# Dr Liz Cade, Professor Stephen Fôn Hughes, Sara Oxbury-Ellis, Dr Chelsea Batty, Nathan Roberts & Dr Mobayode Akinsolu

Healthcare Heroes: Tomorrow’s World

*October 2024*

**Dr Steven Butts**: Good evening. Sorry to interrupt everyone's chatter. I'm Dr Steve Butts, Associate Pro Vice-Chancellor here at Wrexham University, and it is my absolute privilege to welcome public and professional members of the audience, and staff and students from Coleg Cambria and Wrexham University.

This is the first of a series of Wrexham University talks research for this academic year. For those of those of you who live outside of higher education, the academic year starts in mid-September as opposed to the 1st of January for normal people. We've been doing these events for several years now but this is the first panel event we've done, and it complements the Healthcare Heroes event that’s been run throughout the day as a joint initiative between Coleg Cambria and Wrexham University.

We have some extraordinary people here this evening to share knowledge and wisdom, and who recognise the challenges and revolutions in healthcare education and sit on the cutting edge of research with colleagues to transform future healthcare. As someone myself who is a member of an ageing population, I'm fully supportive of the dedication of work our panel and networks of others invest in to best equip the next generation of those who at some point, will likely be looking after all of us. So thank you again and welcome, I will hand over to my colleague, Professor Mandy Robbins, Associate Dean for Research here at Wrexham, who will chair the panel and the proceedings, and the questions and answers once the panel have shared. Thank you.

**Professor Mandy Robbins**: Thank you very much Steve, and welcome everyone as well for braving such a dreadful evening out there. So, as Steve said, my job is to chair this evening, we're going to have four presentations and then there will be the opportunity to ask questions at the end of the final presentation this evening. Just to say, our first presenter Dr Liz Cade, will not be able to stay for questions at the end, but by all means, do email any questions you might have to her and she'll be very happy to take those up with you outside of this evening.

So, first of all we have Dr Liz Cade, Liz is going to be talking to us about Building a resilient healthcare workforce – a mixed-methods study in occupational therapy students undertaking role-emerging placements. Liz, over to you, thank you very much.

**Dr Liz Cade**: Bore da. A career in healthcare offers a rich and rewarding journey in the development of competence and in professional identity. Despite this, working in health environments and patient facing services can place many demands and challenges on you as an individual. An ability to thrive is requisite and building resilience as a process of positive adaptation allows students and practitioners to overcome the challenges they may face.

Students in all health professions are immersed in learning and teaching to build clinical skills and knowledge, as well as informing their professional identity. In addition to on campus curriculum delivery, students are expected to attend clinical placements, immersing them in real life contexts where theory is applied to practice and professional skills are developed, building competence and confidence. Placements are valuable learning opportunities and should be supportive with supervisory mechanisms but can equally be stressful and demanding as students strive to pass the expected learning outcomes.

In occupational therapy, students are expected to have a range of experiences, from traditional health and social care settings to more diverse opportunities, that are referred to as role emerging placements where there is no onsite educator or mentor to serve as a role model. Occupational therapy have been trailblazers in this model of practice in terms of placement supervision, and it's actually been deemed to be highly valuable and very successful for students in their development.

Typically, these are undertaken in later stages of training. Long term supervision guides the process of learning and demonstration of competence. These placements are known to be more challenging. Often likened to a roller coaster, as students navigate their way through the myriad of expectations in creating an occupational therapy role.

Role emerging placements are undertaken in organisations and charities such as those organisations supporting homeless people, those experiencing domestic abuse, drug or alcohol dependence, and even the Fire and Rescue service. My study used a mixed method approach or design, set out to explore what attributes and personality traits were held by those students to not only survive but to thrive in these placements. Turning them into positive and empowering opportunities, preparing them for roles on qualification. 38 students in level five and six completed self-rating questionnaires to measure personality and resilience, pre and post placement across traditional and role emerging placements. Six qualitative interviews were conducted to gather an in-depth understanding of the experiences for those in those role emerging placements, and their perceptions of allocation to these.

Study findings established seven themes outlined here, but with time to only expand briefly, I will focus on several key aspects. First of all, the allocation process of matching student to placement is complex and a personal approach optimised the placement, experience and outcome. Compulsory allocation to the more challenging placements was known to demand more autonomy, confidence, self-belief and professional identity in those students. It also affirmed that given a choice, a lot of students would have preferred a more traditional placement that offered more security and support, but they equally welcomed the opportunity and sense of being deemed capable, that boosted their intrinsic motivation to succeed. Findings suggested that the following traits and aptitude to be requisite for a successful placement.

* Flexibility and adaptability to amend behaviour and approaches to practice: help to bring positive change and a successful outcome.
* Assertiveness: required to embed the occupational therapy role where organisations and staff may struggle to understand its value and show resistance to change.
* Creativity and an entrepreneurial mindset to problem solve and embed the role with few resources was hugely valuable.
* Self-belief, self-efficacy, emotional intelligence and confidence were hugely valued for those students within those placements.
* Diligence and diplomacy was essential as the students navigated their way through the placement, demanding intuitive sensitivity and self-awareness to overcome any organisational negativity towards the student and resistance to change.
* Optimism and the ability to turn negatives into a positive and to overcome the challenges through being open minded and determined to succeed.
* Maturity and life experience supported the students and ability to build resilience, but not necessarily was that age linked.

The final theme indicated that coping strategies and supportive network, peer support, and constructive, timely supervision were all requisite to overcome the challenges. Thinking about these as enablers and protective factors enabling them to thrive despite the challenges.

The data underwent statistical analysis from a quantitative data perspective, to establish correlations. Students who were selected for their attributes purposefully and aptitude to undertake the most challenging role emerging placements, were found to be more resilient before placement and had gained greater resilience as a consequence of a placement in role emerging settings compared to students in the more traditional placement settings. These students scored higher in traits of openness, conscientiousness, extroversion, and agreeableness. They were more emotionally stable or scored lower in neuroticism as one of the traits within the Personality rating scale. Extroversion scored higher post-placement for those in role. Emerging placements attributed to an increase in confidence and personal growth. Agreeableness, so being able to navigate their way through those placements, is positively correlated with higher resilience for the students in those more challenging placements.

To conclude, if you are planning to or have embarked already on a health care career, what can you take away from this? Students need to understand their own traits and characteristics through a journey of self-awareness and reflection for personal growth and development. Recognising protective factors and enablers to thrive in challenging situations is key. Curricular and extracurricular activities such as joining societies within the university, volunteering and a professional body membership (Tina, one of our graduates, has just done her research on that very subject), should facilitate positive risk taking, openness to new experiences, and to nurture a sense of belonging and identity. Placement opportunities bring challenge. Bringing challenge can serve as a platform to develop resilience for all students. The key message is that resilience and the propensity to thrive within health care is a key requisite for becoming a health care practitioner and should be viewed as a dynamic process that can be learned and enhanced through opportunity for personal growth and development over the period of study and placements. Understanding the complexity of placement opportunities and a personalised approach to allocation has scope to build resilience, professional identity and an entrepreneurial mindset.

Thank you.

**Professor Mandy Robbins**: Thank you very much, Liz. Thank you for putting your email address up at the end there, that's very helpful. Next, we have Stephen Hughes, who is from the University Health Boards at Maelor academic unit of medical and surgical sciences. He's going to talk about an innovative approach to collaborative working, staff development and promoting lifelong learning for healthcare professionals. It’s over to you, Stephen. Thank you very much.

**Professor Stephen Hughes:** Hi. Good evening everybody. Diolch yn fawr iawn am y gwahoddiad heno. Thank you all very much for the invitation to come here and talk to you this evening.

For the next ten minutes or so, I'd like to give a brief overview really, about who we are and what we do in collaboration with Wrexham University. As Mandy was saying, what is very, very important to us is promoting the lifelong learning of our health care professionals. As I say, it's just a brief overview about who we are and what we do.

Our academic unit, Maelor academic unit of Medical and Surgical Sciences was co-founded and established just after the Covid period. So, there was myself, I'm employed as a consultant biomedical scientist and one of the directors for the unit along with two colleagues, Professor Iqbal Shergill, who's a consultant urological surgeon based at Wrexham, and also professor of Arvind Arya, who's a consult ENT specialist based in Ysbyty Glan Clwyd also based in Wrexham.

So ultimately, what goals have been set for the unit? Well, generally we want to try and enhance the health board’s research profile by promoting the health board as being like a centre of excellence for undertaking clinical research. In turn, hopefully we will be able to attract and retain high calibre clinicians and also healthcare professionals to the area, which is very, very important. And in order for us to do that, it's equally important that we develop and sustain academic and industry partnership and I'm pleased to say that the work that we're doing with Prifysgol Wrexham/ Wrexham University is absolutely fantastic. I think if we can get those first three statements right, then ultimately all of this will benefit the patients and the public, knowing that your local university and the local health board is actively involved in novel research.

There are some images now, so I probably won't have to speak too much. This is where we're based, we're just opposite the Wrexham Maelor Hospital. It consists of several laboratories and we're very fortunate to be able to boast lots of state-of-the-art equipment to be able to do the research that we do. A lot of the equipment, as I say, is cutting edge and all of the facility is available not only to BCUHB staff but also to the collaborative people that we're working with, obviously including Wrexham University. These are just some images of some staff members, so on the top picture there you can see Stuart, Peter and Helen, who are a member of our MAUMSS team. The bottom picture is Professor Mandana Pennick. Mandana, by day, is a breast surgeon based in Ysbyty Glan Clwyd centrally, but she comes over to the research unit on a regular basis and she now has one of her own PhD students working in a general area of breast cancer, which is fantastic.

Now, I won't have time to go through all of this, but this slide is quite busy but it just provides some information really on the collaborative working and the types of research that's going on not only in Wrexham but across the North Wales coastline. I'll just probably pick a couple of them. So, Professor Iqbal Shergill as I've mentioned previously, is a consultant urological surgeon. I work very, very closely with Iqbal, and we do a lot of work on patients with kidney stones, prostate and bladder cancer. We're working very, very closely with a number of colleagues across the UK on some on some portfolio studies. Dr Artor Abelian is a consultant paediatrician based in Wrexham Maelor Hospital, the work that they are doing is absolutely fantastic and we're proud to be associated with this work. They're working very, very closely with Cambridge as well. So, one of the problems that Art has as a paediatrician is that a lot of the neonates and the pre-term babies may be suspected to having sort of meningitis. Now, the biggest problem with that these days is it does take a bit of time for the results to come through and by this time, Art has had to go ahead and treat these young babies and up to about 90% of these cases have all come back negative, so in many ways they've been over treated. Now in Wrexham, in our laboratories, working with Cambridge, we've managed to create, if you like, a molecular rapid assay that can bring about the test results after about 40 minutes or so, which is pretty good. So, the next stage for us is to try and take it on now to a bigger clinical scale.

What's really important to us as well is working together on a pan Wales approach. As a Welshman originally from Anglesey, we are a small nation and I do strongly believe that we should be working together and then on behalf really of the health board, our academic units or MAUMSS, we work very, very closely with several universities across Wales, and we have some examples of colleagues that we work with in Aberystwyth, in Bangor, in Cardiff, Swansea. Again, to reiterate, Wrexham being our main leading sort of established partner and long may that continue. That's what we want to keep doing.

I've briefly mentioned before as well that we do work with other universities and we do have a very well-established collaboration with the likes of University of Oxford, Warwick, Keele, Birmingham and I've already mentioned Cambridge. On behalf of the health board, myself and a colleague from Bangor, Dr Pasquale, we represent North Wales in the health board as research champions for the Wales Cancer Research Centre which is based in Cardiff. We're affiliated as well with the Wales Kidney Research Unit, which is based in Swansea and then more recently, we've been very much involved with the Northwest Cancer Research Organisation, which is based in Liverpool. Again, with respect to our collaboration, we're strongly affiliated as well with CALIN and the Life Sciences Hub Wales, which are based in Swansea and Cardiff respectively.

Now, the next few slides just showcases really the strong collaborative partnership that we have with our local university in Priysgol Wrexham. Over the past several years, working very, very closely with the Faculty of Social and Life Sciences we've been able to develop and subsequently deliver a suite of professionally accredited postgraduate programs in collaboration with its local health board. So, for example, we're now running successful masters taught programs, MRes programmes, we're looking over the course of the next academic year to introduce more specialist ones in orthopaedics, EMT and respiratory medicine, which would be great for the university and also for the health board. We've got a strong track record of training and being able to sort of see our PhD students through, and the professional doctorates is something that we're really keen to pursue as well. This sort of collaborative partnership has been approved by a memorandum of understanding but ultimately and the main take home message from this, really, it really does benefit everybody because the benefits to staff development, especially from the health point board perspective, is that if you're a new healthcare professional, in collaboration with Wrexham University, we’re able to offer you these postgraduate programs as part of your career development. If you're a senior health care professional or a senior clinician coming in, we can then invite you also to come and do some teaching and to also do some research. So, it's a full circle lifelong learning cycle that we're that we are establishing. As I say there without questions really, we like to think that we are promoting the career development and lifelong learning of all our healthcare professionals also including our academic partners. What we think is very, very important as well, once a year for a week we open our doors to the next generation of scientists, doctors, nurses, allied health professionals. Where the labs are open for a week, I might take them for a day doing some haematology transfusion, another colleague will do something else, and so forth, and then on the last day, we'll invite some allied health professionals, healthcare professionals, generally nurses, doctors, just to talk to them about the different types of careers that are available for them should they wish to want to work in the NHS eventually. That's usually well received and we open it up to all local sort of sixth form and FE college students.

Then, the last few slides again, is just signposting and sort of showcasing really the success that we've had to date. So, Jakub Matusiak is now a colleague of mine. He works as a healthcare scientist working for MAUMSS on a full-time basis. When we established the masters courses with Wrexham a couple of years ago, he was one of the first to graduate, which was absolutely fantastic. Nana was from Ghana and she managed to get some government funding and she, as I say, finished her PhD 14 - 16 months ago, which was again a real nice success story.

Currently we have three PhD students who are enrolled with Wrexham and work with us, if you like, at the hospital. Rhiannon is doing a work in Parkinson's. Hanaan is basically looking at post-operative responses to urology surgery and Emma Randles is focusing on bladder cancer. Every year as well, we take on three junior doctors who've just qualified with their medical degrees and they come and spend 12 months with us doing research and they also, as part of that academic foundation program, they enrol to do the MRes as well with Wrexham University, which is absolutely fantastic.

We've managed to get some funding this year to add two additional students. The last two slides, I promise. Another case study is that Bethan is originally from North Wales, I believe she's from Llanrwst originally, she wanted to come to Wrexham when she qualified as a doctor because of the successful MRes’ that were being offered to her as a junior doctor. So she came and spent two years with us in Wrexham Hospital, she successfully graduated with the MRes from Wrexham University a couple of years ago, and now she's working as a trainee oncologist in Bangor and ultimately she wants to stay in the region to become hopefully one day a consultant. Then we have Jay Shanker, who's an established ophthalmologist surgeon, just to show you that lifelong learning never stops, even though he's been working as a surgeon for many years he liked the look of the MRes and decided to do it himself and graduated last year and managed publish a couple of great papers as well. This is just a screenshot, because we are academic is very, very important that any research that we're doing that we get it out there to the domain so that people can see that we're publishing in scientific and medical peer reviewed journals.

Then finally, we like to think that BCUHB MAUMSS is a novel and innovative academic and research facility that is unique not only to the health board, but to everybody across North Wales. We do hopefully reinforce the university status on behalf of Betsi Cadwaladr University Health Board. As I say, the most important thing for us as well is to aim to encourage, support, develop BCUHB staff, its academic partners and students and thus promoting their career development and lifelong learning as well. Hopefully, by doing all that, we will aspire to become a recognised centre of excellence which will be recognised hopefully one day internationally as well. Thank you very much for your time, diolch yn fawr.

**Professor Mandy Robbins**: Thank you very much, Stephen. It's been great to see your PhD students engaging with our research development sessions here in Wrexham University as well.

So next we have Sara Oxbury-Ellis who's going to talk to us about the development of student led observational and debriefing tools in healthcare education. Over to you, Sara. Thank you.

**Sara Oxbury-Ellis:** Diolch and croseo, thank you and welcome. I just wanted to go through a small evaluative study that I undertook with some of our colleagues from paramedic science, on a tool that we developed to for promoting observational debriefing skills within simulation based education.

Famously, Sir Arthur Conan Doyle, who is the author of Sherlock Holmes, in one of the books Sherlock Holmes says to Dr Watson “you see, but you do not observe”. What we mean by this is about putting this into context about observational skills. Now, observational skills is very important within healthcare practitioners and for our students development and we're just going to play a short video. I just want to put it into context, it's only just over a minute and a half, it does require a little bit of audience participation, so you have to observe very carefully, and we’re hoping that no adverts will come up but a little bit of warning we have no control and hopefully if they do come up it will be a skip. I'll hand over to my colleague.

{Video plays}

The monkey business illusion.

Count how many times the players wearing white pass the ball.

The correct answer is 16 passes.

Did you spot the Gorilla?

For people who haven't seen or heard about a video like this before, about half miss the gorilla.

If you knew about the gorilla, you probably saw it. But did you notice the curtain changing colour or the player on the black team leaving the game?

Let's rewind and watch it again.

Here comes the gorilla and there goes a player and the curtain is changing from red to gold.

When you're looking for a gorilla, you often miss other unexpected events.

{Video ends}

So how many of you actually got all three extras other than the 16 passes? Just a couple. How many of you got two? Yeah, I got the two. I missed the person getting off the stage, which is not very good in healthcare when you’ve got people missing. So, we've got room for improvement. But really, what this was meant to show you, is that observing purposefully, actively engaging and seeing what's going on around you is so vitally important and particularly for our students as we're developing those skills for them to go out into practice and sometimes have to be making decisions on very complex situations that are rapidly changing and they need the ability to be able to determine what is useful, what is not, and to then focus on those things. We term this as situational awareness, that’s what we're looking at.

What I did was a colleague of mine from the paramedic team, we decided to create a tool, so that when students were undertaking simulation-based activities that they could actively engage in observing rather than just watching passively or seeing but really taking note about what's going on. We developed a dual tool of observational and debriefing, because both go very much hand in hand when you're feeding back, when you're handing over to people, you need to have had that observation very detailed beforehand.

This helps, just a small group of students, if they're undertaking simulation, they are learning their clinical skills. Some of them will be actively involved in the actual skill, and then the rest of the group would be then observing. We got them to focus on:

* Actions - so what's going on
* Communication - their environment, so what's happening around them
* Then also what is to be developed, what went well, what could be moved on and improved on.

We call this the ACED tool and then the other half of it was using those components, when they come in to do the debrief and the feedback, that we then had a very structured approach and also that detailed information and we added feel and emotions into that as well, this is our FACED tool.

So, what we wanted to do then was just to evaluate its use really. We undertook a very small scale evaluative study, mixed methods really. They completed a questionnaire that examined some of their knowledge, their understanding and their confidence levels in using observational and debriefing skills. They then had a teaching session on how to observe playing the monkey business video, but other things to help develop that cognitive development and then they undertook some student led simulation-based activities in which they use the tool, and then we did another questionnaire again to find its usefulness.

Overall, this was very successful, very useful. They didn't really, at the beginning, have a very clear understanding of observational skills. They certainly could understand what it was to observe patients, but that wider context they didn't quite grasp, but once they actually used the tool, had the teaching session, then their knowledge and their confidence levels definitely increased and improved. Similarly with their debriefing skills as well, they had a better understanding of what debriefing and feedback meant but these were second years so we think that actually they probably developed some of those skills already out into clinical practice, but again, definitely by using the tool, having that focus and being student led, they were able to develop and they felt that it did improve from ‘little’ to ‘some’ and ‘quite’ in the confidence levels as well.

We asked them just three questions on the second questionnaire, just really about the tool itself, to whether there was anything that we could develop and sort of refine and I'll have a look at the summary really that just explains what we got from that. But, overall, they did find the tool very useful. They did feel that the tool initially was a little bit overwhelming, and there was quite a lot of information on there so we have since then, refined it slightly just to make it more user friendly when they first look at it. The other thing is that this the paramedic team have decided that they're going to split the tool into half and they're going to concentrate on the first years, those really new health care students, to really develop those observational skills and then supplement it with the debriefing skills in the second year. We have actually adapted it further, and it's been picked up and it's now being widely used within simulation for our nursing, for our other allied health professionals as well, which is really fantastic. We have some breaking news as well., literally as we speak. A couple of weeks ago, two of our students, Hannah from mental health nursing and Harry from paramedic, both second years, entered a competition nationally to develop their own simulation-based scenario and they embedded the tool actually into that scenario. They've been selected for as one of four winners to go to Edinburgh, to the conference for the Association of Simulation Practice for Healthcare (ASPiH) and they'll be actually undertaking their simulation scenario with the ASPiH audience, using the tool as well. So that's fantastic news and I'd like to congratulate Harry and Hannah for some fantastic work there and I look forward to going with them to support them, that's a nice bit.

So, to finish off really, it's going back to that, “You see, but you do not observe”. I think observational skills is so vitally important both in personal and work life and it's definitely a skill that can be learned and to be developed, especially when you're looking for gorillas and missing people. I think, you know, if nothing else, watch out for them! But on a more serious note, for our healthcare students it's very important that we have this opportunity within simulation and really be able to develop these skills, so that when they go out into practice that they become very safe, competent practitioners. My contact details are there. We are hoping to put this study into publication for the Journal of Paramedic Practice, we're just writing it up at the moment. So, if anybody's interested in looking at the tool or citation, then please do contact me. Diolch.

**Professor Mandy Robbins**: Thank you very much, Sara. Next we have Chelsea Batty, who's going to talk to us about Smart Hearts, a real time monitoring system for cardiac rehab patients. So, over to you, Chelsea. Thank you.

**Dr Chelsea Batty:** Good afternoon, everybody. Welcome to Wrexham University. My name is Dr Chelsea Batty and I'm a principal lecturer in the Sport and Exercise Science Department.

Over the next ten minutes, I'm going to be talking to you about cardiac rehab. In the UK, if you are suffering from cardiovascular disease or you have recently undergone a cardiac event, i.e. heart attack, or you've recently had cardiac related surgery, you will be offered cardiac rehab. Now, in the UK that is a period of exercise and education. In terms of the exercise, whenever we're prescribing individuals to do exercise, we have to look at it from what we call the ‘fit principle’ perspective. So:

* Frequency, how often they need to go and exercise
* Intensity, how hard
* Time, how long
* Type.

So, in the UK, cardiac patients are expected to go to their local outpatient leisure centre three times a week over an eight-week period. The effort level of that exercise, if we are using objective means, needs to be set at 40 to 70% heart rate reserve. If we're using more subjective means to prescribe that effort level, we will prescribe it based on the 6 to 20 BORG rating of perceived exertion scale and the range on that is 11 to 14. They have to exercise at that intensity level for a minimum of 20 minutes, but the range is 20 to 60. The type of exercise is a combination of cardiovascular based exercise and resistance, but what we tend to see cardiac rehab teams adopting in the UK is what we call circuit style training.

Now, there's been lots of studies that have been conducted over the years to assess the efficacy of cardiac rehab, to improve mortality. Does it make patients live longer, doing this exercise? As you can see, there's an extensive list of studies on the slide, there are studies that say yes, it will make patients live longer in comparison to a group that does not do the exercise, i.e. a non-exercise control group. There are some studies that say actually it doesn't. Now the studies that show it does make you live longer are very outdated. There are trials that have been conducted in the 70s where the surgical and pharmacological treatments aren't where they are up to today. They also include predominantly low risk male patients, so they're not inclusive of differing cardiac populations and also they include trials that were conducted overseas, mainly in America, where they're doing substantially more exercise in terms of what went prescribing here, in terms of the volume. In America, you're likely to do exercise over a 16-to-20-week period, so you might conclude, ‘well is that the reason why they are having positive results’, they're doing more exercise. The studies that are showing that actually it doesn't make patients live longer, are somewhat inclusive to the UK. The *West et al* 2012 study, the ‘Ram it’ trial as we call it, is the biggest randomised controlled trial to date in the UK and it found that patients do not live longer in comparison to this non exercise group.

Now interestingly, there is something that all these studies have in common regardless of whether they show it improves survival or not. They're not very good at reporting what patients were actually doing in terms of exercise. We have some idea of what was prescribed and in terms of the *West et al* trail, it wasn’t this. We were seeing studies that were prescribing exercise over four weeks, over two weeks, which is substantially less than what they should be doing. So you could conclude, ‘well maybe that's why it didn't work’, but overall, none of them are reporting what was actually achieved. There's a difference in what you're asking somebody to do exercise wise and what they actually do.

There's also the opinion that should we even be looking at mortality as an endpoint. As Steve alluded to at the start, he is part of an ageing population. We have this ageing population. Patients are living longer. If they get cardiovascular disease now, the prognosis is really good. However, they're living longer but living longer in a diseased state and that is putting immense pressure on our health care system. We've started to move to look toward softer end points. Does cardiac rehab, i.e. the exercise part of it, improve patients’ fitness? Fitness levels are an independent predictor of survival. If we can improve patient's fitness levels by one MET, which is the equivalent to 3.5mls of oxygen per kilogram of mass per minute, that is associated with a 10 to 20% improvement in survival. So, we're looking for that ‘clinically meaningful’ improvement in fitness.

Again, there's been lots of studies that have done that and as you can see, there is improvements in fitness, but only one study has that ‘clinically meaningful’ improvement in fitness, a 1.55 MET. The rest of the studies, yes, there is an improvement but not ‘clinically significant’ to have that survival association there. Interestingly, this study was conducted in America, so again, you could conclude maybe it's because they're doing more exercise in comparison to what we're doing here in the UK. The other three studies are inclusive to the UK and again, they're not very good at reporting what patients were prescribed to do, never mind what they actually achieved. So that gap in reporting is significant. What did they do? What did they achieve? Because it hinders our ability to link the prescribed exercise dose with potentially improvements in fitness and other health outcomes, so it skews the effectiveness there. It's this concept of what I like to call fidelity. Fidelity means the extent to which a program is carried out as intended. Did patients exercise three times a week? Did they exercise at 40 to 70% heart rate reserve for a minimum of 20 minutes? That's what we need to start to do in terms of studies and the research.

The next steps, in terms of the study that I'm working on with the local cardiac rehab service, and there are 300 cardiac rehab services across the UK that all should start to do this, is to monitor that fidelity. How often are patients coming to class? That's fairly easy to track, attendance is fairly easy. The complexity comes in when we're trying to look at how hard patients are exercising and how long for. Remember, it's 20 minutes at 40 to 70% heart rate reserve. Realistically, we need to monitor it more objectively, so rather than seeing if patients are exercising at 11 to 14 on the BORG scale, which is a subjective method, we need to monitor it more objectively because it's more valid, it's more reliable. The two governing bodies for cardiac rehab in the UK, the ACPICR and the BACPR, recommend we use both means, subjective and objective. However, the objective monitoring using heart rate monitors can be expensive. Does anybody in the room have a Fitbit or know what a Fitbit is? Yes. They're not that expensive really and they can give you data on heart rate. They can give you data on how long you've exercised for in certain heart rate zones but imagine trying to buy all these Fitbits for all the cardiac patients in the UK, it's going to be very expensive.

So, this is where the Polar Verity Sense/ Teams armband come in. So, I will now go back to the slide that should have been there and I'm going to give you a quick demonstration of how this works. So, this is what the app looks like, I've got my 15 patients, I'm the cardiac exercise instructor. They've all arrived at my leisure centre and they're going to be doing a circuit. I can put all their data into the app, the app then works out their heart rate reserve. I then link an armband, which I have on at the moment, to them, and it will give me their heart rate data. So that minute you can see that I've got this heart rate monitor that I'm wearing paired. All I need to do once I've got all my patient data in is press done, I will then start a new session. You can see it's now picking up my heart rate, it's 127 beats per minute. Maybe it's because I'm stood up. Some people would question ‘that's a bit high’, actually, that's normal for standing. I would then press start. I'm working at 67% at the moment. Remember 40 to 70% heart rate reserve is what we need to work at. This is measuring it at a percentage of heart rate max, so to convert that into heart rate reserve it's 60 to 80. I'm working in what we call the light exercise zone at the moment. I would walk around my class with my cardiac patients with the iPad, checking on all the patients, making sure that they're within range. If they're not, I can sort of push them a little bit, but really this is this is about a data gathering tool. We need to be able to collect the data from all these sort of cardiac rehab centres across the UK to see what our patients are actually doing. Until we know what they're doing, we can't then look at it to see if it actually works. At the moment, we know that more exercise is likely to work. However, cardiac rehab teams are already underfunded, already under-resourced, therefore, it's unlikely we're just going to be able to extend the offering of more volume of sessions. So, in the interim, we just need to see what they're doing to see if actually that does work. That's pretty much it from me. So thank you, diolch.

**Professor Mandy Robbins**: Thank you very much. Looking at my Apple Watch, I was reassured by the heart rate there. Next, we have two short videos on transformative technology for tomorrow's world, then after we watch these two short videos, we'll have the opportunity to ask our panel some questions.

{Video plays}

**Dr Mobayode Akinsolu:** Hello there. My name is Mobayode and I’m a senior lecturer here at Wrexham University. Today I’ll be sharing with you about the work that I do in digital healthcare. Particularly, how antennas are facilitating early cancer diagnosis via ultrawideband (UWB) body-centric communications. Antennas are very important; they are at the heart of wireless communications and they have a plethora of applications, including mobile phones and TV broadcasting to name a few.

With a focus on ultrawideband antennas, it is important to emphasise that these class of antennas are very attractive due to several reasons. Firstly, they are ideal for body-centric use, and secondly, they support high resolution tracking and positioning and thirdly, they minimise signal interference. These qualities are what make UWB systems the preferred option of ambient assisted living applications in comparison to modern technology such as WiFi, Bluetooth and GPS.

Here we have an illustration of how AI is being used to determine the best shape or topology for a UWB antenna. It’s important to state here that the AI techniques co-developed here at Wrexham University are state-of-the-art in the AI-driven design of antennas. Primarily, as the antenna shape is being changed by AI, its performance also changes. On the left-hand side here, we are looking at the S-parameter measure that indicates how well the antenna can function. The ultimate goal is to get the response curve to be below -10dB for good impedance matching.

The optimized antenna in the previous slide has been prototyped as you can see in the image on the right-hand side. Now it can be used for early cancer diagnoses. What we have here is an illustration. The whole process is referred to as microwave imaging and in principle what happens is, the antenna is placed in proximity to the human breast and it emits signals that penetrate the breast tissue. The emitted signals are reflected differently from healthy and cancerous cells. This approach in of itself is non-ironising and more accurate than x-rays and it’s also cheaper than MRI. The details of the published research article based on this work is what we have there in the footnote.

Summarily, antennas play a vital role in digital healthcare and here at Wrexham University we have the expertise to develop contemporary and eco-friendly antennas with the aid of AI techniques developed in-house. I’m very happy to discuss avenues for collaborations and funding applications in digital healthcare. Thank you so much for listening.

{Video ends}

{Next video plays}

Music plays

{Video ends}

Lecture proceedings closed by Professor Mandy Robbins.