

Five years on: a national patient and public involvement audit and economic assessment of photo at discharge

KEY WORDS

- » Economic assessment
- » Patient engagement
- » Photography
- » Surgical Site Infection prevention
- » Wounds

In 2014, our hospital introduced the Photo at Discharge (PaD) for cardiac surgical patients. The aim of this study was two-fold: to examine the impact of PaD based on a economic assessment, and secondly to review findings from a 2019 national patient and public involvement (PPI) online survey for the initiative. **Methods:** The economic assessment was based on published data from a propensity case (PS) matched analysis of PaD. Underlying assumptions were cross checked with prospective surgical site infection (SSI) surveillance data submitted to Public Health England (PHE, 2018). Secondly, Hospital Episode Statistic (HES) data from NHS Digital was obtained to determine our re-admissions to other centres for post-operative wound infection. The economic assessment used a 'cost-avoidance' model and sensitivity analysis was performed to examine the robustness of underlying assumptions. In order to capture potential categorical benefits (not allocated monetary value), between the 1st and the 29th April 2019, a national survey was conducted to capture PPI needs and preference. **Results:** Based on PS-matched analysis, using 12 variables of interest in relation to SSI risk, 568 patients who received standard discharge advice were PS matched with 568 patient who received PaD. In relation to the PS study, PaD was associated with £201,672 'cost avoided' for SSI re-admissions, capacity released of on average 246 bed days and in turn, potential for an additional 35 elective surgeries and associated revenue was calculated as £485,485. National feedback suggests strong patient and public support for the scheme: 97% agree that PaD would be beneficial and 95% would like to see the approach incorporated for other surgical categories. **Discussion:** PaD is associated with a number of advantages including patient and public preference, as well significant 'cost-avoidance', capacity released and in turn, revenue generated from additional elective surgery. Future work could include economic modelling of PaD. A further area of interest arising from national PPI feedback is the introduction of PaD to other surgical categories.

Surgical site infection (SSI) following cardiac surgery can extend hospital stay, increase costs and is associated with increased comorbidity and mortality (Vos et al, 2018). The average cost of SSI following coronary artery bypass surgery (CABG) ranges between £22–32,000 (Findeisen et al, 2019). At our institution, the average cost of re-admission for SSI, e.g. excluding SSI detected on primary admission and/or costs incurred in the community, was £26,893, with the majority of costs (46%) associated with ward-bed days (*Figure 1*), with the median length of stay for SSI re-admission of 31 days (average 26 days, including incisional

and organ/space SSI, period April 2010 to March 2013). Length of stay (LoS) was noted longer than that reported for cardiac re-admissions (median 23 days) by Jenks et al (2014); this may be in part due to the scheduling of wound revisions on a 'weekly list'. Costs were incurred by our Trust (a publicly funded healthcare organisation) made up of two tertiary referral hospitals for cardiothoracic services. All costs provided in this study are adjusted for differential timings and provided in constant prices (net present value or 'today's money', 2019). The Bank of England rate of inflation (2.5%) was calculated cumulatively (i.e. compounded over the referenced period).

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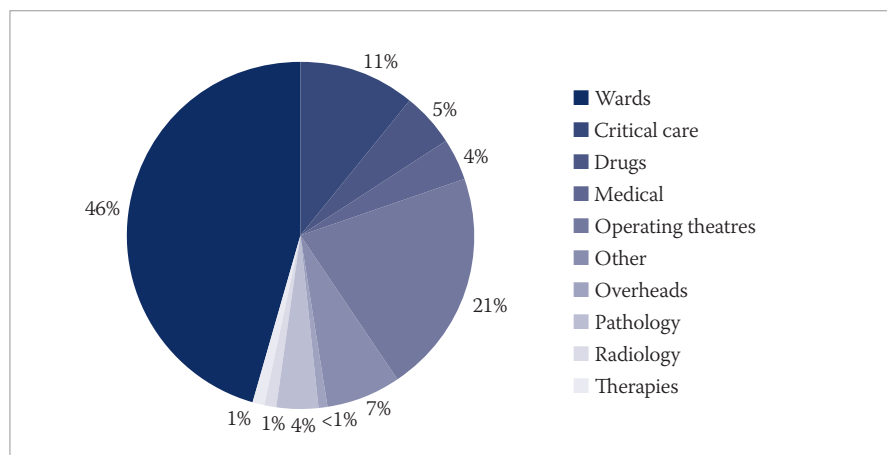


Figure 1. Cost category by proportion (%) of total cost cardiac SSI re-admissions

Harefield Hospital introduced PaD in 2014 and first published our experience in 2016 (Rochon et al, 2016). PaD was co-designed with patients and is a quality improvement project to improve information on the wound for the patient, carer and healthcare provider, aimed at reducing the risk of re-admission. On the day of discharge, the nurse takes a consented picture of the patient's surgical wound, and enters details in a database. The database creates tailored advice infection prevention advice, based on demographics and data entry (e.g. female patient gets advice re: post-op surgical bra [Rochon et al, 2017b], or if leg wounds are indicated, advice on using a separate towel for drying the different incisions, etc). Once completed, the colour form is given to the patient to take home with them, and a copy is saved on the electronic patient record. Staff training on the database and digital photography, as well as quality and compliance reporting, are important as part of the overall of the PaD process (Rochon et al, 2017a).

Feedback from our cardiac patients suggested that by combining a quality colour photo with individualised wound care instructions, patients felt more confident caring for their wounds and identifying and actioning concerns quickly (McCabe et al, 2018). We postulate that by providing a baseline photo, patients have a better understanding of what constitutes 'normal' and 'abnormal healing' specifically for their own wound, a concern raised in seminal work by Tanner et al (2012). Other cardiac centres have adopted and adapted the PaD scheme and more recently, it is being used in other patient groups helped by positive patients (Rochon et al,

2016), staff (Thompson and Dobbs, 2018) and commissioning — PaD was noted as 'Outstanding Practice' as an innovative approach to keeping SSI rates low (Care Quality Commission, 2019) helping to spread the project.

ECONOMIC ASSESSMENT

The costing model selected for this study is 'cost-avoidance analysis' (CAA). This approach highlights negative outcomes avoided (SSI re-admissions) and may be distinguished from cost savings as it does not change current spending (Sin and McMahon, 2015). The PaD costs calculated from the perspective of the commissioning organisation are compared with usual discharge advice (status quo scenario).

Sin and McMahon (2015) outline the format required by HM Treasury for economic assessment and these are applied here, with added modification by Sin and McMahon to distinguish between set-up and running (operational) costs in steady-state.

Set-up costs

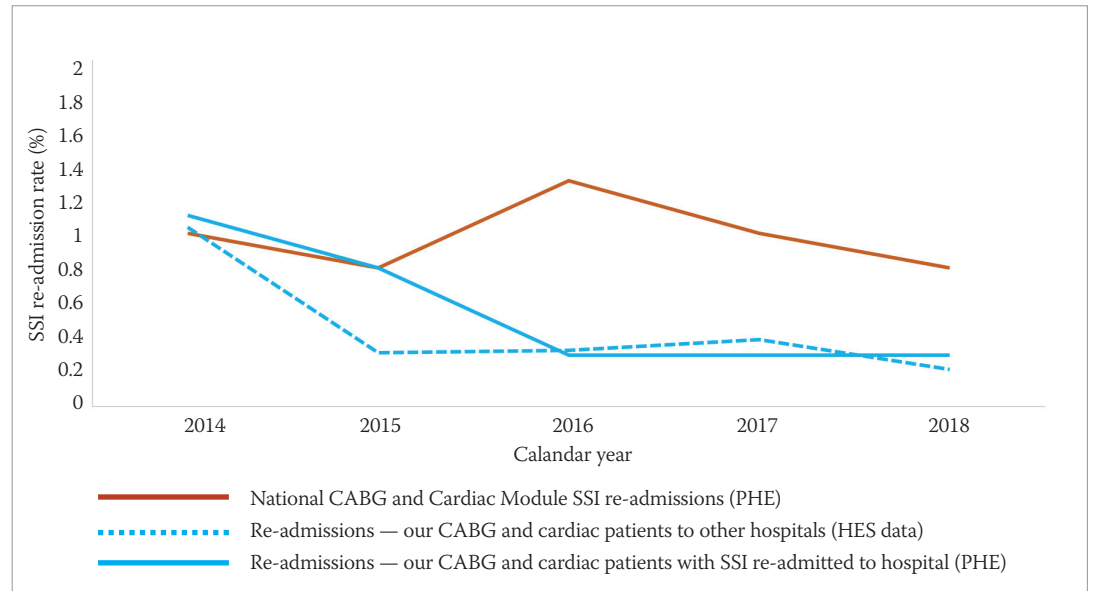
The set-up period for PaD refers to a two-month period. Training for nursing colleagues responsible for discharging surgical patients includes teaching on digital photography, using the database, and practice considerations (Rochon et al, 2017a).

There were two posts involved in the set-up period, costed using a bottom-up or 'activity-based' costing. Initial 'train-the-trainer' education and raising awareness across the surgical wards was provided by a Band 7 nurse (40 hours total over period, £5,521, includes 'on-costs'). The database fields needed to be set up for wards and surgical teams, and user accounts needed to be set up for nursing colleagues by a Band 7 IT colleague (£436 for 15 hours, Inner London Weighting, HCAS).

Running costs

We modified an existing inhouse database for PaD. To estimate running costs, this economic assessment used costs for an electronic database which can produce PaD and associated reports (Clinical Network Systems) for early adopters at £2,400 (VAT inclusive) per annum for unlimited users, and 0.07p per colour printout (£105 per annum, based on approximate 1,500 per year, assuming copies are printed out and not emailed).

Figure 2. Re-admissions — CABG and cardiac patients with SSI re-admitted to hospital (PHE)



Assumptions

As nursing colleagues are responsible for assessing the surgical wound, documenting the findings, and educating patients and carers on wound care, signs and symptoms of SSI, SSI prevention, and SSI identification, PaD falls within routine care and did not meet criteria for 'additionality' (Sin and McMahon, 2015). Non-pay expenditure (i.e. overheads including staff uniforms, stores, etc) did not meet criteria for 'additionality' either. The costing model assumes that cameras, colour printers and computers are available to ward staff (or that PaD copies are sent via email).

COST OF SSI RE-ADMISSIONS

Attribution

The benefits (reduction in re-admission for SSI) are reasonably assumed attributed to the PaD scheme based on the clinical effectiveness reported from a quasi-randomised design, retrospective propensity score matched to adjust for non-random PaD assignment (Rochon et al, 2018). In the retrospective analysis, 568 patients who received PaD were matched with 568 patients who received standard discharge. PS matching was performed using the 'nearest neighbour' (calliper distance of 0.25 and a 1:1 ratio without replacement).

Variable of interest included: age, gender, body mass index, diabetic status, smoking status, renal function, operative urgency, duration of surgery

(minutes), use of internal mammary arteries, method of vein harvest (if applicable) and length of hospital stay (days). There was a significant difference in risk of re-admission for SSI (relative risk = 0.2, 95% confidence interval [CI] = 0.04–0.91). This suggests that PaD reduced the risk of SSI re-admission by 80% and that this was statistically significant ($p = 0.037$).

Attribution was sense checked with two alternative sources: prospectively collected SSI surveillance data on SSI re-admission (any hospital) submitted to Public Health England (PHE) (PHE, 2013) and Hospital Episode Statistics (HES) data from NHS Digital. The latter was obtained from the SSI Dashboard (Imperial College Health Partners [IHP]) and provides information on re-admissions of our cardiac patients for post-operative wound infections to other hospitals (Figure 2). A further cross-check was made on the latter source (HES data, based on clinical coding): this was done by extracting our OPCS and ICD codes for CABG 2018 and compared it with our prospective surveillance data (2.4% [15/620] vs 2.6% [16/620]). This provided us with some reassurance on using HES data in this study. Trends of re-admissions to our hospital (using prospective surveillance) and of our patients readmitted to other hospitals (using clinical coding) demonstrate a similar reduction in SSI re-admissions as the PS-study data (e.g. above a three-fold reduction between our hospital and others

Box 1. Example PPI comments. CIRIS Project ID:003156 conducted for Royal Brompton & Harefield NHS FT by the Patients Association, April 2019

"Fantastic initiative supporting patient safety and infection prevention and control."

"Communication between all stakeholders is hard to get perfectly right. This surely helps, because visual communication is much easier and more important for way some of our brains work."

"Wound was out of sight so would be useful."

"It seems like a no-brainer, and a very simple, effective and efficient method of monitoring progress."

"I'd like to see that practice applied to all different wounds."

"An excellent proposal, it would certainly improve quality of care and recording changes in the wound with positive and negative."

"This recommendation is very worthwhile because it involves the patient in their own healthcare which is one of the NHS Long Term View identified aims."

"This would give the health professionals who take over the care a base line to work from with regard to the healing of the wound."

"Excellent idea. Can't think of anything to add."

"It's important because it enables the patient or carer to monitor the wound themselves and spot any adverse changes at an early stage. Thank you so much for recognising that a carer may need to do this."

"Will clearly be of great benefit, standard procedure? Yes."

over the four-year period since the introduction of PaD in 2014). It is noteworthy that from 2016, PaD compliance was maintained >90% (Thompson and Dobbs, 2018).

Based on the PS-matched analysis data, benefits to the health care system are:

- ▶▶ £201,672 'cost avoided'
- ▶▶ Capacity released: 246 bed days
- ▶▶ More patients receiving care: 35 elective surgeries or more
- ▶▶ £485,485 revenue from CABG surgery.

The capacity released was calculated using locally sourced (Trust) data on CABG isolated elective procedures, January 2014–December 2016. 'Isolated' refers to no additional procedures (such as valve surgery) performed. The total number of cases included was 833, range 3-92 days, with a mean stay of 8.5 days. The median was 7 days (50th percentile). The median of 7 was used for calculations of revenue using 2019-20 Tariff Planned ED28A/NCBPS13E Standard CABG with complex comorbidity (CC) Score 10+ (inclusive of specialist top-up 19.94% Treatment Function code of 172 – Cardiac Surgery, Tariff £13,871). Each procedure also has a "trim point" – as in the number of days expected that the patient is to be discharged within, and rate if this is exceeded. It is assumed for the purposes of cost-avoidance analysis that all patients were elective and discharged within trim point. Within our contracts, we get paid for each activity that we carry out, however, other Providers may have a block contract in place where they will only get a set amount of money – in this instance, there would be no additional payment.

Indirect costs (incapacity to work, income lost by family members, lost leisure time, home care, travel costs and years of productive life lost and intangible costs, i.e. cost to Trust reputation) were excluded from the costing model as these were too resource intensive to retrieve (Sin and McMahon, 2015).

In line with best practice, we undertook sensitivity analysis of the developed CAA model to test for errors, as well as underlying assumptions and conditions under which the values may change (such as SSI re-admission numbers, cost of the database and/or SSI costs) and the potential impact of these (Pannell, 1997) *Figure 3*.

NATIONAL PPI SURVEY: PHOTO AT DISCHARGE

Categorical benefits do not have monetary values presented but are considered benefits arising from PaD. For the purpose of this study, we sought patient and public involvement (PPI) for views on PaD in terms of needs and preferences for 'patient-centred care' (International Alliance of Patient Organisations, 2006). The short survey consisted of two questions and a space for comments designed with PPI, and a section for demographics. The Patients Association (a UK-based advocacy group aimed at improving patient experience of healthcare) was commissioned to run the survey throughout April 2019.

The online survey was open nationally to patients and the public and promoted by the Patients Association media via their newsletter and Twitter account. Overall, 371 responses were submitted to the survey; 97% of participants indicated that PaD would be beneficial and 95% felt that PaD would meet their surgical discharge needs (100% of respondents answered both questions) (*Figure 4 and 5*). Overall, the comments provided by respondents suggested that PaD provided better information and a form of communication for patients and carers, and that it would be useful when interacting with healthcare professionals (*Box 1*). In the minority were comments including practical points covered by PaD, such as consent process, documented assessment and emailing the document. 75% of respondents indicated that either they or someone they cared for had surgery in the last five years (70 participants skipped this question). 46% of those who responded to the question on gender were male, 54% female (20 skipped this question) with the majority over 55 years of age (20 skipped this question) (*Figure 6*). Only 13% (45 individuals out of 349) indicated ethnicity other than white.

DISCUSSION

This economic assessment uses a PS matched study where the risk of re-admission for SSI 0.4% for PaD group and 1.8% in non-PaD group. Based on the published study, findings suggest that for every £1 spent, PaD generates £16 in benefits in 'cost avoidance', e.g. excludes additional revenue generated, categorical benefits, etc. The benefits

Figure 3. Sensitivity analysis of EA for PaD, filtered on current assumptions

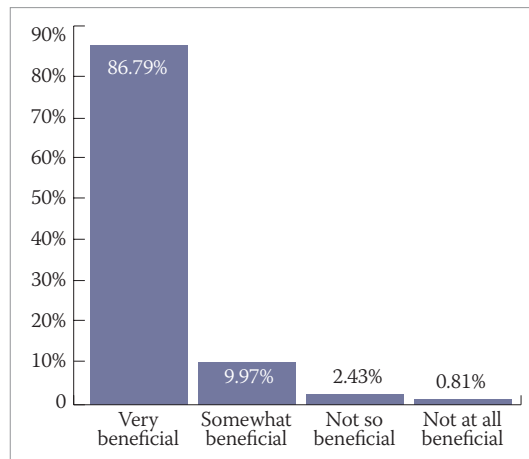
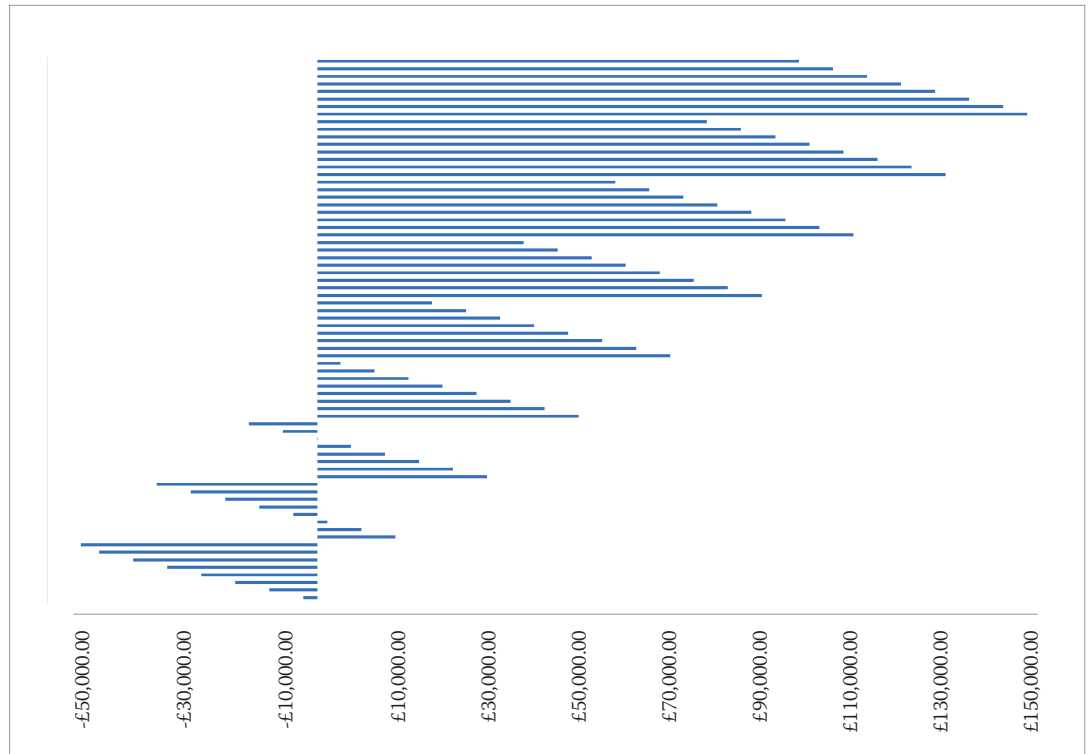


Figure 4. Responses: PaD (colour photo and printed assessment of the surgical wound) (PPI survey, 2019)

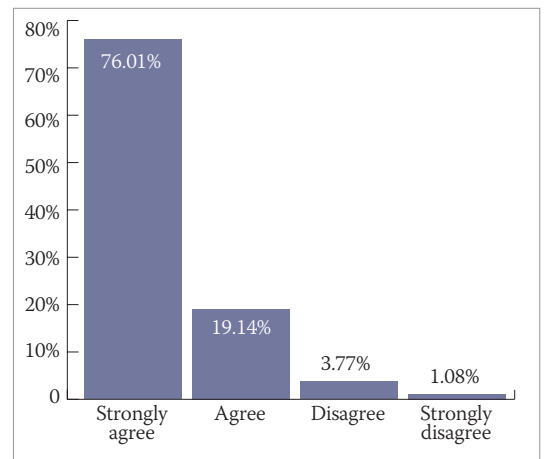


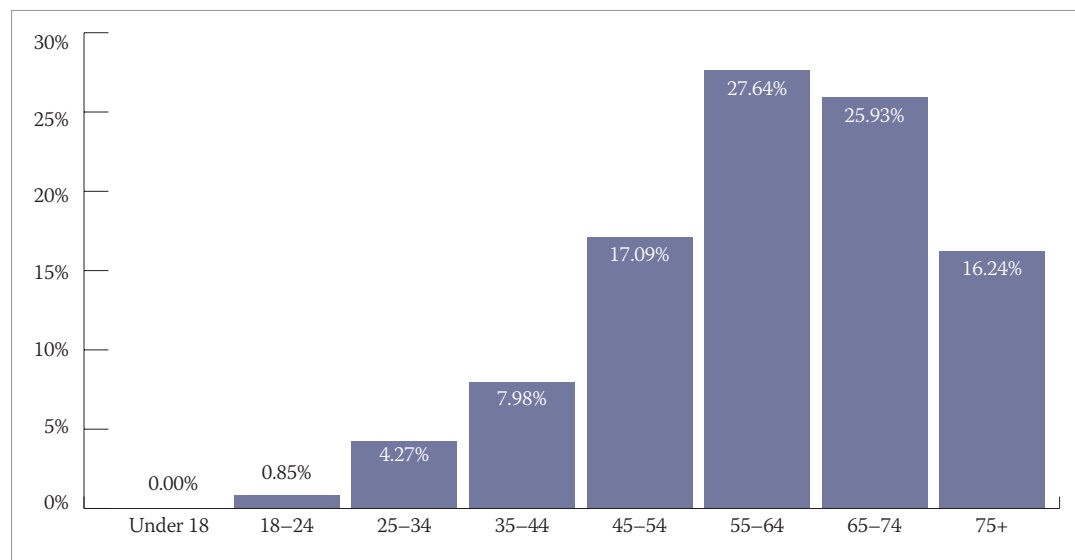
Figure 5. Responses: PaD for standard practice for wound discharge advice (PPI survey, 2019)

to the system refer to isolated-CABG patients, however, trends observed in *Figure 2* suggest a broader benefit for CABG +/- other surgery and general cardiac (non-CABG) patients.

The sensitivity analysis (*Figure 3*) models the effects of combining different values of cost of SSI re-admission, PaD set-up and running costs per annum, and number of SSIs prevented per annum, on the overall 'cost-avoided' of the PaD scheme. In this model the cost of set-up (e.g. staff training and IT

time to modify fields for local ward and consultant names) is fixed, but the annual price of the database licence can change. This analysis demonstrates that based on the most expensive annual price of database (over £56,000), 'costs avoided' appear after two SSI are prevented per year using most values for cost of re-admission (e.g. an average cost of SSI re-admission ranging between £1,000 to £53,000 per SSI). Even at the highest annual cost of the system, once we have prevented eight SSIs in the different

Figure 6. Responses: age of respondents (PPI Survey, 2019)



re-admission costs, there is benefit in terms of 'avoided costs' in all but one case (the lowest cost of re-admission in our model).

Furthermore, the national PPI PaD survey suggests that PaD is beneficial in terms of patient education and promoting self-care (*Box 1*), as well as providing an important link between healthcare settings. This is an important consideration, as a systematic assessment using the Patient Education Materials Assessment Tool (PEMAT) conducted by Zellmer et al (2015) found that despite the broad availability of materials for patients pertaining SSI prevention (including pamphlets and information sheets), these resources performed poorly. Vishnevetsky et al (2018) also cited the importance of accurate, accessible and actionable health information, as low health literacy can impact on health outcomes, placing a burden on healthcare resources (Shoemaker et al, 2014). At discharge, patients are already stressed and overwhelmed by information, and education materials should avoid reliance on the limited capacity of the individual's 'working memory' (Wilson et al, 2012).

The findings from the 2019 survey conducted by the Patients Association reflects similar feedback from our own patients who received PaD on discharge (Rochon et al, 2016). It can be placed alongside positive feedback from surgical staff nurses who deliver PaD (Thompson and Dobbs, 2018). Furthermore, findings from a survey to General Practitioners (GP) (Rochon et al, 2018)

suggested that 95% of 20 GPs surveyed find PaD useful, 'a positive, progressive step... reassurance [for patient/carer] of ongoing management, and useful for clinicians when reviewing the wound' (CIRIS Project ID:002197, 2018). It should be noted that standard practice of adding PaD to the electronic patient record may have influenced changes or improvements to surgical wound closure, and more study is needed to understand this (Rochon et al, 2018).

LIMITATIONS

A limitation of this study is that it arises from a single hospital, which may reduce the generalisability. We have attempted to control for this using sensitivity analysis to challenge assumptions (including the cost and number of SSI re-admissions) underpinning the model. Further, by closely matching patient characteristics, the source study (Rochon et al, 2018) excluded approximately 35% of patients from the study's three year period. In this paper, we used PHE and NHS Digital data to 'sense-check' the assumption of an 80% reduction in SSI re-admissions and were reassured by the reduction in our SSI re-admission trends observed over a four year period in data from PHE and NHS Digital. An additional concern is that our economic assessment was modelled on one alternative strategy (status quo, or 'do nothing' alternative) using verbal advice provided by nurses. A potential limitation is that we did not model other scenarios, such as verbal advice, plus generic wound care pamphlet (e.g. £180 for 200 colour print outs). However, we have applied sensitivity analysis

to consider different cost implications which could be used for such investigations. Finally, a further limitation of this assessment is that we did not include 'costs avoided' by reducing our re-admissions to other hospitals for post-operative wound infections within 30 days, as covered by the NHS England and NHS Improvement national tariff (2017/18) thus under-estimate the true 'cost avoided' for our centre. However, the data from the PS matched analysis was based on prospective surveillance via trained personnel (Rochon et al, 2018). Despite these important considerations, a strength of this work is that it incorporates categorical benefits (not accorded monetary value) from a national PPI survey on PaD. This is an important distinguishing feature of PaD, versus other published materials or resources to engage patients in SSI prevention strategies.

In summary, this economic assessment selected an observational study as a basis to examine the impact of PaD on SSI re-admissions in isolated CABG patients. Attribution was sense-checked with all cardiac SSI re-admissions to our own and other hospitals, using two national data sources (PHE and NHS Digital) and a sensitivity analysis was performed to check for errors and underlying assumptions. As not all benefits have monetary value, we sought national views on the scheme in 2019. Findings from this survey suggest personalised and tailored wound care advice is welcomed broadly from a PPI perspective. Further work could include economic modelling (including costs associated with re-admissions to other hospitals) and extending PaD in other patient groups.

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