Experience of the Toyota Production System in the NHS in the North East of England

Why did we pick Virginia Mason Medical Centre as a partner and why do we not talk about “lean”?

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Abstract

The North East Transformation System (NETS) combines ambitious vision, a “compact” (aligning culture with vision) and a continuous improvement method based on the Toyota Production System (TPS) – as adapted by the Virginia Mason Medical Center (VMMC). NETS shows the expected extremely positive results of adopting and adapting TPS and the authors briefly analyse the success of VMMC and discuss the features of positive adoption of NETS – compared with organisations who have not been as successful. The current transformation of the NHS in England is a possible catalyst for the wider use of NETS.

Introduction

The north east of England has a population of over 2.5 million people living mainly in the two major conurbations surrounding Newcastle upon Tyne and Middlesbrough. There is a large rural hinterland and considerable distances to any neighbouring centres of population. The NHS is approaching £5 billion turnover with excess of 70k staff based in eight major hospital and community service provider organisations, two main mental health service providers, an Ambulance service and approximately 400 primary care practices. The combined NHS in the north east has, in comparison to the rest of England, an unsurpassed track record on financial health, quality of services and delivery of government targets. NHS North East is top in England for public satisfaction, patient satisfaction and staff satisfaction.

The Strategic Health Authority in the north east has led the delivery of these remarkable results through a combination of setting very clear vision and strategic goals, tight performance management based on a clear model of earned autonomy (all the NHS providers are Foundation Trusts signally their clear independence and organisational health), strong consistent leadership (the average tenure of chief executives and other key directors is vastly longer than the NHS average) and a tight “collegiate model” for decision taking (forums for all chief executives and all statutory board chairs lead the strategy implementation).
The clinical vision of the NHS in the north east states clearly the zero tolerance approach developed over the last 10 years, colloquially known as the “7 No-s”:

**The “7 No-s”**
- No barriers to health and wellbeing
- No avoidable deaths, injury or illness
- No avoidable suffering or pain
- No helplessness
- No unnecessary waiting or delays
- No waste

Setting direction in this way has had a number of important consequences but as a framework for leading quality improvement, whilst it is clearly ambitious and aspirational, it doesn’t suggest any “how” or “why”. Much influenced by the work of Jack Silversin\(^1,2\), NHS North East adopted a framework for transformation based on a clear expectation of putting the patient at the centre of everything we do and a balance of effort put into three things:

- Effort in describing vision and strategy in depth
- Effort on clear and common methods to achieve transformation
- Effort on adapting organisational culture and individual behaviours to support and be aligned to the agreed vision (which Silversin calls the “compact”\(^3\))

This framework has been called the “North East Transformation System” (NETS) and it has been widely adopted in all NHS North East Strategies.
It is apparent that a consistency of approach implied by such a framework requires a choice of which “method” would support the required transformation asked of by our ambitious vision. There was plenty of experience to draw upon: the tools and techniques supported by the NHS Institute for Improvement and Innovation were widely used; organisations had some experience of “lean” through working with consultants (e.g. Unipart), through the individual enthusiasm of trained staff/directors (Six Sigma) and the influence of a key regional business in the north east of England (Nissan); through the on-going efforts of trained service improvement managers working in clinical networks on topics like cancer and cardiovascular disease (PDSA cycles, leadership from NHS Improvement etc.). However, no single method appeared to have universal support, no single method was delivering real transformational change and the overall approach was piecemeal rather than strategic. The SHA set about a process to decide what would be the best available way forward.

Experience had created an understanding that a number of criteria would need to be met:

1. An improvement system needed to be systemic – piecemeal or point improvements were not gaining sufficient traction for us to meet our business needs
2. An improvement system needed to work in the various healthcare settings of a whole regional system – from acute tertiary care through mental health to primary and community
3. An improvement system needed to be conceptually easy and capable of rapid adoption by a very large and complex organisation – “black box” cleverness and intensive training (like Six Sigma) was not scalable in the short timescales we wanted to make an impact.
4. We wanted world class results – the NHS in the north East was already good and we needed to inspire excellence

Why VMMC?

Serendipity always has a place in strategic choices and through our work on the Compact with Jack Silversin the SHA was introduced to Virginia Mason Medical Center (VMMC). It was immediately clear that their learning, using a highly pure form of the Toyota Production System (TPS) - which they call the Virginia Mason Production System, or VMPS, was a strong match to our needs. But would their method meet our criteria in a search to create real healthcare transformation?

Was VMPS systemic?

Yes. It is perhaps a common misconception of TPS (or “lean”) that it is a simple tool-kit to do improvement work. Some basic tenants such as the elimination of waste, the application of flow and work levelling do make the application of TPS look like mere process engineering tools; closer examination reveals TPS to be an all pervading organisational culture and a systemic operating model that drives every aspect of the work, for Toyota particularly the quality and safety of their product, the duty of care they have to their staff, their firm belief in the achievability of defect free processes and their passion for a very ambitious vision. VMPS applied these global objectives of TPS in a healthcare setting. This appeared to us to be an unusual (for healthcare) thoroughness in the application of improvement methods and was immediately attractive.
Did VMPS work in various settings?

Yes. VMMC is a tertiary referral centre in Seattle, Washington, providing, for example, specialist cardiac surgical and cancer services to a wide catchment population in the north west USA - and it is also an integrated healthcare provider to local communities with local clinics providing primary care and family medicine. Their experience and evidence showed success for VMPS in every setting and crucially involved the doctors\(^5\) as equal participants in the improvement processes.

Is VMPS conceptually easy?

Yes. VMMC had shown that training to all grades of staff had immediate and lasting impact\(^6\). The core principles of TPS do not require knowledge of statistics, sophisticated jargon or complex techniques – rather it is the ability to see current work clearly, mobilise ideas rapidly and use common principles (like waste elimination, safety proofing and visual control) in every setting.

Did VMPS deliver world class results?

Back in 2006 it was clear that VMMC were “on a journey”. They had turned around financial pressures and they had been stimulated into action by a tragic patient safety incident, they were getting excellent results from their improvement work and their leadership was very enthusiastic about the possibilities of VMPS. The charismatic leadership from their CEO, Gary Kaplan, and their corporate confidence was very impressive\(^7\).

It was instructive to see their passion for improvement via a very direct adoption of TPS. They had been guided by contact with the leadership of Boeing (also based in Seattle) who had a similar experience of the power of TPS. Clearly Toyota themselves were delivering “world class” results and experience has subsequently shown that their confidence was not misplaced. The USA Leapfrog Group (representing the healthcare insurers) named VMMC as “top hospital of the decade” in the USA in 2010, based on an assessment of their quality and efficiency.
What have we learned about TPS?

It isn’t necessary to prove that TPS works. The world literature from every industry in every setting shows that TPS and its derivatives has a beneficial impact on quality, on business competitiveness, on staff engagement and morale and so on – with the same impact seen in healthcare and other public sector organisations. In NHS North East we have shown the same thing and have very impressive results on many metrics, including:

- Reduced length of stay in hospital
- Reduced medication errors
- Reduced staff sickness
- Reduced complaints, higher patient satisfaction
- Many improved and cheaper back-office functions

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<th>Orthopaedics – discharge letters</th>
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<td>99% reduction in lead time</td>
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<td>66% reduction in quality defects</td>
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<td>45% reduction in staff walking distance</td>
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<th>Management of Carpal Tunnel Syndrome</th>
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<td>96% reduction in lead time (from 49 days to 2 days)</td>
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<td>96% reduction in backlog (from 7840 to 320)</td>
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<td>100% reduction in patients referred to secondary care</td>
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<td>67% improvement for diagnosis of carpal tunnel</td>
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<th>Mental health – drugs round</th>
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<td>45% Reduction in inventory (from £48888 to £26670)</td>
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<td>26% reduction in lead time</td>
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<td>100% reduction in defects due to interruptions</td>
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<td>20% reduction in defects due to drug unavailable</td>
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<td>23% reduction in space required</td>
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<td>65% reduction in staff walking distance</td>
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<td>60% reduction in lead time for Edinburgh tray</td>
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<td>100% reduction in inventory</td>
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Experience world-wide of TPS and its many “lean” derivatives also shows, however, that it doesn’t always “work” - in so much as it doesn’t gain traction in the organisation, it isn’t widely adopted by staff and isn’t sustained as the organisations improvement method of choice. Clearly there are some major potential pitfalls to avoid:

- Is the organisation ready and willing to change?
- Does management have the right commitment and capability?
- Who will provide the support (organisations do better with external partners)?
- Is the organisation going to be strategic about whole systems change and embedding improvement?
- Is the planning for TPS/Lean realistic and well communicated?

We forged a partnership with VMMC in 2007 based on their willingness to share their learning and teach us how VMPS works. They had some key messages that Gary Kaplan laid out very early in our adoption of VMPS. They were drawn from their own experience and the guidance they had originally had from Boeing. Included were principles like:

- Organisational top leaders – especially the CEO and board members – had to know, understand and be able to lead VMPS as deeply and as confidently as the topic specialists in the KPO (Kaizen Promotion Office)
- Training was compulsory for any leader in the organisation – including the doctors. To take a managerial role in VMMC means learning VMPS
- Key leaders had to go to Japan on an intensive “see-feel” experience and training course (including factory based “Gemba Kaizen” – doing improvement work on the production line of an air-conditioning manufacturer – and visits to Toyota)
- VMPS (like TPS) included clear method for every aspect of how a business works, from strategic planning to inventory control – and all the modules had to be applied, not just the process improvement techniques.

One of us (SS) was in the first cohort of NHS North East Leaders to go to Japan and to Seattle to learn VMPS and be certified as an improvement workshop leader. The in-depth learning and training included wide reading on TPS as well as hands-on improvement work. The impact is rapid and profound. It is obvious, despite wide currency, that “lean” is an inadequate synonym for TPS/VMPS as it usually only conveys the process engineering concepts rather than the capacity for organisational transformation (and worse, “lean” can carry baggage of compulsory staff reductions, acting like robots because of “standard work” – a huge mistaken belief - and all of the urban myths that swirl around because of the miss-application of lean thinking).

The very first impact of the Japan training is derived from visiting the Toyota Museum. Whilst it is a highly instructive way to learn about the history of TPS and the development of various key facets (from automatic safety and mistake-proofing to just-in-time, kanbans, flow, etc. etc.) it is also rich in very clear signals about what drives TPS, for example:
• Toyota started as a small family “cottage industry” in textile production. Their earliest innovations were aimed at reducing the impact on staff (family members!) of the back-breaking work on spinning and weaving. In extreme summary, TPS isn’t about automation and robotic standardisation, it is about concern for the staff.
• The post-war rebuilding of Japan meant that Toyota couldn’t just copy Henry Ford principles of mass production (there wasn’t the demand for the product volume) but by adapting the Ford ideas (and many other new concepts like “supermarkets”) TPS generated the means to produce higher quality products in relatively small numbers on a mixed production line. That principle scales up extremely well (Toyota production lines are still mixed) yet maintains the very closest connection with the requirements of the customer.

VMMC were driven by safety and quality. Like Toyota (and Boeing) they recognised their industry was not as safe as it needed to be and that they were not, as a hospital system, as focussed on their patients as they should be (like most healthcare, they tended to run systems that were doctor-centric or organisation-centric rather than patient centric – it was the patient who waited for things, not the doctors!). Their drive for improvement was the same as ours in NHS North East. Not primarily about money or volume, but about quality, safety and customer responsiveness.

The Japan component of the training included work with Sensei Nakao (a consultant with Shingijitsu, who deliver the Japan training) who was a direct colleague of Mr Taiichi Ohno, the “inventor” of TPS. His very direct approach includes constant reference to the core principles of TPS and helped both VMMC and NHS North East to see how TPS can apply to healthcare in a way lean thinking perhaps sometimes fails.

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<th>Health Care “Issue”</th>
<th>Taiichi Ohno teachings and reflections</th>
<th>Learning</th>
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<td>Treating patients isn’t a production line</td>
<td>“The principle objective of the TPS is to produce many models in small quantities”</td>
<td>A clinic, a theatre list, a patient procedure is all about doing a lot of different things in small numbers (mixed together but repetitively over time) as efficiently and safely and accurately as possible</td>
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<td>Health care is too complex for “production engineering”</td>
<td>“There is no magic method. Rather, a total management system is needed that develops human ability to its fullest capacity to best enhance creativity and fruitfulness, to utilise facilities and machines well, and to eliminate all waste”</td>
<td>There is a really good fit of TPS with the objectives of managing healthcare and helps overcome a really common misconception that change is work for “service improvement managers”, not for executives and Boards</td>
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Health care is so complex that only the professionals can work out how it should be done

“Why can one person at Toyota motor company operate only one machine, while at the Toyoda textile plant one young woman oversees 40 to 50 automatic looms?” “My job until 1943 was in textiles, not automobiles; this was an advantage….I was new, I could spot its merits and shortcomings in comparison”

Healthcare has been too insular and some of the stubborn problems of safety and “share & spread” should have been solved but haven’t (by professionals and managers) – outside eyes and non-healthcare methods do have something to offer

Lean isn’t for healthcare as it all about laying-off staff and acting like robots

“Management’s responsibility is to identify excess manpower and utilize it effectively...eliminating wasteful and meaningless jobs enhances the value of work for workers”

We have many experiences of the power of TPS to motivate staff, reduce sickness and facilitate clinical engagement. It is a system for leaders, not just for engineers and accountants

Lean is just “dressed up common sense” and healthcare is too difficult and too important to treat with such trivial tools

“the most important point...is the continuing need for practice and training. It is easy to understand theory with the mind; the problem is to remember it with the body. Having the spirit to endure the training is the first step to winning”

Training has been important for everyone – from the chief executive to the minimum-wage domestic, everyone has to “get it” for the real potential to be released

Where are we now on the journey?

Just over 30 senior clinical leaders, chief executives and other directors have been to Japan for the “see-feel” experience and training. The very intensive two week course includes each participant working on their own improvement project, visits as already described including to Toyota and Mitsubishi and an intensive training course based on carrying out an improvement event “on the shop floor” at a Hitachi plant. Both Boeing and VM have stressed the value of the Japan visits and the impact has a number of features:

- The learning drawn from the “Japan prep” – an intensive reading and training course designed to prepare participants for the experience
- The insights drawn from the Toyota museum discussed above
- The hands on training on a busy factory floor (taking healthcare professionals way, way out of their comfort zone and demonstrating in less than 48hrs that improvements can be achieved using the TPS methods)
- The realisation of how an improvement journey impacts organisations (Hitachi and Mitsubishi being at different stages of development)
- The incredible impact of seeing the Toyota production line – which is genuinely and jaw-droppingly impressive

Just over 220 staff have been through full workshop leader training including, alongside all the theoretical and practical training, a study tour to Seattle to see VMPS at work. We had seven participating “pathfinder” organisations across NHS North East (including the SHA headquarters) and
the cohort included a selection of their senior managers (including the chief executive) and a cross section of staff from most grades who were training to be VMPS certified workshop leaders. The impact of the visit was again high and includes the following key features:

- Seeing the impact of TPS in healthcare – being able to talk to the senior nurses and doctors and managers who had been through the training and were “two steps ahead” in delivering real change for their patients
- Sensing the transformation VMPS was bringing about in the culture of a complex tertiary healthcare provider – the engagement of staff, the strength of vision and strategy in all things, the central tenant of putting the patient firsts.
- Walking through the major projects where success had been dramatic – redesigned clinics, whole service system transformations, ward work transformed for nursing staff etc. etc..
- Seeing in action a transformed leadership team creating ambition and an atmosphere of pride in the work of continuous improvement
- Learning about the support processes for success (the KPO, visual control, business planning, Board involvement etc.)

The SHA worked on adopting its “method” by applying VMPS at every level. The basics of 5S incorporated into training for all staff; Rapid Process improvement Workshops (RPIWs) were used to improve significant processes; the business planning of the authority was developed using TPS “world class management” principles; a move of headquarters building allowed a whole system approach to be used from involving staff in the design - through the basic ways of working in open-plan to the “visibility walls” for business control and the performance management of continuous improvement.

All seven organisations have made progress. Two stand out for the extent of their success so far in embedding VMPS into their work:

**Gateshead Healthcare NHS Foundation Trust** is a medium district hospital providing a wide spectrum of local services and a regional referral centre for gynaecological cancer. They have seen widespread improvements in their efficiency and safety metrics and had successful redesign work completed in every setting from sterile supplies to out-patient clinics. They are incorporating all of their learning in a complete redesign of the “front-end” of the hospital, the emergency room, medical assessment service and acute wards.

Outcomes for them are constantly improving and they were recently declared “Medium sized Hospital of the Year” in England. They have been:

- awarded a double ‘Excellent’ by the Care Quality Commission in the latest Annual Health Check process
- acknowledged as one of the top 25 trusts in the country for reporting and submitting patient safety data by the National Patient Safety First Campaign
- awarded full marks in an assessment by the NHS Litigation Authority – one of only 10 Trusts in the country to achieve this. The Trust achieved full compliance across all 50 areas examined at level 3 -which is the highest level of assessment possible.
Tees, Esk and Wear Valleys NHS Foundation Trust\textsuperscript{16} is a large specialist mental health, learning disability and substance misuse services organisation. They have nearly 6 thousand staff providing community and in-patient based services to over 1.6m people.

At the time the NETs programme was starting they appointed a new chief executive whose first task was to take the organisation into Foundation Trust status. One of his first encounters with clinical leaders was for them to express their interest and enthusiasm for VMPS. He subsequently went on one of the Japan training trips and quickly decided this “method” was indeed the way to embed quality improvement systems in the organisation.

TEWV have been one of the most committed exponents of VMPS. Their adaptation of the systems and processes of VMPS (VM do not provide mental health services) have gained immediate support across the Trust and attracted great interest in the wider mental health and learning disability world. For such a large mental health services trust their performance is excellent, characterised by comparatively few patient complaints, good staff morale and expanding services. They have:

- Achieved all national targets
- Reduced waiting times
- Reduced length of stay on Acute Assessment and Treatment Wards
- Virtually eliminated mixed sex accommodation (97% of inpatient beds are single rooms with 73% en suite)
- Reduced incidence of violence and aggression (34% in 2 years)
- Achieved very positive results from the CQC Annual User Surveys (Adult Inpatient and Community Services)
- Achieved very positive results from the CQC review on systems for Safeguarding Children
- Achieved national recognition for their Veterans Programme

Martin Barkley, CEO of TEWV, reports that in addition to all the direct patient, staff and safety benefits, they have already made “...significant savings amounting to several million pounds as a result of redesign in adult services and older peoples services leading to a reduction of 120 beds, a reduction of 17.5\% of bed base”

Why have they been particularly successful? The learning has exact parallels with other reviews of how TPS really works\textsuperscript{8,11}:

- Total commitment by the leadership team, including having a chief executive who learns the methods and leads improvement workshops themselves (as well as exhorting their staff to lead improvement)
- Emersion in learning TPS from first principles and in a very pure form (VMPS uses, for example, documentation that a production line manager in Toyota would instantly recognise) but incorporating openness to relevant adaptation relevant to healthcare
- Commitment to widespread training and involvement in all staff
- The use of improvement techniques in a balanced strategic framework that includes attention to vision and business strategy and attention to the “staff compact” that aligns all
staff with the right culture and behaviours to succeed at continuous improvement and deliver the organisations strategies.

There are organisations in NHS North East, outside the seven “pathfinders” group, who haven’t chosen to adopt VMPS yet. Their reticence hasn’t been solely because of a perceived lack of evidence or necessarily because they have an alternative solution to the continuous improvement challenge (in theory the NETS framework could be delivered with any “method” as long as it worked in conjunction with vision and compact) but tends to be the opposite of the successful features of the pathfinders:

- No clear commitment by the leading managers and Board to any particular improvement method (even where there is great commitment to improve and be “the best”, i.e. they tend to use multiple methods)
- No “spirit” (as Taiichi Ohno would put it) for the specific training required to progress with TPS/VMPS – seen perhaps as too expensive, too time consuming for key staff, and even “not for me” when it is realised the bosses have to train too
- No single organisational strategy or corporate urgency in which to position improvement, no attention to the compact, silo working and anyway “too much to do”: too many targets, too much demand, too many pressures (compares closely to Radnor’s analysis

The term “Lean” appeared itself to be an impediment, as if pre-conceived ideas were more powerful than the evidence.

That is not to say that the NETS programme and adoption/adaptation of VMPS isn’t spreading. The North East Ambulance Service has joined the pathfinder group, as have more Primary Care Trusts, the Cancer and Cardiovascular Networks and some general practices. (Most of the emphasis on improvement so far has been in hospital and specialist services. NHS County Durham has experimented with VMPS in Primary care (with very promising results) and a clear strategic goal now is to spread the learning more widely amongst General Practitioners. The SHA has given an innovation grant to 5 practices to work on bottom-up implementation in primary care.)

There are three messages that we have found work well in communicating purpose:

- This is about quality & safety improvement and waste reduction, not cost reduction
- It is a method that supports thinking to solve problems, not applying tools for tools’ sake
- It is about management and staff working together, not about sacking people

This learning is ultimately why we don’t talk about lean! Lean is all too readily thought of as an improvement “toolbox”, cutting costs and laying off workers. This is probably a factor in why it doesn’t always get traction with some organisations and many staff.

Our conclusion thus far is that the NHS in the north east of England has had a very important experiment with adopting a strategy for continuous improvement based on TPS, following a well-trodden path. Through the award of a NIHR SDO grant, NETS is being formally evaluated by a partnership of Durham University and Newcastle University Business School. Results from that process will emerge soon.
What next?

With the radical and far reaching changes introduced to the NHS in England by the Health Service Reform Bill the regional structure on which NETS was based disappears. The case for raising the quality, safety and efficiency with which health services are delivered – combined with a growing requirement to be transparent about outcomes remains and is a global need. There was never a better time to catalyse change in favour of a system (such as NETS) which is capable of delivering more for less at higher quality.

NETS set absolute standards but engaged in pragmatic reforms in pursuit of those standards. NETS had a soundly established evidence base to support its strategy. It has a strong cohort of well-trained leaders working on the system in the North East. It has an exemplar hospital in Virginia Mason as its assurance that the system produces practical results.
The NETS programme needs to be taken on by the new institutions created by the forthcoming act, possibly by the Commissioning Board. There is a very good case for the creation of a new institution to drive the transformation through on a hospital by hospital basis. The changes required at a hospital level are complex and establishing far reaching reforms in one hospital institution could spin out into the rest of the system.

At present there is no answer to the question as to where this process should go but we have confidence that the issue remains and will return in one form or another because the need for this kind of engagement is apparent throughout the healthcare system. Certainly Gateshead Healthcare NHS Foundation Trust, Tees Esk and Wear Valleys NHS Foundation Trust and the other NETS pathfinder organisations will not be turning back. They will be using the NETS framework and learning from and adapting VMPS in the long term.

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