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In This Issue

Welcome

While technology and innovation generally go hand-in-hand, technology tends to be about solutions, while innovation is about doing things better. The World Health Organization (WHO) explains that 'health innovation' should improve the efficiency, effectiveness, quality, sustainability, safety, and/or affordability of healthcare. This definition includes 'new or improved' health policies, practices, systems, products and technologies, services, and delivery methods that result in improved healthcare.

While technology has a huge part to play in this process it must be measured against the requirements to improve from within the organisation itself. At the heart of innovation, is the need for collaboration and the sharing of ideas, and by clearly identifying opportunities to deliver services and care in new ways, along with the justification for those necessary changes, providers can ensure that technology is adopted in ways that are meeting the collective needs of different stakeholders, across the organisation.

By approaching healthcare innovation in terms of 'value-over-function' healthcare technology developers can, similarly, create technology-driven products that align more effectively with the innovation aspirations of their clients.

In this issue we address the role of innovation in healthcare and consider different ways that providers and systems are adopting technology within their wider innovation processes.

The article 'Making the Case for Responsible Innovation' proposes an alternative model for innovating in the Digital Health space. Living Labs provide an environment for multi-stakeholder participation with a particular focus on service users, an open-ended exploration of the problems and co-creation of potential solutions incorporating the principles of 'Design Thinking'. Similarly, Aneliya Stoyanova of Progress discusses how the term "innovation" is fraught with nuance and means different things to different segments of healthcare.

Also, in this issue we include original research from USC's Center for Body Computing that assesses the Health Impacts of Unlimited Access to Networked Transportation in Older Adults; an interview with Dr. Gidi Stein, co-founder and CEO of MedAware, where we discuss the role of technology in reducing medication-related risk; and, a thought-leadership piece from Professor Mike Trenell, co-founder of Changing Health, that asks 'How to Scale Health Tech Sustainably?'.

Matthew Driver
Editor

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Innovation in Healthcare

Are we Looking for Phoenixes When we are Seeing Butterflies?

By Alison Houghton, Progress

The term "innovation" is fraught with nuance and means different things to different segments of healthcare. Leonardo da Vinci wrote: "Simplicity is the ultimate sophistication." Ironically, for some healthcare segments, innovation could be akin to a caterpillar metamorphosizing into a butterfly and for others, it could be a phoenix rising from the ashes. What healthcare innovation looks like will be determined on what problems healthcare organisations are attempting to solve and what outcomes they need to deliver.

Innovation Can Start with Basic Issues

If we look at patient no-shows, it does not seem like a sophisticated problem that would require innovation. However, available data demonstrate that patient no-shows can impact clinical workflows and delay patient diagnosis. For the last several years, many organizations have used a variety of DIY solutions to tackle patient no-shows and while some of these methods have improved patient appointment adherence —phone calls, emails, and SMS — most of these DIY methods create patient fatigue and new cycles of non-adherent patient behavior. Can something as basic and simple as getting patients to their appointments be innovative? With a growing population of chronically-ill patients, who present with multiple comorbidities, reducing patient no-shows is crucial for the long-term health of chronically ill patients as well as the overarching health of society.

Healthcare has a prodigious amount of information on patient appointments, but that information is frequently decentralised or housed in siloed databases that bring little value to organisations that are aiming to improve the patient experience and drive adherence. Although, there are numerous solutions that are available to remind patients to attend clinic, most of these solutions are not context driven. Additionally, most of these solutions don't predict if, when, and why a patient does not attend their clinical appointment.

In truth, healthcare innovation is a craft cocktail that is one-part behavior modification and two-parts readiness and willingness to change. Sometimes innovation can simply be about elevating an endemic problem with a new tool kit of options that enhances clinical workflows, improve patient outcomes, and drives operational efficiency. For example, identifying, predicting, and prioritizing adherence workflows is sophisticated innovation.

The Role of Machine Learning

Machine learning (ML) coupled with the integration of different data sources and real-time data can help healthcare organizations create innovative, personalised strategies to improve patient adherence, such as understanding what external factors – weather and child care needs, etc. —impact patient no-shows. By automating and aggregating data, healthcare organizations can create patient model types to determine how best to get patients to keep scheduled appointments and when to overbook patient appointments to avoid care coordination scheduling gaps. Moreover, organisations can use patient appointment data to maximize clinical workflows by strategically triaging staff based on patient needs and staff expertise.

A Roadmap for Healthcare Innovation

To drive innovation simplicity, healthcare entities:

1. Need to identify a problem they need to solve.
   » You know your institution better than anyone else. By identifying the problem that you need information technology (IT) to solve, you will be making IT spending decisions based on a real-world fit for your organization's long-term and short-term objectives, not a one-size-fits-all approach.
2. Identify the outcomes that implementing the IT solution or platform should deliver.
   » Knowing what outcomes need to be achieved will save you time, money, and reputation. Innovation for the sake of "cool factor" credentials is not innovation. What is cool and trendy today might be dated or obsolete tomorrow.
3. Work with IT companies that align with your mission statement. Some questions you might want to ask include:
   » Is this company investing in technologies specific to healthcare or they repurposing solutions from other verticals to be applicable in healthcare?
   » Has the company hired individuals with deep healthcare experience and expertise?
   » Is this company truly vested in healthcare and have a product roadmap to demonstrate their commitment?

IT solutions and platforms are a catalyst that can drive operational efficiencies and improve patient outcomes, but each healthcare entity will need to determine how they need to innovate. ■

Focus on the User & Don't Break Anything
How to Scale Health Tech Sustainably

By Professor Mike Trenell, co-founder of Changing Health, a specialist provider of personalised behaviour change programmes for Type 2 diabetes management, prevention and weight loss.

We're moving toward a healthcare future, a one where we are empowered to live longer lives not by other people, but by our smart devices. Digital health is bringing our life choices to the fore and through real-time education, health, fitness and lifestyles are now in the palm of our hands, easing burdens on healthcare professionals and over stretched healthcare systems at the same time.

People with long term conditions - Type 2 diabetes, cancer, COPD and mental health difficulties, for example, can now be supported - and support themselves, in managing these conditions using technology that is already proven and readily available. As these apps, wearables and digital therapeutics are steadily rolled out across the nation, the potential to transform long term health outcomes at scale is almost boundless.

That future is exciting. But there's a risk that we're moving towards it so quickly that we lose sight of the user's own needs in the pursuit of technological innovation. In our enthusiasm for novelty or what we hope will be breakthrough innovation, we may forget about the vital user-centricity that lies at the heart of the most effective digital health interventions.

Technology should enhance people's sense of being in control and of having access to relevant and timely information – rather than making them feel like digital units in an anonymous machine. For digital health solutions to be scaled sustainably, it must pass four key tests:

1 Have the user's needs, wants and limitations been fully understood?

Actual behaviour can be very different to theoretical or modelled behaviour. So, engage with users by communicating with them as much as possible, running regular user experience (UX) audits to gain a better understanding of how they're using your product or service, what they like or don't like about it, and where there's room for improvement. Regardless of scale, there should never be an end to this process.

2 Is the technology accessible (and is support available)?

Many tech companies assume that their products and services are so simple, smart and intuitive that anyone can use them 'straight out of the box' with only the most basic of instructions. In reality, there's evidence that many of the people with the most challenging healthcare needs often struggle with new technology, particularly those with the lowest household incomes. So digital health innovations must be designed for - and with - an inclusive range of stakeholders to ensure that nobody is left behind.

3 Is there a necessary human dimension?

We mustn't forget that certain moments require human contact. Automated health predictions, for example, may improve efficiencies and free up healthcare professionals' time, but the patient on the receiving end of some emotional news deserves to hear it from a person, not a chatbot. The knowledge that somebody is there when needed can improve the user experience immeasurably.

4 Does the user know how their data is used?

Users trust digital health innovators to handle their data responsibly. That means maintaining the highest standards of transparency. Recent research suggests, however, that this is far from routine. Of the 24 most popular medicine-related apps, it found that19 shared user data with third parties, many of which advertised the ability to share with 216 "fourth parties" - advertisers, telecoms companies and credit reporting agencies. Many users will not be aware that their personal information is being used in this way. Making data practices clear from the outset and giving full control of those practices to the user is vital.

In just a few years' time, the point of care will no longer be our doctors' surgery or hospital; it will be wherever we can collect, access and interpret data. Importantly though, doctors, and 'Actual Intelligence' will not be replaced by Artificial Intelligence, but rather will be augmented by it.

Provided we can scale data-driven healthcare sustainably by ensuring patient centricity always comes first, our smart devices will become the enablers for a healthier population - and a happier one too. ■

Health Impacts of Unlimited Access to Networked Transportation in Older Adults

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Health Impacts of Networked Transportation in Older Adults

ABSTRACT

Background
Transportation barriers in older adults with chronic disease can lead to adverse outcomes like inability to access care and social isolation. Networked transportation can potentially meet this need and impact overall health. However, the lack of familiarity with services and limited use amongst older adults pose potential barriers to adoption.

Methods
The impact of networked transportation on overall health was studied by offering three months of free and unlimited Lyft, Inc. (San Francisco, CA) rides to patients aged 60 years or older with chronic disease and self-reported transportation barriers. Upon enrollment, subjects were provided personalized training on the networked transportation, surveys, and activity trackers (Fitbit, Inc., San Francisco, CA).

Results
Of the 150 subjects, 93% utilized Lyft with 86% using the mobile application (app). The mean number of rides was 69±65 with significantly more rides ordered through the app compared to calling-in (76±67 vs. 24±19, p<.05). Medical appointments accounted for 12% of destinations with remaining rides used for errands, entertainment, social visits, and fitness classes. Daily step counts did not increase with ride use (average steps: 2619±2796 versus 3614±3470, p>.05). Improved quality-of-daily-living was reported in 90% of subjects and 66% reported increased social visits. Upon study completion, 80% of subjects reported they would continue to utilize networked transportation although cost was a main deterrent.

Conclusions
Older adults with chronic disease taught to use networked transportation report less social isolation and increased quality of life. Future studies should utilize economic modeling to assess cost-benefits of networked transportation for older adults.

KEYWORDS: networked transportation, Lyft, Uber, ridesharing, older people, technology

INTRODUCTION

Persistent transportation limitations prevent older adults with chronic disease from receiving necessary medical care and access to other resources essential to overall health, such as fitness activities and social engagement.[1–4] This is a critical problem for older adults as the lack of medical access and activity, as well as social isolation, are known predictors of adverse health outcomes.[5] One-fifth of older adults, and even more for those with chronic disease or socioeconomic disparities, do not drive and as many as one-third of those who do drive face driving restrictions.[4,6] This population is reliant on family members or caregivers, public transportation, or existing government-sponsored ride programs, which are costly, inefficient, and are too often ineffective.[7–9] While previous studies have begun to examine the impact of transportation barriers on medical access, these study designs have been limited in that they have not focused on older adults, technology adoption, or additional aspects of health.[10] Amongst a flood of digital technology solutions, networked transportation is empowering many people while disrupting the current paradigm of transportation.[11] Networked transportation has the potential to meet the transportation need of older adults and impact overall health, yet the low adoption rates due to lack of familiarity with the service or software in this rapidly growing population pose a potential barrier.[12–14] This novel research study investigates a possible solution for this high impact problem and explores the wide influence of transportation on multiple aspects of health in an older population.

METHODS

Three-months of free and unlimited networked transportation (Lyft, Inc., San Francisco) were offered to Keck Medicine of USC patients in order to study the impact of networked transportation on the overall health of older adults with chronic disease, including transportation adoption through analysis of ride frequency and destinations, access to medical care, social engagement, activity levels, and quality-of-daily-life. Subjects were eligible if they had chronic disease, were 60 years or older, were English speakers (due to third-party language restrictions), had self-reported transportation barriers (widely defined as financial issues, parking issues, car trouble, traffic stress, social burden of asking friends or family, etc.), had the ability to self-transport in and out of a vehicle, and whom resided in Los Angeles County or one of the five surrounding counties (Ventura, Kern, Riverside, San Bernardino, and Orange Counties).

All subjects were provided with personalized training on the use of the mobile application (app) or for those without access to a smartphone were provided with a call-in service for accessing rides. Regardless of ride-access, all subjects' activity levels were recorded via provided wrist-worn wearable activity monitors (Fitbit, Inc, San Francisco, Ca) over a two-week interval following enrollment and also throughout the three-month ride-access study interval. At enrollment and upon study completion, questionnaires were administered including demographic, transportation and technology use, as well as subjective and objective psychological and social factors, such as Satisfaction with Life, Geriatric Depression, and Social Support.[15–17] The Satisfaction with Life scale contained statements such as, "the conditions of my life are excellent" and "if I could live my life over, I would change almost nothing", while the Geriatric Depression Scale asked questions such as "do you feel full of energy? and "do you feel that your situation is hopeless?"

Statistical analyses were performed using R Statistical Software.[18] Percentages were calculated for the type of rides taken. Descriptive statistics and percentages were calculated for all demographics, pre- and post- study surveys, as well as the number of rides taken, cost of rides, and daily step count. Welch T-Tests were used to assess differences between app users and call-in users on age and number of rides.[19] A chi-square test of goodness-of-fit[20] was performed to assess whether there were differences between app users and call-in users on gender frequencies, living arrangements, education levels, income, and employment. To examine whether there was a difference between the number of daily steps taken during the baseline and ride-access study period, a paired t-test was performed. Paired t-tests were also used to compare pre- and post-study validated measures of Satisfaction with Life and Geriatric Depression.[21] To examine whether the number of rides taken were associated with Social Support, Satisfaction with Life, or Geriatric Depression, correlations were run.

RESULTS

The study sample included 150 subjects (mean age 72±8 years, range 60-94 years; 63% female; 54% Caucasian; >45% relied on others for transportation needs; 40% lived alone; 47% annual income <$50,000, 96% high school diploma). Subjects resided all over the six-county catchment, as seen in Figure 1; the average distance from subjects' residences to Keck Medical Center was 20 miles. A majority of subjects reported having heard of networked transportation prior to study enrollment, but few had used the services on a regular basis, citing cost, unfamiliarity, and discomfort as reasons for disuse. Of the entire cohort, 93% of subjects participated in the study by ordering Lyft rides. At enrollment, subjects reported that the most frequently used mobile phone services were email and web browsing.

Figure 1. Map of Keck Medical Center (in yellow) and subjects' zip codes (in blue).
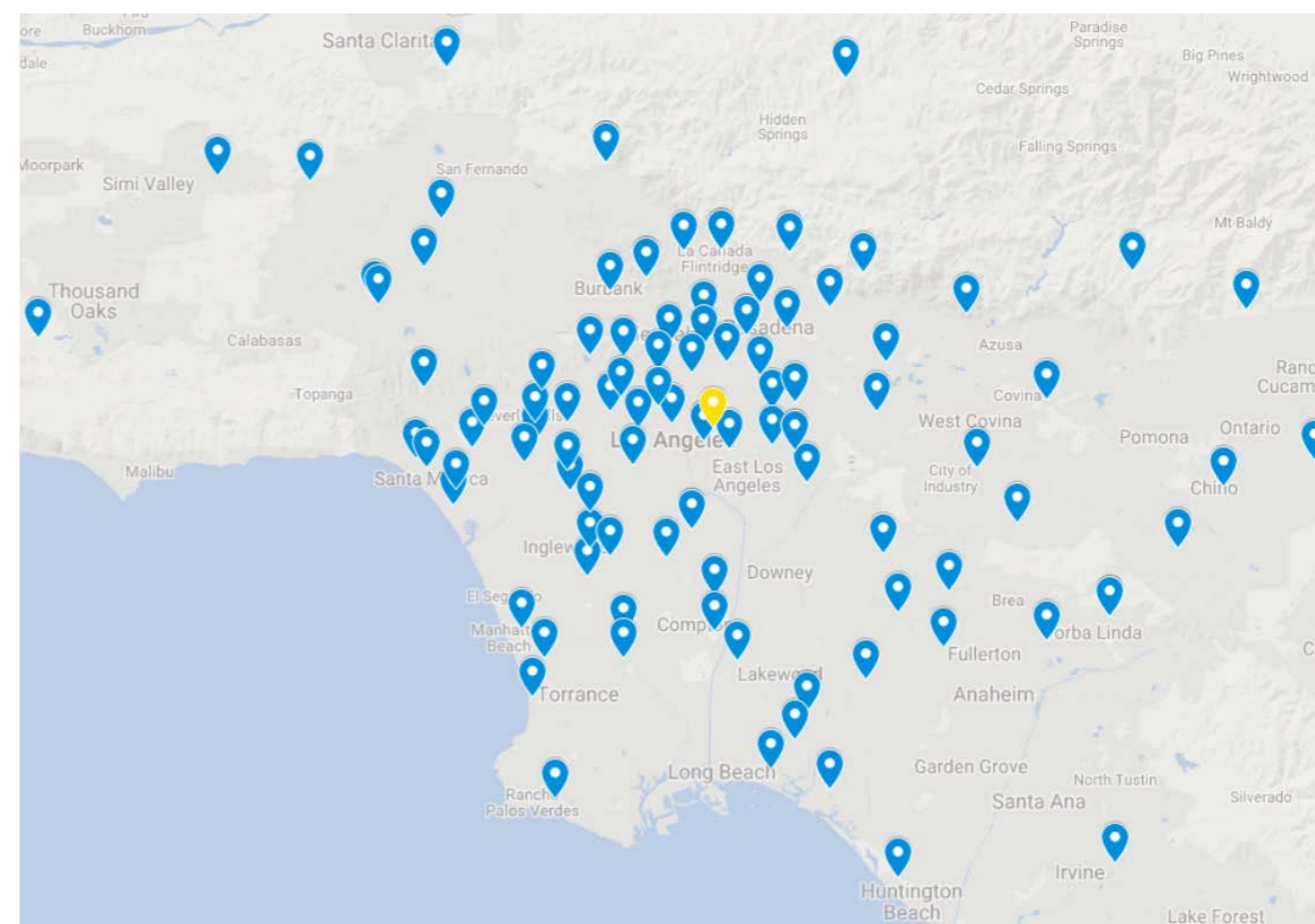
A majority of subjects (86%) opted to use the mobile app to order rides, with the remainder of subjects using the call-in service (16%). The mean number of rides per subject was 69±65 (range 4-346, mean cost per subject/month $500). Significantly more rides were taken by app users compared to call-in users (76±67 vs. 24±19). Mobile app users were also significantly younger on average (71±7 vs. 79±9), but there were no differences between user types on gender frequencies, living arrangements, education levels, income, or employment. The average cost of a ride was $21.72±$19.33. Medical appointments accounted for nearly one-third of all destinations and the remaining rides were used for errands, to access entertainment and other leisure activities that included social visits and fitness classes. The majority of subjects reported using networked transportation as their primary transportation to medical visits and social visits. Over 80% of subjects reported that they would continue to utilize the transportation, the remainder reported that the main deterrent to continued use was cost.

At baseline subjects were relatively sedentary (walking about one mile per day) and access to networked transportation did not significantly increase activity as measured by step count. Daily step counts did not increase significantly from the baseline to the ride-access study period (mean daily steps 2619±2796 versus 3614±3470).

On the post-study survey, subjects reported improved quality-of-daily-life with access to unlimited rides (92%). At baseline, for the Satisfaction with Life Scale and the Geriatric Depression Scale, the study cohort matched population normative averages for the age range.[15,16] There were no significant differences between pre- and post- study validated measures of Satisfaction with Life and Geriatric Depression. The number of rides taken was significantly negatively correlated with self-reported Social Support, but not with Satisfaction with Life or Geriatric Depression. Forty-seven subjects (31%) were lost-to-follow-up due to homelessness, cognitive decline, death, hospice, prolonged hospitalization, or unknown reasons and thus did not complete post-study surveys.

DISCUSSION

The study results show high adoption of networked transportation by an older population with chronic disease, and as a result of the transportation, easier access to health care, increased social engagement, and improved subjective quality-of-daily-life. These results confirm that patients had the health resources available, i.e. established medical care and socializing opportunities, yet transportation was a significant barrier to accessibility.

A significant majority of subjects opted for and actively used the app version (about one ride a day) of the transportation, despite subjects being novice app users and having reported that before the study the main use of their smartphones was geared toward email and web browsing. This is a hugely important finding exemplifying that older populations are willing and capable of adopting new technologies, contrary to previous reports that showed low adoption of networked transportation. One possible explanation for the high adoption in our study was the deeply personalized and engaging pre-study educational training on the app technology, and the continued technology support through-out the study that left subjects reporting on the ease of use of the app and service.

Subjects used the networked transportation for a variety of outings, including medical appointments, entertainment, social visits, and fitness activities. Although there were no significant differences found between pre- and post-validated survey responses for Satisfaction with Life and Geriatric Depression, subjects reported very significant improvements in access to care, social engagement and general quality-of-daily-life with adoption of networked transportation solutions for older adults. One possible explanation for these findings are that while transportation remains a crucial aspect to overall health in this population, additional factors associated with chronic disease and socioeconomic status, such as food insecurity and lack of housing stability, remain essential and potentially lacking.[22,23] It is also feasible that the measures were not the best tools to capture the differences and thus perhaps new and more nuanced surveys are required to appropriately measure these effects in this study population. It may be possible that to see significant effects on deeply established psychological and sociological factors, a study duration of greater than three months is required. Future studies should focus on the long-term effects of reduced transportation barriers by examining a longer study duration.
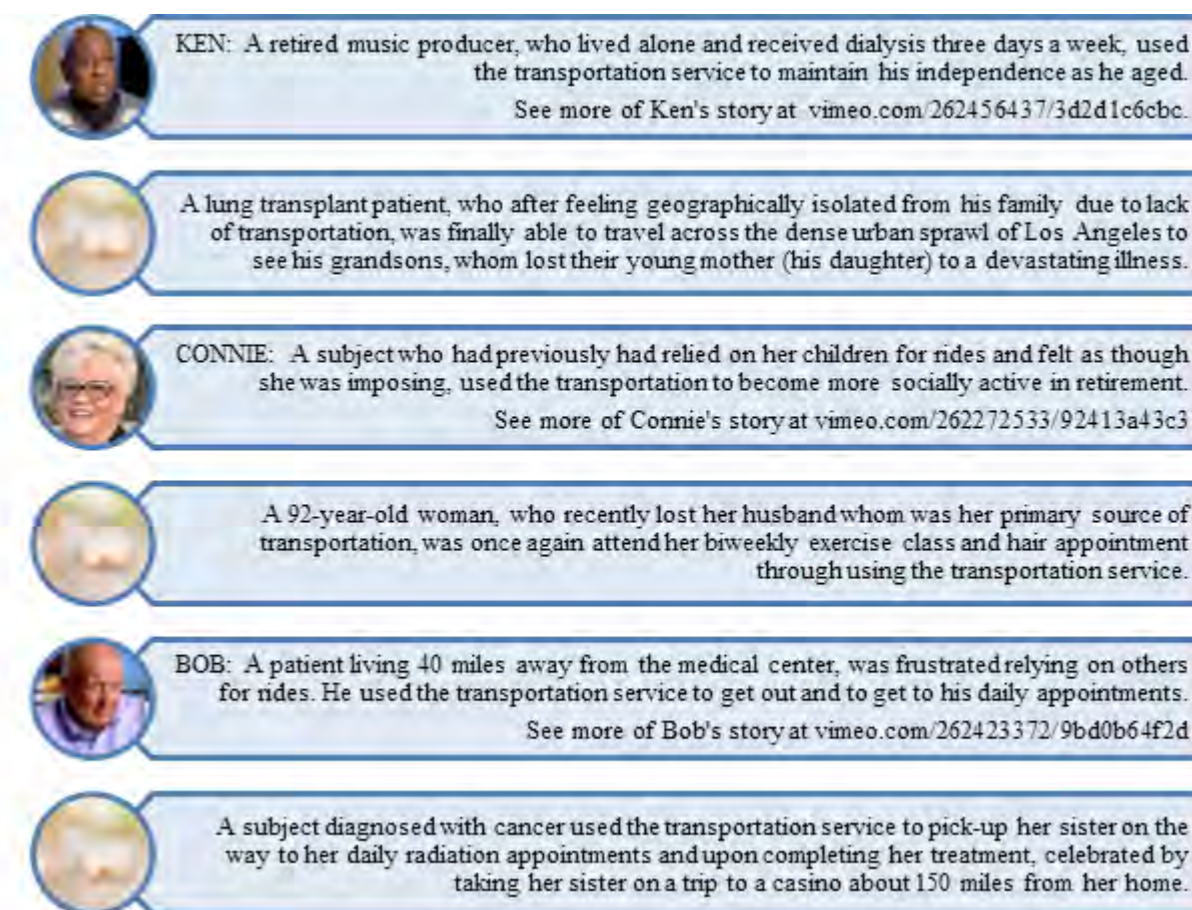
Daily step counts did not significantly differ between the baseline period and the ride-access study period. This may be due to the fact that having ride access meant subjects were taking transportation more and walking less to certain destinations. Future studies should employ different measures of activity, such as self-report of fitness activities and locations, to supplement step count from activity trackers, as they may be more meaningful measures of activity. These results also indicate that this cohort was a chronically ill population, e.g. undergoing treatments for cancer, and thus activity could be limited, which underscores the vulnerability of this sedentary population.

Subjects who reported feeling more socially-supported took fewer rides, which may mean that people who are socially supported require less rides due to transportation that is available to them from their support network. This again highlights the value and importance of networked transportation, or more broadly transportation, in helping to relieve social isolation, which is one of the biggest predictors of adverse health outcomes.

This study design was unique and novel in that study staff were able to deeply understand the complicated ways in which transportation is a barrier to older adults, a concept that can be difficult to quantify. From the multitude of stories our research staff encountered that included somber tales of older adults taking multiple busses, relying on busy family members that live far away, or waiting several hours for van transport are memorable and disconcerting. The fact emerged that transportation transcends simple relocation from point-A-to-point-B and encompasses multiple human facets of life, e.g. physical and emotional discomfort. Anecdotal reports from subjects were overwhelmingly positive; upon study completion one subject wrote, "I am so happy to have learned how to use Lyft. It makes me feel safe and in control and gives me new travel and socializing options and freedom." Research staff were able to experience the stories of study subjects and in doing so observe the unique ways in which networked transportation caters to the complicated needs of older adults (Figure 2). These stories highlight the complicated nature of how transportation barriers restrict the overall life of an older adult. When this simple barrier is removed, these adults show improved metrics in essential aspects of health, such as access to medical care, social engagement, and improved quality-of-daily-life.

Figure 2. Patient Vignettes

KEN: A retired music producer, who lived alone and received dialysis three days a week, used the transportation service to maintain his independence as he aged. See more of Ken's story at vimeo.com/262456437/3d2d1c6cbc.

A lung transplant patient, who after feeling geographically isolated from his family due to lack of transportation, was finally able to travel across the dense urban sprawl of Los Angeles to see his grandsons, whom lost their young mother (his daughter) to a devastating illness.

CONNIE: A subject who had previously had relied on her children for rides and felt as though she was imposing, used the transportation to become more socially active in retirement. See more of Connie's story at vimeo.com/262272533/92413a43c3

A 92-year-old woman, who recently lost her husband whom was her primary source of transportation, was once again attend her biweekly exercise class and hair appointment through using the transportation service.

BOB: A patient living 40 miles away from the medical center, was frustrated relying on others for rides. He used the transportation service to get out and to get to his daily appointments. See more of Bob's story at vimeo.com/262423372/9bd0b64f2d

A subject diagnosed with cancer used the transportation service to pick-up her sister on the way to her daily radiation appointments and upon completing her treatment, celebrated by taking her sister on a trip to a casino about 150 miles from her home.

Transitioning from the free access to networked transportation, the majority of subjects reported that the largest barrier to continuing to use the networked transportation, after study conclusion, was cost. In order to leverage the value of the resources available through private companies, this pilot study should be replicated to include an economic model that can accurately measure the cost-benefits of providing networked transportation to older adults. Additionally, the often-overlooked secondary cost of family members or friends taking off from work, as well as other paid or unpaid duties to provide transportation, have not been well quantified with similar models. Programs offering affordable networked transportation to older adults is beginning to be implemented on a small scale, such as Santa Monica's Mobility On-Demand Everyday (MODE) program in Southern California offering Lyft rides within city limits for $0.50 per ride to older adults, however these programs need to be enacted on a national or even global scale.[24] The data from this study should incentivize insurance payers and innovation programs to introduce similar large-scale programs. Covering rides for older adults could not only improve hard outcomes, such as rates of hospitalization, but also improve overall health as demonstrated in this study.

KEY TAKEAWAYS

1. Older adults adopt and use networked transportation to access medical care, as well as fitness, social, and leisure activities, thus improving their perceived quality-of-daily-life.
2. Older adults are motivated to break down the barriers disrupting their own health and are willing and are even enthusiastic about adopting novel technology solutions in order to do so, but education and support remain key elements in rates of success.
3. Cost was the primary deterrent preventing older adults from continued use of networked transportation following study completion.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

DECLARATION OF SOURCES OF FUNDING

ETHICS COMMITTEE APPROVAL

The study was approved by the Institutional Review Board of the University of Southern California (USC IRB HS-17-00729).

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Paving the Way for Personalised Healthcare

Dr John Creek, Director, Disruptive Innovation and Dan Boot, Head of Digital, Disruptive Innovation at RB, discuss the role of digital technologies in personalised healthcare.

Personalisation has long been an added value which many of us have bought into, customising gifts and clothing to make sure we get the most 'us' version of an otherwise homogenous product. This preference for personal is now extending beyond the high street to cover all aspects of life – with healthcare no exception.

Two decades ago, personalised healthcare was simply science fiction. Now, thanks to significant progress in several fields, including diagnostics, ingredients and technology, it's almost within touching distance. However, getting a grasp on personalised healthcare will depend on bringing these fields together and driving interdisciplinary collaboration in the healthcare space.

Leveraging consumer tech

Over the past five years, global consumers have gained a voracious appetite for self-tracking. iPhones have a health app integrated as standard, while 2017 saw an incredible 172.2 million wearable devices shipped. Around the world, consumers are turning to these to keep tabs on their health; tracking steps taken, calories consumed, or hours slept in a bid to make healthier lifestyle choices.

Consumer technologies hold huge potential as vehicles for personalised healthcare solutions. Some consumer healthcare companies are already realising this, developing digital interventions with relevant clinical outcomes, delivered via a mobile application.

One such product is Neuriva, a science-backed dietary supplement and complementary digital training programme developed to support brain health. The app-based brain training element works by assessing users to identify specific areas for cognitive improvement and supplying a customised training regime based on the results.

Bringing Neuriva to fruition depended on pooling expertise from numerous parties, including digital health start-ups and consumers within its target market. The product very much exemplifies why partnerships will be fundamental if we're to leverage consumer technology – an incredibly powerful tool – to deliver personalised healthcare solutions.

Advancing in the age of AI

While mobile phones and wearables will play a pivotal role in placing personalised healthcare solutions into the hands of global consumers, even more sophisticated technologies will sit at their heart.

The past decade has witnessed phenomenal advancements in artificial intelligence (AI) and machine learning (ML) algorithms, huge increases in cloud compute power as well as declining data storage costs. These are now paving the way for personalised healthcare, enabling teams to analyse the reams of data generated through genetic testing, clinical data and health records, and identify patterns and trends within them. This is often the starting point for determining when a personalised solution will be effective – and cost effective.

AI's potential to power personalisation extends beyond the laboratory though. Moving forward, the technology will come to underpin numerous mobile applications designed to deliver personalised self-care solutions. We're already seeing this in the mental healthcare space, with several apps using AI to provide tailored mental healthcare advice through chatbots.

AI is also being employed by mental healthcare professionals to capture data and generate real-time insights on patients. The technology is already capable of spotting and learning distinct verbal indictors, which can be used to identify issues or track progress. Soon, we'll see its learning potential applied to personalise treatments, with people offered tailored mental healthcare solutions that have proven effective in treating people very much like them.

Looking to personalised nutrition

Another field where we're seeing scientifically credible, personalised consumer healthcare solutions emerge, is nutrition. RB's Vitalmins is one example. The customisable supplement programme is anchored to a personalised health assessment questionnaire, which considers the user's lifestyle and desired health outcomes, such as achieving a healthy weight. Users then receive a tailored supplement package based on their results.

Vitalmins again demonstrates the role of technology in personalised healthcare and exemplifies why partnerships will be so important in its progression. Behind the questionnaire sits a complex algorithm developed by the University of Miami and tested with Olympic athletes. By simplifying this, making it attractive and easy to use, we've been able to take something bespoke to the masses.

As global populations age and major health issues, including obesity and diabetes, rocket up the healthcare agenda, we'll see a rapid increase in personalised therapeutics, treatments and products targeted at chronic conditions. Although innovation in this space is already thriving, there are obstacles that must be overcome if we're to fully harness the potential of personalised nutrition and progress personalised healthcare.

Overcoming the challenges

At present, there are two dominant challenges facing personalised healthcare; credibility and scalability. Driving large-scale, cross-sector collaboration in the healthcare sector will be critical in addressing these.

If we're to move personalised healthcare from a nascent field to a fully established one, we must ensure that the solutions we're taking to market are scientifically credible and effective. This is paramount if we're to build consumer confidence in personalised solutions, especially digital interventions, which present a departure from pills.

Developing these effective solutions will depend on consumer healthcare organisations pooling expertise with a whole host of external partners, including technologists, data-scientists, ingredients companies and behavioural specialists.

Once solutions are developed, the next challenge is taking them to a mass market. This is a perhaps a little simpler with digital interventions, as these are able to piggyback on well-established consumer technologies which are already in market.

Scaling other personalised solutions, such as dietary supplements, will depend on consumer healthcare companies innovating in tandem with the manufacturing sector. Over the next two decades, we predict significant shifts in this space, as technologies like 3D printing and on-demand manufacturing make small batch production economically viable.

The future of personalised healthcare

Personalised healthcare presents huge opportunity for global consumers, economies and those in the healthcare sector. Over the coming decades, personalised healthcare solutions, including digital interventions, will play an increasing role in supporting self-care. They have untold potential to improve general health and reduce the burden of chronic conditions on groaning healthcare systems.

Digital technologies will be paramount for progressing personalised healthcare. However, the real breakthroughs will be made when people from different disciplines work together to deliver effective solutions that meet real healthcare requirements. ■

INDUSTRY NEWS

News and Information for Digital Health Professionals

Collaboration to Accelerate Clinical Decision Making for Stroke Patients

Connected healthcare specialist Wellbeing Software is working with stroke imaging company Brainomix to accelerate the introduction of AI and deep learning to assist clinical decision making for ischemic stroke patients.

When a patient is admitted to hospital with a suspected ischemic stroke, they undergo a CT scan to confirm or rule out a diagnosis. Patients are then assessed to receive treatment such as thrombolysis, endovascular treatment or for severe cases, decompressive craniectomy. These treatments are time-sensitive, and decisions must be made within the first few hours to ensure the best possible outcome.

Brainomix's E-ASPECTS solution is designed to assist healthcare professionals to make faster, more informed decisions by applying Artificial Intelligence (AI) when assessing ischemic stroke damage. It interprets scans based on metrics drawn from over 150,000 images, sourced across 27 countries including UK, Germany, Spain, Italy and the United States. The platform is able to quantify the volume of ischemia against the ASPECTS score and provide a standardised stroke diagnosis quickly.

Brainomix is the latest provider to integrate their technology through Wellbeing Software's AI Connect platform, which enables hospitals to embed their chosen algorithms into radiology workflow, no

matter what RIS or PACS they're running. Wellbeing's extensive market coverage and unrivalled expertise in radiology information systems, and connectivity, is enabling the rapid adoption and optimisation of AI in the UK.

Riaz Rahman, VP Healthcare Global at Brainomix, said: "Early intervention is key to improve recovery following an ischemic stroke. By applying AI and deep learning, clinicians are able to make informed decisions regarding treatment, reducing the chances of further brain damage or mortalities. As the market leader in Radiology Information Systems (RIS), Wellbeing is well placed to accelerate the integration of AI and deep learning in the NHS."

Wellbeing research found that 85% of respondents acknowledged the benefits of AI integration within RIS workflow, including its ability to support work management and report prioritisation, especially the notification of critical findings.

Chris Yeowart, Director at Wellbeing Software added: "Working with innovative companies like Brainomix represents a real opportunity for the NHS to access transformative AI technology, and to embed it quickly and easily into their everyday workflow through our vendor neutral gateway. We are actively engaged in a ground-breaking regional project with Brainomix which we look forward to announcing shortly." ■

World's First Wireless, In-heart Micro-computer Implanted in UK Patient for First Time

The world's first wireless, in-heart, microcomputer has begun its first clinical trial in the UK at Queen Elizabeth Hospital in Birmingham. Doctors hope that the ground-breaking technology will dramatically improve the quality of life for people living with heart failure, helping them better manage the condition and prevent the need for admissions to hospital.

The device, called V-LAP, is the first of its kind and is implanted in the heart's left atrium, which will give the earliest, most accurate data of the heart's performance. The sensor does not have a battery, which means it could last for all of the patient's life. It is charged remotely from outside the patient's body, feeding back data to doctors as it does so.

The company behind the V-LAP wireless heart monitor, Vectorious, hope that by providing regular data, rather than relying on the current assumptions based on physical findings, doctors will be able to help patients actively manage their conditions and reduce the need for them to be admitted to hospital. This will not only improve the quality of life for the patient, but as heart failure is the most common reason for people over 65 to be admitted to hospital, accounting for 63,000 emergency admissions a year, the device can help make multi-million-pound savings for the NHS*.

The implantation, the first of many more planned in the UK, appears at the same time as an analysis by the British Heart Foundation, which shows that the number of people dying from heart and circulatory diseases before the age of 75 is rising for the first time in 50 years.

Professor Francisco Leyva, Consultant Cardiologist at Queen Elizabeth Hospital said: "This new device has the potential to combat three of the biggest problems relating to heart failure disease; low patient quality of life, repeat admissions to hospital and the astronomical cost to the healthcare system of readmissions."

"Today, physicians base the treatment of heart failure on external signs and symptoms such as shortness of breath and gaining weight - which appear at a late stage, so the patient doesn't get the medication they need to stable their condition early enough. 44% of patients are re-hospitalized within a year from the first acute event, so this device shows real promise in reducing those readmissions, and the costs associated."

The minimally-invasive procedure to implant the device is a low risk one and is completed in less than an hour. In normal use, patients are able to return home the same day after the operation.

The data provided by the device is analysed by artificial intelligence and machine learning will be used to provide doctors with

information to help them intervene early, to detect important events and help patients remain well balanced medically and safe.

Heart failure results from weakened blood flow, due to the heart's "pump failure", causing both pressure to build up in the lungs ("congestion") as well as insufficient supply of oxygen to tissues, ending in respiratory symptoms as well as fatigue. When this condition is severe it may even result in pulmonary edema, which is a situation whereby the lungs are filled with fluids, but by detecting pressure in the heart earlier, doctors can use easier and less invasive interventions to help sufferers and prevent deterioration.

Oren Goldshtien, Vectorious' CEO said: "We believe the V-LAP monitor is a game changer in helping the one million people living with heart failure in the UK take control and manage their disease. Heart failure patients deserve the best treatment and quality of life possible"

"V-LAP provides the earliest and most accurate data from patient's heart, enabling doctors to adjust the patient's medication early enough and as a result to avoid their condition worsening and unnecessary hospital admissions.

"By having individual, long-term data for each patient, doctors will be able to react to each individual, rather than resorting to the guess work and estimations that are currently the case. We have already successfully implanted the V-LAP in patients in Germany and Italy and thanks to an accurate pressure reading from their hearts, they are getting a treatment customized to their specific condition. We are very excited about running our study now in the UK, and would encourage existing patients to contact Hammersmith and Queen Elizabeth hospitals to see if they could be enrolled in our ongoing study." ■

India's EHR Market set to Grow at a CAGR of 5% through 2025

New data suggests that the Indian electronic health records (EHRs) market, which accounted for approximately 9% of the Asia-Pacific (APAC) EHR market in 2018, is expected to grow at a compound annual growth rate (CAGR) of 5% through 2025.

Representing a significant market for expansion in the usage of electronic health records (EHRs), plans by the Indian government to digitise its healthcare system with interoperable electronic health records (EHRs) look set to further drive the country's EHR market, says GlobalData, a leading data and analytics company.

Rohit Anand, Medical Device Analyst at GlobalData, says: "Lack of digitisation and health insurance coverage are the two major challenges in India. The government needs reliable data on disease, tests and medicines to formulate a rationale healthcare policy."

In July 2019, the Ministry of Health and Family Welfare of Indian government released National Digital Health Blueprint (NDHB). The ultimate goal is to achieve Universal Health Coverage (UHC) through 'Ayushman Bharat'. The two key objectives of this program are to set-up 150,000 Health and Wellness Centres for primary healthcare and provide healthcare coverage to over 100 million poor and vulnerable families.

Anand adds: "UHC will generate a large amount of health data and digital health records can provide support and accelerate this transformation. EHRs will provide the Indian government with access to direct and reliable healthcare data and information on health conditions. This data will help the government to regulate the cost of treatment and medical research."

However, the implementation of EHR is currently limited to major private hospitals such as Apollo and Fortis & Max, and few government hospitals such as AIIMS mostly in urban India. Lack of awareness, high initial investment, scarcity of trained staff and lack of mandatory guidelines to store healthcare records electronically are a few of the major barriers for low adoption of EHR in India.

Anand concludes: "An enormous effort by the government and support from clinicians is needed to make this project a success. In addition, a large population that the Government of India is planning to cover only understands local or regional language. Creating digital support systems in multiple languages is going to be a challenge. Safety and privacy of personal and health data are some of other issues that the government need to address." ■

Partnership to Boost Leeds HealthTech Sector

A new cross-sector partnership has been announced that aims to boost the HealthTech sector across the Leeds City Region.

Senior leaders from the healthtech industry, the regional enterprise partnership, the NHS, local authorities, and five universities have signed agreements designed to create a dynamic, new partnership that will accelerate health technology innovation in the region. The hope is that more than three million citizens across the Leeds City area will potentially benefit from the collaboration.

The new partnership agreement will put in place the strong, coordinated leadership and support required to fully capitalise on what is a globally burgeoning market. In 2015, that market was estimated to be worth $371 billion and was forecast to grow to $529 billion by 2022.

That growth is being driven by factors such as growing and ageing populations, the rise in levels of obesity and chronic illness, technological developments and an increasing demand for medical devices.

This bold commitment is the first of its kind in the region. Partners have signed a memorandum of understanding (MoU) to drive forward new approaches in improving patient and population health and care through better and faster healthtech innovation.

The move also aims to radically speed up the region's productivity and economic growth in the sector, which is seeing an unprecedented rise across the UK and globally. As the UK's largest economic region outside of London, the Leeds City Region already has a world-leading concentration of excellence in healthtech. It is home to

» more than 250 healthtech businesses
» 200 digital and technology businesses operating in the health and care sector
» leading centres of academic excellence in research and innovation, and
» West Yorkshire and Harrogate Health and Care Partnership, the third largest integrated health and care partnership in the country.

The new MoU was arranged and prepared by Leeds Academic Health Partnership (LAHP), one of the biggest partnerships of its kind in the UK.

Rob Webster, CEO Lead for West Yorkshire and Harrogate Health and Care Partnership said: 'We are delighted to be part of this agreement. Innovation in health technology has the potential to transform services, improve health outcomes and most importantly save people's lives. This Memorandum of Understanding is an important step in developing closer partnerships between health technology companies and health and care organisations across our area.

"It means that people will be able to benefit more quickly and systematically from technologies that can help them. It will also drive inward investment into our region and support our goals for inclusive growth."

In signing the MoU, all partners have agreed to work together to drive economic growth and improve health outcomes and service efficiency by:

1. finding personalised and community-based healthtech solutions that help the people of the Leeds City Region to live healthier lives for longer, particularly those living in identified priority neighbourhoods
2. sharing insights into what citizens and patients in the Leeds City Region need, to determine what the priorities should be for health and care services and industry. Together, all partners will then work together on agreed priority themes that meet citizens' needs
3. driving inward investment in healthtech in the region to support economic growth which is inclusive, benefiting all communities.

Professor of mechanical engineering at the University of Leeds, John Fisher, who led the production of the Leeds City Region SIA, said: "This MoU signals an important step towards embracing the opportunities and realising the ambitions set out in the Government's Industrial Strategy. It paves the way for us to reduce fragmentation, further harness expertise and capability and radically strengthen the Leeds City Region's position as a leading global player in healthtech.

"Each partner will play their part in helping address and overcome the barriers to innovation. By working together in a new, focussed and coordinated way, we will accelerate radical improvements in patient care, health service efficiency and drive economic growth and productivity across the region and the UK."

The MoU offers a new opportunity for partners to better understand the region's health needs, and how they can support development, testing, and deployment of healthtech at scale. ■

HealthTech Arkansas Announces Latest Cohort

HealthTech Arkansas has announced the six startup companies selected for the 2019 HealthTech Arkansas healthcare accelerator.

The announcement was held at the Arkansas Heart Hospital with a welcome from Dr. Bruce Murphy, followed by a message from Governor Asa Hutchinson and short presentations from each of the six companies in the cohort.

The six companies were selected from hundreds of applicants across 18 different countries and are headquartered in innovation capitals like San Francisco, New York, Boston, San Diego, and Seattle. The strength of this cohort is evident in the fact that these companies already have 177 full-time employees and have raised over $90 million of external capital after forming the companies, a substantial increase over the companies selected for last year's inaugural program.

"We are excited to reveal the new cohort and introduce them ⇨

to Arkansas and the powerful teams available to them at all of our healthcare provider partners around the state," said Jeff Stinson, director of HealthTech Arkansas. "The guaranteed pilot projects from nine hospitals from around the state is what truly sets our accelerator program apart from others in the country. This is what allowed Arkansas to attract such high-quality companies to the program."

The six companies are:

Bardy Dx, Seattle, WA

A revolutionary device for diagnosing heart arrhythmia, the Carnation Ambulatory Monitor (CAM™) is a lightweight, extended-wear ECG patch monitor that delivers unparalleled comfort, convenience, and clarity.

Droice Labs, New York City, NY

Droice Labs is an AI company specializing in understanding real-world clinical data to help physicians provide better care to their patients. Droice Labs uses novel Natural Language Understanding (NLU) methods while working with some of the largest hospital systems, health insurance companies, life sciences companies, and government bodies across the United States and Europe.

Health Note, San Francisco, CA

Health Note is an AI platform helping to improve patient encounters by gathering pre-visit information and creating a doctor's note. Health Note saves physician and staff time by confirming information instead of exploring and documenting.

Medumo, Boston, MA

Medumo is an enterprise software application that helps hospitals deliver instructions to patients in a more intelligent way. This application takes existing instructions, breaks them up into more digestible pieces, and automatically delivers them to patients at critical moments via various modalities with links to interactive web pages.
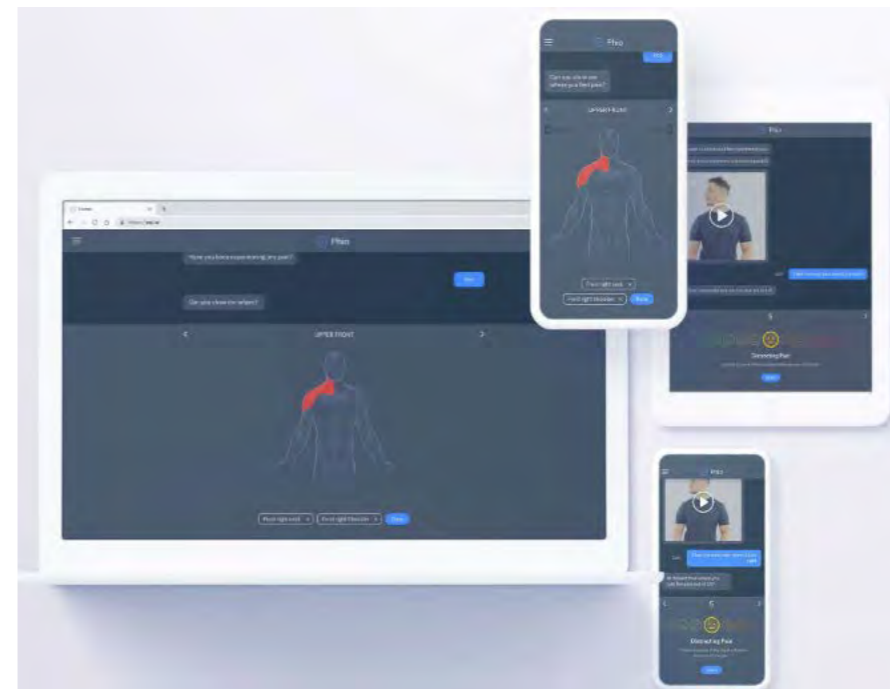
OMNY Health, San Francisco, CA

OMNY has developed a data marketplace where healthcare providers can upload their non-PHI supply chain and billing data via APIs in real-time. Manufacturers subscribe to the marketplace and pay for the real-time data that they consume, this generating additional revenue streams for providers that supply the data.

toSense, San Diego, CA

toSense has developed CoVa™ 2, a low-cost, easy-to-use monitoring system featuring three primary components: Necklace (a body-worn sensor), Gateway, and Web-based System. The Necklace measures vital signs, complex hemodynamic parameters, and time-dependent physiological waveforms. It sends this information to several different Gateways, which receive and forward it to a Web-based System for clinical review.

The cohort will participate in a program that provides them the opportunity to pilot solutions specifically identified by Arkansas Heart Hospital, Arkansas Children's, Arkansas Urology, Baptist Health, CHI St. Vincent, Conway Regional, Mercy, the University of Arkansas for Medical Sciences (UAMS), and Washington Regional Medical Center as areas of opportunity within their organizations, from heart health and cardiac care to medical devices and software platforms. Each company will receive seed investment as well as complete and total access to clinicians and administrators while executing their pilot projects. ∎

A Digital Physiotherapist

EQL, part of the Google Cloud for Startups Programme and backed by handl Group, is looking to change the way that MSK conditions are triaged and managed with the introduction of its new chatbot Phio.

Unveiled earlier this year, it forms part of a developing portfolio of products designed to radically improve global healthcare systems.

Following the launch we sat down with Jason Ward, CEO and Co-founder at EQL, who told us about the company's plans going forward.

Phio is a chatbot that thinks and acts like a Physiotherapist, initially providing an agile triage tool for all MSK conditions, with a Digital Injury Management tool to follow later in the year. It uses AI and machine learning to be able to constantly evolve and adapt its behaviour to every user, giving it a 'personality' and the ability to absorb knowledge. A personalised tone and language are used to enhance engagement and adherence.

Designed to improve patient outcomes via an app, it reduces the need for human intervention thereby increasing

efficiency and fast-tracking patient care. Sophisticated algorithms guide users to the appropriate pathway: urgent care for those presenting with 'red flag' symptoms; face-to-face care for those not suited for self-managed care; and a Digital Injury Management option for those presenting with low-grade injuries. Phio's decision tree is underpinned by the latest clinical frameworks and this is closely monitored alongside the collection of vital lifestyle data.

Accessible 24/7 and available in any language, Phio is a fraction of the cost when

compared to traditional physiotherapy triage and human-led self-managed care. Phio is an ideal option for companies in the health insurance market and those operating in the private and public healthcare sector. It can complement existing services and is a strong alternative for many telephone based and remote physiotherapy services. It also offers dramatically improved customer journeys and has the ability to radically improve health outcomes.

"Phio can be seamlessly implemented to suit our clients' needs and requirements," Ward says, "Tailored clinical decision trees reflect the required pathways and data points."

"Limited resources mean access to healthcare is often poor, costly and cumbersome with excessive waiting times and limited connectivity between practitioners and patients. This can result in high costs and less than optimal health outcomes. We are determined to change

this and level the playing field when it comes to accessing healthcare. We believe in democratising healthcare."

Phio is currently being piloted with a number of large clients across both the private and public healthcare market.

Commenting on the feedback that the company has had since the launch, Ward continues: "Since we launched I have to say that our feet haven't touched the ground! We have been inundated with interest from organisations including NHS providers, Clinical Commissioning Groups (CCGs), global insurance companies and Occupational Health providers."

"As a result we are in the process of signing MOUs with over 30 organisations, with our first pilots starting in the next few weeks."

"There has been a lot of international interest too, particularly from the US and Middle East, and we are looking carefully at our global growth strategy."

The company will build on its product portfolio later in the year with a digital injury management tool designed to enhance the Phio offering. Beyond this there are aims to apply the technology to other conditions and similar unmet needs within the healthcare system. ∎

Blood Tests Project puts Hospitals Ahead of the Interoperability Curve

Royal Papworth Hospital NHS Foundation Trust and Cambridge University Hospitals NHS Foundation Trust have achieved a first-of-type in the UK by interfacing their electronic patient record (EPR) systems – Lorenzo at Royal Papworth and Epic at Cambridge University Hospitals – to speed up lab ordering and results. The interface means blood test orders and results can be shared electronically between the two organisations, delivering significant time and safety benefits for lab staff and clinicians and putting the trusts at the forefront of NHS IT interoperability.

Royal Papworth Hospital has just moved into a state-of-the-art building on the Cambridge Biomedical Campus, alongside Cambridge University Hospitals (Addenbrooke's Hospital and The Rosie Hospital). The two trusts share a pathology service, so ahead of the move a complex piece of IT integration work was undertaken to enable timely sharing of blood tests for patients at Royal Papworth. The work included a first-of-kind integration development between the DXC Lorenzo EPR system used by

Royal Papworth, and the Epic EPR used by Cambridge University Hospitals NHS Foundation Trust.

Andrew Raynes, Director of Digital and Chief Information Officer at Royal Papworth Hospital NHS Foundation Trust, describes this as "a huge feat." "In total, we needed to integrate five systems, but the major challenge was the interface between Epic and Lorenzo," he says. "There was no reference anywhere else in the country to doing that, but, with Cambridge University Hospitals, we collaboratively achieved a bi-directional interface and we did it in just seven months."

Dr Afzal Chaudhry, Renal Consultant and Chief Clinical Information Officer at Cambridge University Hospitals, added: "Being able to share laboratory results in a digital way with our neighbouring hospital supports our clinical colleagues in providing more effective and quicker care for our shared patients, which improves patient outcomes." ➡

Replacing laborious processes

The link has eliminated many of the time-consuming processes. Chris Johnson, the Chief Medical Information Officer at Royal Papworth, explains; "Prior to the integration, we would order a test using our order communications system," he says. "If the test was going to be done at Addenbrooke's Hospital, we would print out the request, marry it up with the blood bottle, and send it over to the labs at Addenbrooke's, where it would be transcribed into the Epic EPR.

"When the test was completed, the result would be automatically emailed back as a pdf due to the lack of integration between the trust's systems. Administrative staff at Royal Papworth would have to open-up the pdf, rename it, add some patient identifiers, and save it into a file-drop so it could be sucked up into our document management system. "Or, if it was numerical data, our qualified lab staff would have to sit down at a computer and transcribe the details from these pdfs into our lab system, so it could display the result to clinicians. It was an extremely laborious process, prone to error, prone to delay. With the EPR integration, all of that work has now gone away."

Faster, safer results

This has delivered significant benefits. Most obviously, turnaround times have improved dramatically. "Thanks to this collaboration, we are now receiving results digitally within 48 hours, which means that clinical decision making can happen far more quickly." Patient safety has also improved, because there are fewer points at which complex results must be copied from one form or system to another.

Eamonn Gorman, the Chief Nursing Information Officer at Royal Papworth, says that although there were checks in place at each stage, he is pleased that this transcription has been largely eliminated. "As a nurse, you are always worried about patient safety, he says. "I now have much more confidence in the safety of the results. I definitely sleep better at night knowing that transcription is no longer an issue."

The integration has also enabled some improvements to be made to the front-end of the Lorenzo system at Royal Papworth through which clinicians pick-up results. Instead of being faced with a long list, clinicians can use an 'in-tray' to pick up the results that are most important for their patients and acknowledge results electronically. "If the result is normal, it sits in the Lorenzo EPR, but if it is abnormal, then it is flagged up," Gorman explains. "So, there might be 50 results in the Lorenzo EPR and five in the in-tray; and that's great because they're the ones that you need to know about."

Complex integration requires trust collaboration and clinical engagement

The integration project involved some complex technical work involving both trusts and a lot of clinical engagement to make sure that clinicians, lab staff and IT systems were all speaking the same language when it came to what tests are being ordered and what the results mean. In total, five IT systems were involved. The pathology and radiology systems at Royal Papworth can both

be used to request tests and order results, so they both had to be integrated with the Trust's Lorenzo system. The major integration was between Lorenzo and Cambridge University Hospitals' Epic EPR lab module. At the Royal Papworth side, this was achieved using the hospital's Viaduct integration engine, another DXC product. Viaduct manages all of the HL7 messaging between systems at Royal Papworth and communicates directly with the Ensemble integration engine at Cambridge University Hospitals. Where appropriate, Viaduct sends test requests to Addenbrooke's for its labs to process. On return, the test results are directed to the appropriate system - Lorenzo, if patients are on a hospital ward, or the system in use on the critical care unit - so that they are easily available to the attending clinicians.

"One of the big challenges was making sure that our charts aligned with the lab's charts," says project manager Marie Hills. "For example, we had to make sure that what we called a 'full blood test' matched what the lab called a 'full blood test' and then we had to test to make sure that all the systems understood that in the same way. "Then we had to make sure that what was displayed in Lorenzo could be clearly understood by clinicians, and that no changes had been made to the results in their transmission." This involved extensive collaboration with colleagues at Cambridge University Hospitals and everybody involved in the project stresses that clinical engagement was key to getting this right. "You need everybody at the table, and you need to make sure that risks have been identified and mitigated before you press go." Raynes says.

Ahead of the interoperability curve

The integration has delivered benefits over and above faster turnaround times and improved patient safety. Fewer repeat tests are being ordered because the results come back quicker in a digital way and are easier to share with clinical teams.

Raynes says the project has national significance, because it shows that hospitals don't have to be using the same EPR system to exchange information with each other, and that interoperability works. "There has been an idea, since the days of the former National Programme for IT, that we all need to be on the same system," he says. "That has been challenged by the Wachter Review [a report ordered by former Secretary of State for Health and Social Care, Jeremy Hunt, on the state of NHS IT] and the

tech vision [a more recent vision published by Hunt's successor, Matt Hancock].

"They say that interoperability is the way forward, and we have shown that this is right. What matters is that systems use open standards and open application interfaces (APIs), so they can talk to each other. Now, we are ahead of the curve. We have put policy about interoperability into practice, and we have done it

collaboratively with our neighbouring trust".

"This is an exceptional programme of work involving the commitment and dedication of both technical and clinical teams at both trusts" said Chaudhry. "This collaboration is a natural extension of our hospitals' partnership and another key achievement in providing joined-up healthcare between a patient's care settings using digital technology." ∎

Virtual Companion Startup Aims to Combat Loneliness in Chronic Disease

French start-up Wefight, have raised €1.8m to accelerate the development of their virtual companion technology, which aims to combat loneliness in those with chronic diseases. The technology, named 'Vik', has already been made available to patients living with breast cancer, depression, asthma and migraine, however many more patients are expected to benefit from the technology.

One third of adults in European Union member states are living with a chronic disease, and studies show feelings of loneliness are high in patients living with such conditions.[1,2] Loneliness has a significant negative impact in chronic disease and can lead to poor disease management, depression, as well as higher and longer rates of hospital admissions.[3]

"Loneliness in chronic disease is a significant concern as it has a huge impact on those living with such conditions; as well their families, health systems and society as a whole," said Dr. Kurt Höller, Director of Business Creation at EIT Health.

"We have an overwhelming number of people living with chronic diseases in Europe, and this is continually growing in line with our ageing population. In order to help people with chronic diseases live as well as possible, we must be smart about how we approach disease management. Artificial intelligence has the potential to meet the needs of patients without adding further burden to already struggling health services, and we are proud to support WeFight in their ambitious vision for their technology.
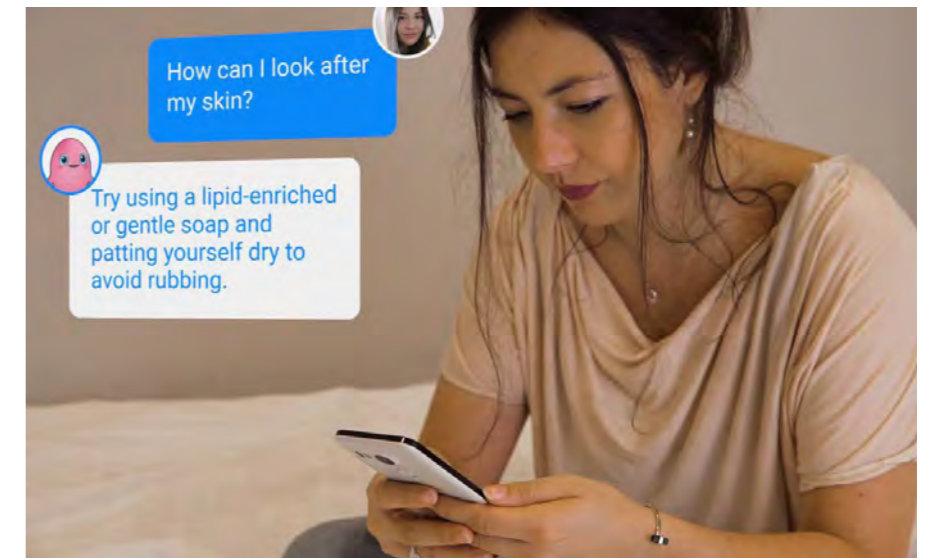
The EIT Health investor network connects European health-oriented investors with promising start-ups to encourage cross-border financing and co-investments," continued Höller.

Wefight was created in 2017 by Benoît Brouard and Pierre Nectoux, who combined their knowledge of healthcare and technical expertise to create Vik - a virtual companion who answers patient questions related to their condition, treatment and care pathway. The Wefight team aims to take 'Vik' to 30 more disease types by 2020; and will utilise the funds raised, in part, through the EIT Health Investor Network to help them achieve their goal. The funds secured through the EIT Health network were provided by Investir&+, Angels Santé, Business Angels des Grandes Écoles, and MELIES Business Angels.

"Our team is proud to have convinced investors who share our values and who will bring their expertise to help us

increase Vik's social impact," said Benoît Brouard, Co-Founder and Director of Wefight. "We wanted to meet the needs of patients and address caregivers' needs. To achieve this, we included patient associations in the development of Vik from the very beginning. This allowed us to understand the daily concerns of patients and tailor Vik to their needs," Brouard continued.

References
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2. Effects of loneliness on illness perception in persons with a chronic disease. Journal of Community Nursing, 2018. Available at: https://onlinelibrary.wiley.com/doi/pdf/10.1111/jocn.14273.
3. Open Psychol J. 2015; 8(Suppl 2): 113–132. Available at: www.ncbi.nlm.nih.gov/pmc/articles/PMC4636039. ∎

'Smart Patch' Supports New Care Pathways for Patients with Advanced Liver Disease

Results of a new study have identified new pathways for managing patients with advanced liver disease based on new methods employing data-driven bio-markers.

In a preliminary study, the London research team validated the Patient Status Engine and Lifetouch sensors from Isansys Lifecare, as an ideal remote monitoring system and used it to create a baseline heart rate variability (HRV) data set from a group of healthy volunteers. They then used the Lifetouch to assess heart rate variability (HRV) remotely and non-invasively on patients admitted to the Royal Free Hospital with an acute decompensation (a significant deterioration) of advanced cirrhosis.

One hundred and eleven patients were included in the collaborative study between the University College London Royal Free Hospital, UK, and the University of Bonn, Germany, which showed that a significant reduction in heart rate variability is a feature of acute decompensation of cirrhosis and, remarkably, predicts 90 day mortality in these patients.

The results concluded that continuous, wireless monitoring of HRV is feasible in patients with advanced liver disease. The study also supported the hypothesis of both hospital teams that reduced HRV, correlates with severity of liver decompensation, facilitating the identification of high-risk patients, and allowing for

timely interventions. In light of these findings, the study suggests the future potential for such continuous monitoring and the prospective health economic benefit of measuring HRV remotely.

The report said: "Traditional ECG measurement of HRV encompasses short-term 5-minute ECG segments being interpreted separately as reflecting HRV in that specific time window, under stable physiological conditions. The Lifetouch system by contrast, not only facilitates continuous monitoring irrespective of the individuals' daily activity or physical ill-health but also helps negate the short coming of limited ECG time capture which make further interpretation difficult. Using the remote monitoring device, we were able to interpret HRV in all monitored in-patients with acute decompensation."

Keith Errey, CEO of Isansys, said: "We are pleased to have been able to contribute to this important and ground-breaking work that has shown how patients, clinicians and providers will benefit from a new class of data driven biomarkers. We look forward to continuing the work with the two teams on the next full-scale demonstrator phase of this vital project.

"The Patient Status Engine is more than a remote patient monitoring platform. It is able to directly produce the most complete and accurate physiological data sets outside an intensive care unit, for all patients including those at home. These data sets are the basic requirements for transformative new ways of diagnosing and managing patients as AI and deep learning methods become more widely used in healthcare." ■

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1-2

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15-16

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7-9

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13-14

DigitHealth Leaders

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18-21

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19

Investival Showcase

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10-11

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28-29

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