



SusQI project report: Eliminating the second group and save prior to laparoscopic cholecystectomies

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Abstract:

Project Aim: To eliminate the second group and save (G&S) blood test in the preoperative pathway for laparoscopic cholecystectomies (LC) at University Hospitals Sussex NHS Trust.

Method and measurement:

A process map (Appendix 1) was created to identify areas of waste and low value activity, namely the second G&S blood test. We engaged with a wide variety of staff and patients via a short survey to understand the social impacts the change could have. A patient safety audit was conducted via review of LCs performed at the trust. A rapid literature review was performed to identify studies reporting transfusion or bleeding rates post-LC. A basic cost analysis of the G&S was undertaken with the prices extrapolated to the audited patient group. To consider environmental impact, we calculated data on the average miles travelled per patient, the items involved in the collection of blood tests, personal protective equipment used by clinicians and the weight of materials going into clinical waste incineration. Using respective carbon emissions factors, we determined the CO₂e saving.

Results

Our audit and literature review supported the hypothesis that eliminating of the second G&S is likely to be safe. By doing so, up to 2.5 tonnes CO₂e per year and >£3000 (based on a conservative estimate of 250 cases) could be saved. Social benefits include reducing inconvenience and travel costs to patients and reducing concerns of low value or over-investigation of patients, increasing clinical pressures.

Conclusion:

We demonstrated that eliminating the second G&S in the preoperative workup for LC procedures is a safe intervention. Across the UK, approximately 61,220 LCs are performed every year¹⁶. The elimination of this one blood test could therefore save over 600 tonnes of CO₂e annually, as well as save resources such as blood bottles of which there was recently a shortage across the UK¹⁶. The reduction of testing also adds social benefits of increased convenience to patients, and reduced workload for staff.





Background:

At University Hospitals Sussex (UHS) Trust patients undergoing day case laparoscopic cholecystectomies (LC) are currently required to have preoperative assessments with the aim to reduce on-the-day cancellations and improve patient safety. Our pre-operative guidelines demand two group and save (G&S) samples to facilitate perioperative transfusions if required for any 'major' operation. While LCs are considered a 'major' operation as per the National Institute of Health and Care Excellence (NICE)¹, the risk of bleeding from the LC procedure is very low², and NICE make no recommendation for G&S as this is considered operation specific.

It was our view that default testing prior to LCs has little to no impact on management. The idea of eliminating unnecessary G&Ss for low-risk procedures is not new³⁻⁸, and has come to light due to significant potential financial savings, ranging from £10-24 per G&S depending on the Trust³⁻⁵. One UK Trust found eliminating the second G&S for approximately 600 LC patients could save £13,280 per year⁵. In France, anaesthetic guidelines do not necessitate any preoperative blood tests for LC,⁹ and a national study identified excessive G&S tests cost >€5,000,000 over 4 years for only four routinely performed operations (including LC).

The Trust performs on average 250-300 LCs per year. Our preoperative services are based at a more remote site (in Haywards Heath) within the Trust. With every patient travelling to two G&S appointments, the social implications for patients and the cost to the environment is high. Currently 1 in 20 car journeys are attributable to healthcare in the UK¹¹. Further, the consumables required to take blood are all single use. Our Trust orders 2,000,000 plastic blood bottles, 383,400 venepuncture sets and 189,000 tourniquets per year (Freedom of Information request). Unfortunately, it is not possible to determine what percentage of this is due to G&S tests, however with pathology testing is the single highest volume medical activity¹⁰ and tests that do not impact management place additional pressure on outpatient phlebotomy services.

As clinicians involved in a wider research collaborative, we are motivated to change clinical practice based on the best available evidence and disseminate findings to the wider research community. We are driven to find simple solutions to the environmental crisis within healthcare.

Specific Aims:

We aim to eliminate the need for the second G&S prior to LC and demonstrate associated savings across the triple bottom line. To do this we will:

1. Ensure omitting the second G&S prior to LC is safe
2. Calculate the carbon footprint of the second G&S within the context of LCs at the Trust
3. Calculate the cost implications
4. Gather information regarding the social impact on patients
5. Engage staff and raise awareness of the project, with the hope that other specialties will follow suit



Methods:

We created a process map (Appendix 1) jointly with the Head of Preoperative Assessment to understand the wider context of the project, and to identify target areas to implement change and our change ideas.

We presented at the Trust Green Clinical Workstream Meeting, and consequently many key clinicians approached the team to help with data collection and staff engagement. Information services and quality improvement leads were approached for assistance in patient surveys. Laboratory technicians were contacted to understand the processing of blood samples and calculate a more exact carbon footprint.

Anaesthetists frequently involved with General Surgical lists were approached via email to address concerns and gain consent for the change to be trialed. We also presented the project at a Green Anaesthesia meeting via Teams.

Measurements:

Clinical / Patient safety impacts:

To ensure this was a safe intervention, we contacted the Trust Central Information Unit (CIU) to acquire a record of all LCs performed at the Trust since January 2020. Blood test results, operation notes and discharge letters were audited via our online computer systems for each patient to determine how many required blood transfusions perioperatively.

A rapid literature review was performed using PubMed to identify studies reporting transfusion or bleeding rates post-laparoscopic cholecystectomy to compare our findings and maximise safety using the following search criteria: (transfusion [Title/Abstract]) AND (laparoscopic cholecystectomy [Title/Abstract]).

Social impacts:

The Trust quality improvement leads were contacted, and a meeting was set up with the Patient Engagement coordinator who permitted a short survey for preoperative patients (Appendix 2). The survey was disseminated via QR code accessible for patients at their preoperative assessment and on day the case ward.

Environmental impact:

We calculated the carbon footprint of the outpatient G&S using a bottom-up approach by;

- Auditing 29 patients undergoing LCs to determine how many blood tests and appointments were required and the average mileage per patient (using their postcodes and Google Maps).
- Collected all items needed for phlebotomy from ward stock (see image, clockwise from top left: vacutainer, gauze, Chloraprep stick, vacuettes, tourniquet). We then deconstructed and weighed each



constituent part. The BEIS and ICE databases were used to determine the carbon footprint for individual components (see Appendix 3).

- Personal protective equipment (i.e., gloves and gowns) has been calculated previously at this Trust so figures were taken directly from this¹².
- Due to timing and staff constraints the laboratory was unable to provide information about how the blood tests were processed. Therefore, an input-output approach was used. The Sustainable Development Unit figure for kgCO₂e/£ was used in conjunction with the costs obtained.
- Figures for clinical waste high temperature incineration from the paper by Rizan et al. (1074 kgCO₂e/tonne including transport)¹³ were used to calculate clinical waste disposal. We excluded waste disposal for any items that might be disposed of in the laboratory (e.g., vacuettes) and therefore incorporated in the cost of the laboratory processing, to avoid duplication.

Financial impacts:

A basic cost analysis of the G&S was undertaken. The laboratory manager supported us to obtain costings for commonly performed preoperative blood tests at the Trust. The figures provided were those charged to external users of the service and therefore may be an overestimation of the true cost. However, this is for laboratory processing only and does not encompass the equipment, staff time etc. The prices were then extrapolated to the audited patient group.

Results:

Clinical outcomes:

An audit of 243 LC patients at the Trust found only two (0.83%) requiring a blood transfusion (one of which was an emergency case). Both received transfusions several days after their operation and had a further G&S prior rendering the second preoperative sample redundant.

The literature review in addition to these cases found 110 studies of which 17 reported the intra- and postoperative transfusion rates for LCs. Of almost half a million patients, the overall transfusion rate was 0.36%, therefore, elimination of the second G&S is likely to be safe. See Appendix 4 for summary table.

Environmental sustainability:

An initial audit was undertaken prior to the Green Surgery Challenge. It included patients undergoing LC from 07/07-22/09/2020 during which time 40 procedures were performed. Eighty-five percent of patients were ASA I (i.e., fit and well), with a mean age of 49. This audit was repeated for the 29 most recent day-case LCs (dates 04/01 – 19/05/21 (there was a substantial break in operating due to the pandemic)). The mean age was 55, and the average number of preoperative visits to hospital was 2.7. Patients travelled on average 23 miles return for each appointment.

We used averages of miles travelled and simplified the analysis to assuming each patient only underwent two blood tests. The carbon footprint of the first set of blood tests (typically a full blood count, urea and electrolytes, liver function tests and the first G&S) is 12.13 kgCO₂e including patient travel (by a medium sized vehicle). The carbon footprint of the second G&S is 10.39 kgCO₂e.





By eliminating the second G&S for LC procedures, we could save up to 2.5 tonnes CO₂e per year (based on a conservative estimate of 250 cases). The breakdown of the carbon footprint for the second G&S is demonstrated in Appendix 5.

Social sustainability:

Ten day-case perioperative patients completed the survey. Due to list cancellations, we were unable to approach exclusively LC patients, so sampled several different general surgery and urology patients. We found 50% needed to make alternative social arrangements to attend for their tests (including time off work and escorts). All patients except one travelled by motor vehicle (self-driven or taxi), spending on average £5 per journey. Only half had their tests done at their nearest hospital. Interestingly, all patients except one felt more at ease attending in person at least once prior to their operation. No patients had ever considered the environmental impact of healthcare, but most agreed the NHS should be more environmentally friendly.

Example patient quotes;

- Patient 1: *"I don't really mind attending appointments... less stressful than I thought it would be"*
- Patient 3: *"I spent over £60 travelling back and forth.... Going from Hastings to Haywards Heath, my friend brought me here. Today my operation has been cancelled. I was waiting 3 years"*
- Patient 6: *"I don't know why I needed two blood group tests, no one explained that to me"*

The Head of Preoperative Assessment expressed her concerns about the impact of over-investigation of patients on her staff and patient safety; with increasing workload some of the more important investigations are overlooked. Similarly, both phlebotomy and laboratory capacity are stretched.

Economic sustainability:

This intervention has no investment costs. The G&S is estimated at £12 at our Trust (the finance department were unable to provide a precise figure), which is considerably less than other studies⁴⁻⁸. This represents the laboratory cost only and does not include the cost of phlebotomy, portering services, venepuncture consumables and building costs. Therefore over 250 cases, this could offer a cost avoidance to the Trust of >£3000 (as per NHS efficiency map¹⁴).

Barriers encountered:

We were unable to meet with the lead laboratory technician with the aim to determine the exact process and materials used for blood test processing due to staffing pressures and lack of time. Consequently, a top-down approach was used to determine the carbon footprint of the laboratory processing of the tests, which is likely to be an over-estimation of the true footprint.

Some staff perceptions and personal opinions on the importance of the second G&S procedure impacted on our ability to implement change within the project timeframe. To support in education and culture change, the Head of Anaesthetics organised a formal presentation at the Anaesthetics Governance Meeting in August 2021. Following this meeting, we were able to generate interest and



raise awareness about the carbon footprint of the preoperative process in general and aim to apply this change to several operations.

Conclusions:

We demonstrated that eliminating the second G&S in the preoperative workup for LC procedures is a safe intervention which could save 2.5 tonnes of CO₂e and >£3000 per year to the Trust. This equates to 10kgCO₂e per patient, the equivalent of a 225g beef steak. There are added social benefits of increased convenience to patients, and reduced workload and laboratory processing for staff. Across the UK, approximately 61,220 LCs are performed every year¹⁶. The elimination of this one blood test could therefore save over 600 tonnes of CO₂e annually.

Although travel contributed most of the footprint, with many thousands of tests being undertaken each year in a variety of secondary care settings, rationalising blood tests in general with better knowledge of their environmental impact could also save money¹⁵ and resources. Following submission of this project, our Trust was one of many impacted by the Becton Dickinson (BD) blood bottle shortage in August 2021¹⁶. NHS England published a report urging clinicians to rationalise and prioritise testing, which advised to 'avoid group and screen testing unless a patient is likely to require a transfusion'.

UHS is rolling out an electronic preoperative assessment (EPOA) in the near future, which should bring more opportunities to reduce patient travel and empower patients to complete their own assessments, for example, by uploading basic clinical data such as blood pressure, height and weight. Together these changes could mean many younger, fit and well patients avoid any in-person visits prior to their operation.

This project has come at an important time during the UHS Green agenda. There is a new Green Clinical Workstream, and a rapidly increasing number of Green Ambassadors tasked with carrying out quality improvement projects throughout the Trust. This case study has been used to motivate the Green Ambassadors and has been featured in some of the Workstream Meetings. It has also supported us to establish relationships across the Trust at various levels of patient pathways to support education, dissemination on information and to implement change.

The liberal requesting of preoperative G&S is commonplace in other specialties and surgeries, such as day-case orthopaedics⁶ and urology³. We hope this project will encourage anaesthetic departments to reassess their preoperative workups and consider the need for such tests. This could have an enormous impact on the carbon footprint of the service, in conjunction with moving assessments online. We hope our project will engage others by highlighting the simplicity of this change and motivate action in other surgical procedures and other hospitals across the UK.





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Appendix 1: Process map for patients needing a laparoscopic cholecystectomy with resource use key.





Appendix 2: Patient Engagement SusQI: Pre-operative investigations

1. Did you attend for pre-operative investigations, appointments, or blood tests (i.e., anything related to your surgery but before attending for the operation itself)?
 - a. Yes
 - b. No

2. Which hospitals did you attend for these investigations (tick all that apply)?
 - a. Princess Royal
 - b. Royal Sussex County
 - c. Lewes Victoria
 - d. Other (please specify)

3. Did you visit your closest UHS site for your investigations and appointments?
 - a. Yes
 - b. No
 - c. For some but not all

4. How many times did you need to visit hospital for these?
 - a. Once
 - b. Twice
 - c. Three times
 - d. Four or more times

5. How did you travel to your appointments?
 - a. Own car – self-driven
 - b. Own car – driven by someone else
 - c. Someone else’s car / driven by someone else
 - d. By foot
 - e. Public transport (Cycle, Train, Bus, Taxi)
 - f. Hospital transport
 - g. Other (please specify)

6. How much did you spend on travelling to each appointment?
NB: Approx. 20p per mile if travelling by car (e.g., Brighton to PRH = approx. £5.60 return)
 - a. £0
 - b. £0-5
 - c. £5-10
 - d. £10-20
 - e. >£20

7. Which of the following arrangements did you need to make to attend these appointments (tick all that apply):
 - a. Time off work
 - b. Childcare
 - c. Alternate care for another dependant
 - d. Alter existing plans / commitments
 - e. Other (please specify)
 - f. N.A

8. Were any of your tests or appointments cancelled / rescheduled?
 - a. Yes
 - b. No

9. Were you contacted about any abnormal findings pre-operatively which needed actioning before surgery? (please specify)

10. Was your operation cancelled?
 - a. Yes
 - b. No





11. If yes, did you need to re-attend for repeat testing?

- a. Yes
- b. No

12. How far do you agree with the following statements? (1 strongly disagree, 5 strongly agree)	1	2	3	4	5
Attending fewer pre-operative appointments would improve my experience					
Attending my nearest hospital or GP for investigations would improve my experience					
Online or telephone pre-operative assessment would improve/ improved my experience					
Travelling to pre-operative appointments was convenient					
I understood what the tests were for					
Having pre-operative tests improved my experience					
Having pre-operative tests made me less anxious about my operation					
Attending appointments disrupts my daily life					
Attending appointments disrupts the daily lives of others around me					
I am concerned about the environmental impact of healthcare-related activities					
I think the NHS could / should be more environmentally friendly					

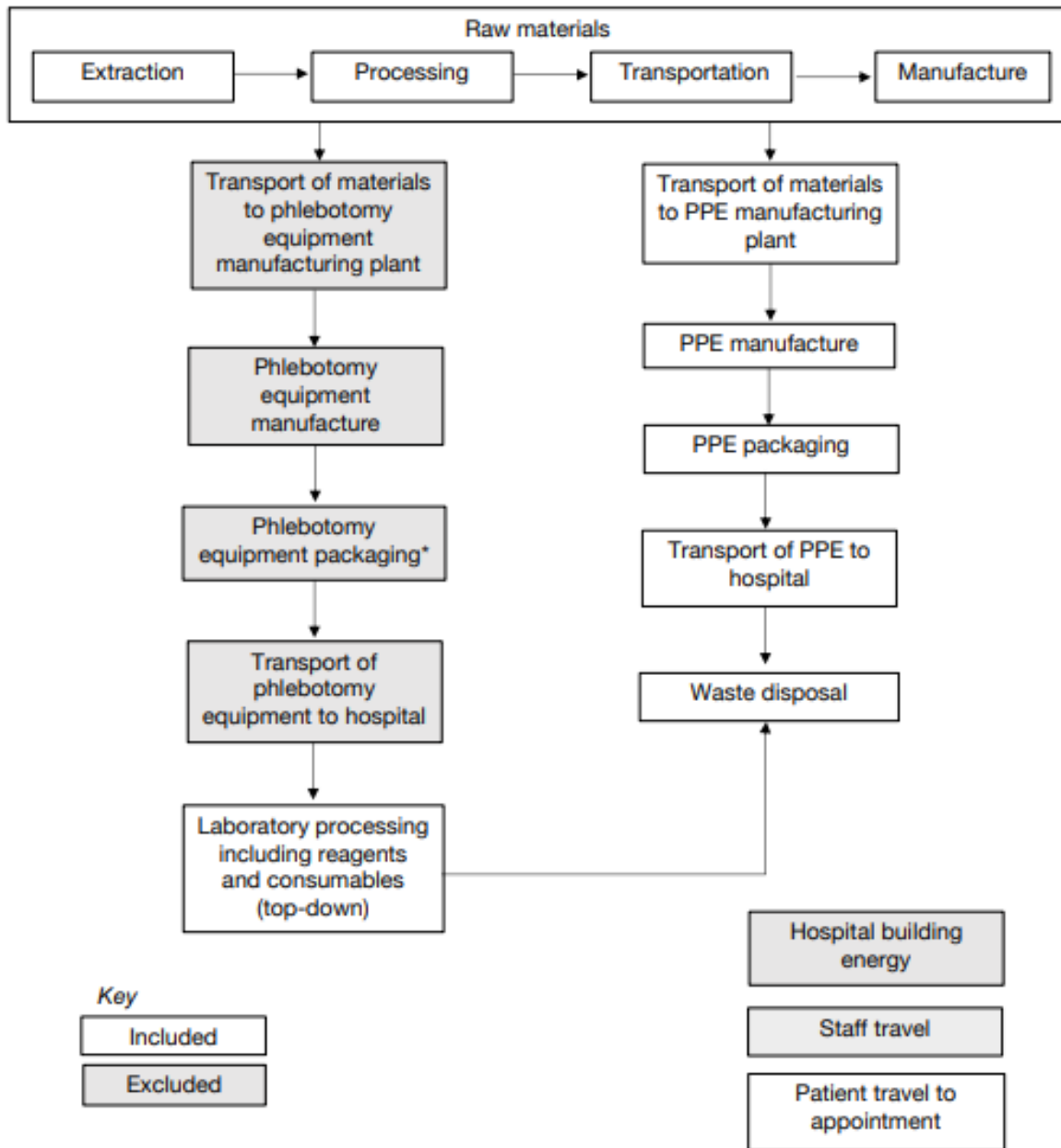
13. Any further comments on your preoperative experience?





Appendix 3: System boundary for carbon foot printing.

*Emissions of packaging of individually wrapped pieces of equipment were included (e.g., venepuncture set, gauze), but not the packaging that all items are transported in (e.g., boxes of venepuncture sets, film wrap etc.).





Appendix 4: Literature review summary table of post-laparoscopic cholecystectomy plus our audit finding

<i>Author</i>	<i>Year</i>	<i>Country</i>	<i>n</i>	<i>Transfusions (n, %)</i>
<i>GSC Brighton</i>	2021	UK	243	2, 0.82%
<i>Fong⁹</i>	2021	UK	1002	0, 0
<i>Barrett-Lee¹⁴</i>	2018	UK	25	0, 0
<i>Tandon¹⁰</i>	2017	UK	2079	12, 0.58%
<i>Beloil¹¹</i>	2017	France	459615	1425, 0.31%
<i>Thomson¹⁵</i>	2016	UK	293	0, 0
<i>Suuronen¹⁶</i>	2015	Finland	17175	223, 1.30%
<i>Hamza⁶</i>	2015	UK	913	8, 0.87%
<i>Mahar¹⁷</i>	2012	India	890	15, 1.70%
<i>Quinn¹⁸</i>	2011	UK	4462	49, 1.10%
<i>Ghirardo¹⁹</i>	2010	USA	1167	6, 0.51%
<i>Wolf²⁰</i>	2008	USA	1210	11, 0.90%
<i>Usal²¹</i>	1999	USA	2589	12, 0.46%
<i>Stuttman²²</i>	1995	Germany	1048	2, 0.19%
<i>Chan²³</i>	1994	Hong Kong	300	0, 0
<i>Harris²⁴</i>	1993	USA	100	1, 1%
<i>Donohue²⁵</i>	1992	USA	200	2, 1%
<i>Graber²⁶</i>	1992	USA	100	1, 1%
	Total		493,411	1769, 0.36%

Appendix 5: Breakdown of carbon footprint for the second preoperative group and save

