TechSolns

Impact on COVID-19 from Technology Solutions in NPA Regions

Brief overview

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Lead Partner:

- School of Computing, Engineering and Intelligent Systems, Ulster University, Derry, Northern Ireland

Partners:

- Nemlia Sp/f, Faroe Islands
- University of Oulu, Finland
- Centre for Rural Medicine – Region Västerbotten, Sweden

Associated partners:

- Medicines Optimisation Innovation Centre, Northern Ireland
- University of Limerick, School of Medicine Ireland
- Healthcare Analytics Limited, Northern Ireland
- Interactive Health Ltd., Scotland
- Kraydel Ltd, Northern Ireland
- Centria University of Applied Sciences, R&D - Wellbeing and Entrepreneurship, Finland
- Norwegian Centre for Rural Medicine (NCRM), University of Tromsø, The Arctic University of Norway
- NHS Highland, Scotland, UK
- Akureyri Hospital, Iceland
- Institute of Public Health in Ireland
- Wyld Networks Ltd, United Kingdom

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1. Introduction

In December 2019 there was an outbreak of the SARS-CoV-2 virus which originated in the Hubei province of China (Esakandari *et al.*, 2020). In the months since the outbreak, the virus has spread globally.

Over the past 12 months, technology has played a vital role in all aspects of Covid-19 management. This includes the adaptation of existing technology and the creation of new products because of innovation. Such technologies can range from medical devices to artificial intelligence and data analytics (Wang and Tang, 2020). These technologies have been used for a range of purposes including clinical diagnosis, disease tracking, predicting patient outcomes and the development and validation of treatment options (Kumar, Gupta and Srivastava, 2020). The impact of successful technology integration into Covid-19 management is demonstrated by using countries such as South Korea as an example. During the initial outbreak, South Korea had a death rate of only 0.5 per 100000. This was in stark contrast to other regions such as the USA which had a death rate ten times higher despite being better prepared for a pandemic and having greater hospital resources. It is thought that the improved implementation of contact tracing apps and quarantine measures using digital applications contributed greatly to South Koreas success in reducing the impact of Covid-19 (Whitelaw *et al.*, 2020). Similar success has also been observed in other countries, notably Taiwan which remained relatively unaffected by the Covid-19 crisis. This was mainly due to countries open-source culture and the idea of 'open data'. Health information communication using smart cards enabled effective rationing of face masks while APIs were developed to provide public information regarding testing and mask supply within defined geographical regions (Wired, 2020). Digital coordination thereby enabled a rapid and effective response to any outbreaks that occurred and helped manage resources at a local and national level.

The TechSolns project aims to assess the impact that technology has had during the Covid-19 pandemic across the Northern Periphery and Arctic (NPA) region programme partner countries. This includes a range of technology solutions that aim to address the physical/mental, economic, and social challenges that have occurred during the pandemic, especially for the most vulnerable individuals. The findings of the current research will provide an overview of the efficacy and cost-effectiveness of such technologies which can guide governments and policymakers. Improvements in technology development and better implementation at a population level will provide economic, social, and health benefits.

2. Methods

To identify eligible companies and technology to include in this report, a threefold approach was used. Firstly, we conducted a scoping review of technology solutions in response to COVID-19 in the Northern Periphery and Arctic Area using a web search. The key terms used to identify the solutions included 'COVID-19', 'technology', 'AI', and the name of each country in the NPA region. We also scraped twitter for information by searching for hashtags such as 'techforce19', 'NHSX', and 'covid19tech'. Additionally, we checked reputable news websites for articles on covid-19 technology solutions, regularly visiting sites such as BBC, the guardian, and the telegraph for news items.

Secondly, we attended multiple innovation webinars to learn about technology solutions to the pandemic and gather relevant companies / contacts from these.

Finally, we utilised the existing networks of start-up companies, government agencies, academics, healthcare providers, health and tech entrepreneurs, and health charities from the Partners and Associate Partners on the project and identified suitable case studies from these contacts.

We collated all this information and identified the key companies which had strived with COVID-19 innovation. Each of these companies were then invited to attend a scheduled interview, and those that agreed were asked a series of 11 questions which provided an overview of the company including current expertise, target markets, and how these have changed due to the Covid-19 pandemic. Interviews were conducted online and the responses to each of the questions were recorded and used to create a summary of findings for each company. We present the summaries from these interviews below.

3. Sample results

3.1 Iceland - Origo

Origo is one of the largest IT companies based in Iceland, currently employing approximately 500 people. The interviewee Guðjón Vilhjálmsson is their current director of healthcare solutions. Origo covers a spectrum of IT-related products including hosting, software development and IT services for the Icelandic health system, such as prescription services and a national patient portal system.

With a track record of successful healthcare-based IT solutions, Origo developed a system for COVID-19 testing of visitors to Iceland. It allowed travellers to pre-register online and pay for a PCR test which would be administered on arrival in Iceland. When a traveller signed up, they would be provided with a bar code which would be used for tracking the person test sample. In the case of a negative result, the traveller is sent a text message, however, if the result were positive then an automated process

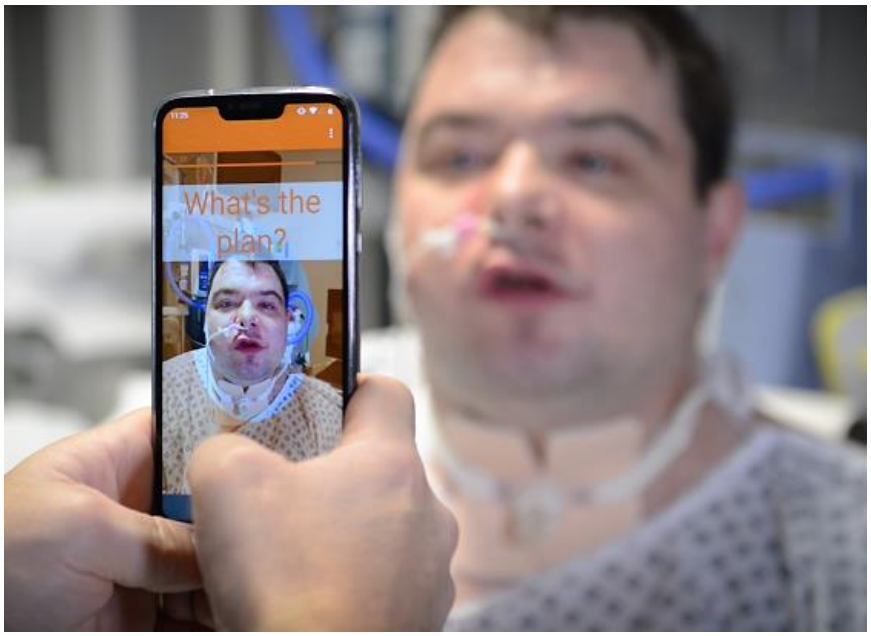
of contacting relevant healthcare agencies would begin. This process was entirely developed by Origo from original sign-up to final contact. The testing system proved so effective that it was expanded out to all COVID-19 testing in Iceland and is being adapted for the upcoming vaccine roll-out.

When asked if Origo had learned any significant lessons about development during a pandemic, Guðjón said that effective project prioritisation can lead to big achievements within a small-time frame, for example, the development and rollout of the COVID-19 testing system. Additionally, processes sometimes need to adapt to modern circumstances, for instance, the idea that you could go online and book a test without review is a foreign concept in comparison to typical healthcare processes. Since developing the software, Origo have been approached by the Directorate of Health to adopt the COVID testing software for the country's cancer screening process.

3.2 Northern Ireland - Liopa

Liopa is a spinout company from the Centre for Secure Information Technologies (CSIT) at Queens University, Belfast and was established in 2015. Liopa specialises in the development of a visual speech recognition (VSR) platform called LipRead which uses a camera to capture video input of lip movements and uses deep neural network (DNN) processes to analyse lip movements and perceive what has been spoken.

The main target audience of LipRead is patients who have undergone a tracheotomy. Normally, staff are required to lip read manually, which can be difficult and stressful for both patients and staff. LipRead helps ease the process. The application can also provide benefit to stroke patients who have difficulty communicating.



Liopa has marketed their existing product to meet the needs of patients during the Covid-19 crisis. Many Covid-19 patients who require ventilator care often need to receive a tracheotomy. LipRead can help facilitate communication during rehabilitation. Covid-19 has therefore helped to accelerate testing and maturity of the product, especially following an Innovate UK award which was received earlier in the year.

3.3 Ireland - Tapa Healthcare

Tapa Healthcare is an Irish medical company based in Dundalk and is led by CEO Peter Donnelly. The company was founded based on the concept of Early Warning Scores (EWS) which are used to proactively manage a patient's health. READS is the product currently marketed by the company which consists of software that is integrated seamlessly into a hospital server alongside the existing Electronic Health Records (EHR) system. READS is based on an efficient workflow involving the ability to assess, anticipate, and treat a patient. In the assessment stage, a series of baseline measurements are obtained at point-of-care (POC) providing an overview of the patients current physical and mental state. READS has been developed to use purpose-built algorithms which use this data to predict a decline in a patient's condition thereby enabling anticipation. As a result, the patient can receive appropriate interventions at an early stage before deterioration begins. This preventative approach creates a better prognosis, streamlines the treatment process, and reduces workload by avoiding potential complications occurring due to deterioration. This system has been incorporated into hospitals in countries such as UAE, Germany, Denmark, and Switzerland where existing networks of EHRs have been established.

In response to the Covid-19 pandemic, Tapa Healthcare has adapted READS through the addition of algorithms to predict deterioration of Covid-19 patients. This enables the many benefits of the system to be applied to this new cohort of patients. Additionally, many patients who recover from Covid-19 may suffer long-term complications due to existing co-morbidities. This has led to an expansion of the existing target market to provide domiciliary care. This would enable the long-term monitoring of patients at home in cooperation with care workers who would be required to provide POC assessment. Plans to develop a new product based upon READS but with the specific purpose of providing home care has occurred because of the pandemic.

3.4 Scotland - Wyld Networks

Wyld Networks has offices in Cambridge and Brighton and currently employs 11 people. They specialise in the development of wireless mesh software solutions and IoT networks. Wire mesh solutions are used for the peer-to-peer connection of smartphones without the need for Wi-Fi or 5G. This is often utilised in dense locations such as stadiums, retail, and concert venues where many devices are present in a small area at the same time. This wireless connectivity can be used for location-based advertising which is communicated to users within a defined geographical area.

Following the Covid-19 pandemic, the current technology has been adapted by the addition of new capabilities. The target market has also shifted from advertising to use within a health and care setting, namely care homes. In this instance, the geozoning capability enabled by mesh networks is used to create heatmaps that indicate those areas within care homes where staff or visitors infringe on the 2m social distancing rules. This information can be used to create alerts when social distancing becomes a problem and for the creation of compliance reports that can help inform policy decisions and implement strategies to reinforce social distancing, enabling the safety of staff and patients.

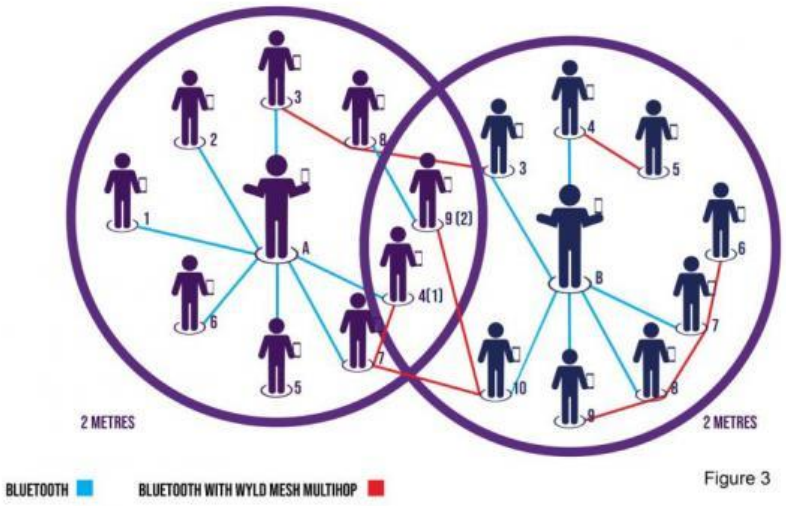


Figure 3

3.5 Faroe Islands - Thetis

Thetis is a private veterinary and environmental agency located in Tórshavn, Faroe Islands. Thetis tests drinking water quality and food products for export, primarily fish and salmon. Before the COVID-19 pandemic, the staff count was 5.

Marita D. Magnussen, PhD and CEO of Thetis explains, that after the COVID-19 virus came to the Faroe Islands, the government enforced COVID-19 testing at the borders (airports and harbours). The government inquired Thetis directly, to take on this task.

Thetis was authorized to handle bacteria, not human viruses. They would need to reconfigure their lab and upgrade their hardware to meet the government's request. But Thetis took on the project. They set up a new microbiological laboratory and invested in new lab equipment. Handling live human viruses normally requires a BSL (biosafety level) 3 accreditation, but as the BSL safety framework is not used in the Faroe Islands, Thetis implemented swabs that immobilised the virus. This way, they were able to lower risk, and safety requirements.

Talking to Magnussen PhD about how the pandemic has affected business ideas, “COVID has given us a push”, she says. Thetis have shown to be able to work and adapt to the situation, she explains. Now, the government has become a major client, and Thetis has the authorization to handle sensitive data. A lesson learnt from past events, is to be foresighted on how to invest in hardware. The hardware acquired for the COVID-19 tests will enable them to perform botulism tests in the future. Only 2 other laboratories in the Danish Kingdom provide this service, she explains. Botulism tests are in demand from local salmon producers, and Marita expects them to outcompete their competitors in terms of costs.

3.6 Finland - BioNavis

Founded in 2006, BioNavis currently employs 6 individuals within the city of Tampere in central/southern Finland. They specialise in the development and commercialisation of plasmon resonance technology. Initial research began at VTT, but since moved to BioNavis which was established to continue development of the technology as an independent organisation. The plasmon devices and SPR chips that were manufactured as a result have been marketed to universities and research institutes.

In response to Covid-19, the SPR sensor slides were adapted for the detection of antibodies in serum samples that have been produced due to infection. This has enabled the development of an anti-pathogen antibody assay that provides the ability to test for infection in a manner that is fast and cost-effective. Therefore, the product is suitable for the testing of large populations in a healthcare setting. The success associated with the application of this technology for healthcare purposes has resulted in

plans to secure funding for additional research and development with the hope of expanding upon the products currently offered.

3.7 Sweden - Cuviva AB

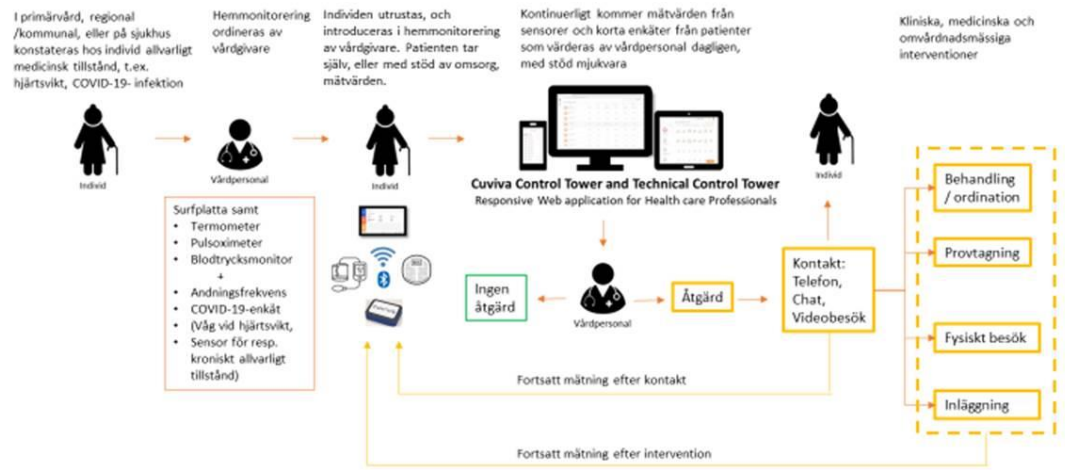
Cuviva has 14 employees with several external consultants involved. Head office is in Gothenburg, Sweden. They mainly work with municipalities and regions in Sweden but have lately also worked in Britain. Interviewed is Karl-Johan Palmgren, CCO. Cuviva has specialized in digitalization and the democratisation of technology for the elderly. Their platform is focused on monitoring several health indicators and giving support to patients and healthcare users in their various treatments. Cuviva's platform is useful whether the patient has multiple diagnoses or more specific illnesses.

Cuviva had the platform on the market before the pandemic but has adapted it to the current situation. The platform is in its essence a distance spanning technology and is therefore well adapted for health care practices with less physical contact. The platform has more sensors than before the pandemic, for example, measurements of respiratory rate, and they have made adaptions to better fit support and follow-up for Covid patients.

Cuviva's platform allows patients to be moved to their home while the hospital still is able to keep track of the patient's health status. Municipalities and regions are now considering new digital solutions to a greater extent. Processes from earlier have halted and the climate is more reactive than proactive. While there are more discussions about new solutions it is hard to get concrete decisions. Most functions in Cuviva's platform were there before Covid as their product is designed to be broad. The Covid focus has rather been on minor adaptions to better fit the situational needs of the customers.

The pandemic has shown how adaptable and agile their solution is. There are however problems with longer implementation processes as the health care system's resources are urgently needed in other places.

Vårdförlopp A - Den kliniska modellen hemmonitorering av multisjuka och sköra äldre, samt även COVID-19 infekterad, av måttlig grad, som ej kräver respirator



cuviva