ARCH – Applied Research for Connected Health

an Enterprise Ireland and IDA Ireland Technology Centre

Exploiting Existing Innovation across ARCH Industry Members

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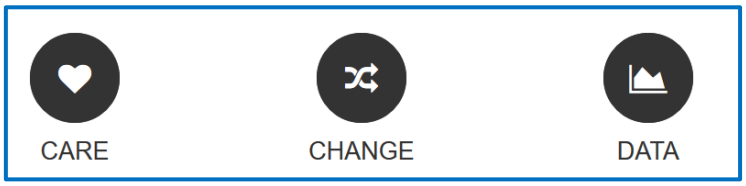
Introduction

The Applied Research for Connected Health (ARCH) is an industry-led multidisciplinary research technology centre. ARCH continuously keeps abreast of healthcare innovation through its research team and collaborative industry partnership in Ireland. ARCH provides access to world class clinicians, academics and patients cohorts to explore and evaluate potential model solution for global market in Connected Health approaches. This applied research approach focuses on three core themes in Connected Health:

1. **Care**: examines current care practices and identifies opportunities for Connected Health technology to improve practice;
2. **Change**: explores the process and impact of change on healthcare delivery models and how organisations overcome various barriers towards Connected Health innovation;
3. **Data**: identifies how systems, services and software can be introduces to enhance healthcare service operations and assesses its impact through data and process analysis techniques.

When combined, these three themes offer an exciting opportunity to explore how existing ARCH industry partners could collaborate on forming a strategy to establish new technological developments such as a national e-pharmacy service ecosystem. While acknowledging the obvious barriers of market focus and intellectual property associated with such a proposal, it is worth considering how we could 'connect' industry in order to connect healthcare services. This report briefly discusses the emergence of Connected Health and examines ARCH industry partners' innovation, their focus on particular healthcare solutions and the opportunities which may exists in e-pharmacy.



The Problem: Pharmacy Services

Irish pharmacists and their supporting staff play a vital role in the primary healthcare system. Pharmacists are committed to delivering a quality, accessible, personal and professional services which places emphasis on patient-centric care. Throughout the development of this research project, we identified that there are a number of opportunities for process improvements within the pharmacy and care pathways to generate additional value. Specifically, we identified the problems associated with the lack of process transparency and visibility, growing number of patient admissions and their need for medication risk assessment, lack of staff, lack of insight on patient journeys and where pharmacy may best intervene to shorten their journey to optimise pharmacy service provision, lack of approved metrics to assess pharmacy services, and the lack of a national medication strategy to support pharmacy. In recent years, there has been considerable interest in examining the potential of e-pharmacy solutions to address some of these problems. For example, within

the HSE E-Health Strategy or Ireland[1] there is particular focus on e-prescribing. The USA the Centre for Medicare and Medicaid Services[2] defines e-prescribing as

> *"…the transmission, using electronic media, of prescription or prescription-related information between a prescriber, dispenser, pharmacy, benefit manager, or health plan, either directly or through an intermediary, including an e-prescribing network. ePrescribing includes, but is not limited to two-way transmissions between the point of care and the dispenser."*

While e-prescribing is a key element of pharmacy or e-pharmacy, there are many intertwining issues which hamper achieving efficient service performance. Thus, establishing an e-pharmacy ecosystem (Figure 1) requires a number of components to drive its success. We categorise these to include digital prescribing, the availability of data (and analytics), the integration and standardisation of solution (including technology) and the effective implementation of a change management programme. However, before we can achieve this, we must first explore what current practice is within a pharmacy environment. Deliverable 3 shed some light on the key issues experienced in modern pharmacy services. We presented these and discussed the need to introduced innovative Connected Health solutions. We examine these in light of ARCH industry partners healthcare innovation competencies and capabilities with a view to explore how we could collaborate and establish a successful e-pharmacy ecosystem.

[1] http://www.ehealthireland.ie/Knowledge-Information-Plan/eHealth-Strategy-for-Ireland.pdf

[2] Department of Health and Human Services. Medicare Program; ePrescribing and the Prescription Drug Program; Final Rule. 2005. Available online from: http://edocket.access.gpo.gov/2005/pdf/05-22026.pdf.

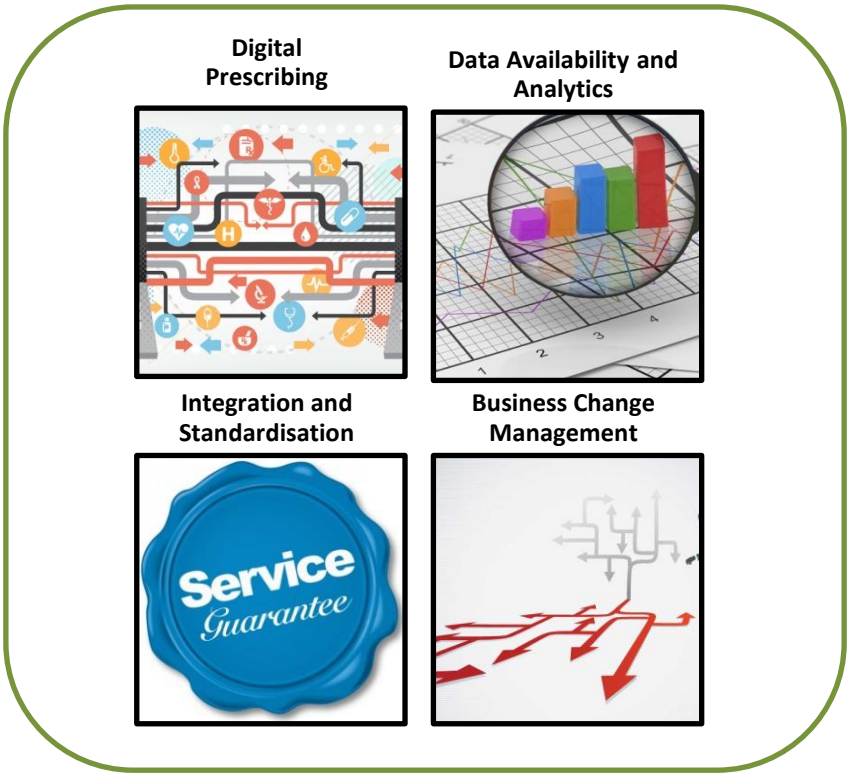


Figure 1 Towards an e-Pharmacy Ecosystem

Emergence of Connected Health

Societal and demographic changes, coupled with economic challenges, have driven the need for us to reconsider how we deliver health and social care in our community (Rodrigues et al. 2012). Healthcare places considerable financial burdens on both public purse and personal finance. In addition, due to demographical shifts, there is a growing demand for care to be delivered in a more personalised context, to deliver 'smart' solutions via technological devices. Connected Health is an emerging and rapidly developing field which has the potential to transform healthcare service systems by increasing its safety, quality and overall efficiency. While considered a disruptive technological approach in healthcare, it is used by different industries in various sector contexts (for example, healthcare, social care and the wellness sector). Thus, various definitions for Connected Health exist with different emphasis placed on healthcare, business, technology and support service providers, or any combination of these. We view Connected Health to extend beyond healthcare institutions and focus on the delivery of personalised and patient-centric health management by healthcare professionals and others, including patients and their families, through the use of electronic methods and defined processes. We capture this in the term 'ecosystem'. A Connected Health Ecosystem implies that we to strike a balance between the various requirements and dynamics associated with different stakeholder groups in a modern healthcare sector. For example, this can include primary care,

secondary care, payers, policy makers, pharmacies, clinicians, patients, family members, innovators, public officials, patient groups, academics and entrepreneurs collaborating to experiment, develop protocols and tests, and evaluate new Connected Health service solutions. As technological solutions seek to enable such connectivity between healthcare stakeholders (Hebert and Korabek, 2004), there is a growing interest in examining how ICT enables Connected Health solutions. For the purposes of this report, we are interested in examining how ARCH partners could lead developments in e-pharmacy.

The widespread availability of technological solutions presents the healthcare technology community with a timely opportunity to extend healthcare capabilities. There is a growing demand for more patient-centric care solutions. In addition, the growing burden on government to improve healthcare performance with dwindling resources places significant pressures on healthcare organisations and professionals to provide safe and quality care. Connected Health presents opportunities to address some of these problems and builds on previous initiatives such as telehealth, telemedicine, e-health by offering greater connectivity for patient-centric solution through sensor technologies, wearable technologies, mobile technologies, cloud technologies and system integration development. The traditional paper-based healthcare system is often location-specific than a more open and digital healthcare environment. Therefore, as we continue to search for methods to improve healthcare efficiency by shifting from the traditional system, exciting opportunities are created through the redesign healthcare models and service delivery processes. Connected Health provides a key service to meet healthcare requirements and extend technological functionally through a range of devices to supply accurate information to the right person, at the right time to improve healthcare quality. In doing so, Connected Health can improve healthcare efficiencies, empower patients, reduce costs and alleviate the burden and demand for resources associated with hospitalisation. Therefore, within ARCH, we are considering how we could redesign healthcare by moving towards a more preventative, proactive and incentivised care model rather than the traditional treatment, costly and reactive care model. This will enable the patient to self-manage their own healthcare and identifying potential issues at early detection stages. It will support healthcare professionals to better facilitate the provision of care through an informed healthcare supply value network. However, the connectivity between healthcare stakeholders is pivotal to the success of establishing a Connected Health ecosystem.

Pharmacy

One key element of the Connected Health ecosystem is the pharmacy service. Building on previous ARCH deliverables (Deliverable 1-4) we offer a conceptual account of how ARCH industry members could begin to contribute towards establishing an e-pharmacy service environment. The success of e-pharmacy has been witnessed in various locations across the world. For example, in the USA, healthcare organisations have

adopted Avera Health (Deloitte, 2015). Avera Health [Case Example 15] operates seven hospitals, providing a telemedicine services (eCare) to a network of eighty-six hospitals and over one-hundred facilities across six-hundred-thousand square miles (about the size of France and Germany combined). It telemedicine services include eICU (electronic Intensive Care Unit), eEmergency, ePharmacy, eConsults and eLTC (electronic long-term Care). The company reports to have saved an estimated cost of $143 million per annum on healthcare services (Deloitte, 2015). Another Connected Health company, Merck Sharp and Dohme (MSD), utilises monitoring and management connected Health approach for COPD patient with the use of "Closecare". MSD was commissioned by Harrow Clinical Commission Group (CCG) to improve care for patient suffering Chronic Obstructive Pulmonary Diseases (COPD). A trial of patient monitoring services called 'Closercare' makes provision for remote monitoring of patients with wireless linked devices which are observed by a team of nurses. If abnormal results are observed by any of the nurses, they can monitor the patient further or call the patient to discuss available medical interventions. As a result of this technology, there was 50% reduction in admission, 12% drop in Accident and Emergency, and 16%-20% saving cost for patients with previous hospital admissions for similar cases. (Deloitte, 2015). Apart from these two examples, our research indicates that various software applications and devices produced by both healthcare and non-healthcare companies can have innovative solutions for healthcare delivery. Examining how existing ARCH partners could support an e-pharmacy Connected Health ecosystem if a first step towards exploring technology integration possibilities. Consider for example, the exploration of some key questions which may stem from the emergence of Connected Health with particular focus on e-pharmacy:

- How can we redesign pharmacy services to extend beyond the hospitals and into community care environments?
- How can we better empower patients to avail of safe and timely medicine management services?
- How can we evaluate the effectiveness of e-pharmacy service innovations over traditional pharmacy service and care pathways?

As we examine the promise of Connected Health technologies, we believe the answers to these questions have the potential to open up business opportunities for ARCH industry partners. At a high level, Figure 1 illustrates the possibilities of establishing a Connected Health Ecosystem through the affordance of many technologies, for example, mobile phone technology, wearables, digital security and monitoring via electronic means.

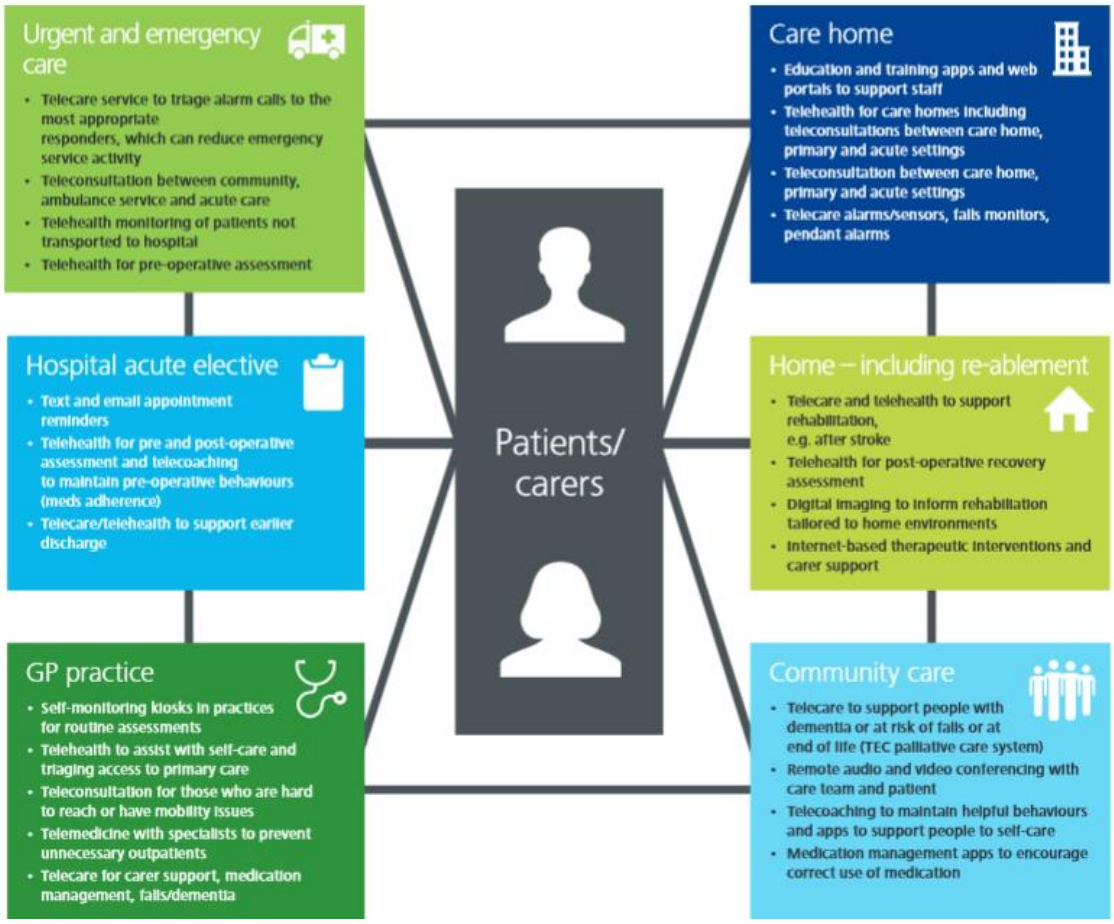


Figure 2: Connected health Possibility (Deloitte, 2015)

The interconnections illustrated in Figure 1 maybe considered as interactions or resource (e.g. information and/or treatment) flows. From this research perspective on e-pharmacy, consider these links as medicine flows and consider how Connected Health technology may facilitate this interaction. ARCH industry partners have various technical competencies and capabilities which could facilitate various aspects of the e-pharmacy care pathway.

ARCH & Industry Opportunities

ARCH provides a unique resource to both support and engage industry partners in developing and extending Connected Health innovations which can deliver better healthcare services, including medication/drug delivery via medical devices. E-pharmacy presents a multi-faceted Connected Health challenge, requiring specialised value chains through networked solutions. Thus, a modular innovation or open innovation approach to deliver sustainable value for healthcare stakeholders may be an option to consider amongst partners. Table 1 below attempts to provide an overview of the industry partners, their innovations and role of how we can begin to view ARCH and industry partners. In Table 1, we categorise ARCH companies as:

a) **Healthcare Technology Consumer (HTC):** either end-users of a healthcare technology or the company benefits from technology usage as a consumer of the products.

b) **Non-Healthcare Focus Technology (NHFT):** develops healthcare technology which has wellness benefits but not necessarily used within the healthcare sector.
c) **Generic Healthcare Provider (GHP):** develop products or technologies which can be adapted to suit end-users for specific healthcare or wellness demands.
d) **Healthcare Focus Technology (HFT):** develops healthcare services products or technologies.
e) **Others**: provides technology education or support for vendors of care processes.

Building on the overview in Table 1, we present another examine how ARCH partners are targeting specific health conditions. Table 2 examines some of the key areas addressed by ARCH industry partners.

Company	Overview	Product Name	Target Market	Solution		Cost Structure		Access/Categories
				Standalone	Mobile	Fee	Free	
ADA Security System	Provides technology that help users collate their various health information in a secured environment from various care delivery systems, for monitoring, analysis and sharing purpose. http://ada-security.com/	Homesafe Care: A medical technology that help patient maintain adequate on-going care by integrating with some home existing devices and sending patient information or situation into a feedback database for carers attention with remote health monitoring services (TR1)	Homecare	√	√	√		Uses internet and some already existing home devices/Non Healthcare focus Technology, and others.
		Monitored Alarm: A wearable panic button that can be used personally, socially or locally to engage an instance help of a service provider in case of an emergency (TR1)	Homecare, Hospitals, community		√	√	√	Uses internet /Non Healthcare focus Technology, and others.
Boston Scientific	Less-invasive medical devices provider, manufacturer and marketer of broad range of interventional medical specialist. www.bostonscientific.com/en-US/home.html	LATITUDE™ NXT: A mobile app used by clinicians to give access to LATITUDE™ NXT Website to read patients information and generate required reports. (TR2)	Hospitals, Clinicians		√	√		Uses Internet, web/Healthcare Focus technology, Generic Healthcare provider.
		LATITUDE Consult™ System: A consult communicator used to read data from patient's implanted devices via a telemetry wand placed over the patient devices (TR2)	Hospitals, Clinicians	√		√		Uses Internet, web/Healthcare Focus technology, Generic Healthcare provider.
		LATITUDE™ NXT Patient Management System: A remote monitoring devices that helps Clinicians query information connecting to Boston Scientific LATITUDE Platform and gets feedback from patient as well (TR2)	Clinicians, Hospitals	√		√		Uses Internet, web/Healthcare Focus technology, Generic Healthcare provider.
Dolmen	Provides creative design and innovation consultancy that help channels a better user's service. http://www.dolmen.ie/about/							Non healthcare focus technology, Generic Healthcare provider
HealthBridge Technology	Creative innovation of technologies, systems and services in mental health services in a way that improves quality care, patient safety and healthier outcomes http://www.healthbridgetechnology.com/	Pocket-Therapy: Provides a self-monitoring and management behavioural analytical mobile tools used by clinicians in conjunction with patient. (TR4)	Homecare, psychiatric hospitals,		√	√		Internet/Healthcare focus technology, and others
Hermitage Medical Clinic	A private hospitals that specialises in medical, surgical and advance radiotherapy care to patient using the latest medical technology http://www.hermitageclinic.ie/							Health Technology Consumer
ICON	Provides high quality pharmaceutical development services to pharmaceutical, biotechnology and medical devices industries with focus on management and analysis of programs that support clinical development http://www.iconplc.com/	ICOLabs™ Medical Review Application (IMRA™): A web based application that provides access to patient's current laboratory data analysis when it is needed from anywhere in the world. (TR6)	Clinicians, Hospitals	√		√		Uses Internet/Healthcare focus Technology, Generic Healthcare provider
		Medical Image Review and Analysis (MIRA): A system that provides imaging data analysis and management via authorized users for clinical research trials. (TR6)	Radiography, Clinicians	√			√	Internet or web/ Healthcare focus Technology, Generic Healthcare provider
		IKE™: A comprehensive image based Knowledge management portal, providing access to study specific knowledge and tools. (TR6)	Radiography, Clinicians	√		√		Internet or web/ Healthcare focus Technology, Generic Healthcare provider
		PDx-POP®: A software tools for speeding up the repetitive process of population pharmacokinetic modelling and analysis.(TR6)	Pharmacy, Hospital	√		√		Internet or web/ Healthcare focus Technology, Generic Healthcare provider

Table 1: Collated from ARCH Partners and Website

Comapany	Overview	Product Name	Target Market	Solution		Cost Structure		Access/Categories
				Standalone	Mobile	Fee	Free	
Novartis	A pharmaceutical and manufacturer of various innovative drugs used in various healthcare services as well as some eye-care product. http://www.novartis.ie/	AcrySof® Intraocular Lenses (IOLs): An implanted lens which can replace the natural eye lens in cataract surgery. (TR7)	Ophthalmology, Pharmacy			√		Healthcare focus Technology, Generic Healthcare provider
Open Health	An online service provider for alcohols problems solutions in Irish society. http://www.openhealth.ie/		Homecare	√	√	√	√	Uses Internet/Health technology consumer, others
Phillips Healthcare	A diversify technology company that provides for patient care through various innovative medical solution, to some specialised health areas for better care and cost reduction http://www.philips.ie/healthcare	HealthSuite: An open cloud base platform which collects, compiles, analyses clinical and other data from multiple devices and sources. (TR9)	Hospitals, Clinicians			√		Uses internet/Healthcare focus Technology, Generic Healthcare provider, others
Relate Care	Provide unique patient access, telehealth and contact to their healthcare service providers in a safe, convenient and timely manner www.relatecare.com		Homecare, Hospitals	√	√	√	√	Healthcare technology consumer, others
ResMed	A company that manufactures, develops and markets a medical products use in diagnosis, treatment and management of respiratory disorder with focus on sleep-disordered breathing http://www.resmed.com/uk/en/consumer.html		Homecare, Hospitals, Pharmacy	√		√		Healthcare focus Technology, others
S3 Group	Professional solution, product and service providers of Digital TV, Connected Health and Semiconductor to engage patient in making an informed decision to their care delivery system http://www.s3group.com/	Remote Patient Monitoring (RPM): A system device with diverse range of product gears toward patient care delivery outside a care delivery system such as Hospital. (LR12)	Homecare, Pharmacy, Medical-Devices Vendors, and Clinician	√	√	√	√	Internet/Healthcare Technology consumer, Non healthcare focus technology, Generic healthcare provider
swiftQueue	An online patient appointment booking avenue that help reduced the traditional queue stress management for healthcare professional. https://www.swiftqueue.com/	Saas Platform portal: A mobile and internet avenue for patient to schedules and manage appointments with Healthcare professionals. (TR13)	Clinicians, Hospitals, Patients	√	√	√	√	Internet/Health Technology Consumer
Theya Lingerie	Caters for post breast cancer and cosmetic surgery patients or patient undergoing radiotherapy treatment for a suitable and adaptable medically design lingerie. http://theyalingerie.com/		Women Post-surgery care					Non healthcare focus technology, others
Two-Ten-Health (tth) Salud	A Dental Information Management System that provides software solution and professional services to Dental school and Hospital worldwide. http://www.twotenhealth.com/		Dental colleges, Hospitals	√	√	√	√	Other, Healthcare focus technology
VideoDoc	Upcoming video house call that may help some patient safe cost and transportation stress. http://videodoc.co.uk/		Homecare					Health Technology consumer, others
Vitalograph	Design, manufactures and marketing of respiratory diagnostic and therapeutic products https://vitalograph.ie/	Spirometers: A medical devices designed to measure the amount of air inhale and exhale in a patient lungs and send data collated to a professional for analysis (TR17)	Hospitals, Pharmacy, Patients	√		√		Uses Internet/Generic Healthcare provider, Healthcare focus technology
		Monitors and Screeners: A medical devices designed to measure the amount of air inhale and exhale in Chronic Obstructive Pulmonary Diseases (COPD) patient lungs and send data collated to a professional for analysis. (TR17)	Hospitals, Pharmacy, Patients	√		√		Uses Internet/Generic Healthcare provider, Healthcare focus technology
Vu2vu	A customer service providers for and marketer for Vidyo Inc. A company that specialises in Tele-presence video conferencing system. http://vu2vu.com/	Vu2Vu*Click*™ : A software which turn any Windows or Macintosh computer into an HD Telepresence (face-to-face meeting capability) one to one or one to many user's experience with the use of internet system. (TR18)	Homecare	√			√	Internet/Health Technology consumer, Non healthcare focus technology

Table 1 (continued): ARCH Partners Overview

Partners	Conditions / Healthcare Focus									
	Diabetic	Neurological	Respiratory	Digestive	Bones & Joint	Heart	Urological	Dermatological	Dental & Oral	Eyes
ADA Security System		✓	✓			✓				
Boston Scientific		✓	✓	✓		✓	✓			
Dolmen										
HealthBridge Technology		✓								
Hermitage Medical Clinic	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ICON	✓		✓		✓	✓		✓	✓	
Novartis		✓	✓	✓		✓		✓		✓
Open Health		✓								
Phillips Healthcare			✓			✓				
Relate Care	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ResMed			✓							
S3 Group	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
swiftQueue	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Theya Lingerie										
Two-Ten-Health (tth) Salud									✓	
VideoDoc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Vitalograph			✓							
Vu2vu										

Table 2: Showing ARCH Partners Diseases Condition Range Covered

Possible Connected Health Opportunities

We have profiled ARCH industry partners (Table 1 and 2) illustrating how their innovations relate to specific elements of Connected Health. Using this, we can consider the value-add by merging some existing Connected Health solutions within a care pathway. For example, to facilitate e-pharmacy, we can conceive how to use patient care delivery in a single technology point of contact and work towards an initial Connected Health coordinated solution. The ability for various ARCH partners to connect and combine their technologies could enhance the speed of Connected Health care to ensure support such as:

- Patient Communication
- Patient Monitoring
- Patient self-management and awareness
- Healthcare professionals and carers caring co-ordination

The totality of managing such steps using various combined technology builds on the potential of Connected Health. Figure 2 offers a high-level view of a potential Connected Health system with existing ARCH partners. Before we examine pharmacy services within a hospital context, we reviewed the potential of ARCH partners to support various aspects of care pathways, i.e. adopting a 'theoretical' view of where ARCH is positioned. We offer a high-level mapping of ARCH partners (Figure 2). After further collaborations with the researcher participants, i.e. pharmacists, we will build on this model and refine it developing an improved mapping solution as the project progresses.

The ARCH industry ecosystem model emerged from our analysis and categorisation of the range of innovations offered by ARCH industry partners in the field of Connected Health. We categorised these as:

- Scheduling innovation;
- Treatment and Design innovation;
- Prevention innovation;
- Analytics innovation;
- Recovery innovations;
- Communication innovation.

We identified which companies would match each category (and some companies would match more than one category) before we began to map how they would fit into a wider Connected Health ecosystem. As part of our future work, we will be tasked with identifying where these companies would support a patient journey and how they could deliver a vital Connected Health service within various care pathways.

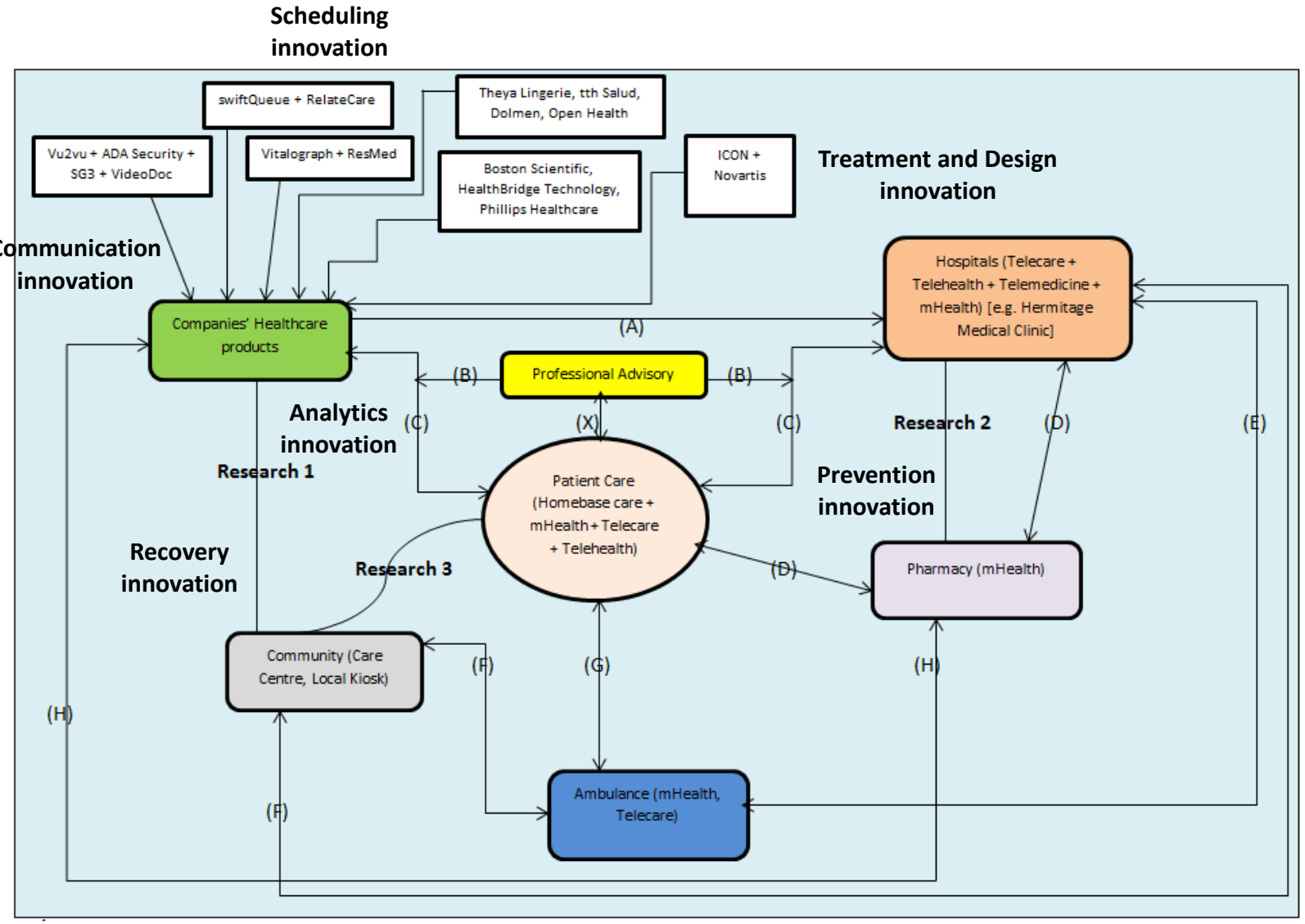


Figure 3: Possible ARCH Industry Ecosystem (including e-pharmacy)

We describe the available healthcare products from ARCH partners as being accessible to hospitals, clinicians and patients to support medicine management in e-pharmacy through the patient journey as follows:

(A) Technologies which facilitate access to services such as booking appointment platform for patients and physicians confirmation of the appointment at the **Hermitage Clinic** using technologies provided by **swiftQueue** or **RelateCare** services. **HomeSafe** or **S3** tools can be used for patient monitoring and for physician care measurement (*Path C*). Some of **Vu2Vu*Click*** series product can be supplied for telecare between patients and clinicians (*Path X*). This will also record patient history and provide a summary of medicine management (including allergies etc.).

(B) Review and product advice by healthcare specialist to companies (B-Left arrow) as well as review and advices for at-home patient uses (B-Right arrow), having consulted patient record.

(X) Telemedicine using some of **Vu2Vu*Click*** product series (e.g **vidyoDesktop**) between the specialist and at-home patient for consultation (**HealthBridge)**, education (**ARCH**), monitoring and observation (**S3**)especially for critical condition patient (**HSE**) and the health status with specific drug treatments.

(C) Telehealth and telecare approach using **LATITUDE™ NXT** Patient Management System (**Boston Scientific**) for patient response to treatment, Remote Patient Management (RPM) (**S3 Group**) and Monitored Alarm (**ADA Security**) for continue patient care and monitoring. mHealth service may be provided using **LATITUDE™ NXT** (**Boston Scientific**) or **Pocket-Therapy** (**HealthBridge Technology**). Patients can update their health status on daily basis at home and provide results of medicine management to the local care centre. It also includes interaction between patients and a company products or services (e.g. using appointment schedules in **swiftQueue**, a training or educative discourse, or purchase product directly from **ResMed, Vitalograph, ICON**)

(D) Pharmacy's collaboration with hospitals and clinicians (D- top arrow) while supplying recommended medication to patients (D- Left arrow). mHealth solutions can be used for medication adherence and monitoring.

(E) M-health, teleHealth, telemedicine between hospitals clinicians and ambulatory or helicopter services for emergency care. It includes using Electronic Health Records (EHR) to exchange at-scene health information (e.g. images and healthcare records), directly to an emergency department for accurate preparation and delivery of patient care, medicine management and time saving solution (e.g. **MIRA™ by ICON**).

(F) Using tele-medicine, m-health, telecare in a community area (e.g. nursing home) and shopping centres by installation of some specific health-check-kiosk (blood test or pressure measurement centre, weight-height analysis centre, etc.) where patients can enter their unique ID number and send health-status feedback to healthcare services for

analysis. This may trigger the need for admission requirements, treatment instruction or advice by the professionals is required. I**MRA™ and LATITUDE™ NXT PATIENT MANAGEMENT SYSTEM, Vu2Vu*Click*™** series may offer solutions here.

(G) Using m-health, homecare, telecare approaches, a patient can send health-status for monitoring, analysis and prevention purposes related to care, treatment and medicine management. **Pocket-Therapy, LATITUDE™ NXT, Vu2Vu*Click*™** series maybe offer useful capabilities to extend pharmacy services and support community care monitoring and medicine adherence.

(H) Some products may be suppliers (made available) to pharmacy (e.g. drugs or devices) and some product are specifically requested from company by pharmacy.

Building on this conceptual ARCH industry ecosystem model this also opens up discussions on new research opportunities in the field of e-pharmacy. We will explore this further in Deliverable 6 where we propose a research strategy within ARCH.

Conclusion

The report has reviewed current ARCH industry partners, their technological innovations and explored how we could further 'connect' healthcare to support a Connected Health care delivery ecosystem. This initiates many new research opportunities in the area of open innovation to support partners further establish Connected Health developments. We are now embarking on case studies within Galway University Hospital, University Hospital Limerick and Hermitage Hospital. This research will allow us to examine the pharmacy pathway based on practical experience within the hospitals, and through that, identify potential innovations and collaborations between ARCH partners to support e-pharmacy developments. Following this step, further research may focus on:

- ✧ How can the existing innovations be extended for new solutions or new markets?
- ✧ What additional developments are required to existing products for improved seamless integration in healthcare service systems?
- ✧ What new products are required to achieve a national Connected Health agenda?

Connected Health solutions will continue to extend patient care outside the hospitals (e.g. monitoring and management using technology). It will enhance the ability for tele-presence and tele-medicine improved mechanisms of information exchange and healthcare self-management. Employing a Connected Health strategy for patient care and treatment (i.e. medicine management) will create effectiveness and efficiency in family, carer, community and patient engagement in healthcare delivery. We will explore this in more detail in Deliverable 6 where we propose an e-pharmacy research strategy with ARCH industry collaboration.

Glossary Key Term

Bones and Joints Conditions	**There are several diseases associated with these conditions. The comprehensive list can be found on the NHS website (NHS, 2015)**
Connected Health (CH)	The combination of various Information Communication Technologies (ICT) that is available and channelling it towards healthcare sector to deliver care to patient when and where it is needed.(BioBusiness, 2010)
Dental and Oral Conditions	These include diseases of the teeth and oral and nasal cavity. Such as Gum Diseases, Gingivitis, Cavities, etc (NIH 2014)
Dermatological Conditions	These include diverse skins diseases and conditions. A comprehensive list can be found on the link below (AOCD)
Diabetic condition	**This a continuous condition that makes a person's blood sugar level to become too high. The two main types are Type 1 Diabetes and Type 2 Diabetes. (NHS, 2015)**
Digestive Condition	This includes the diseases of the liver, digestive tract and its peripherals. Example includes Acute Pancreatitis, Obesity, Gastroparesis, Ventral Hernia, Chronic Pancreatitis, etc. (UCSF, 2015)
Eyes Conditions	This covers the eyes disorders or diseases such as ASTIGMATISM, STRABISMUS, CATARACTS, etc. (geteyeSmart, 2015)
Heart Conditions	Since there are many heart related diseases and conditions. The conditions under this content will cover each of the various conditions and cardiovascular diseases that are affecting people; such as pulmonary Hypertension, Heart failure, vascular disorder, congenital heart diseases etc. (UCSF health, 2015) and (AHA 2015)]
Neurological Condition	These are disease of the brain, spine and the nerves that join them together. Example includes Brain Tumour, Epilepsy, Parkinson's Disease, Stroke, Multiple Sclerosis, Brain Aneurysm, ALS, Peripheral Neuropathy, Dural Arteriovenous Fistulae, Spinal Cord Tumour, Arteriovenous Malformation, Memory Disorder, Headache, and Post-Herpetic Neuralgia. (UCSF, 2015)
Personal Digital Assistants (PDAs)	A term for mobile handheld devices that provides computing and information storage as well as capability to retrieve the information both for personal or business use.(techtarget, 2015)
Respiratory condition	Some of the most prevalent are Asthma, Chronic Obstructive Pulmonary Diseases (COPD), Lung Cancer, Cystic Fibrosis, Sleep Apnoea, and Occupational Lung Diseases. (PHAC, 2014)
Urological Conditions	These covers the diseases of the urinary tract, pelvic pain, urinary incontinence, urologic cancer, priapism, peyronie's diseases etc. (UCSF, 2015)

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