Targeted postoperative wound care kits delivered as part of digital surgical site infection surveillance after cardiac surgery: Early findings from a quality improvement project

Background: Digital monitoring in patients' own home after surgery enables early identification of wound complications. Treating emerging complications early may prevent wounds from worsening or becoming infected, thereby avoiding more costly treatment.
Aim: To deliver targeted wound-care kits to cardiac surgery patients reporting early wound concerns.
Methods: A 'proof-of-concept' quality improvement project commenced in June 2025 at two cardiothoracic centres. Adult cardiac surgery patients reporting early sternotomy wound concerns through a proactive digital surgical site infection (SSI) surveillance service received a wound-care kit and supported self-management at home. Outcomes included time taken to deliver the kit, patient acceptability, escalation to clinician-directed treatment and the number of SSIs.
Results: Twenty patients were recruited with 16 (80%) receiving the kit within 24 hours (mean delivery time 12 hours). Three patients required escalation to clinician-directed treatment, one patient developed an SSI and learning from small tests of change resulted in updates to the inclusion/exclusion criteria. Patient acceptability was high and the mean cost of the intervention was £106.97.
Conclusion: Targeted wound-care kits delivered through proactive digital SSI surveillance are feasible and acceptable. Larger studies are needed to evaluate clinical effectiveness, antibiotic use and cost-effectiveness.

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After surgery, around 20% of patients develop a wound healing concern, such as dehiscence, seroma, haematoma or infection (Guest et al, 2015). These complications may be expensive to treat and have poor clinical outcomes for patients. For example, surgical site infections (SSIs) impose billions globally in annual healthcare costs (WHO, 2018) and are associated with longer hospital stays, re-admissions, further surgery, poorer outcomes and increased risks of sepsis and mortality (Zimlichman et al, 2013; Badia et al, 2017; Wong et al, 2019; Monahan et al, 2020). In England, national SSI data reports a persistent burden (UK Health Security Agency [UKHSA], 2025), with a significant impact on NHS hospital, primary care and community services (Guest et al, 2023).

However, if wound complications are detected early, early treatment may prevent complications from worsening and becoming harder and more expensive to treat (Tanner et al, 2024). Digital monitoring may enable wound complications to be detected earlier (McLean et al, 2021).

In 2020, Royal Brompton and Harefield Hospitals (RBHH) implemented a proactive digital SSI surveillance programme with Isla Health, providing remote reassurance, advice, and referral where required (Rochon et al, 2023). The service is delivered through a Central Digital Wound Hub (CDWH) based at Guy's and St Thomas' NHS Foundation Trust. It supports many surgical specialities, including approximately 2,000 cardiac patients each year (National Adult Cardiac Surgery Audit, 2025).

At RBHH, over one-quarter of digitally monitored patients report early wound complications, such as dehiscence, inflammation or non-purulent discharge that do not initially meet SSI criteria. However, approximately one in 10 of these patients subsequently progresses to symptoms consistent with SSI. The majority of cardiac SSIs (79%) at RBHH are detected after hospital discharge through the CDWH service. Between May 2024 and April 2025, the overall coronary artery bypass graft (CABG) SSI rate for RBHH, including patient-reported SSIs via digital monitoring, was 8.7% (86/992). For the same period, the overall cardiac (non-CABG) SSI rate was 4.9% (50/1,019).

Providing advice and self-management treatment for patients reporting early wound complications may help prevent progression to infection. Previous studies have evaluated providing patients with resources prior to discharge, such as chlorhexidine gluconate for washing (Johnson et al, 2016; Money et al, 2018; Agarwal et al, 2019; Moore et al, 2021; Cox et al, 2023) or specialised dressings to reduce postoperative wound complications at home (Henarejos et al, 2022; Cox et al, 2023). UK guidelines recommend that patients transferred between hospitals are provided with a 1-week supply of appropriate wound dressings (National Wound Care Strategy Programme, 2024). However, these approaches apply interventions universally and may be at odds with minimising resource use (Adderley et al, 2022).

To our knowledge, no studies have examined targeted provision of bespoke wound-care resources combined with proactive digital SSI surveillance in the home setting for SSI prevention.

Aim

This quality improvement project (QIP) was implemented to deliver an antibiotic-sparing SSI prevention kit for cardiac patients reporting early wound healing concerns through remote wound monitoring.

Methods

Project design

The QIP design followed the Model for Improvement framework using initial questions to define the project followed by iterative PDSA (Plan, Do, Study, Act) cycles to test and refine the intervention (Langley, 2009). The SMART aim of the QIP was to have patients who reported early wound complications via digital SSI surveillance receive a bespoke kit within 24 hours of reporting. Outcome, process and balancing measures were identified.

The QIP team included the surgical site surveillance team within the CDWH and a consultant microbiologist.

Formal ethics committee approval was not required for QIPs, although institutional approval was obtained (CIRIS ID: 009888).

Patient and public involvement

In advance of the QIP, a local survey with Likert five-point scale focusing on self-managed wound care at home was conducted with 100 patients. Eighty-seven per cent of patients (87/100) said they would find it helpful or very helpful to be sent a dressing, while 86% (86/100) said they would find it helpful or very helpful to be sent antimicrobial washes or wipes (Rochon et al, unpublished).

Population and setting

The QIP was conducted between June and November 2025 at two London-based tertiary cardiothoracic centres: Royal Brompton Hospital and Harefield Hospital, both part of Guy's and St Thomas' NHS Foundation Trust.

Eligible participants were adults (≥18 years) who had been discharged home following cardiac surgery, were engaged in the digital SSI surveillance pathway and were willing and able to self-manage their wound at home. The first patients to meet the inclusion criteria were approached until 20 patients were included. Inclusion criteria were early wound-healing concerns involving the skin, or the skin and subcutaneous tissue only on the chest wound, identified from photographs and a wound-healing questionnaire, with subsequent telephone follow-up to confirm assessment. This included:

- Superficial wound dehiscence.
- Mild local signs of inflammation.
- Non-purulent, non-continuous wound exudate not requiring primary closure or daily dressing changes for exudate management.

Patients were excluded if they had systemic signs of infection, including a temperature ≥38°C, or were already receiving antibiotics for the wound. Those reporting symptoms suggestive of sternal instability, such as pain, clicking or movement during coughing or mobilisation, were referred for in-person clinical assessment and excluded from the QIP. Patients requiring ongoing wound management by a healthcare professional, including dressing changes or other clinical wound care, were also excluded. As this was a preliminary proof-of-concept QIP, only sternal wounds were included; leg, radial and drain-site incisions were excluded. Following learning from the PDSA cycles, the exclusion criteria were expanded to include patients reporting increasing pain as their only symptom and those awaiting wound specimen results.

Intervention

With the Isla proactive digital SSI surveillance

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programme, patients submit photos and information about their wound in response to weekly SMS or email message requests. Patient information is reviewed by specialist staff working within the CDWH who either reassure the patient there is no infection, obtain more clarifying information or identify a wound complication and initiate a referral for treatment.

For this QIP, patients with wound photos showing early signs of non-infected complications were telephoned to confirm willingness to take part and self-manage their wound and also check for any sensitivities or allergies. After confirming with the responsible surgical team that the patient was suitable for self-management, QIP patients were then sent a kit using an express courier service. While the CDWH is open 7 days each week from 9 am until 5 pm, kits were only able to be dispatched from Mondays to Fridays when CDWH staff were on site. The postoperative wound care kit was developed to support early wound management at home and included wound care supplies tailored to each wound along with instructions. Initially, a 1-week supply was sent but this was found to be insufficient. Thus, 2 weeks' worth of supplies were dispatched, based on wound presentation, including wound cleansing material, wound repair gel, dressings and chest support garments.

Chest support (such as a vest or surgical bra) was provided to reduce tension on the new wound and reduce the risk of dehiscence. Patients were called the next day to answer any questions on the kit and were followed up weekly (with patient-initiated submissions between requests, as required) thereafter.

Measures

Outcome measures were:

- Percentage of patients with early non-infected wound complications who subsequently developed a sternotomy SSI.
- Percentage of patients who were escalated from patient self-management using the kit to clinician-directed treatment, including initiation of antibiotics and/or professional wound management.

The process measure was the percentage of patients receiving the wound care kit within 24 hours of a wound concern being identified.

Balancing measures included:

- Patient acceptability regarding the condition of the kit on arrival, clarity of instructions, perceived effectiveness, and comfort of use.
- The cost of kit components and courier delivery. Staff time was excluded as prevention activities and stock provision are considered core service functions (McMahon and Sin, 2013).

Data collection and analysis

SSI data from patients participating in the QIP pertaining to the sternotomy wound were collected at 30 days post-surgery via Isla, and also at 2 weeks after the kit was received if this was outside the 30-day follow-up. Standard definitions of SSI from the UK Health Security Agency (UKHSA, 2013) were applied. Trained surveillance staff prospectively identified and recorded SSIs, including those detected during hospital readmission and those reported after discharge using the UKHSA patient wound-healing questionnaire. Hospital readmissions for SSI were extracted from the electronic patient record system (EPIC Systems) and data on NHS visits, antibiotics, the cost of kit items, courier fees and patient satisfaction surveys were collected through Isla. All data were exported into Microsoft Excel (Version 16.0.10380.20037) for data cleaning, validation and preparation prior to analysis. In keeping with small QIPs, descriptive statistics were used to summarise outcome measures, process measures, and patient acceptability (NHS Institute for Innovation and Improvement, 2017).

PDSA cycles

Three PDSA cycles were undertaken **[Table 1]**.

Results

Participant characteristics

During the QIP period, the first 20 patients who reported early non-infected sternotomy wound concerns through the remote monitoring pathway and agreed to participate in the project were sent an SSI prevention kit. Most underwent coronary artery bypass graft (CABG) surgery (n=14/20, 70%), and the majority of procedures were elective (n=15/20, 75%). The mean patient age was 59.3 years, and the median BMI was 29.20 kg/m^2, with eight out of 20 (40%) patients having diabetes. Further demographic characteristics are shown in **Table 2**.

Outcome measures

Surgical site infection

One QIP patient developed a sternotomy SSI within the predefined surveillance period, detected on readmission (see below, Escalation of care).

Escalation of care

Three patients required escalation from self-management using the kit to clinician-directed treatment within the 30-day period.

The first patient attended an unscheduled in-person outpatient wound assessment. At that time, no antibiotics were prescribed, but a wound swab was obtained. The surgical team agreed that the wound did not appear infected and providing a self-management kit was appropriate. The sample grew *Pseudomonas aeruginosa*, thus the surgical team and CDWH agreed to stop the kit (patient had used the kit for 3 days) and asked the GP to commence oral antibiotics and dressing management. The patient was later readmitted with an SSI.

As the QIP was in its early implementation phase, the second patient was advised by the CDWH to attend their general practice for precautionary review after 1 day of kit use, taking their comorbidities into account. Antibiotics and dressings were subsequently initiated, although the patient did not meet the predefined SSI criteria.

The third patient received the SSI prevention kit after presenting to the Accident and Emergency Department 23 days postoperatively with increasing pain at the submammary incision site, without any

Table 1. Overview of QIP PDSA cycles.

Cycle	Change Cycle 1 Design, set-up and targeted pilot (weeks 1–4)	Change Cycle 2 Workflow testing (weeks 5–12)	Change Cycle 3 Timing optimisation and kit refinement (weeks 13–32)
Activities	A Health Equality Assessment was completed to ensure equitable access to the intervention. In parallel, step-by-step instructions for using the SSI prevention kit were developed through the organisation's Health Content process, including review by senior clinicians and patient and public representatives. Funding for the QIP was secured from the Heart and Lung Clinical Care Group's innovation fund. The team agreed the contents of the SOS wound care kit and finalised stock management, storage and distribution arrangements. Courier logistics were established, including same-day delivery feasibility and handover points. Data collection and record-keeping processes were also defined. The first three kits were sent during this cycle and patient satisfaction was collected.	Patients were reviewed for suitability and kits were dispatched accordingly.	Feedback indicated that the first digital wound review occurred too late in the postoperative pathway. Remote prescriptions for antibiotics were explored with pharmacy and infectious diseases colleagues.
Learning	Stock relocated as kits could not be collected from Guy's Hospital main reception. High delivery cost for patients living >37 miles from sites, so the distance from the hospital was amended as inclusion/exclusion criteria. Antimicrobial wash was changed to antimicrobial wipes as these were easier for patients to use. The number of dressings was increased to cover 2 weeks rather than 1 week as patients in the cycle ran out of products too early.	Patients with increasing incisional pain were excluded as this may be suggestive of deeper infection. During this cycle, it became clear that rapid tests of change weren't possible because there weren't as many suitable patients as first envisioned.	Requests were adjusted from 4 days to 2 days after hospital discharge. Chest supports were added to the kit following patient feedback. Patients with pending specimen collection at the time of review were added to the exclusion criteria.

other associated symptoms. Antibiotics were not prescribed. After using the kit for 2 days, the CDWH arranged an outpatient review because of persistent pain. The patient attended the appointment 25 days after surgery, at which time the wound was drained, although the type of fluid was not documented. Antibiotics were prescribed, and a fluid sample taken during the procedure subsequently returned negative results. This patient did not meet criteria for SSI.

Where applicable, amendments to the exclusion criteria are described in Table 1. Overall, 17 patients were able to continue self-management using the kit without escalation to clinician-directed treatment.

Process measures

Kit delivery time

Sixteen out of 20 patients (80%) received their SSI prevention kit within 24 hours of detection of an early wound complication (mean delivery time 12 hours; range 1 hour 32 minutes to 52 hours 48 minutes). Four patients experienced delays beyond 24 hours. Reasons included delays due to weekends (n=2), due to a busy operating schedule, delaying approval from the CDWH receiving surgical team that the patient was suitable for self-management (n=1), and courier collection after the daily cut-off time (n=1).

Table 2. Characteristics of patients who received the SSI prevention kit.

Demographic	n=20
Surgery category	(n, %)
CABG	14 (70%)
Non-CABG	6 (30%)
Surgery urgency	(n, %)
Elective	15 (75%)
Urgent	5 (25%)
Emergency	0 (0%)
Age in years, mean, (range)	59.3 (34-81)
BMI, median (range)	29.20 (22.70-46.37)
Diabetes (n, %)	8 (40%)
Sex	(n, %)
Male	11 (55%)
Female	9 (45%)
Distance in miles from hospital, median (range)	19.78 (3.58-217.29)
Ethnicity	(n, %)
White	8 (40%)
Asian	6 (30%)
Other	1 (5%)
Not stated	5 (25%)
Index of Multiple Deprivation (IMD)	(n, %)
1 (most deprived)	0 (0%)
2	2 (10%)
3	2 (10%)
4	2 (10%)
5	2 (10%)
6	4 (20%)
7	0 (0%)
8	2 (10%)
9	1 (5%)
10 (least deprived)	5 (25%)

Balancing measures

Patient acceptability

Patient acceptability of the kit was only assessed in the first cycle, to generate rapid learning on the intervention and enable improvements in subsequent cycles if required (Knudsen et al, 2019). Using a five-point Likert scale, patient satisfaction with the intervention was high. All three respondents in cycle 1 reported being satisfied or very satisfied with the condition of the kit upon arrival, support and resources provided, and all product evaluations received the highest rating.

Cost of the intervention

The mean cost of the SSI prevention kit was £106.97 (range £46.00–£384.66). The most expensive components were chest support garments (surgical bra £47.40; surgical vest £96.00). Courier delivery costs ranged from £14.57 to £312.86, depending on distance.

Discussion

This quality improvement project evaluated the feasibility of delivering a targeted postoperative wound-care kit to cardiac surgery patients who reported early wound concerns through a remote monitoring service. The intervention was implemented successfully within the existing digital monitoring pathway, with 80% of patients receiving the kit within 24 hours of detection of wound concern. Delays were primarily operational and related to staff availability, with two of the four delayed deliveries occurring when wound concerns were identified over weekends while staff were working remotely and one due to the availability of the surgical team.

Overall, these small-scale, preliminary findings suggest that targeted provision of wound-care resources in response to early wound symptoms is feasible within the existing service pathway, although optimisation of operational processes, particularly weekend dispatch and staffing, may be necessary to improve delivery timeliness. Using digital SSI surveillance to initiate self-care rather than referring to community nurses may reduce costs, ultimately enhancing outcomes and patient experiences while easing pressure on overstretched services (NHS England, 2019).

The patient-reported SSI rate following CABG or cardiac surgery at RBHH is 5.4%. Although the QIP was not designed or powered to formally evaluate effectiveness, one sternotomy SSI was observed within the defined surveillance period. Given the small sample size (n=20), this finding should be interpreted cautiously. Nevertheless, targeted early wound support delivered through remote monitoring may have the potential to interrupt the progression from early wound symptoms to infection in selected patients.

Patient acceptability was high in the small sample (n=3). This supports a previous study finding that patients would like greater involvement in their wound management via remote monitoring (Tanner et al, 2025). Supporting patients to manage early wound complications with appropriate resources and guidance may offer a practical strategy to reduce progression to infection while avoiding unnecessary antibiotic use.

Although the intervention aimed to support antibiotic-sparing management where appropriate, during follow-up, three patients required escalation from self-management to antibiotic therapy, which highlights the flexibility within the digital SSI surveillance pathway to quickly signpost patients to existing commissioned services when the need arises. However, integrating prescribing pathways into the remote monitoring service may improve responsiveness and continuity of care in future iterations of the intervention.

From a health system perspective, the intervention may have implications for healthcare utilisation and costs. Cardiac SSIs are associated with substantial morbidity and financial burden. A cardiac SSI is estimated to cost, on average, €12,402 (£10,723; Blüher et al, 2020). Given the high cost associated with cardiac SSI readmissions, interventions that successfully prevent infection could potentially lead to meaningful cost savings. Although this QIP was not powered to evaluate economic outcomes, the relatively low cost of the prevention kit compared with the cost of SSI management suggests that further economic evaluation would be valuable.

Key learning from the QIP related to storage and distribution logistics. Limited storage space meant that stock needed to be organised so that it remained both accessible and properly managed. Courier arrangements also posed challenges: some providers could not reliably guarantee same-day delivery and delivery costs increased substantially for addresses outside London. Dispatch processes at the main site further complicated operations. Kits could not be left at the hospital main reception, where most CDWH staff are based, and instead had to be handed directly to the courier (nine floors down). To improve efficiency, stock was relocated to Harefield and Royal Brompton hospitals, where couriers could collect kits from the main receptions. These experiences highlight the importance of designing clear and reliable operational processes when implementing similar services.

Undertaking this project using QIP methodology enabled real-world testing of the intervention and iterative refinement of processes. However, there were a number of limitations to this work. The small numbers involved and lack of randomisation or a comparator group, meant that causal attribution of outcomes to the intervention was not possible. As the QIP was only conducted among patients having cardiac surgery, testing with other surgical patient groups would be beneficial. Finally, the soft tissue layers overlying the sternum are relatively thin, offering limited separation from deeper structures and increasing the risk that superficial infections may progress to severe complications (Stoddard et al, 2026). Clinicians often maintain a low threshold for prescribing antibiotics due to the potential severity of deep sternotomy wound infection complications (Salehi Omran et al, 2007; Ivert et al, 2024). For this reason, the identification of suitable patients took much longer than expected and highlights an important limitation of scale in this patient group. In this QIP project, the risks of deterioration were mitigated by clear standard operating procedures for initial and ongoing assessments, the provision of resources, including chest support, and ongoing oversight of patients on the self-management pathway by the surgical team.

Conclusion

This 'proof-of-concept' QIP is a start in addressing a clinically relevant gap in postoperative wound management. By intervening only when early symptoms were reported, the intervention may represent a more efficient and patient-centred approach to postoperative wound management. Overall, this QIP demonstrates the potential feasibility of integrating targeted wound-care resources within a digital postoperative monitoring pathway and may enhance patient engagement in early wound management. Future work should include larger multicentre evaluations with comparator groups to assess clinical effectiveness, antibiotic use, patient experience, and cost-effectiveness. Additionally, further refinement of operational processes — including weekend dispatch, courier logistics and prescribing pathways — will be important to support wider implementation.

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