

# Milton Keynes University Hospital:

## Versius® Robotic Assisted Surgery Case Study

February 2022 | CMR Surgical



# Foreword

"Growing demand for NHS services coupled with a large waiting list worsened by the COVID-19 pandemic have further highlighted the need for us to find ways to deliver care differently. Unique challenges require unique solutions, and I am so proud of our work to date with CMR Surgical.

At Milton Keynes University Hospital, we have always been keen to explore technological innovations and to be one of the first to put them to good use. It is rare that one of these innovations can help us to both improve patient outcomes and staff wellbeing with very little change to our infrastructure but this is exactly what the Versius system has enabled us to do.

I am pleased to say that our positive culture of improvement and willingness to embrace change meant we were one of the first hospitals in Europe to start using Versius at the start 2020. The timing was fortuitous, given what lay ahead with the pandemic, and the ability to offer more minimal access surgery (MAS) certainly stood us in good stead.

The figures you will read in this document speak for themselves and while these are great news for us, just as important as that are the people behind the numbers.

When I hear the stories of patients having complex and life-changing surgery who, thanks to Versius and our skilled clinical teams, are back home with their families within a couple of days I am struck by the very real impact that MAS has on the lives of those we treat.

For our surgeons too, this technology is transformative. Not only are we giving them access to the best tech that science can offer, we're also helping to prolong their careers by introducing a solution which reduces the physical strain on their bodies. If improving the health and wellbeing of our staff wasn't enough, the return on investment we see by retaining the best staff for longer was reason enough to work with CMR.

We knew that for robotic assisted surgery to be commercially viable and to reach patients as quickly as possible, the utilisation of the system needed to be high. This is what Versius has offered us. A flexible system and an engaged, expert implementation team committed to working with us to get the most out of the technology.

We hope our story gives some insight into how Versius is helping us to improve patient outcomes, save bed days and upskill our teams. This is a start of an exciting journey for us and we look forward to sharing more in the future."



Professor Joe Harrison,  
Chief Executive, Milton Keynes University Hospital,  
NHS Foundation Trust

# Introduction

A case study reporting on the success of the Versius RAS (Robotic Assisted Surgery) programme at Milton Keynes University Hospital (MKUH) following the first 242 surgical procedures, summarising the progress of the programme to date, including the implementation and subsequent expansion of the programme. It includes detailed commentary from all departments and teams that have touchpoints with the programme, data reported by MKUH, data from CMR Surgical's clinical registry as well as Versius system telemetry. The case study examines the following topics:

- The background and business case for introducing Versius to MKUH.
- Early observations regarding impact Versius is making at the Patient, Surgeon, Department, Organisation & Population level, with particular focus on the clinical, operational and health economic gains.
- The interdependence across MKUH and the partnership with CMR Surgical (CMR) that has helped to make the programme a success.
- What has changed and/or improved at MKUH following the introduction of Versius and how has the programme scaled to date.



# Background

Minimal access surgery (MAS) is widely accepted as the preferred approach for soft tissue abdominal surgery, where clinically appropriate.<sup>(1)</sup> It is also often recognised in national guidelines as preferable for both the patient and the healthcare system.

Despite the widely acknowledged benefits, less than 50% of patients in Europe and the U.S get access to it, with significant socio-economic, geographic and demographic disparities in access.<sup>(2,3)</sup> These trends are reflected in the UK, where just 47.2% of hysterectomies are performed via MAS,<sup>(4)</sup> and in England & Wales MAS uptake varies significantly by region, from 38% to 76%, as reported in the recent national colorectal cancer audit.<sup>(5)</sup>

One of the barriers to the uptake of MAS is thought to be related to the limitations of manual laparoscopic equipment, and the resulting difficulties in both training and performing MAS. RAS is believed to eliminate many of the physical limitations of manual laparoscopic equipment and is therefore often seen as an enabling technology to provide the benefits of MAS to more patients. MKUH is tackling this issue head-on for the patients it serves. In 2019, the hospital developed a business case with a vision to become one of the lead centres in the region for the most advanced form of MAS and chose to work with CMR Surgical as a commercial partner to help deliver on this vision.

## Problem statement

Around 2,000 patients undergo soft tissue surgery in the abdomen and thorax at MKUH every year that could be suitable for a MAS procedure.<sup>(6)</sup> In 2019, around 60% of gynaecology patients, and 20% of colorectal patients received open surgery, despite the well established benefits of MAS.

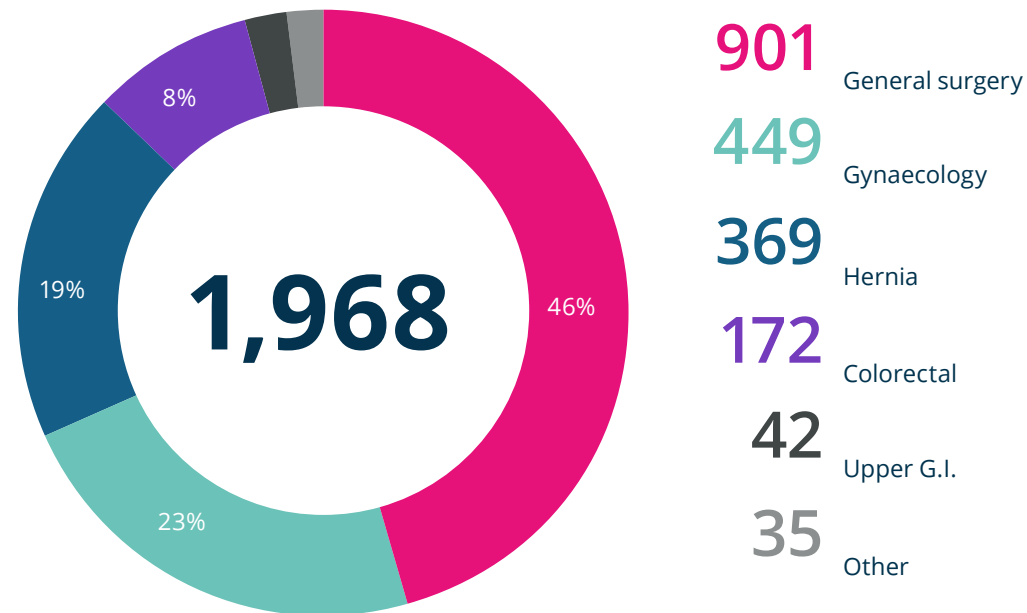


Figure 1. MKUH soft tissue surgery procedure volumes 2019, <sup>(6)</sup>



# Business case

## Key targets & improving patient experience

In 2019, an article by The BMJ highlighted that many NHS hospitals in England are routinely putting patients in beds that should be reserved for emergencies or busy periods. Data obtained by the British Medical Association (BMA) from hospital trusts through freedom of information requests show that many are regularly using so-called “escalation beds” for routine care in a response to ever growing patient demand.<sup>(7)</sup> Escalation beds are used in addition to permanent bed stock and are brought in by hospitals to provide capacity for limited periods in temporary or repurposed wards or as additions to existing wards. The vast majority of NHS hospitals commonly deploy them in winter.

Even well beyond the pressures of the winter, hospitals in England are having to deploy escalation measures to cope with levels of demand. Around 90% of NHS trusts were still using escalation beds - on 1 May 2019, with little sign of this practice ending,<sup>(8)</sup> the escalation bed occupancy required during the COVID-19 pandemic has seen the waiting list more than double to 4.7 million people.<sup>(9)</sup>

In England, prior to the COVID-19 pandemic, around 1% of the 8 million yearly elective operations were cancelled at the last minute for non-clinical reasons, including lack of ward or critical care bed availability. One in 10 of these cancellations also breach a commitment in the NHS constitution to offer a new operating date within 28

days of a cancellation.<sup>(7)</sup> Prior to the pandemic, around 8,000 patients per year were having their operations cancelled with no new operating date agreed within 28 days.<sup>(10)</sup>

At MKUH, prior to the COVID-19 pandemic, around 160 patients had their elective operations cancelled for non-clinical reasons per year, including a lack of availability of ward or critical care beds, and 10% of those cancellations were not offered a new operating date within 28 days.<sup>(8)</sup>

MKUH determined that there was scope for converting many surgical procedures to MAS techniques with the benefits of reduced length of stay and improved outcomes and experience for patients. They identified a potential total length-of-stay saving of 175 bed days per year, by adopting Versius and partnering with CMR on the delivery of a multi-speciality Versius RAS programme.

## Patient care

The expected impact on patient care was that for the first time patients would have access, when appropriate, to RAS, and that it could facilitate a minimal access approach for patients who would not have otherwise had access to it.

The patient benefits of MAS are well acknowledged in medical literature and include reductions in post-operative pain, complications, scarring, and opioid use as well as a shorter length of inpatient stay and faster return to normal activities.<sup>(11,12)</sup>

For some procedures, a minimal access approach can help preserve normal bodily functions (e.g. bladder, bowel and sexual) which can lead to improved quality of life and treatment satisfaction scores for patients after surgery.<sup>(13)</sup>

## Workforce recruitment

A recent survey reported that around 20% of surgeons in the UK and the U.S, and 15% of surgeons in Germany think they may need to retire early due to the physical impact of conducting laparoscopic surgery.<sup>(14)</sup> Versius RAS offers improved surgeon ergonomics compared to manual laparoscopic surgery and has the potential to extend surgical careers and reduce workplace injury.

The retirement age of surgeons has already been extended and is likely to be extended further. It is believed that robotic technology can play a role in avoiding premature retirement, and address the recruitment shortfall in surgery.<sup>(14)</sup> A Versius RAS programme is also expected to have a positive impact on recruitment and retention of staff.

## Making best use of the estate

The size and modular design of Versius allows the system to be easily moved and integrated into existing workflows. Unlike first generation platforms, it can be used in any theatre appropriate for manual laparoscopic work. This allows the Trust to introduce robotic services across multiple specialties without requiring structural modifications to the estate.



# Stakeholders

## Versius programme team

Operational Management	<a href="#">Katy Philpot</a> Associate Director of Operations, Women and Children's CSU	Anaesthetics	<a href="#">Jamie Strachan</a> Consultant in Anaesthesia & Intensive Care Medicine	Senior Reporting Officer	<a href="#">John Blakesley</a> Deputy Chief Executive
Surgeons	<a href="#">Barrie Keeler</a> Consultant Colorectal Surgeon & Robotic Lead <a href="#">Anjana Singh</a> Consultant Colorectal Surgeon <a href="#">Richard O'Hara</a> Consultant Colorectal Surgeon <a href="#">Adnan Qureshi</a> Consultant Colorectal Surgeon <a href="#">Nidhi Shandil Singh</a> Consultant in Obstetrics & Gynaecology <a href="#">Kailash Nakade</a> Consultant in Obstetrics & Gynaecology <a href="#">Achal Khanna</a> Consultant General Surgeon <a href="#">Parveen Vitish-Sharma</a> Consultant General Surgeon	Nursing Staff	<a href="#">Alicia Tabada</a> Lead Robotic Nurse Colorectal & General Surgery <a href="#">Sam Bhebhhe</a> Lead Robotic Nurse Gynaecology <a href="#">Kate Narcise</a> Senior Robotic Nurse Gynaecology <a href="#">Rosemund Alifoe</a> Robotic Scrub Nurse Gynaecology	Project Manager	<a href="#">Jennifer Kearney</a> Associate Director of Operations
		CSSD	<a href="#">Marea Lawford</a> Head of Decontamination Services <a href="#">Sylvia Martuccio</a> HSDU Team Leader	Clinical Governance	<a href="#">Ian Reckless</a> Medical Director / Deputy Chief Executive
		Implementation	<a href="#">Robin Thomas</a> CMR Surgical - Implementation Team		

# Implementation

## Service delivery

The growth of the robotic surgical programme is illustrated here. The programme was initiated with one colorectal operating team (2 surgeons) and included a hiatus of three months (months 5–7) due to the impact of the COVID-19 pandemic. The gynaecology programme started at month 8, and was followed by general surgery three months later. General surgery was temporarily suspended (months 14–16), again due to COVID-19. Lastly, at month 18 a second colorectal team began operating, giving a total of eight surgeons.

Average setup times have improved progressively as the surgical teams have moved through the learning curve.

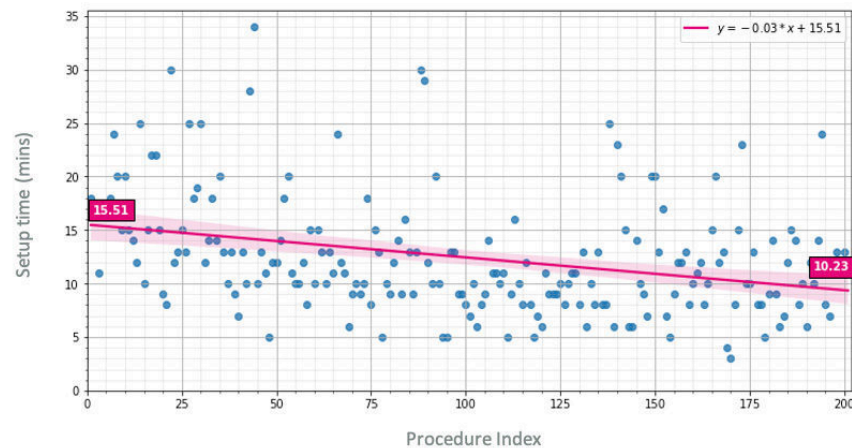


Figure 2. Average MKUH Versus procedure setup times.

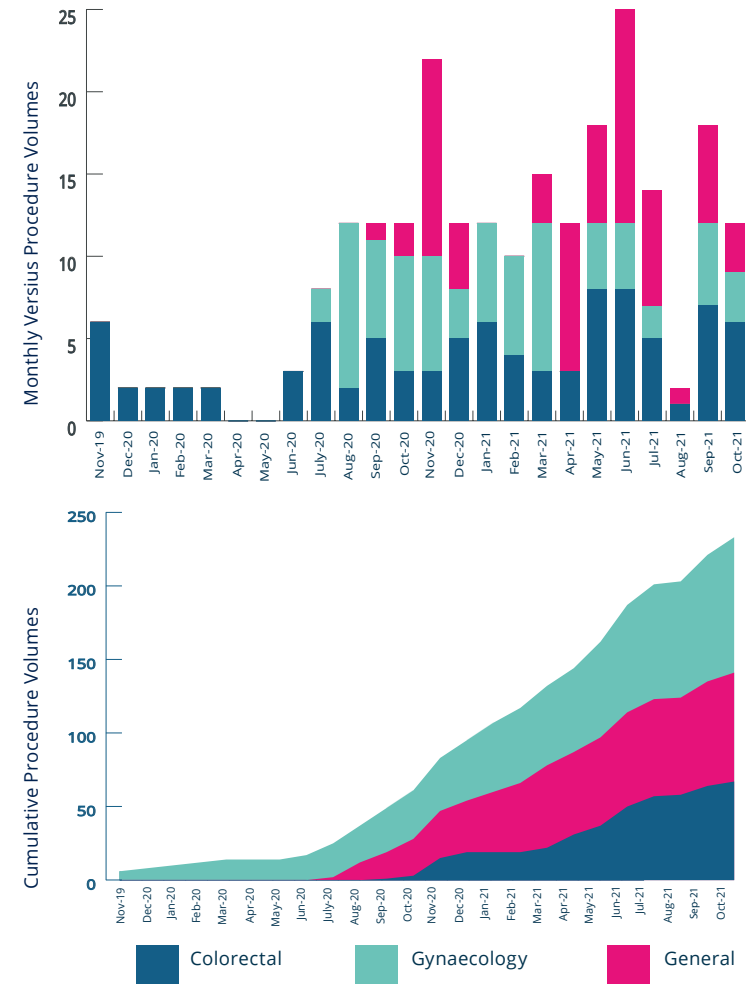


Figure 3. MKUH Versus procedure volumes over time, shown monthly and cumulative.



Illustrated below, MKUH has been able to rapidly develop a multi-speciality robotic programme for abdominal surgery, across a range of benign, complex benign and cancer procedures, and Versius has enabled a greater proportion of these procedures to be completed via a MAS approach. Versius usage data indicates that MKUH has been utilising Versius well during core theatre hours, scheduling two to three cases per day where possible.

Speciality	Versius procedure	Procedures in registry
Colorectal	Anterior resection	27
	Right Hemicolectomy	24
	Abdominoperineal Resection	12
	Left Hemicolectomy	5
	Rectosigmoidectomy	4
	Panproctocolectomy	2
	Sigmoid Colectomy	2
	Closure of colostomy	1
	Loop colostomy	1
	Subtotal Colectomy	1
General	Inguinal Hernia	28
	Cholecystectomy	15
	Incisional hernia repair	4
	Repair of other hernia of abdominal wall	3
	Umbilical hernia repair	3
	Other	2
	Appendicectomy	1
	Connection of ileum	1
Gynaecology	Ileostomy	1
	Total Laparoscopic Hysterectomy	30
	Abdominal hysterocolpectomy	16
	Radical Hysterectomy	8
	Bilateral Salpingo-oophorectomy	6
	Diagnostic endoscopic examination of ovary	3
	Unilateral Salpingo-oophorectomy	2
	Oophorectomy	1

Figure 4. MKUH Versius procedures captured in the CMR surgical registry.

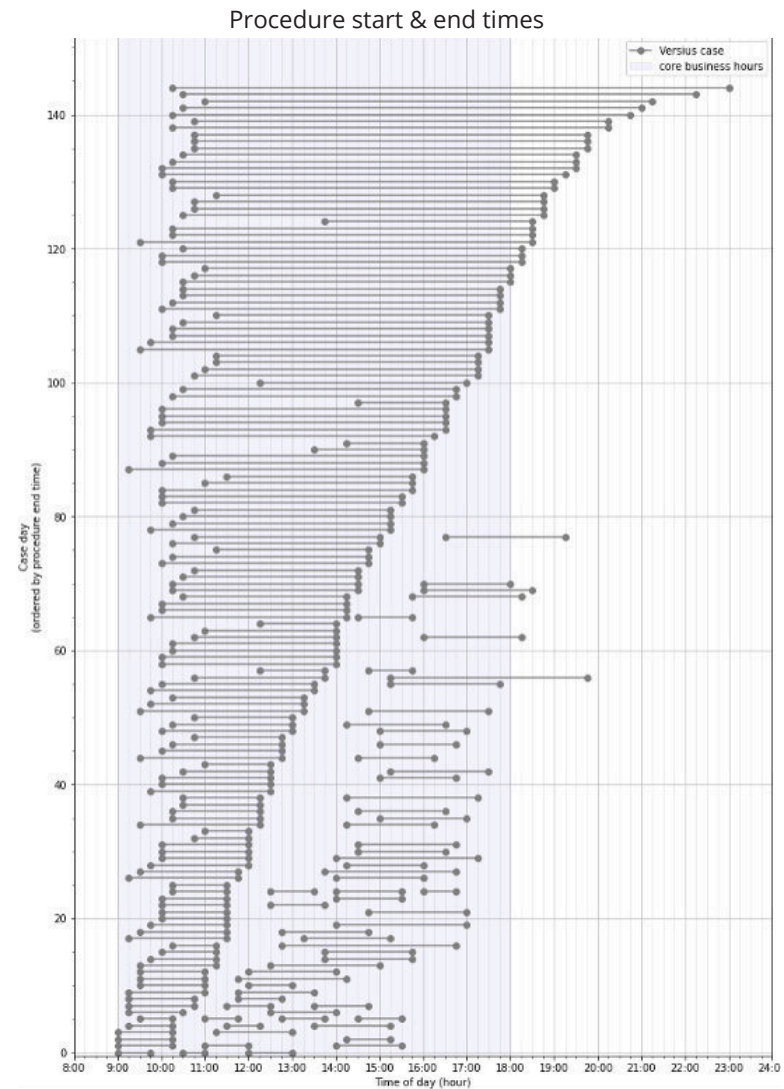


Figure 5. MKUH Versius procedure volumes over time, shown monthly and cumulative.

# Key achievements



242

Cumulative patients treated



34

MKUH staff trained to use Versius



3

Examples of leading the way



100

Colorectal



8

Surgeons

1<sup>st</sup>

First Versius GYN programme in Europe



79

Gynaecology



6

Circulatory



Highest volume Versius site in the UK



63

General



7

Registrars



World's first Abdominal Wall Reconstruction using Versius



13

Scrub team

# Nidhi Singh

## Consultant in Obstetrics & Gynaecology

“The implementation of the Versius Programme has been smooth, well organised and with a high level of support from our partner, CMR. In addition to CMR’s approach, I believe that the design principles of Versius have also been central to our progress with implementation. The staff and I find the robot very easy to use, easy to interact with, and easy to troubleshoot. Once trained and up the learning curve, we have become relatively autonomous in using the system.

This is shown in our procedure duration, and set-up / tear-down times, which are improving month on month. When it comes to medical devices, I believe passionately about the benefits of simplicity – and I think our rate of adoption reflects the simplicity and usability of Versius, which has and will enable us to offer more MAS to our patients.

We started our programme with low complexity procedures, one procedure per list, following a carefully governed introduction. We are now consistently performing two major procedures per list, and plan to move up to three low complexity procedures per list in the next few months. We are motivated to do this because we have been able to convert large open incision procedures to minimal access procedures using Versius.

Consequently, my patients are experiencing faster recovery, and a lower length of stay than they would have with an open incision. This reduced length of stay has a material impact on bed availability – an issue that most NHS hospitals are currently facing.

Examining why we are able to do more MAS with Versius is a complex but important topic. Fundamentally, Versius is helping me to deliver some

of the best outcomes I have seen in my patients. I believe it achieves this, in part, by providing a highly ergonomic method of working, because the console is fully customisable for my needs. Undertaking a day of surgery is effortless compared to manual techniques and I feel I am able to work more comfortably, for longer, and I feel less physical and cognitive stress.

I have known quite a few surgeon colleagues needing to take time off work with wrist and shoulder issues resulting from manual surgical techniques, and I believe Versius will help me to avoid these types of work-related injuries and extend my working career over time. In addition to ergonomics, the open console design affords excellent communication with all members of the surgical team and good situational awareness.

**The introduction of Versius at MKUH has helped me to offer more of my patients a minimally invasive procedure, bringing with it shortened recovery, hospital stay and a faster return to normal life.**



Finally, and perhaps most importantly, when compared to manual surgery, I find it easier to perform complex surgery via a minimal access route using Versius because of the articulating instruments, tremor filtration, and the enhanced, immersive 3D visualisation.

Couple these with a device that allows me to approach the operation as I would do laparoscopically – you can place the ports where you want, the ports are standard laparoscopic ports and the profile of the instruments are similar to our laparoscopic instruments – the introduction of Versius at MKUH has helped me to offer more of my patients a minimally invasive procedure, bringing with it shortened recovery, hospital stay and a faster return to normal life."

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”



# Barrie Keeler - Colorectal

## Consultant Colorectal Surgeon

"Implementing the Versius RAS programme has been a rewarding experience for myself and the rest of the clinical team at MKUH. We are extremely grateful to our colleagues in HSDU, operational management, the hospital leadership team, all of whom have been patient and supportive in working through the inevitable learning curve and process adjustments during implementation.

On reflection, we didn't need to change much to accommodate Versius – it allows us to approach our operations with a laparoscopic mindset, with no specific requirement to change any of our ancillary equipment and no changes to our estate. The architecture of Versius, with its small, modular design meant there were very few barriers to the uptake of RAS here at MKUH. That being said, during the implementation of Versius, we did take the opportunity to change our morning briefing, as well as to take a more consistent approach to planning each procedure.

Everyone knows how far along we are and what is required from them at each stage of the procedure. Naturally, we were keen to implement our first robotic programme safely and effectively, so working with our Clinical and Implementation Governance team, we agreed a 'dual-consultant operating' approach during our initial learning curve, which we worked hard with our operational management teams to protect from confounding schedules.

Using Versius has quickly become routine for us, and whilst we haven't explicitly examined the learning curve yet, it's been quite easy for the surgeons and the nursing teams to adopt it. Having spent time training in theatres with other surgical robots, I can say that Versius addresses a number of issues presented by the other systems. The dimensions of Versius (particularly its low operating height), and the open surgeon console facilitate good communication; its weight and architecture means the theatre team don't mind moving it around; and I think its architecture and usability promotes superior teamworking to other

operating modalities. We are now conducting many of our colorectal procedures via a MAS approach, and we are also able to offer more patients with complex treatment requirements the care they need closer to where they live.

These benefits are being realised as a direct consequence of MKUH's investment in Versius. Some of these cases are taking longer than they would have if they were completed open, but this additional time in theatre can be offset by a lower length of hospital stay and an enhanced recovery after leaving hospital. Given the complexity of care requirements for colorectal patients, in concert with our implementation of Versius, we are working to enhance and optimise our care pathways around surgery, which we expect, over time, will show an improved length of stay as a result of the sum of marginal gains in many areas.

**We didn't need to change much to accommodate Versius – it allows us to approach our operations with a laparoscopic mindset.**



There are a number of reasons why I expect the Versius programme to grow and develop further here at MKUH. Around 7% of cases are now performed open, prior to Versius, this would have been somewhere between 15-20%. While we are already way ahead of the National Bowel Cancer Audit (NBOCA) recommendation that 50% of patients are offered MAS, we want to offer a MAS approach to all patients where it is clinically appropriate to do so, in line with the benefits seen in published literature. Anecdotally we are seeing less pain post-operatively reported by our patients where Versius has been the mode of operation and this is something we want to examine more carefully in future research.

Versius has been uplifting for our theatre staff and has improved morale. I would go as far as to say it has been invigorating and a big motivator for the team around the programme. Our patients are proud and amazed that this technology is being offered locally. It has raised the hospital profile extensively and we have attracted a lot of new high calibre consultants, filling posts quickly with great people. We are communicating and sharing best practice across specialities far more than we did previously, supporting one another in procedures far more than before. Finally, it has opened the door for us to conduct more research in surgery than we would have done previously, and have been able to bring on a research fellow to begin trials. Versius has been the catalyst for all of this and is helping to make MKUH theatres a great place to work, and we feel proud to be part of the service."

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”

# Jamie Strachan

## Consultant Anaesthetist

“Integrating and implementing new, complex technologies into the operating theatre is always exciting, particularly when the technology has the potential to standardise practice and improve outcomes. In my experience, good change management principles facilitate adoption and uptake. I think this is something we have gotten right at MKUH during the implementation of our Versius RAS programme and I believe this has been achieved through strong, supportive governance, good cross-speciality dialogue, operational flexibility and a can-do attitude.

In preparing for the acquisition of Versius, I was tasked to develop the anaesthetics plan for the introduction. A key consideration was that the anaesthetists at MKUH work across all surgical disciplines, which helps with on-call requirements. After being trained by the CMR team and completing the first few cases successfully, I co-ordinated observations for others working in the department to build understanding and competencies relating to access, monitoring and patient positioning

when Versius was being used. All of my colleagues were quickly able to work alongside Versius, and I think a big part of the speed of adoption relates to the design principles of the system – which aims to help lower the barriers to adoption of RAS.

It needed to be simple to implement, and it has been. As part of the planning, I got into conversation with anaesthetists at other hospitals on their experience of RAS. One common thread was the challenges presented by previous generation RAS systems with overhead boom-mounted robotic arms – these challenges including difficulties in visualising and accessing the patient, and challenges in visualising and communicating with the rest of the surgical team. I got the feeling that the workflow needed to be built around the robot, when really, our workflow should be built around the patient.

I was pleased to see that CMR has addressed these challenges with Versius. While all RAS systems appear to add real-estate at the bedside, the flexibility in

positioning Versius’ bedside units, as well as its capabilities in terms of reach, allow you to create the space required. With a bit of planning, we have developed set-ups that work well for each surgical team. Given that Versius has small bedside units, visualisation and communication with the team is as good as it is with manual approaches, and we value this highly.

If I was advising a colleague on starting a new RAS programme, I would say: try not to alter much about what you do, because you don’t need to, and look for a RAS solution that enables this.”

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# Jennifer Kearney

## Associate Director of Operations

"I cannot emphasise enough how fantastic the CMR implementation team have been in supporting us getting our robotic programme off the ground. Having implemented many new projects previously at the hospital, I have never known a complex implementation be managed so well – I think this speaks to the partnership we have with CMR, as well as the commitment, approach, and capability of the CMR team, particularly in handling complex operational challenges quickly and without fuss – challenges that were inevitable when introducing RAS for the first time.

We established a robotic steering group prior to the implementation of Versius, including representation from our clinical, operational and Central Sterile Services Department (CSSD) teams as well as the CMR implementation team. This action-oriented group has been central to managing and planning the introduction and implementation of Versius and we meet regularly to assess the progress of the programme, tackling challenges head-on with quick decision making. The group has also been diligent in

planning for future surgical teams to be trained. Another benefit reported back to me came following a recent visit to our theatres by a team of Human Factors academics from Cranfield University. They described that when compared to our other theatres, they had observed a more efficient, cohesive team performance in the robotic theatre, when compared to our other theatres. I think this is related to the standardisation of practice we see by the robotic teams, that stems from them being trained together on how to work with Versius.

The benefits of standardisation are clear when you consider the implications of standardisation initiatives such as the WHO surgical safety checklist. With this in mind, I think we should support the introduction of new technologies that enable standardisation, and I see opportunities for MKUH to offer more standardised surgical practice with Versius as the programme scales up.

We see a growing need to expand the use of Versius at MKUH, to scale some of the benefits we have already observed by developing the robotic programme. A key challenge ahead for the partnership will be the need to train our staff at scale as the programme expands to help meet service demand."

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”



# Robin Thomas

## CMR implementation team

“It’s been a great privilege to work alongside a multi-disciplinary MKUH team to assist them in implementing their Versius programme. One of the key factors driving the success of the programme is the supportive environment that exists across specialities, most notably amongst the surgeons. This also extends to the theatre management team and co-ordinators – who have created a supportive environment and have flexed to accommodate dual consultant operating during the initial, stepwise implementation of Versius.

Having worked as a scrub nurse prior to joining CMR, I have an acute appreciation for the needs of the surgical team: we work together, we know when to challenge one another, when to offer support and guidance, and when not to. We collaborate and work in partnership, in the spirit of the commercial agreement CMR has with MKUH.”



# Outcomes

## Results

MKUH patient outcomes for their first 160 procedures have recently been published as a case series in the International Journal of Surgery (96 (2021) 106182), including 68 colorectal, 60 gynaecology, and 32 general surgery procedures.<sup>(15)</sup>

All patients undergoing Versius surgery were consented for collection of data on demographics, pre-, intra-, and postoperative outcomes.

Data collection was performed prospectively from the start of the robotic surgical programme. Here is a summary of the results, as reported in the case series:

**Table 1**  
Patient Characteristics<sup>(15)</sup>

Characteristics	Colorectal (n=68)	Gynaecology (N=60)	General Surgery (N=32)
Gender, male/female	45/23	0/60	23/9
Age (years), mean ± SD	62.3 ± 14.3	51.1 ± 12.5	55.3 ± 13.3
ASA, n (%)			
1	4	11	8
2	55	46	22
3	9	3	2
Charlston Comorbidity Index, median (range)	2.5 (0-9)	1 (0-6)	1 (0-5)
Body Mass Index (kg/m <sup>2</sup> ), mean ± SD	28.3 ± 5.0	29.8 ± 5.7	28.5 ± 3.0
Indication for surgery, malignant/benign	54/14	23/37	0/32

**Table 2**  
Perioperative and postoperative outcomes<sup>(15)</sup>

Outcome	Colorectal (n=68)	Gynaecology (N=60)	General Surgery (N=32)
<b>Perioperative</b>			
Console Time (mins)	159 (21-320)	115 (24-321)	55 (8-152)
Median (range)			
Bed side unit set up time (mins), Median (range)	11 (5-39)	12 (7-34)	11 (5-25)
Conversion to open, n (%)	3 (4.4%)	0	0
Pain score (out of 10), Median (range)			
- Day 1 post-op	4 (0-10)	-	-
- Day 2 post-op	5 (0-10)	-	-
- Day 3 post-op	4 (0-10)	-	-
Length of stay (days), Median (range)	6 (3-34)	-	-
<b>Postoperative</b>			
Major complication within 30 days, n (%)	5 (7.4%)	0	0
Readmission within 30 days, n (%)	6 (8.8%)	3 (5%)	0
Reoperation within 30 days, n (%)	4 (5.9%)	0	0

**Table 3**  
Major Colorectal Complications by Clavien-Dindo grade<sup>(15)</sup>

Grade	Description
Grade IIIa	Intra-abdominal collection requiring radiological drain (n = 1)
Grade IIIb	Anastomotic leak requiring return to theatre & formation of end colostomy (n = 1)
	Extraction site hernia requiring open surgical repair (n = 1)
	Haematoma requiring washout in theatre (n = 1)
	Perineal wound infection requiring examination under anaesthesia & vacuum dressing (n = 1)



## Colorectal

The sixty-eight colorectal cases were mainly performed for malignant indications (79%) and included twenty-two right-sided resections (right/extended hemicolectomies and ileocolic resection), twenty-five anterior resections, ten abdominoperineal excisions of rectum, three left hemicolectomies, one sigmoid colectomy and one pan-proctocolectomy. In addition, there were two completion proctectomy for inflammatory bowel disease (one with ileo-anal pouch formation), three stoma reversals (two Hartmann's colostomy reversal and one intracorporeal ileocolic re-anastomosis) and one colostomy formation.

The patient demographics are illustrated in Table 1. Thirty-two percent of patients had a BMI exceeding 30 kg/m<sup>2</sup>, classed as obese. Nineteen patients had previously undergone abdominal surgery (28%).

Console and bedside unit docking times are illustrated in Table 2, along with Day 1–3 pain scores. For malignant cases the median lymph node yield was 16, and there were no positive resection margins.

Three operations were converted to open surgery; two due to dense adhesions and one due to the presence of a T4 perforated tumour. Length of stay was a median of 6 days, with a range from 3 to 34 days. The longest stay was due to lack of available services to

manage a vacuum dressing in the community, and the patient was medically fit for discharge for some time, remaining an inpatient purely for wound management. Five patients whose operation was completed via minimally invasive surgery experienced a major complication (7.4%). Details of individual complications can be seen in Table 3.

Four patients underwent reoperation within 30 days of their initial operation, all within the primary admission. In total there were six readmissions (8.8%) within 30 days. Three patients were readmitted with intra-abdominal collections, one with a wound infection, and two with postoperative vomiting.<sup>(15)</sup>

## General surgery

The thirty-two general surgery operations comprised of eighteen inguinal hernia repairs (one bilateral), six cholecystectomies, and eight other hernia repairs (including ventral, incisional and parastomal).

Demographics are presented in Table 1. The majority of these cases were day cases, with median length of stay 0 days (range 0–3). One patient remained an inpatient for 3 days due to urinary retention and pain. There were no major complications, and no readmissions or reoperations within 30 days.<sup>(15)</sup>

## Gynaecology

The patient demographics are illustrated in Table 1. Similar to the colorectal group, the mean BMI was overweight ( $29.8 \pm 5.7$ ), but in this cohort the proportion of obese patients (BMI >30) was even higher at 52%. Forty-three percent of patients had a history of previous abdominal surgery.

The most common gynaecological operation was total robotic hysterectomy and bilateral salpingo-oophorectomy, with forty-eight of these being performed. There were also six bilateral salpingo-oophorectomies, four ovarian cystectomies, and two unilateral salpingo-oophorectomies (one involving extensive adhesiolysis).

There were no conversions from robotic surgery, no reoperations and no major complications. Length of stay ranged from 0 to 4 days (median 1 day). Three patients were readmitted within 30 days (for small bowel obstruction, pain, and intra-abdominal collection) and all were managed conservatively.<sup>(15)</sup>

## Operational

Jennifer Kearney, Associate Director of Operations, said: “Listening to my surgeon colleagues, it’s clear that Versius has created a more ergonomic working environment for them and they experience less physical and mental fatigue during surgery. It’s also fantastic to see that we are offering more minimally invasive surgery than we ever have before, particularly in gynaecology.

Before we acquired Versius, 60% of patients having a hysterectomy were only offered open surgery. Now, most of our hysterectomies are done via a MAS approach, any remaining open cases are not suited to the MAS approach, and my surgeon colleagues are due to publish data on this in 2022. This is fantastic news for the people of Milton Keynes and the wider population we serve.

We’re saving around 450 bed days per year following the implementation of Versius, this takes us way beyond the 175 bed days we anticipated saving in our original business case. Our patients are getting home earlier, which is freeing up beds for the hospital, which means we can bring other patients through the system more readily, so the net effect for us is that the Versius programme doesn’t cost us any more to run than manual surgery. If Versius was implemented across the NHS as we have, there are big efficiency and quality gains to be made that would comfortably validate the investment.

Attracting and retaining surgical staff is something we have struggled with historically due to our proximity to London. Following the introduction of Versius, we now have access to technology typically seen in larger centers. As a result, we have had a fantastic uptick in recruitment of surgical staff, filling a number of key consultant posts, as well as a research fellow post in colorectal.

We introduced red and green pathways for the management of patients during the COVID-19 pandemic as part of our pathway management strategy to ensure continuity of care. This approach, combined with the gains we are seeing via the Versius programme, is having a material impact on our ability to manage the demand for beds. As a result, we have improved how we prioritise beds, and we now have more protected beds for escalation requirements.”

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## Operational

Katy Philpott, Associate Director of Operations, Women and Children's Commissioning Support Unit, said: "Prior to the investment in Versius, in gynaecology, less than half of the 450 women requiring soft tissue surgery annually were offered a minimally invasive approach. For those women who were not offered it, the vast majority require five days in hospital and three or more months off work post-surgery. When you combine this with the psychological impact associated with some of these procedures, returning to a normal way of life presents a big challenge.

Access to Versius has been a complete game changer for the women we serve, and we are now delivering far more minimally invasive care as a result. In fact, the only women who are not offered a minimal access approach now are cases where it is not clinically appropriate.

Women who receive their treatment via a RAS approach with Versius are experiencing a much quicker return to normal activities, with the majority of patients off work for between two and four weeks. An unexpected observation is that this is also an improvement versus patients who have received manual laparoscopic surgery, who typically take two months to return to work. More work needs to be done to validate this observation, but it is highly encouraging to see, and having been a patient myself, I have an acute appreciation for the impact this sort of gain has on patient recovery and wellbeing.

From a gynaecology perspective, we know for sure that the introduction of Versius is having a positive impact on our bed occupancy, with patients now going home in 1-2 days, with fewer patients requiring a HDU (High Dependency Unit) bed following their surgery. As a guide, an occupied bed in a standard ward costs the hospital £220 per day to staff, compared to a HDU bed at £1,000 per day.

In gynaecology alone, we estimate that we are saving around 8 HDU bed days annually following the introduction of Versius, which enables us to either reduce the cost burden of our interventions or offers further capacity to cope with demand.

The investment in Versius has been fantastic for our patients, our surgeons, our trainees, our service, and is proving to be an important investment in improving the wider health economy for our community."

**The introduction of Versius is having a positive impact on our bed occupancy, with patients now going home in 1-2 days, and fewer requiring a high dependency unit bed following their surgery.**

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# Discussion

MKUH has been able to implement and expand a robotic assisted surgery programme with Versius across three specialities with limited prior surgeon experience in robotic surgery. Despite this, the outcomes are comparable to data in previously reported literature.<sup>(15)</sup>

Examining the colorectal cohort, the largest randomised trial comparing laparoscopic and robotic rectal surgery (the ROLARR trial) yielded conversion rates from robotic to open surgery of 8.1% when undertaken by experienced robotic surgeons, compared to the overall conversion rate of 4.4% reported in the MKUH series, and 5.3% for rectal resection.<sup>(16)</sup> More recent studies have reported conversion rates to open of between 0% and 3.9% for robotic colorectal surgery and up to 18% for laparoscopic surgery.<sup>(17,18)</sup> Risk of conversion is higher in patients with a BMI of over 30, who made up 23.1% of the ROLARR population, but 32.4% of the patients in the MKUH cohort.<sup>(15)</sup> All malignant colorectal cases in the MKUH case series had a negative resection margin, compared to 5.1% seen in ROLARR and corresponds to the 0% rate seen in other studies.<sup>(15,17)</sup>

Similar trends regarding the relationship of obesity to conversion rate have also been reported in gynaecology. A recent study found that the rate of conversion to open for robotic hysterectomy was 5.5%.<sup>(19)</sup> Despite the high proportion of obese patients, and high prevalence of previous abdominal surgery (43%) in the MKUH case series, there were no conversions

to open surgery. This is of clinical significance as the length of stay for open hysterectomy has been shown to be between 3 and 6.5 days longer than after minimally invasive hysterectomy<sup>(20)</sup> which is considerably longer than the median stay of 1 day for all gynaecology patients and 1.5 days for hysterectomy patients in the MKUH case series.<sup>(15)</sup>

There were no major complications in the general surgery cohort, which compares favourably to a recent meta-analysis of robotic general surgery which reported an overall median complication rate of 2.6%,<sup>(21)</sup> though direct comparison is limited by relatively low case numbers in the MKUH case series. Sixty-nine percent of the general surgery patients were discharged home on the same day as their operation, demonstrating that the Versius system is feasible for use both with major operations and high-volume day-case operations.<sup>(15)</sup>

The introduction of any new surgical device requires overcoming the learning curve associated with that device. The learning curve was not assessed in the MKUH case series, but as the majority of surgeons in this study were naïve to robotic surgery, operating times are expected to drop over time. There was no relationship between complication or conversion rates and surgeon experience in this series.<sup>(15)</sup> The number of operations required to reach competence varies widely between reports, but studies have shown that although 74 cases are needed to reach competence when a robotic service is initially set up, this number

drops to 25–30 procedures once the service is already established.<sup>(22)</sup>

Introduction of a multi-specialty programme can help to accelerate this learning curve and allow exponential growth both in case numbers and technical competence for a unit. High volume operations such as hernia repairs and cholecystectomies ensure that theatre teams gain experience with the system, which can then be extrapolated to the more complex operations. This concept of an institutional learning curve can justify the wider use of a robotic system even for cases where the cost benefit ratio is yet to be clearly defined.<sup>(15)</sup>

More research will be undertaken in the future to further validate the observations and reported gains MKUH has experienced following the introduction of Versius.



# Summary

The MKUH case series demonstrates that the Versius system can safely be used for multiple surgical specialties, in a complex patient population. Use of the system is feasible for general surgical, gynaecological, and colorectal surgical procedures, and scaling up of operative volumes is achievable. The clinical outcomes illustrate those experienced by a centre at initiation of a robotic surgical programme, and are in keeping with existing modalities and robotic platforms, demonstrating that there is scope for further expansion of the usage of Versius.<sup>(15)</sup>

MKUH has reported a net health-economic gain and improved healthcare resource utilisation following the introduction of Versius, which has enabled MKUH's surgeons to offer a minimal access approach to more patients, who recover and return home to normal life more quickly. This has resulted in 450 bed days saved annually (including 8 HDU bed days) - an important gain which is helping MKUH to manage challenging bed pressures more effectively. MKUH surgeons are also reporting improved ergonomics and comfort when operating using Versius, when compared to other operating modalities.

Scaling the MKUH experience with Versius in hospitals around the world has the potential to bring minimal access surgery to all those who need it, and showcases the potential for Versius robotic assisted surgery to offer health-economic value to health systems grounded in solidarity.



## About Milton Keynes University Hospital

Milton Keynes University Hospital (MKUH) NHS Foundation Trust is a medium sized district hospital in the UK that provides a full range of acute hospital services and an increasing number of specialist services to the growing population of Milton Keynes (UK) and the surrounding areas. With around 550 beds and employing more than 4,000 staff, the hospital sees and treats approximately 400,000 patients each year comprising of both outpatient and emergency attendances.

MKUH is a digital pioneer and one of 18 hospitals named as a 'fast follower' of NHS England's Global Digital Exemplars programme. CMR Surgical's Versius® Surgical Robotic System is one of several digital innovations that is helping to improve the lives of both patients and staff in Milton Keynes.

## About CMR Surgical Ltd.

CMR Surgical (CMR) is a global medical devices company dedicated to transforming surgery with Versius®, a next-generation surgical robot. Headquartered in Cambridge, United Kingdom, CMR is committed to working with surgeons, surgical teams and hospital partners, to provide an optimal tool to make robotic minimal access surgery universally accessible and affordable. With Versius, we are on a mission to redefine the surgical robotics market with practical, innovative technology and data that can improve surgical care.

Founded in 2014, CMR Surgical is private limited company backed by an international shareholder base.

## The Versius® surgical robotic system

Versius® resets expectations of robotic surgery. Versius fits into virtually any operating room set-up and integrates seamlessly into existing workflows, increasing the likelihood of robotic minimal access surgery (MAS). The portable and modular design of Versius allows the surgeon to only use the number of arms needed for a given procedure. Biomimicking the human arm, Versius gives surgeons the choice of optimised port placement alongside the dexterity and accuracy of small fully-wristed instruments.

With 3D HD vision, easy-to adopt instrument control and a choice of ergonomic working positions, the open surgeon console has the potential to reduce stress and fatigue and allows for clear communication with the surgical team. By thinking laparoscopically and operating robotically with Versius, patients, surgeons and healthcare professionals can all benefit from the value that robotic MAS brings. But it's more than just a robot.

Versius captures meaningful data with its wider digital ecosystem to support a surgeon's continuous learning. Through the Versius Connect app, Versius Trainer and CMR clinical registry, Versius unleashes a wealth of insights to ultimately improve surgical care.

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