth. The third global survey on ehealth includes pharmacy-related ehealth indicators. Advances in ehealth place an obligation on pharmacy staff to demonstrate proficiency, or digital literacy, in using ehealth technologies.

Objective: The aim of this study was to provide an indepth exploration of the ehealth and digital literacy experiences of pharmacy staff in the north east of Scotland.

Method: A qualitative local case study approach was adopted for observational and interview activities in community and hospital pharmacies. Interview and observational data were collated and analysed using a framework approach. This study gained management approval from the local health board following ethical review by the sponsor university.

Results: Nineteen pharmacies and staff (n=94) participated including two hospitals. Most participants were female (n=82), aged 29 years and younger (n=34) with less than 5 years pharmacy experience (n=49). Participants identified their own digital literacy as basic. Most of the pharmacies had minimum levels of technology implemented (n=15). Four themes (technology, training, usability, processes) were inducted from the data, coded and modelled with illustrative quotes.

Conclusion: Scotland is aspirational in seeking to support the developing role of pharmacy practice with ehealth, however, evidence to date shows most pharmacy staff work with minimum levels of technology. The self-reported lack of digital literacy and often mentioned lack of confidence in using IT suggest pharmacy staff need support and

training. Informal work based digital literacy development of the pharmacy team is self-limiting. Usability of ehealth technology could be a key element of its' acceptability. There is potential to better engage with ehealth process efficiencies in both hospital and community pharmacy. As Scotland increasingly invests in ehealth pharmacy technology, it is important that it also invests in pharmacy staff training.

Keywords: pharmacy technology; ehealth; digital literacy; pharmacy staff; education; training

INTRODUCTION

eHealth is defined by the World Health Organization (WHO) as the adoption of information and communication technologies in delivering health services.[1] There are many forms of ehealth including, for example, telehealth, mobile health (mhealth), electronic prescribing (e-prescribing) and technology enabled care (TEC).[1,2] Advances in ehealth are benchmarked by WHO in their Global Observatory reports.[3] These reports present country by country ehealth implementation and adoption levels as determined ehealth experts identified by WHO in each of 125 countries. Pharmacy-related ehealth indicators were included in the third global survey on ehealth recognising the profession alongside physicians, dentists and nurses.[3] eHealth pharmacy information management systems, storing patients' contact details, their primary care physician practice, allergies and dispensing data, are included in the report's electronic health record category. Central to the push for global ehealth adoption is the potential to promote patient safety.[1-3] As these national indicators show, WHO are not alone in recognizing that patients, as health care consumers, are moving towards more proactive participation in taking decisions about their own well-being often influenced by online health-related information.[4-6]

Pharmacy should not be viewed as different from other technology developments which involve modification of working practices and processes, training in the application of the technology and service evaluation to promote usability and acceptance. The King's Fund highlight eight technologies which it predicts, 'will be changing how and where care is delivered; and offering new ways to prevent, predict, detect and treat illness.'[7] The eight technologies include: the smart phone; at-home or portable diagnostics; smart or implantable drug delivery systems; digital therapeutics; genome sequencing;

machine learning; blockchain; and, the connected community.[7] Many of these predictions are already reality for the general public in community settings across Scotland. For example, health information for promoting patients' self-management of healthy living, support for living with long-term conditions, voluntary sector support and signposting to access the right care at the right time. In Scotland this is led by: award winning ALISS (A Local Information System for Scotland; ALISS.org);[8] Alliance Scotland (Alliance-Scotland.org.uk) supporting health and social care integration with a focus on giving voice to people who are disabled or living with one or more long-term conditions and their carers;[9] also part of The Alliance is Digital Health and Care (DHC; http://dhcscot.alliance-scotland.org.uk/) encouraging citizen participation in developing ehealth applications which support shared care;[10] the Digital Health & Care Institute (DHI; https://dhi-scotland.com/) bringing together researchers in innovation pools;[11] NHS Choices website facilitates symptom checking (patient based Decision Support System; www.nhs.uk) with recommendations for follow up actions;[12] and NHS24 telehealth and telecare organisation website (nhs24.com) and remote delivery of pharmacy services;[13] and condition specific support such as MyDiabetesMyWay (NHS Tayside).[14] The wide range of technology enabled care innovations continues to emerge in Scotland (sctt.org.uk)[15] including mobile health (mHealth) technologies for patients and health and social care staff based on smart (cell) phone and tablet access or 'Attend Anywhere' technology from Australia[16] promoting equality of access to remote pharmaceutical services in NHS Highland in Scotland. [17]

Each holds clear implications for health and social care staff training in keeping pace with the ehealth information and digital literacy while 'changing how and where care is delivered.'[18] The Scottish general public is not alone in gaining access to systems which

allow online access to book GP practice appointments, order repeat prescription and to see their own GP-held medication history and allergies.

These advances in both healthcare professional and patient ehealth activity place an obligation on pharmacy staff to demonstrate proficiency, or digital literacy, in using technology in their daily pharmacy practice, as is the expectation across not just health but all sectors of employment.[18] Digital literacy is described as 'being able to make use of technologies to participate in and contribute to modern social, cultural, political and economic life.'[7] Importantly, making effective use of those skills through digital engagement in occupationally based activities is a widely-held expectation. As ehealth is increasingly the norm within healthcare, the digital literacy of the workforce comes into focus.[19,20] Indeed, few United Kingdom (UK)-based healthcare providers can readily function without ehealth technologies. However, the curricula for accredited pharmacists or pharmacy technicians, regulated by the General Pharmaceutical Council (GPhC) in the UK, does not explicitly include ehealth or digital literacy, unlike their United States equivalent, the Accreditation Council for Pharmacy Education (ACPE).[21,22]

Within Scotland, National Health Service (NHS) care and prescriptions are dispensed free of charge. Electronic prescribing (e-prescribing or electronic transfer of prescriptions) is the norm in primary care with the prescriber, usually the primary care general practitioner (GP), providing the patient with a printed prescription.[23] Community pharmacy technology infrastructure is designed around the barcoded, paper-based prescription and the Scottish wide area network (SWAN; changeover in progress from the N3 network, NHS National Network).[24] The barcode represents a unique prescription number (UPN). All GP practices and community pharmacies are

linked via SWAN (or N3) to a central server. When a prescriber issues a barcoded paper-based prescription to a patient, an e-message containing the details is sent via SWAN (or N3) to be held on the central e-pharmacy message store server.[25] When the patient hands in the related prescription at a community pharmacy, the barcode is scanned and the matching e-message is retrieved to populate the patient's pharmacy care record (PCR) on the pharmacy management system (PMS) ready for the pharmacy team to check and dispense listed items based on the prescriber's instructions.[23]

While this simplified description of the e-prescribing process may reflect the patients' side of the pharmacy counter, behind the scenes presents varying digital literacy challenges for pharmacy staff. A range of PMS are installed on a spectrum of complexity of hardware infrastructure. While fulfilling the same NHS Scotland contracted core services, each pharmacy management system features different interfaces and different functionality.[25] NHS contracted community pharmacies in Scotland provide four core services: (1) the Acute Medication Service (AMS) for emergency medicines supply; (2) the Minor Ailment Service (MAS) providing free over-the-counter medicines for registered, eligible patients for common, self-limiting conditions; (3) the Chronic Medication Service (CMS) for review and supply of medicines for registered patients with long-term conditions on a shared care plan with optional (24 or 28 week) serial prescribing, as agreed with the general practitioner/physician; and, (4) the Public Health Service (PHS) which promotes healthy lifestyle choices, local health promotion activities and smoking cessation. The first three services (AMS, MAS, CMS) are ehealth related and technology-based, collectively referred to as e-pharmacy.[23] As with any business, there will also be a range of additional software functionality for stock control and ordering, email, website maintenance, pharmacy group or national chain multiples

linking anything from a single Ethernet connected PC-based network server with linked barcode reader and label printer to a multiple robotic medicines management system with organization-based intranet, wi-fi and multiple PCs each with barcode reader and label printer. Although hospital-based pharmacies fulfil a different function, dispensing for both inpatient and outpatient clinics, their hardware infrastructure will be similar to that of a large community pharmacy.

Scotland has 14 local health boards delivering a free-at-point-of-care National Health Service.[26] NHS Grampian in the north east of Scotland employs over 17,000 staff delivering healthcare to a population of over half a million. The area has eight hospitals, only two of which would be considered major, and 131 community pharmacies (51 in Aberdeen City, 53 in Aberdeenshire, 27 in Moray).[27] Key findings from a recent quantitative study conducted in the area found that, with few exceptions, pharmacy staff perceived their own digital literacy to be at a basic level.[8] Secondary outcome measures of role, age, gender and work experience were not found to be clear determinants of digital literacy. However, given the global policy driven aims to embrace the potential of ehealth, pharmacy staff need to be more digitally literate to harness technologies in pharmacy practice effectively and efficiently.[1-3]

The Scottish Government and NHS in Scotland have recognized that everyone within the pharmacy team needs to be 'supported to make the best use of new technology' if pharmacy is to fulfil its potential in meeting patient care and safety needs. This progressive aim has found support from professional bodies such as Community Pharmacy Scotland, the Royal Pharmaceutical Society (RPS) and National Pharmacy Agency.[28-30] Policy and strategy drivers in Scotland aim to change the role of pharmacy

practice within the integrated health and social care team. By releasing the pharmacist for a more clinical, patient-facing role, which makes best use of professional skills, patient access to health advice on common, self-limiting conditions can be provided in community pharmacy. This in turn may reduce pressure on GP appointment waiting times addressing the anticipated shortage of GPs in Scotland. In addition, recent initiatives have seen more pharmacists based within general practice with the aim of all pharmacists becoming registered, independent prescribers by 2023.[31-34] As the policy driven intention is to support role development of pharmacists through increased adoption of technology, the whole pharmacy workforce needs to be digitally literate as pharmacist role development will inevitably impact on the role of pharmacy technicians and medicines counter assistants across Scotland.[31] In early 2017, the Chief Medical Officer for Scotland described the vision as 'staff doing different things, in different ways, and developing new skills' inevitably underpinned by technology.[34]

This qualitative study aims to build on our previous quantitative and review based research[19,20] to provide an indepth exploration of the day-to-day ehealth and digital literacy experiences of pharmacy staff in the north east of Scotland.

METHOD

Study Design

A qualitative, multiple, local case study approach was adopted for observational and interview activities conducted between August 2012 and March 2013. Literature based best practice was adopted throughout to reduce bias and promote trustworthiness of data, subsequent findings, and recommendations.[35]

Setting

Community and hospital pharmacies across NHS Grampian in the north east of Scotland.[27] Scottish government has devolved powers for health within the UK. There are fourteen geographically based local health boards in Scotland.

Sampling

Lead pharmacists within NHS Grampian and practising academic pharmacists assisted with theoretical sampling for the study based on: urban and rural settings; geographical variation; technology infrastructures; and, implemented pharmacy management systems. It was anticipated that up to 15 community and 2 hospital pharmacies would be included.

Recruitment

Those same lead pharmacists made the initial personal contact with the identified pharmacy managers outlining the aims of the study, by email or telephone, inviting interest to participate and permission to pass on their contact details to the researcher. The researcher emailed the pharmacy manager an information sheet and consent form which included permission to extend the invitation to their pharmacy staff. On receiving pharmacy management approval, by email or postal service, the information sheets and consent forms for staff were delivered, within a 50 mile radius, to the pharmacy by the researcher, always emphasising that consent was individual and voluntary. Those outside the 50 mile radius were sent by mail. Although sample size is not relevant for qualitative case study research the authors aimed for data saturation, the point at which no further themes would emerge.[36,37]

Data Collection

Data collection took place on a date and at times convenient for the pharmacy staff and lasted from 20 minutes in a pharmacy staffed by only one medicines counter assistant up to six hours in a fully staffed hospital outpatient dispensary. ‘Guided conversations’

in the form of brief, opportunistic interviews with pharmacy staff, explored views and experiences of using technology and related digital literacy education and training.[38-40] Interviews were informal, often interrupted to fit around day-to-day pharmacy activities. Interview questions (Box 1) were based on a pre-piloted, semi-structured interview schedule supplemented by questions arising from researcher observations of technology use on the day.

Box 1. Semi-structured interview schedule

What technologies do you use?
- How do you use them and what for?
- How reliable are those technologies? What do you do when the technology lets you down? How and where do you get help?
- Are there any technology related standard operating procedures you follow, for example start up/ shutdown, back ups and updates?

- How did you learn to use those technologies?
  - When and where did you learn to use those technologies?
  - Who and what helped or hindered you in learning to use those technologies?
  - How would a new member of staff learn to use those technologies?
- What technology related training was there in your pharmacy related course?
  - What technology training do you think could or should be available?
  - What technology related CPD opportunities have you been aware of?

From observational activities:
- 'I noticed you using x. Can you tell me more about that, please?'

Interview notes and observations were recorded on an A3 clipboard with paper, post-it notes and pen. The placement of the technology infrastructure was sketched and questions based on observations noted as a reminder for the researcher to follow up with pharmacy staff when convenient. Each pharmacy was allocated a number for reference throughout. As some pharmacies had very few staff, quotes are identified at pharmacy level rather than participant level, to promote participant anonymity.

Data Collector

The researcher, conscious of reflexivity, introduced herself as a technologist with no pharmacy background interested in how people use and learn to use technology.

Data analysis

Field notes from pharmacy research activities were typed up and organized for analysis. The immediacy of the collation activity encouraged immersion in the data to aid analysis and reflection. A five-step framework approach of: familiarisation; forming an initial thematic framework; indexing; charting and mapping; and interpretation was followed, looking for patterns and constructs within and across cases.[40]

Ethical review

This study gained approval from Robert Gordon University School of Pharmacy and Life Sciences Ethical Review Panel and was deemed service evaluation exempt from NHS ethical review.

RESULTS

Nineteen pharmacies and their staff (n=94) participated including two of the main hospitals in the area at which point the researchers agreed saturation as no new themes were emerging. Only one community pharmacy declined to participate due to staff shortages. No potential participants withheld consent or withdrew from the study. Pharmacy setting demographics are reported in Table 1.

Table 1. Pharmacy setting demographics

Description	Category	n=19
Pharmacy type		
	Hospital	
	medium	1
	large	1
	Community	

	large, multiple (>25 pharmacies)	2
	large, independent multiple (5-25)	2
	small, independent, multiple (1-4)	13
Setting		
	Urban	10
	Rural	9
Technology		
	Robotics (1 hospital)	4
	Low tech	15
Pharmacy management system		
	JAC	2
	Cedigem	8
	Nexphase	1
	Positive Solutions	3
	ProScript	5

241

242 Participant (n=94) demographics (Table 2) show the diversity of pharmacy roles
243 covered with most participants female (n=82), aged 29 years and younger with (n=34)
244 with less than 5 years pharmacy experience (n=49). Participants identified their own
245 digital literacy as fairly basic against a progressive range of national and European
246 computing courses with most opting for the second step of six, 'Computing for the
247 Quietly Confident' (n=39).

248 **Table 2.** Participant demographics

Description	Category	n=94
Participant's role		
	Pharmacists	24
	Locum Pharmacists	2
	Pharmacy Technicians	19
	Dispensing Assistants	15
	Medicines Counter Assistants	34
Gender		
	Female	81
	Male	13
Age		
	29 years and younger	34
	30 to 39 years	14
	40 to 49 years	22
	50 to 59 years	21

	60 years or older	3
Years of experience in pharmacy	5 years or less	49
	6 to 10 years	24
	11 to 15 years	4
	16 to 20 years	9
	21 or more years	8
Self-reported digital literacy level (based on national and European Information Technology courses)	'Computing for the Terrified'	19
	'Computing for the Quietly Confident'	39
	'Computing for the Courageous'	13
	'European Computing Driving Licence (ECDL)'	14
	'ECDL Advanced'	5
	'Diploma or Degree'	4

Themes inducted from data

Four recurring themes (technology, training, usability, processes) were inducted from the data, analysed and modelled with illustrative quotes.

Technology

Pharmacy technology observed ranged from the low tech (minimum specification of a single PC server with broadband connection linked barcode scanner with label dispenser, printer, fax machine and cash register) through to state-of-the-art robotic management and dispensing facilities. Many complained of slow N3 (update to SWAN in progress) connections and poor performance of networked PCs and cash registers. Most had a laptop, often kept in the consultation room and used for tracking prescription progress, for pharmacist use in consultations or for staff training.

Barcode scanners were seen to be an essential technology in pharmacy with the ability to,

'reduce the chance of mis-hearing or mis-reading' (Pharmacy 19),

- with less chance of mistakes following through to the dispensing process. However, some were resistant to adopting the full functionality, perhaps because it is a,

'heavy, handheld barcode scanner which doesn't always work' (Pharmacy 19).

A creative solution observed in one pharmacy, involved a pharmacy technician making a V-shaped fan of prescriptions then flicking through them under a stand-mounted, barcode scanner (Pharmacy 7). Another adopted a technique similar to counting bank notes, carefully positioned under the barcode scanner (Pharmacy 14).

Some pharmacies had made a substantial investment in providing technologies (Pharmacies 11,15,17). These included electronic prescription endorsing machines or dose dispensing systems capable of holding liquids, sealed with the patient's photograph and full instructions for care providers. Nevertheless, pharmacies were observed to still be major users of fax technology with heavy reliance for stock ordering and document exchange. The telephone was still in heavy usage to contact GP practices for missing prescriptions or prescription items the patient expected to collect. Paper-based systems were still the norm for controlled drug registers and in-pharmacy services such as public health promotions including smoking cessation and nicotine replacement therapy.

The adoption of high tech robotic pharmacy solutions was the exception with some,

'sceptical about robots in pharmacy but haven't seen one in operation' (Pharmacy 16),

while others in the same pharmacy saw advantages in that the robot,

286 'saves space, saves time, does stock handling both in and out, stock control
287 including rotation and identifying unused lines, ordering and exception
288 reporting' (Pharmacy 16).

289 While the Minor Ailment Service (MAS) evidenced a ground swell of acceptance, the
290 Chronic Medication Service (CMS) had yet to reach full functionality and yet to be fully
291 embedded within community pharmacy and GP practices.

292 Pharmacy management systems (PMS) software implemented for handling e-
293 prescribing, MAS, CMS and stock control were observed to vary in interface look-and-
294 feel but with the same essential functionality. A pharmacist, based in a low tech, rural,
295 community pharmacy, asserted there was a,

296 'lack of technology in pharmacy...we want a joined up system that facilitates the
297 pharmacist's job' (Pharmacy 5).

298 Several pharmacies had installed MethaMeasure, a system for processing and
299 dispensing methadone prescriptions. Where MethaMeasure was fully adopted,
300 pharmacy staff and patients were keen to demonstrate its fingerprint recognition and
301 photo identification with the only downside noted as,

302 'new and updated prescriptions must be keyed in manually'

303 (Pharmacy 11).

304 However, one pharmacy, observed as trending toward adopting greater technology, had
305 tried the system but,

306 'gone back to 5 litre bottle with pump' (Pharmacy 16),

307 because of spillage problems.

Several extra technologies were observed including the use of Bluetooth for photo transfer, a barcode supported prescription tracking service in hospital pharmacy, use of smartphone apps for document upload and sharing, applications supporting access to laboratory test results, specialist patient care for oncology and mental health monitoring technologies.

Training

There was overwhelming evidence from pharmacy staff at all levels, ages and stages that they could not recollect information technology (IT) training as part of their pharmacy education and yet said that it was central to their everyday practice. What was less clear from interviews and observational data was whether there was a need for IT training as pharmacy staff,

> 'know what you need to know' (Pharmacy 1),

while others said they,

> 'can do what has to be done if shown how, but don't understand' (Pharmacy 12),

or there is,

> 'no point in including technology training in courses' (Pharmacy 17).

Observational notes described the,

> 'expectation of IT skills' (Pharmacy 1),

will be prevalent amongst pharmacy staff but also the,

> 'expectation that the pharmacist will hold the knowledge for all aspects of running pharmacy processes, shop premises and staff mentoring' (Pharmacy 2),

which begs the question, who trains the trainer? The current form of learning observed was informal sharing and cascading of IT skills from the pharmacist or staff member moving from another pharmacy or different background, bringing new but self-limiting knowledge.

The lack of time and place for training within pharmacy premises during working hours was raised,

> 'usually done at work, sometimes occupying the consultation room, if time allows' (Pharmacy 10).

For most community pharmacies there will only be one consultation room and one laptop so resource capacity is limited.

While some identified with IT as a normal part of their life,

> 'grown up using IT so always had access' (Pharmacy 14),

another within the same pharmacy spoke of dissonance of IT for them,

> 'don't like change, lack confidence in using IT and don't use it outside work' (Pharmacy 14).

The concept and reality of IT-based online training or e-learning was another topic raised, with some,

> 'fearful at the thought of elearning' (Pharmacy 12),

while others raised the related concern,

> 'don't know how mentoring will be affected by move to elearning' (Pharmacy 13).

A solution adopted in one pharmacy was to,

> 'use elearning but print it off, pharmacist takes printed copy home to check' (Pharmacy 14).

Prior experience and use of technology outside work were noted as facilitators to usability. Although IT systems were said to be easy to learn, perhaps limiting the need for specific training, barriers included the level of assumed knowledge, poorly designed interfaces and resistance to both process change and new technology.

Usability

Availability of manuals for one PMS was seen as a facilitator of usability (Pharmacy 4) which others raised as unavailable (Pharmacy 8). Some suggested pharmacy technology was,

> 'fairly easy to learn' (Pharmacy 11),

but this was countered by evidence suggesting there is,

> 'a lot of assumed knowledge' (Pharmacy 8),

with some systems viewed as lacking user friendly elements, for example, CMS tabs (Pharmacies 1,10,11,13,16), processing dosette box changes (Pharmacies 7,18), handling split packets (Pharmacies 18,19) or expressing a preference for manual systems (Pharmacy 17).

Barriers to accessibility were raised in both low and high tech pharmacies where some,

> 'find technology useful but struggle to get to grips with new stuff' (Pharmacy 3),

or are,

'not keen on technology, not confident using IT, don't use it outside work' (Pharmacy 19).

Another noted that ease in using pharmacy technology,

'depends on your use of technology outside work' (Pharmacy 18).

During observational activity, a whole pharmacy team, spoke of their lack of confidence in using IT, with the pharmacist joking that when something goes wrong they would,

'just pick a button' (Pharmacy 12).

Technical support was viewed as readily available for e-pharmacy services with contact numbers on display in most community pharmacies. Prominently placed post it notes, business cards and lists were pointed out to the researcher as key phone numbers,

'at least weekly to allow technician to provide a local fix from a remote location' (Pharmacy 1),

but,

'helplines are available Monday to Friday 9am to 5pm otherwise rings through to USA' (Pharmacy 10).

Most reported few problems with power failures or surges (Pharmacies 2,6,11,13,14,15,16) affecting stability but many were affected by,

'tills prone to freezing or go slows with lots of crashes' (Pharmacies 1,13,14),

or,

'second PC and laptop too slow to use' (Pharmacies 10,13,14,18,19),

and,

> 'repeated crashes with 10 minutes to restart 2 or 3 times per week' (Pharmacies 2,4).

During observation the researcher noticed a pharmacist casually switch the modem off and back on without comment (Pharmacy 13).

Although the, 'robot usually works OK' (Pharmacy 17), the researcher asked about strategically placed spatulas, brooms and a step ladder (Pharmacies 11,17,19). These were kept to hand for clearing jams in the hopper, delivery chutes and robot area.

One unexplained system failure described as taking place each morning with the immediate hospital discharge letter system,

> 'iDL crashes at 10am, times out and have to log back in' (Pharmacy 19),

but there was acceptance of the natural consequences of the rurality of much of the North East of Scotland where,

> 'extra challenges of remoteness, for example, deliveries, technicians, weather affecting power and internet' (Pharmacies 13,14).

Facilitators of usability were dominated by the functionality of robotic systems which,

> 'allows for versatile, query-able stock control' (Pharmacies 17,19),

and,

> 'provides an audit trail so able to see who, what and when which increases patient safety' (Pharmacies 17,19).

Although some complained that,

412 'items from the hopper are rejected, for example, can't find the barcode, it's a
413 bottle or shiny packet' (Pharmacy 15),

414 or,

415 'the robot hides CDs [controlled drugs]!' (Pharmacy 19),

416 when items got trapped in the corner sections of the ceiling mounted conveyor belt
417 housing, but the generally expressed feeling was,

418 'I love the robot, wouldn't be without it!' (Pharmacies 17,19).

419 However, these few pharmacies (n=4) with high tech robotic systems were the
420 exception, with the remaining pharmacies (n=15) operating with minimal IT
421 infrastructures.

422 Usability was also improved by the functionality provided by the internet, allowing,

423 'quicker, easier communications,' and, 'more up to date information online,
424 rather than in books, and it's more to hand' (Pharmacy 19),

425 including on hospital wards, and also improvements provided by,

426 'the legibility of electronic prescriptions' (Pharmacy 19).

427 Other barriers to usability created by lack of functionality related to local networking
428 issues,

429 'till A speaks to till B but B doesn't always speak to A – A has the printer but B
430 does the orders' (Pharmacy 1),

431 or e-pharmacy's lack of interconnectedness for electronic records related to different
432 pharmacy information systems,

> 'PCR [pharmacy care record in CMS] should be linked to PMR [patient medication record for all dispensing data] to reduce manual entry and duplication' (Pharmacy 1),

also demonstrated by the lack of,

> 'a centralised system so duplication of effort and records, both digital and paper' (Pharmacy 5).

Nevertheless, pharmacy staff displayed optimism and ingenuity acknowledging,

> 'local shortcuts are useful – provided you know them' (Pharmacy 8),

while it was,

> 'like Blue Peter [UK expression meaning a make do and mend workaround] sometimes with lag time with labels to print, templating issues losing the space between numbers' (Pharmacy 18).

Processes

From observational activity, it was clear that in community and hospital pharmacies, 'all processes are centered on the computer' (Pharmacy 4). The main focus of pharmacy dispensaries is the safe and efficient processing of prescriptions which requires stock control and standard operating procedures. The majority of prescriptions in Scotland involve electronic prescribing over an N3 (or SWAN) internet connection but many processes remain paper-based and minimal use of robotics.

Pharmacy technicians and medicines counter assistants patiently demonstrated the handling and processing of prescriptions to the researcher. They scanned the barcode to populate the pharmacy management system on screen, conducted checks, placed the

prescription and labels in the correctly coloured basket to indicate whether the patient was waiting, collecting later or for delivery. Handwritten nurse practitioner prescriptions or e-prescriptions that would not scan or paper-based hospital prescriptions were processed manually. Issues raised around technology in the prescription process were associated with duplication of effort, manual processing, inconsistency in relation to payment and claims processes and local, non-standardised requirements. There was a tolerance of staff continuing with their preferred manual systems, even where technology-supported alternatives were in place.

System maintenance processes were equally varied and in several cases the effect of the researcher asking, 'can you tell me about your back up system, please,' prompted pharmacy staff to question the physical security and purpose of their onsite back ups and archives. Some explained the built in server based backups for patient medication records; some pointed out the pen drive plugged in but were unaware of handling or storage of the device; some had an onsite safe and operated a rotational physical back up. Stock control processes in pharmacy were generally conducted on a just-in-time basis. Multiple cross checking of controlled drugs was common, and usually handwritten, with physical measurement of liquids resulting in wastage.

The use of the internet for pharmacy processes such as checking email or medicines information or one-off customer orders was again varied. In some cases, tight filters prevented any internet access outwith the PMS so even NHS email could not be checked during the working day. Other pharmacies benefited from full, open internet access.

Technology specific standard operating procedures (SOP) were rarely evident but many reminders were noted on post its or on whiteboards. One SOP noticed by the researcher

in a community pharmacy was issued by the PMS supplier for regular system activities but there were,

> 'SOPs for daily, weekly, monthly tasks but none technology-related' (Pharmacy 1).

Paper-based processes remain prevalent in both hospital and community pharmacy,

> 'large amounts of paperwork, such as invoices and copy orders, to be kept for seven years with storage issues and time consuming shredding' (Pharmacy 14).

The duplication of effort and clear technology alternatives were a cause of frustration for some in community pharmacy,

> 'take smoking cessation, handwrite three copies of the same form – one for the patient, one for the pharmacy and one to be sent to Aberdeen for someone else to key in – all duplication of effort and handwriting again and again – why is it not part of MAS?', and, 'serial prescribing is still paper-based even when described as an online system' (Pharmacy 5).

The drive to 'improve the safety of people taking medicines' is central to all pharmacy activity, however, many pharmacies remain under-resourced with minimum technology implemented so the reliance on human checking remains unsupported.

Heavily paper-based systems offer challenges of duplication and repetition of records, cascading communication of updates, storage and destruction implications. Few examples of technology-related SOPs were evidenced but sharing of login details, inconsistency and lack of understanding of back up and update procedures were evident.

DISCUSSION

Key findings

Key themes of technology, training, usability and processes have been evidenced from the observational and interview activities conducted during fieldwork. Increased implementation of ehealth in pharmacy has the potential to support the role development amongst pharmacy staff who in turn could support an increasingly digitally literate general public.

Technology: Scotland is considered to be well-advanced in electronic prescribing but the paper prescription token is retained for the GP to give the patient to present in community pharmacy and for pharmacy to evidence dispensing for the payment claims process.[3] Telephone calls to GP practices for clarification of changes to patient prescriptions were indicative of the lack of progress towards a shared, electronic health record which many consider pivotal in promoting quality and safety in integrated patient care alongside the developing role of pharmacy. Many processes remain repetitive and paper-based. So, although Scotland is aspirational in seeking to support the developing role of pharmacy practice with technology, evidence to date shows most pharmacy staff work with minimum levels of technology.[19]

Training: pharmacists and pharmacy technicians are trained without explicit reference to ehealth and pharmacy technologies in their curricula.[22] The self-reported lack of digital literacy and often mentioned lack of confidence in using IT suggests pharmacy staff need training. Informal work based digital literacy development of the pharmacy team is self-limiting and unlikely to promote the expected efficiencies of ehealth.

Usability: the design of pharmacy management systems would benefit from involving the pharmacy team in usability testing and improved linkage to core elements of

524 community and hospital services. With increased technology planned to support
525 pharmacy role development this could be a key element of acceptability.[34,41]
526 Processes: greater awareness of technology related processes and standard operating
527 procedures will be important in pharmacy. There is clear potential to better engage
528 with process efficiencies that increased technology in hospital and community
529 pharmacy could bring to release pharmacists for a more clinical role reducing pressure
530 on GP practices.[32,34]

531 **Strengths and limitations**

532 To the best of our knowledge, this is the first indepth qualitative study to focus on the
533 whole pharmacy team, their interaction with ehealth and their digital literacy. These
534 findings complement quantitative results and a review reported elsewhere.[19,20]

535 The insights into training, learning styles, usability and technology related standard
536 operating procedures plus overall lack of technology may resonate with other
537 jurisdictions. The potential for transferability of the findings to other contexts is
538 strengthened by stratified sampling which facilitated access to a breadth of pharmacy
539 type, setting, level of technology and pharmacy management system implementation.
540 Furthermore, the technology expertise and independence of the researcher gained
541 insights unlikely to be collected by a pharmacy specialist.

542 However, it was a limitation of the study that the convenience interviews were not
543 audio-recorded to promote accuracy of data collection. Also, the study may be limited
544 by its geographical focus, on a relatively small sample, from one local health board area.
545 This study is contributory, defensible in design and has been rigorous in conduct to
546 promote trustworthiness of findings.[40]

Relevance to national and global pharmacy practice

From a global perspective on health service connectivity, WHO note that, 'a trusted environment for the health Internet is essential and fully achievable' but needs to 'be consistent with public health objectives in order to serve the public, civil society, governments and industry on a global scale.'[41]

In Scotland, healthcare technologies continue to develop that 'trusted environment' with SWAN improved connectivity replacing the N3 network, tentative moves towards healthcare professional shared access to electronic patient records (NHS Tayside) and technology-supported remote delivery of pharmaceutical primary care services (NHS Highland).

Scotland's health and social care policy objectives promote equality of access to services for both healthcare professionals and patients is further promoted by the development of mobile apps for smart (cell) phone and tablet. Taking familiar technology from personal life into work has seen an increase in 'bring your own device' (BYOD) supported by more widespread public wi fi and 3G/4G/5G mobile access. There is an opportunity to build work based training around the digital literacies increasingly evident in day-to-day life.[7,19]

However, the main constraint is lack of access to shared electronic health records which limits the medication history, diagnostic and test results available to inform community pharmacist consultations; a top priority for the Royal Pharmaceutical Society in the UK.[29] In contrast, the Scottish Government is investing heavily in adding pharmacists, some of whom will be independent prescribers, to the healthcare teams in GP practices where they will have access to patient health records. Some pharmacists experience the anomaly of working part time in both GP practices and community pharmacy with access to health records to inform decision making in one setting but not the other.

There is a clear need for a workforce 'fit for future needs'[41,42] supported by the RPS assertion that, 'pharmacy education should ensure a basic standard of IT literacy'[43] aligned with the BCS CITP call for every citizen to be, 'able to make use of technologies to participate in and contribute to modern social, cultural, political and economic life'.[18]

Globally the pharmacy policy intention is to continue to increase reliance on IT with staff supported in role development, 'to ensure a workforce that is fit for purpose and that meets the future service needs'.[1,29-32] However, 'given the strategic importance of this tech [technical] literacy, we must move away from the belief that people can acquire these essential skills by osmosis.'[5]

This research demonstrates the distance to be travelled to meet the technological aspirations in Scotland of the '2020 Route Map' for an appropriately trained, resourced and supported workforce.[42,44] This is mirrored in the United States where, 'the most important improvement in health IT evaluations is increased reporting of the effects of implementation and context'[45] and 'its anticipated evolution, with a focus on quality, patient safety, communication, and efficiency.'[46]

Conclusion

On the basis of global policy, technological and workplace progress, it could reasonably be expected that digital literacy will be an expectation of the pharmacy team in all developed countries therefore, 'Digital skills need to improve continuously across the whole UK population so that all sectors and organizations can maximise their competitive potential offered by the rapidly developing applications of digital technologies'.[47] As future patients are increasingly likely to say 'I expect my health and social care information to be captured electronically, integrated and shared securely to assist service staff and others that need to see it.'[41] Global policy and strategy suggests

it is all about 'Making the Vision Real' so service staff and carers including pharmacy staff need to meet those standards of digital literacy.[44] As Scotland increasingly invests in ehealth pharmacy technology, most recently piloting 'spoke and hub' robotic dispensing centres, it is important that it also invests in pharmacy staff training.

Further research

Future research should focus on identifying the potential for increased engagement with pharmacy technology in community and hospital settings with due recognition of the defined levels of all aspects of digital literacy and increasing patient and carer based technologies. Also of interest will be the development, implementation and evaluation of what could become known as pharmacy (health) informatics in the UK syllabus for the education and training of all levels of pharmacy staff.

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