

OPTIMIZING PATIENT CARE PATHWAYS

England's National Health Service (NHS) Cancer Vanguard leads the development of new care models that will be used as an inspiration to the rest of the country's healthcare system.¹ As part of its mission in setting the direction for cancer care in the U.K., the Cancer Vanguard, which is revered around the world for its cancer treatment, sought to identify opportunities for optimizing care pathways for colorectal cancer (CRC) and improving the patient experience. In collaboration with Merck, a long-term partner in Colorectal Cancer (CRC) research and treatment, and uMotif, a patient data-capture platform, IQVIA proposed a first-of-its-kind solution for analyzing and visualizing care pathways.



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A first-of-its-kind solution for analyzing and visualizing care pathways

The Cancer Vanguard accepted IQVIA's proposal to work in partnership with Merck and uMotif to measure and analyze differences in patient treatment along the metastatic CRC (mCRC) patient pathway, compared to nationally recognized best practice. In doing so, the Cancer Vanguard wanted to identify and establish best practices for colorectal cancer care.

This partnership resulted in a first-of-its kind healthcare analytics solution providing unique visual analysis of possible variations that exist within a hospital and across other hospital benchmark sites, distilled into a knowledge discovery platform. The analytics are powered by IQVIA's depth of expertise in real-world healthcare data visualization and our capabilities in integrating novel patient experience data from uMotif and other specialist IQVIA data assets.

The call went out in mid-2016: could pharmaceutical companies suggest innovative, fast-paced projects to optimize both cancer service and medicines use in line with the Royal Pharmaceutical Society's guidance? England's Cancer Vanguard program invited the industry to submit proposals through the National Health Service (NHS) Cancer Vanguard Pharma Challenge.

IQVIA was one of six companies (out of 40) that were selected to participate in the prestigious initiative. We proposed that by working in collaboration with Merck, a long-term partner in CRC research and treatment, and uMotif, a patient-data-capture platform, we could identify unwanted service variation in the delivery of CRC care and enhance the Cancer Vanguard's understanding of the patient experience.

The collaboration would draw upon IQVIA's proprietary data (Real-World Evidence (RWE), drug usage data, anonymized patient-level cost

ABOUT THE CANCER VANGUARD

The Cancer Vanguard program was formed in 2015 by England's National Health Service (NHS) to serve as the leading transformative body for oncology services in the U.K. It consists of three trusts: The Christie NHS Foundation Trust, The Royal Marsden NHS Foundation Trust, and University College London Hospitals NHS Foundation Trust. The Cancer Vanguard serves a population of 10.7 million (18 percent of England's population) and provides an unprecedented opportunity to create new models of cancer care that can be replicated nationally. Each of the three cancer vanguard organizations lead a local delivery system - The Christie leads the Greater Manchester Cancer Vanguard Innovation, The Royal Marsden - RM Partners in north west and south west London, and University College of London Hospitals - UCLH Cancer Collaborative covering north east and central London and west Essex.

and experience data); our expertise in designing RWE studies and evidence platforms, and our data integration and data visualization technologies. While Merck would provide its extensive experience, knowledge and understanding of the disease management challenges in mCRC. uMotif would provide an innovative platform for capturing patient-reported symptoms, experiences and outcomes.

The result would be to establish, through a groundbreaking collaboration between pharmaceuticals and healthcare service providers, best practices in mCRC care that the Cancer Vanguard could share across the healthcare ecosystem.

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HUMAN SCIENCE IMPROVING OUTCOMES

OBJECTIVE: OPTIMIZE THE USE OF ONCOLOGY MEDICINE ROUTINELY

With the mission of advancing cancer services across the U.K. healthcare system, the Cancer Vanguard trusts are engaged in setting best practice and providing tested approaches to achieve them. The project's goal draws upon this need to identify ways with which the NHS could improve clinical outcomes and the patient experience in mCRC care.

Further goals were to

- **Identify** unwarranted variation in practice pathways for mCRC within the secondary care setting
- **Promote** the choice of cancer medications based on evidence

- **Enhance** the Cancer Vanguard's understanding of the cancer patient's treatment experience
- **Present** results in a way that NHS decision makers and healthcare professionals could easily understand and use to embark on their own journey of discovery with the data

BENCHMARKING ANALYTICS: STUDYING VARIATION IN HOSPITAL PATIENT CARE PATHWAYS

The basic structure of the analysis went from general to increasingly specific, as we drilled into deeper and deeper detail (See Figure 1). The focus was on three of the Cancer Vanguard's trusts, each of which has a local delivery system.

Figure 1: Care Variation Analysis Using Benchmarks

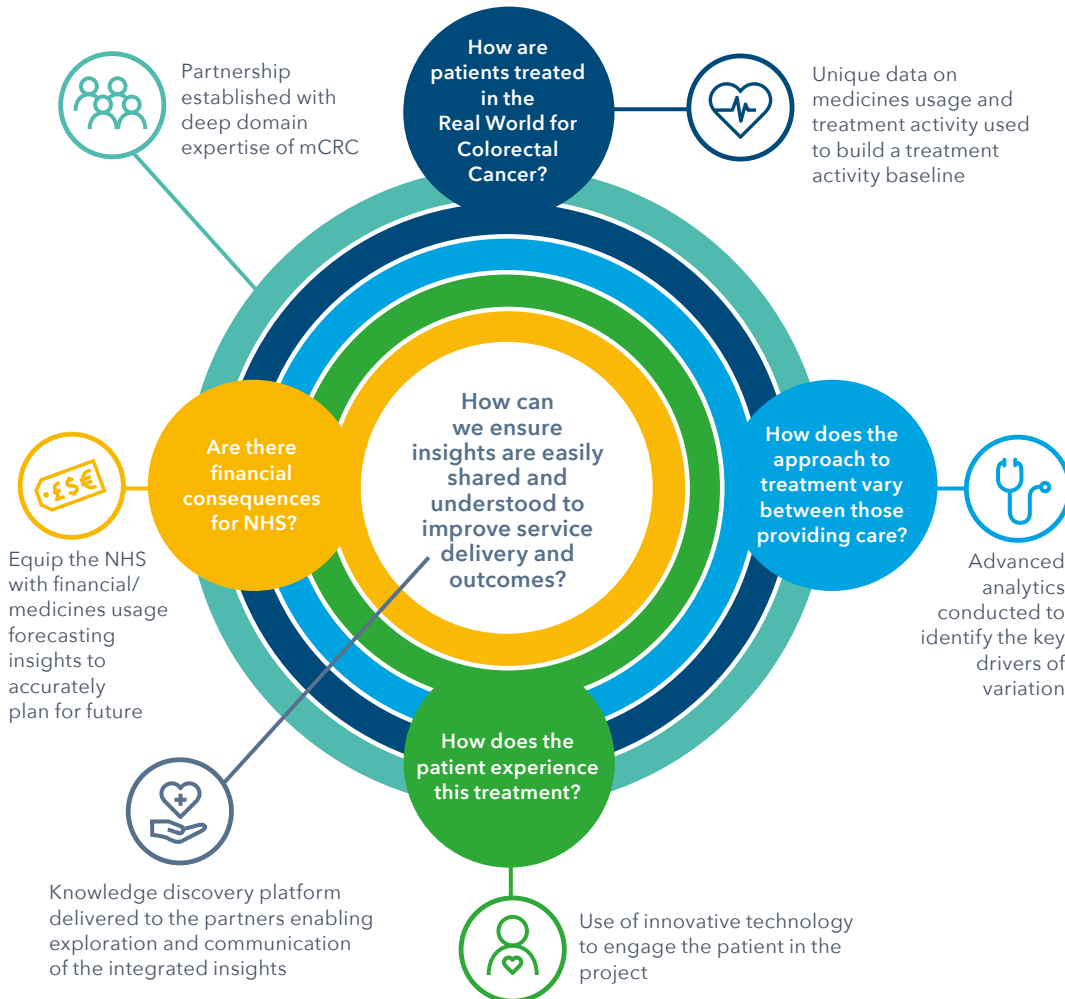
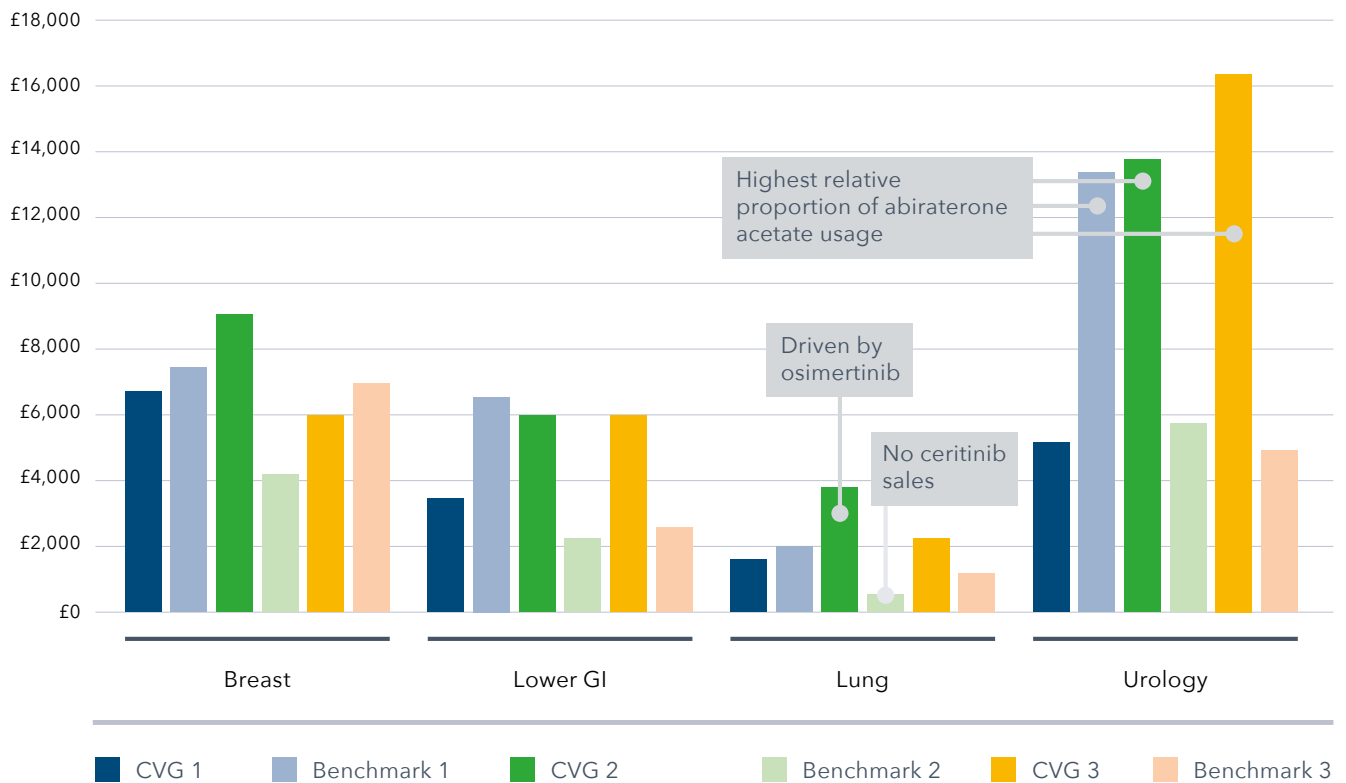


Figure 2: Average Spend on Targeted Treatments Per Patient (MAT October 2016)



*Spend: NHS list price

**BREAST: pertuzumab, trastuzumab emtansine, trastuzumab & lapatinib.

LOWER GI: oxaliplatin, cetuximab, panitumumab, aflibercept. LUNG: afatinib, erlotinib, gefitinib, osimertinib, ceritinib, crizotinib. PROSTATE: abiraterone acetate, cabazitaxel & enzalutamide

UNDERSTAND MEDICINE USAGE

As a first step, we performed a current-state analysis of how oncology drugs (e.g. antineoplastic and monoclonal) are used at a trust level across the four most prevalent cancers in the U.K.: breast, lung, bowel and prostate. The average spend per patient, by tumor type for targeted treatment varied considerably across the trusts, as illustrated in Figure 2. From this, we were also able to develop a five-year forward view of cancer medicine use in each of the four disease areas. This allowed us to develop a holistic view of the current and future state of how drug usage impacts mCRC pathways in the U.K.

Further, we examined oncology patient counts at a trust/hospital level to select benchmark hospitals comparable to the Cancer Vanguard trusts. We looked at NHS hospitals that had similar patient volumes and similar proportions of breast, lung, bowel and prostate cancer patients.

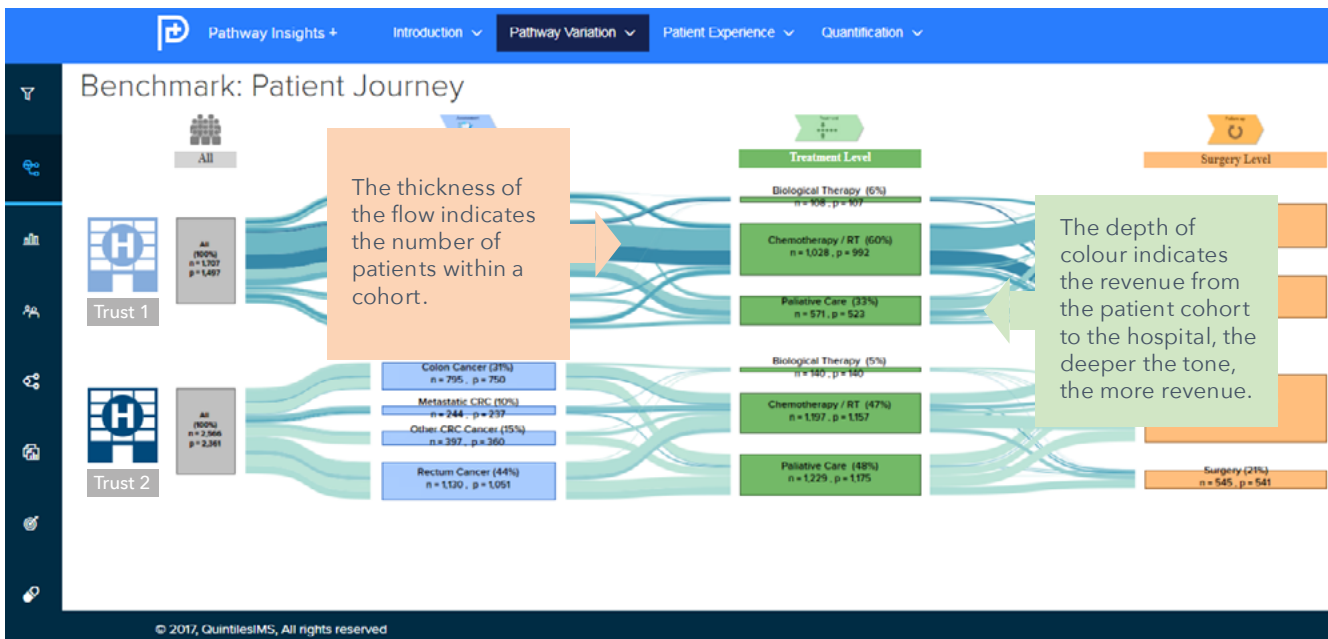
IDENTIFY UNWARRANTED VARIATIONS IN CARE

Narrowing our focus, we looked at the clinical pathway for mCRC across the three Vanguard trusts, as compared to three other benchmark NHS trusts. To do this, we drew upon NHS Hospital Episode Statistic (HES) as well as other data assets such as - IQVIA Hospital Pharmacy Audits (HPA) and UK cancer data (SACT) and our own patient-episode linking algorithm. We examined patient pathways for approximately 13,000 patients and established points of interest, or checkpoints, within each therapeutic route. For each therapeutic activity along the way, we calculated the volume and service income to the trust.

The integrated, longitudinal view of mCRC patient care pathways was generated with a year's worth of patient-level hospital data and loaded for analysis into the knowledge discovery platform

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Figure 3: Comparing Patient Pathways Between Hospitals



During the project, IQVIA developed a knowledge discovery platform – Pathway Insights+ which allows a unique visualization of granular patient flows within their care settings. The visualization allows the user to identify and interactively select from the patient flows (left to right) specific cohorts and look at the variation that may exist at key points during a patient’s journey. Variation can be identified by comparing with similar flows in other comparator hospitals.

- IQVIA Pathway Insights+, to serve as an active tool for ongoing data investigation and visualization.

Figure 3 is a screenshot of a patient journey comparison between two of the three trusts available on the platform. The visualization illustrates from left to right the routes taken by patients in getting mCRC care within the hospital. The thickness of the connecting lines reflects the number of patients on a particular pathway, and the density of the color is indicative of the associated income. The actual visualization is interactive: users can click on the boxes to drill into the data for one trust, which automatically calls up the equivalent data for the comparator trust.

Using the platform, it is possible to discern for metastatic CRC (mCRC) patients, the key drivers

of the observable treatment variance across the two trusts.

The analysis of the clinical pathways revealed what appeared to be some inconsistent adherence to the guidelines put forth by the National Institute of Health and Care Excellence (NICE). There was some variation in the use and timing of biological therapy, possibly due to physician treatment preferences. The models of care also varied considerably across the three trusts in patients’ length of stay in the hospital, which ranged from 8 days to 11.8 days for comparative patient cohorts. This variance is explained to a greater or lesser extent by whether the trusts perform complex colorectal cancer surgery. Further investigation is planned to fully understand these findings.

Figure 4: uMotif: Patient Data Capture Mobile Application



ENGAGE PATIENTS IN DESCRIBING THEIR EXPERIENCE

Within one trust, mCRC patients were asked to complete a baseline questionnaire and then to record their symptoms, outcomes and satisfaction with care using clinically validated instruments. Outcomes were measured via the EQ-5D questionnaire, patient satisfaction via the INPATSAT32 questionnaire and symptoms via a customized mobile application created by uMotif. The application was available on wearable and non-wearable connected health devices, and 60 percent of the patients approached agreed to use it to indicate the severity of their symptoms.

Using the petal motif shown in Figure 4, in which individual petals represent a measure such as sleep, mood, mobility and appetite, patients could fill each petal with color to indicate the severity of their symptoms. The treating physicians could also track their patients' symptoms over time.

IDENTIFY DRIVERS TO ACHIEVE BEST PRACTICE AND QUANTIFY POTENTIAL SAVINGS FROM STANDARDIZING

In the final phase of the project, we compared the drivers influencing variation in the mCRC pathways within the Cancer Vanguard in order to uncover service practices which were most effective and efficient.

We performed a multi-linear regression analysis of more than 200 variables to identify the key drivers of income variation. (See Figure 5). We found that greater consistency in care could be achieved at one Cancer Vanguard trust by focusing on just five (out of 200) key drivers of variation in care, to include length of stay, number of patient events and colon surgery. We developed a key performance indicator (KPI) around income variation, reflecting the opportunity that these drivers of variation represent.

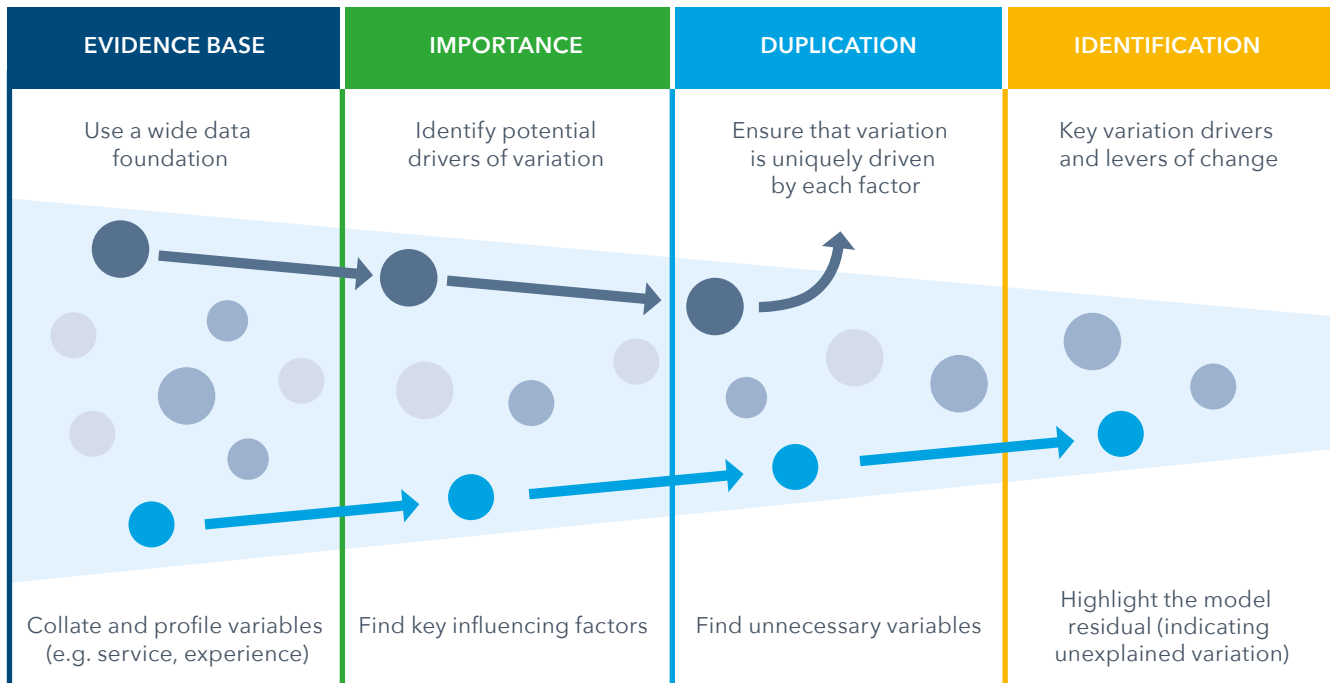
The KPI takes into account that in a complex healthcare system, variation is not fully captured by the data. This was identified in the form of statistical residuals denoting mainly non-costed activity or behavior. The KPI design also allows a standard way of making like-for-like comparisons around variation amongst trusts.

As leading tertiary centers, the Cancer Vanguard trusts have an express remit to set the direction for cancer care in the U.K. These findings, therefore, are important to improving clinical approaches and to raising the standard of care within other care centers and hospitals throughout the country.

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Figure 5: Steps to Identifying Drivers of Variation



Overall the project identified areas of improvement with a potential for the delivery of significant savings across the mCRC pathways in provisioning an effective service. It is to be noted that a diverse set of approaches exist for commissioning cancer care within the U.K. Results from the project points to several avenues that needs further detailed and specific investigations while considering the local dynamics of cancer care commissioning as well as hospital’s service strategy.

**BENEFITS:
A MODEL TO CONTINUOUSLY ASSESS AND
ACHIEVE BEST PRACTICE CARE MODELS**

The project gave the Cancer Vanguard a new way of visualizing complex cancer services that can be explored and refreshed over time to measure the impact of any policy and practice changes.

The approach provides a continuous way of assessing service performance, making relevant

changes in CRC care, ensuring that changes take effect and fine-tuning the service if needed. The research also gave the Cancer Vanguard a blueprint that it could follow to

- **Optimize its use of cancer medications**, allocating its budget where it will have the most impact in delivering better patient outcomes
- **Manage its pharmacy costs** in the coming five years. Pharmacy managers had insight into where their budgets would need to increase and where they might find savings.
- **Discuss treatment approaches** between trusts to reduce unwanted variation in care
- **Drive behavioral change** in clinicians with insights from patient reported outcomes and experience.

This last point deserves further mention. Clinicians’ ability to monitor patients’ symptoms and Quality of Life (QoL) remotely can potentially allow them

to change their model of care by intervening as needed based on real-time data; they don't need to wait several weeks for a patient's next in-person visit to evaluate a patient's ability to cope with treatment. Some research has suggested that such early responsiveness to patient-reported symptoms prevents downstream consequences and may increase survival times for cancer patients.²

To test this theory, one trust is planning to launch a randomized controlled trial (RCT) in the use of symptom-tracking technology to assess if the capture of these data and the enhanced clinical decision-making it affords has the ability to extend life.

Merck also benefited from its participation in the project, gaining insights into

1. How its treatment for mCRC was actually being used in the real world; and
2. What patients experience while being treated for mCRC.

With this in-depth understanding, Merck can have more informed discussions with physicians about its treatment, and the company can consult with the NHS on how it might help improve patients' experiences and outcomes.

CONCLUSION

This extensive project was innovative in its collaboration between partners, analytical deliverables and application of patient-engagement technologies. The NHS Cancer Vanguard and its partners now have a map of current cancer service within three Cancer Vanguard trusts, insights into patients' views of their outcomes and a tool that can be used to monitor the change needed for an effective and lean cancer-service model.

In future projects, we plan to extend our approach of analyzing variation amongst service, medicines use, and patient experience. This will allow healthcare to pinpoint areas of improvement by continuously benchmarking against other hospital pathways thus identifying real world best practices that hospitals can aspire for. Our vision at IQVIA is to transform patient care from the ground up.

COMMENTS FROM COLLABORATORS

"The formation of the Cancer Vanguard gave us an unprecedented opportunity to explore new ways of working with the pharmaceutical industry. The aim has always been to ensure the best use of cancer medicines in a way that improves patient experience. Our work with IQVIA is an example of how the health service and industry can join forces to deliver sustainable improvements in cancer services."

Rob Duncombe, Chief Pharmacist
The Christie

"Merck has welcomed the opportunity to partner with the Cancer Vanguard and IQVIA on this important project."

"The work has showcased what can be achieved when stakeholders come together with a common goal and Merck's further understanding of how mCRC treatments are being used in real life will enable our company to deliver value to the NHS in a more efficient and meaningful way. We look forward to future opportunities to work with the NHS in this way."

Stuart Hill, Head of Marketing, Oncology,
Merck

REFERENCES

¹ <https://cancervanguard.nhs.uk/about/>

² Deborah Schrag, MD, MPH et al. Overall Survival Results of a Trial Assessing Patient-Reported Outcomes for Symptom Monitoring During Routine Cancer Treatment. JAMA, June 2017 DOI: 10.1001/jama.2017.7156