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<td>Knott, Amy; Yeovil District Hospital, Pathak, Samir; Yeovil District Hospital, Department of Surgery McGrath, John; Exeter Surgical Health Services Research Unit, Department of Urology Mythen, Monty; University College Hospital, Anaesthesia Kennedy, Robin; St Mark’s Hospital, Department of Surgery Horgan, Alan; Freeman Hospital, Department of Surgery Carter, Fiona; Yeovil District Hospital, Academy Francis, Nader; Yeovil District Hospital, Department of Surgery</td>
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Knott A\(^1\) Senior House Officer
Pathak S\(^1\) Specialist Registrar
McGrath JS\(^2\) Consultant Urological Surgeon
Kennedy R\(^3\) Consultant Colorectal Surgeon
Horgan A\(^4\) Consultant Colorectal Surgeon
Mythen M\(^5\) Professor of Anaesthesia
Carter F\(^6\) Manager of the Southwest Surgical Training Network
Nader K Francis\(^1\) Consultant Colorectal Surgeon

Affiliations
1. Department of General Surgery, Yeovil District Hospital, Higher Kingston, Yeovil, BA21 4AT
2. Exeter Surgical Health Services Research Unit, Royal Devon and Exeter NHS Foundation Trust, EX2 5DW
3. Department of Surgery, St Marks Hospital, Northwick Park, Watford Road, Harrow, Middlesex HA1 3UJ
4. Department of Surgery, Freeman Hospital, Freeman Road, High Heaton, Newcastle Upon Tyne, Tyne and Wear NE7 7DN
5. Department of Anaesthesia, University College Hospital, 235, Euston Road, London, NW1 2BU
6. Yeovil Academy, Yeovil District Hospital, Higher Kingston, Yeovil, BA21 4AT
Corresponding Author

Mr N K Francis
Consultant Colorectal Surgeon,
Yeovil District Hospital,
Higher Kingston,
Yeovil,
BA21 4AT
Tel: 01935 384244
Fax: 01935 384653
E-Mail: nader.francis@ydh.nhs.uk

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Contributors

Dr Amy Knott – analysis of results, drafting and editing of paper.

Mr Samir Pathak - analysis of results, drafting and editing of paper.

Mr John McGrath – study design and content, drafting and editing of paper

Mr Robin Kennedy - study design and content, drafting and editing of paper

Mr Alan Horgan - study design and content, drafting and editing of paper

Mr Monty Mythen - study design and content, drafting and editing of paper

Dr Fiona Carter - study design and content, analysis and results, drafting and editing of paper

Mr Nader Francis - study design and content, analysis and results, drafting and editing of paper

Guarantor

Mr Nader Francis

Nader.francis@ydh.nhs.uk
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Ethical approval was not required

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All authors, external and internal, had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Data Sharing Statement

Dataset available from the corresponding author, Mr Nader Francis. (nader.francis@ydh.nhs.uk)

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ABSTRACT

Objective: The Department of Health’s Enhanced Recovery Partnership Programme (ERPP) commenced a spread and adoption scheme of Enhanced Recovery After Surgery (ERAS) throughout England. In preparation for widespread adoption the ERPP wished to obtain expert consensus on appropriate outcome measures for ERAS, emerging techniques being widely adopted and proposed methods for the continued development and sustainability of ERAS in the NHS. The aim of this study was to interrogate expert opinion and define areas of consensus on these issues.

Design: A Delphi technique using three rounds of re-iterative questionnaires was used to obtain consensus.

Participants: Experts were chosen from teams with experience of delivering a successful ERAS programme across different surgical specialties and across various disciplines.

Setting: The first two rounds of the questionnaire were completed online and a final, third round was undertaken in a meeting using interactive voting.

Results: 71 experts took part in this study. Consensus statements agreed that patient experience data should be recorded, analysed and reviewed at regular ERAS meetings. Recent developments in regional analgesia, the increased use of intraoperative monitoring for fluid management and cardio-pulmonary exercise testing were the main emerging techniques identified. National standards for those outcome measures would be welcomed. To sustain success in ERAS, the experts highlighted clinical champions and the presence of a dedicated ERAS facilitator as essential elements. For future networking, a unanimous agreement was achieved on the formation a national network to facilitate spread and adoption of ERAS and to promote research and education across surgery.

Conclusions: Consensus was achieved on regular measurement and review of patient experience in ERAS. Agreement was reached on the role of regional analgesia and the use of oesophageal Doppler for intraoperative goal directed fluid therapy. In order to facilitate the further spread and adoption of best practices and to promote research and education, an ERAS-UK network was recommended.
INTRODUCTION

Enhanced Recovery After Surgery (ERAS) protocols aim to reduce the stress response to surgery and optimise postoperative recovery by employing a multimodal approach to perioperative management. The safety of ERAS protocols has been demonstrated in numerous randomised trials (1-4) and a number of studies and meta-analyses have shown the efficacy of ERAS. Reduced length of stay, reduction in morbidity in the elderly, faster return of bowel function, earlier mobilisation and lower pain scores have all been demonstrated (5-9).

Despite the evidence and encouraging results demonstrated by pioneering groups (10, 11), the initial uptake of ERAS across the UK has been slow. In 2009, a collaborative initiative, the Enhanced Recovery Partnership Programme (ERPP), was established in England with aim of promoting spread and adoption of ERAS, in colorectal, musculoskeletal, gynaecology and urology major elective surgical pathways. This initiative successfully raised awareness of the benefits of ERAS and promoted sharing of good practice between expert teams and novice centres (12). This programme also highlighted the fact that there is no clear evidence regarding certain issues, such as measurement of patient experience as an outcome measure in ERAS, the impact of new technologies, and how to sustain the benefits of ERAS in the long term. Hence, the aim of this study was to examine those areas in order to obtain consensus on these issues.
METHODS

The Delphi technique was used in this study. This technique involves a re-iterative process of interrogation of a group of experts. Expert opinion from various sources is combined using qualitative then quantitative methods with the aim of converging on a shared consensus result (13,14). Notable characteristics of the Delphi technique include anonymity, controlled feedback of opinion, re-iteration of concept and potential for application of statistical analysis techniques. It has been widely used in healthcare in areas such as epidemiology, education and improving clinical practice (15-17).

Experts were defined as those individuals working as part of a multi-disciplinary team that had been providing an ERAS programme in the UK for at least 12 months with demonstrable improvements in length of stay. 86 experts representing 32 different NHS trusts across England were recruited into this study and were invited to complete the first round questionnaire. These represented 41 colorectal surgeons, 18 anesthetists, 8 musculoskeletal specialists, 2 gynaecologists and 2 urologists. The expert group also included 15 other members of the multi-modal team, such as an ERAS facilitator, pre-assessment clinic specialists and primary care specialists.

The first round questionnaire addressed the following themes:

1. Measuring patient experience.
2. Impact of new technologies and techniques on ERAS in the context of the greater use of laparoscopic surgery.
3. Ensuring sustainability including data collection and networking.

Open-ended questions were formulated by the authors in collaboration with key members of the ERPP Advisory Board (listed in Acknowledgments). Experts were invited by e-mail to either complete an on-line questionnaire (Table 1) or to complete a paper version and return by post during May 2010. The responses to this first round were then grouped together to generate a limited number of statements or choices to form the second round questionnaire in July 2010 (Appendix 1). Experts
were then asked to rank their agreement against each statement.

The set of statements/questions comprising the third round were based on analysis of the responses obtained by the first two rounds, backed by a comprehensive review of the literature on the subject matter. Following the presentation of round two results, statements/questions were offered to the participating group using PowerPoint projection slides. Each statement/question had a maximum of 10 options, on which each participant had to express an opinion or rank in order of perceived importance. The responses were collected in real time by use of TurningPoint Audience Response System technology with separate handsets for each participant. Table 3 summarises the level of agreement required to obtain consensus.

The third round was carried out during the first ERAS conference in Bristol in September 2010. It was facilitated by key members of the ERPP advisory board who did not vote but defined the terminology and encouraged group discussion before voting on each and every issue.
RESULTS

70 experts responded to the first round questionnaire out of (81.4% [70/86]), while 66 experts representing 34 different teams across 27 NHS trusts contributed to the second round responses (77.1% [27/35]). 32 experts representing 21 NHS trusts attended the third round meeting and contributed to the consensus statements.

1. Patient Experience Data

Round one identified several methods to record and use patient experience data, which were then categorised and voted upon in round two (Figure 1). The preferred methods of recording data were routine patient satisfaction questionnaire, patient diaries, patient reported outcome measures and patient focus groups. There was also agreement in round two regarding how the data should be utilised; to adjust the pathways and complete audit cycles (Figure 2). In this round also, an enhanced recovery facilitator was identified to be responsible for collecting data on patient experience by 63.3% (19/30) of the group (positive verdict), while 33.3% (10/30) preferred clinical governance team.

In round three, 53.8% (14/26) of the expert group supported the current use of routine patient satisfaction questionnaires and 30.8% (8/26) supported patient recorded outcome measures. Finally, a majority positive verdict (96.2% [25/26]) agreed with the following consensus statement:

Patient experience data should be recorded, analysed and reviewed at regular enhanced recovery meetings, where problems are investigated and adjusted where necessary, thus completing the audit cycle.

2. Impact of new technologies and techniques

In the first round, participants described 23 technologies that may positively impact on ERAS in future. These spanned all surgical domains and are shown in Table 4.
The four most popular areas were chosen for further investigation in future rounds. These were post-operative pain management, oesophageal Doppler, CPEX testing and minimal access surgery (MAS).

\textit{a) Post-operative pain management}

Round two presented to the participants a range of non-epidural pain management methods. Participants identified regional analgesia, including wound infiltration and spinal anaesthesia, as more likely to have the most impact on ERAS (Figure 3). In addition, with the emergence of regional analgesia participants were asked to comment on the role of epidural analgesia; 36.0% (9/25) suggested open abdominal surgery and a minimal or non-existent role was suggested by 40.0% (10/25) of experts.

In the final round, a majority positive verdict (91.3% [21/23]) agreed with the consensus statement:

\textit{Epidural pain control should be used for specific types of operation (e.g. open abdominal surgery) or for selected patients.}

\textit{b) Oesophageal Doppler}

Round two showed variability among centres in the impact of intraoperative oesophageal Doppler for goal directed fluid therapy with responses ranging from ‘excellent’ to ‘no benefit’. There was no consensus achieved to support its routine use for all cases. Concerns included financial restrictions (76.9% [20/26]) and lack of support from colleagues (57.7% [15/26]). However, a positive verdict (73.1% [19/26]) showed awareness of robust evidence to support its use and benefits in ERAS for selected cases.

\textit{c) CPEX Testing}

Round two identified that 43.3% (13/30) of the expert teams use CPEX testing for routine pre-operative assessment, with two sites currently piloting its use. Participants stated various key factors that were necessary to successfully introduce CPEX testing such as ensuring funding, integration into the pre-assessment clinic and close liaison with anaesthetists. Of all the experts using CPEX testing,
61.9% (13/21) supported selective use in high-risk patients. There was a majority positive verdict (90.5% [19/21]) on the following consensus statement:

**CPEX should be used selectively for high-risk patients and a multi-disciplinary approach should decide which patients would benefit from this testing.**

d) **Minimal Access Surgery (MAS)**

In round two the impact of MAS to enhance recovery in various specialities is displayed in Figure 4, with the maximum impact on ERAS still being seen in colorectal surgery. In round three, there was discussion on importance of having training schemes, similar to that of the national training programme for laparoscopic colorectal surgery, in other specialties (19). There was no consensus achieved on this topic.

3. **Ensuring Sustainability**

a) **Sustainability**

Table 5 shows proposals on how to sustain the success of ERAS taken from round one responses. The most prevalent suggestions were to hold regular team update meetings, to promote clinical champions, to deliver continual education and feedback teams and to have a designated ERAS facilitator.

Participants in rounds two and three highlighted clinical champions and a motivated team, plus the presence of a dedicated ERAS facilitator, as essential elements to sustain success (Figure 5).

b) **Audit and Data Collection**

Round one generated several ideas for clinical governance issues related to ERAS data collection. These included regular local audits of data and central databases of results/ complications. The issues that emerged here were what to measure and who should have overall responsibility for data collection.
Round two identified measuring patient readmission (97.0% [32/33]) patient experience (97.0% [32/33]), complications (93.9% [31/33]) and length of stay (93.9% [31/33]) as key areas for data collection. However, after discussing outcome measures in round three, it was recognised that there is no current evidence to define the optimum standard of complication rate or patient experience in ERAS. Thus, there was an agreement that there should be national standards for those outcome measures, reflected in the following consensus statement and supported by a majority positive verdict (95.8% [23/24]):

_There should be a national standard written for ERAS to allow benchmarking._

An ERAS facilitator (85.3% [29/34]) was identified as the person who should have overall responsibility for data collection. However, the group also noted that consultants and the local clinical governance unit should also be involved collection of data.

c) **Future Networking and Support of Novice Sites**

This section addressed the future of ERAS in England following the ERPP: is there a need for networking and, if so, how can this be achieved? The majority agreed that there is a need for continued networking.

Round one identified online forums and annual meetings as key future strategies to promote networking and to support novice sites. Round two supported the formation of a national network, an annual meeting and web-based forum as preferred format of future networking (Figure 6). This was confirmed at the final round with a unanimous agreement (25/25) with the consensus statement:

_Future networking for the ERAS groups in the UK will be through a national network, an annual meeting and supported by a web-based forum._

The main functions of the national network are to share experience and knowledge, to share consensus on best practice, to co-ordinate research projects and to support development of recommended standards of practice regarding outcome measures in ERAS (Figure 6). There was a unanimous verdict on the aim of this association:
The Enhanced Recovery After Surgery Society (ERAS-UK) aims to advance research and education across all dimensions of enhanced recovery.

**DISCUSSION**

The ERPP commenced a spread and adoption of ERAS programmes throughout England from 2009-2011, the current Delphi study examined ways to consolidate this initiative. In addition, this study aimed to examine expert opinion on the benefits of emerging techniques, for which there is currently no robust evidence to support their adoption. Finally, the identification of outcome measures to ensure the quality of ERAS protocols, and methods to sustain the initial benefits of ERPP across different surgical specialities required investigation.

Delphi method was used as a structured, opinion-based technique to reach consensus on a number of areas where clear evidence was lacking. Consensus statements, despite their weak evidence, are still the optimal method in identifying areas to channel further research and development in ERAS, including implementation and future practice. The initial rounds of this study identified many issues and the selection of those most relevant to practice in the UK were chosen for consensus statements.

Measuring patient experience has been highlighted as a fundamental aspect of ERAS and has now been supported by a national drive use patient experience as an outcome measure in England (20). Despite this, it remains recognised as an area that is currently not well practised in ERAS. Using patient experience data could benefit patients by illustrating areas of local ERAS pathways which need improvement, such as challenges with compliance. Also, understanding these experiences from the patients’ perspective will help clinicians, managers and commissioners to gain an accurate impression of how ‘useable’ the whole system is by a patient who interacts with it. This will encourage the delivery of more appropriate and more effective ERAS systems.
Although, this study identified patient satisfaction questionnaires, health related quality of life and patient diaries as means of measuring patient experience, further validation studies on their format in ERAS are required (21).

A key component of the ERAS pathway is effective postoperative analgesia, and routine use of epidural analgesia was recommended in the original ERAS pathway (22). However, with the Minimal Access Surgery and the rapid emergence of alternative analgesic techniques, such as wound infusion catheters, Transversus Abdominis Plane (TAP) block and spinal opioid analgesia, the role of routine use epidural analgesia has been questioned. This study highlighted the limited role of epidural analgesia in standard post-operative care following abdominal and musculoskeletal surgery, and as such it should potentially be limited to major open surgery. However, randomised control trials are required in this field to ascertain optimal post-operative analgesia within ERAS and MAS.

The key factor to ensure sustainability was to adopt ERAS as the standard of care in routine surgical practice, which should continue beyond initial trials and funding. A motivated team with clinical leadership and supported by a dedicated ERAS facilitator were the main factors to maintain success of ERAS. Data collection should be carried out by each unit and in line with defined national standards (such as Health Episode Statistics) of clinical outcome measures such as length of stay, re-admission and complication rates in addition to patient experience. ERAS facilitators, local clinical governance and lead consultants should collectively be responsible for gathering and distributing the data.

The only domain with unanimous agreement in this study was towards the formation of a national ERAS network, encompassing all surgical specialties and members of the multidisciplinary team. The aims of this association would be to promote research and education and to encourage developing national standards in ERAS. In response to the findings of this manuscript, “Enhanced Recovery After Surgery-UK” is in the process of registration and aims to fulfil the objectives created in this consensus study.
CONCLUSIONS

Consensus was achieved on the importance of the consistent measurement of outcomes including patient experience within ERAS. Agreement was also reached on the use of regional analgesia after major surgery and selective utilisation of cardio-pulmonary exercise testing. This study highlighted the increasing awareness of the evidence to support the use of oesophageal Doppler for intraoperative goal directed fluid therapy. Clinical championship and a dedicated facilitator underpin sustaining success in ERAS. A clear consensus was obtained to support the development of national standards and the formation of an Enhanced Recovery After Surgery Society in the UK (ERAS-UK).
REFERENCES


18. TurningPoint Audience Response System: www.turningtechnologies.com


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TABLES AND FIGURES

TABLE 1: Round 1 Questionnaire:

1. Measuring Patient Experience
   a) How do you measure patient experience of enhanced recovery in your centres?
   b) How do you use this feedback to improve enhanced recovery pathways?

2. Impact of new technologies and techniques
   a) What new technologies or techniques are you aware of that may have a positive future impact on enhanced recovery?

3. Ensuring sustainability
   a) How can the good results from initial adoption of enhanced recovery be sustained over time?
   b) What ideas do you have for future clinical governance?
   c) Is there a need for expert enhanced recovery sites to continue to communicate/network in the future and what form should this take?
   d) How can expert enhanced recovery sites assist novice groups with adoption and implementation?

TABLE 2: Categorisation of group responses

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<thead>
<tr>
<th>Verdict</th>
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<tr>
<td>Majority positive verdict</td>
<td>≥70% in favour</td>
</tr>
<tr>
<td>Positive verdict</td>
<td>55-69% in favour</td>
</tr>
<tr>
<td>Split verdict</td>
<td>50-54% in favour</td>
</tr>
<tr>
<td>Negative verdict</td>
<td>55-69% against</td>
</tr>
<tr>
<td>Majority negative verdict</td>
<td>≥70% against</td>
</tr>
<tr>
<td>No opinion</td>
<td>&lt;50%</td>
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### TABLE 3: Suggestions of new technologies that may positively impact on ERAS in future

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<th>n=</th>
<th>Postoperative</th>
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<td>Oesophageal Doppler</td>
<td>13</td>
<td>Pain busters</td>
<td>3</td>
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<td>Correction pre-op anaemia</td>
<td>1</td>
<td>Increased laparoscopic surgery</td>
<td>5</td>
<td>Chewing gum</td>
<td>2</td>
</tr>
<tr>
<td>Streamlined DOSA</td>
<td>1</td>
<td>Wound infiltration</td>
<td>5</td>
<td>Oral opiate antagonist</td>
<td>1</td>
</tr>
<tr>
<td>CHO loading</td>
<td>1</td>
<td>Rectus sheath catheters</td>
<td>5</td>
<td>(colorectal)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TAP blocks</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local blocks (laparoscopy)</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Robotics</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LiDCO™ monitoring</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local anaesthetic infiltration (knee)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patient specific instrumentation (knee)</td>
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<td></td>
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<td></td>
<td></td>
<td>NOTES</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energy devices for haemostasis</td>
<td>1</td>
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<td></td>
</tr>
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<td></td>
<td></td>
<td>Magnesium as analgesic</td>
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<td>Peripheral MU antagonists</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Transexamic acid</td>
<td>1</td>
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CPEX – cardiopulmonary exercise, DOSA, CHO - carbohydrate, NOTES - natural orifice transluminal endoscopic surgery, TAP - tranversus abdominis plane
### TABLE 4: Proposals on how to sustain success in ERAS

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<tr>
<th>Proposal</th>
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<tr>
<td>Regular staff/ team update sessions</td>
<td>10</td>
</tr>
<tr>
<td>Feedback positive results to team</td>
<td>9</td>
</tr>
<tr>
<td>Continuing education of new team members</td>
<td>8</td>
</tr>
<tr>
<td>Audit of compliance to protocol</td>
<td>6</td>
</tr>
<tr>
<td>Designated ERAS facilitator</td>
<td>5</td>
</tr>
<tr>
<td>Update pathway/ programme in line with new evidence</td>
<td>3</td>
</tr>
<tr>
<td>Senior clinical champion plus enthusiastic team</td>
<td>3</td>
</tr>
<tr>
<td>Embed as standard of care</td>
<td>3</td>
</tr>
<tr>
<td>Executive leadership</td>
<td>3</td>
</tr>
<tr>
<td>Ward nurses empowered to take control</td>
<td>2</td>
</tr>
<tr>
<td>Continuously strive to do better</td>
<td>2</td>
</tr>
<tr>
<td>Use positive experiences/ results to give team confidence</td>
<td>2</td>
</tr>
<tr>
<td>Driven by enthusiastic clinical nurse specialists</td>
<td>1</td>
</tr>
<tr>
<td>Update and review pathway every 6 months</td>
<td>1</td>
</tr>
<tr>
<td>Team members feed suggestions into meetings</td>
<td>1</td>
</tr>
<tr>
<td>Spread ERAS across whole of surgical service</td>
<td>1</td>
</tr>
<tr>
<td>Anaesthetic standardisation</td>
<td>1</td>
</tr>
<tr>
<td>Need to change whole ward culture</td>
<td>1</td>
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<tr>
<td>Review and update pathway every 3 months</td>
<td>1</td>
</tr>
<tr>
<td>Share patient experiences</td>
<td>1</td>
</tr>
<tr>
<td>Change in management is necessary requirement of implementation</td>
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<td>National publication of results</td>
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<td>Research</td>
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<td>Challenging and changing perceptions of patients and staff</td>
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FIGURE 1: Methods of recording patient experience data – results of round 2 voting.

FIGURE 2: Preferred methods of using patient experience data – results from round 2 voting.
FIGURE 3: Non-epidural analgesic methods that will have the most impact on ERAS

- Wound infiltration
- Regional anaesthesia
- Spinal analgesia
- Rectus sheath catheters
- Pain modulating drugs
- Pain busters
- Oral opiate antagonist
- Magnesium as analgesic

FIGURE 4: Impact of MAS on ERAS specific to specialty.
FIGURE 5: Promoting Sustainability in ERAS – results from round 2 voting

FIGURE 6: Suggestions for future networking methods – round 2 results
FIGURE 7: Suggested roles of a national association for ERAS
1.1) What are the most robust and efficient ways of recording patient experience – rank 3 options:
- Informal discussion between patient and MDT member
- Structured discussion between patient and MDT member
- Patient panel or focus group
- Patient diary
- Routine patient satisfaction questionnaire
- Occasional or interval patient satisfaction questionnaire
- Routine use of Patient Recorded Outcome Measures
- Quality of life type questionnaires

1.2) What are the most robust and efficient ways to use patient experience data – rank 3 options:
- Review at monthly MDT meetings
- Review at 6 monthly MDT meetings
- Completion of the audit cycle
- Investigate and adjust problem areas
- Investigate and conduct research before amending practice

1.3) Who should be responsible for collection and analysis of patient experience information:
- Consultant responsible for patient care
- Specialist nurse
- Enhanced recovery facilitator
- Local clinical governance team

TOPIC 2: Impact of new technologies and techniques

2.1) In your opinion, which will have the most significant impact on enhanced recovery in the future - rank 3 options:
- Regional anaesthesia
- Spinal analgesia
- Wound infiltration
- Rectus sheath catheters
- Pain busters
- Magnesium as analgesic
- Oral opiate antagonist
- Pain modulating drugs (e.g. pregabalin)

2.2) What role should epidural pain control have in ER in the future?

Use of Oesophageal Doppler

2.3) Based on your own experience, what is the impact of using oesophageal Doppler?

2.4) What evidence are you aware of to support the use of oesophageal Doppler?

2.5) Why is Oesophageal Doppler not used routinely in all centres?
- Financial restrictions
- Lack of evidence to support use
- Lack of staff training
- Lack of support from colleagues
- Other

Cardiopulmonary exercise testing

2.7) Do you currently use cardiopulmonary exercise (CPEX) testing in your centre?
- Yes
- No
- Currently considering or piloting

2.8) If you have experience, what is the best method to set up CPEX testing and what are the challenges?

2.9) If you have experience, how do you currently select patients for CPEX?
- Routine testing of all patients
- Selective testing for high risk patients
- Other methods

Minimal access surgery

2.10) What benefits does minimal access surgery bring to ER?

2.11) What impact has the national training programme for laparoscopic colorectal cancer surgery training had on enhanced recovery?

2.12) What future impact may the national training programme for laparoscopic colorectal cancer surgery training have on enhanced recovery?

TOPIC 3: Ensuring Sustainability

3.1) In your opinion, are the most robust and efficient ways to ensure sustainability – rank 3 options:
- Regular team update sessions
- Continuing education of new team members
- Having a senior clinical champion plus an enthusiastic team
- Audit of compliance to protocol
- Employing a dedicated enhanced recovery facilitator
- Leadership from senior hospital management
- Embed pathway as the standard of care
- Empower ward nurses to take decisions/ control
- Feedback success/ positive results to the team
- Challenging perceptions of patients and colleagues
- Other

3.2) Consider the options for future networking listed described below- rank 3 options:
- National association
- International association
- Web-based forum
- Informal network
- Annual meeting
- Occasional surveys

3.3) Consider the possible functions of an enhanced recovery network listed below:
- Share experience and knowledge
- Consensus on best practice
- Co-ordinate relevant research projects
- Collaborative publication of evidence to support ER
- National meetings
- Regional meetings
- Seminars, workshops or courses
- Collaborate to change perceptions and out-dated practice
- Provide support for novice sites
- Set and monitor standards for good practice of ER
- Accredit training events
- Dialogue with commissioners and senior management

3.4) Consider the statements listed below and select the option that reflects your opinion: (Strongly agree, agree, disagree, strongly disagree, do not know)
- Novice teams should visit expert sites of their choice to see ER in action
- Expert teams should have managerial and financial support to host novice team visits
- Novice teams should attend courses or workshops run by expert sites
- The courses and workshops currently available are sufficient to meet the needs of novice teams
- New types of educational events should be designed to meet training needs
- Expert teams should share documentation with novice sites
- Current information sharing networks meet the needs of novice sites
- Members of expert teams should provide mentoring to novice teams
- Members of expert teams should have managerial support and backfill to mentor novice teams

3.5) Select all the options that you feel should be measured as an audit of enhanced recovery:
- Compliance to ER elements
- Length of stay
- Re-admission
- Complications
- Adverse incidents
- Patient experience

3.6) Consider the statements listed below and select the option that reflects your opinion: (Strongly agree, agree, disagree, strongly disagree, do not know)
- The consultant responsible for patient care has responsibility for ER audit
- The enhanced recovery facilitator has responsibility for ER audit
- Local clinical governance has responsibility for ER audit
- Each centre should perform their own, local audit
- There should be a national ER audit tool
- Performance should be measured against nationally agreed standards
- Support should be available for teams who do not meet specific standards

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This study was commissioned by the Cancer Action Team, on behalf of the Enhanced Recovery Partnership Programme, England

Knott A¹
Pathak S¹
McGrath JS²
Kennedy R³
Horgan A⁴
Mythen M⁵
Carter F⁶
Nader K Francis¹

Senior House Officer
Specialist Registrar
Consultant Urological Surgeon
Consultant Colorectal Surgeon
Consultant Colorectal Surgeon
Professor of Anaesthesia
Manager of the Southwest Surgical Training Network
Consultant Colorectal Surgeon

Affiliations
1. Department of General Surgery, Yeovil District Hospital, Higher Kingston, Yeovil, BA21 4AT
2. Exeter Surgical Health Services Research Unit, Royal Devon and Exeter NHS Foundation Trust, EX2 5DW
3. Department of Surgery, St Marks Hospital, Northwick Park, Watford Road, Harrow, Middlesex HA1 3UJ
4. Department of Surgery, Freeman Hospital, Freeman Road, High Heaton, Newcastle Upon Tyne, Tyne and Wear NE7 7DN
5. Department of Anaesthesia, University College Hospital, 235, Euston Road, London, NW1 2BU
6. Yeovil Academy, Yeovil District Hospital, Higher Kingston, Yeovil, BA21 4AT
Corresponding Author

Mr N K Francis
Consultant Colorectal Surgeon,
Yeovil District Hospital,
Higher Kingston,
Yeovil,
BA21 4AT
Tel: 01935 384244
Fax: 01935 384653
E-Mail: nader.francis@ydh.nhs.uk

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Contributors

Dr Amy Knott – analysis of results, drafting and editing of paper.

Mr Samir Pathak - analysis of results, drafting and editing of paper.

Mr John McGrath – study design and content, drafting and editing of paper

Mr Robin Kennedy - study design and content, drafting and editing of paper

Mr Alan Horgan - study design and content, drafting and editing of paper

Mr Monty Mythen - study design and content, drafting and editing of paper

Dr Fiona Carter - study design and content, analysis and results, drafting and editing of paper

Mr Nader Francis - study design and content, analysis and results, drafting and editing of paper

Guarantor

Mr Nader Francis

Nader.francis@ydh.nhs.uk
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Ethical approval was not required

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All authors, external and internal, had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Data Sharing Statement

Dataset available from the corresponding author, Mr Nader Francis. (nader.francis@ydh.nhs.uk)

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ABSTRACT

Objective: The Department of Health’s Enhanced Recovery Partnership Programme (ERPP) commenced a spread and adoption scheme of Enhanced Recovery After Surgery (ERAS) throughout England. In preparation for widespread adoption the ERPP wished to obtain expert consensus on appropriate outcome measures for ERAS, emerging techniques being widely adopted and proposed methods for the continued development and sustainability of ERAS in the NHS. The aim of this study was to interrogate expert opinion and define areas of consensus on these issues.

Design: A Delphi technique using three rounds of re-iterative questionnaires was used to obtain consensus.

Participants: Experts were chosen from teams with experience of delivering a successful ERAS programme across different surgical specialties and across various disciplines.

Setting: The first two rounds of the questionnaire were completed online and a final, third round was undertaken in a meeting using interactive voting.

Results: 86 experts took part in this study. Consensus statements agreed that patient experience data should be recorded, analysed and reviewed at regular ERAS meetings. Recent developments in regional analgnesia, the increased use of intraoperative monitoring for fluid management and cardio-pulmonary exercise testing were the main emerging techniques identified. National standards for those outcome measures would be welcomed. To sustain success in ERAS, the experts highlighted clinical champions and the presence of a dedicated ERAS facilitator as essential elements. For future networking, a unanimous agreement was achieved on the formation a national network to facilitate spread and adoption of ERAS and to promote research and education across surgery.

Conclusions: Consensus was achieved on regular measurement and review of patient experience in ERAS. Agreement was reached on the role of regional analgnesia and the use of oesophageal Doppler for intraoperative goal directed fluid therapy. In order to facilitate the further spread and adoption of best practices and to promote research and education, an ERAS-UK network was recommended.
INTRODUCTION

Enhanced Recovery After Surgery (ERAS) protocols aim to reduce the stress response to surgery and optimise postoperative recovery by employing a multimodal approach to perioperative management. The safety of ERAS protocols has been demonstrated in numerous randomised trials (1-4) and a number of studies and meta-analyses have shown the efficacy of ERAS. Reduced length of stay, reduction in morbidity in the elderly, faster return of bowel function, earlier mobilisation and lower pain scores have all been demonstrated (5-9).

Despite the evidence and encouraging results demonstrated by pioneering groups (10, 11), the initial uptake of ERAS across the UK has been slow. In 2009, a collaborative initiative, the Enhanced Recovery Partnership Programme (ERPP), was established in England with aim of promoting spread and adoption of ERAS, in colorectal, musculoskeletal, gynaecology and urology major elective surgical pathways. This initiative successfully raised awareness of the benefits of ERAS and promoted sharing of good practice between expert teams and novice centres (12).

As the ERPP was coming to an end, it became apparent that certain ambiguous issues existed surrounding how to sustain success of ERAS delivery and the measurement of patient experience in ERAS, which are not well addressed in literature. There was also a need to explore the adoption and impact of the emerging new techniques, which are not included in the original ERAS protocol. Examples include preoperative Cardio-pulmonary exercise (CPEX) testing, use of minimal access surgery (MAS), goal directed fluid therapy and alternative analgesic modalities. Hence, the aim of this study was to obtain consensus views on these key elements to ensure continual success of ERAS delivery in England.
METHODS

The Delphi technique was used in this study. This technique involves a re-iterative process of interrogation of a group of experts. Expert opinion from various sources is combined using qualitative then quantitative methods with the aim of converging on a shared consensus result (13,14). Notable characteristics of the Delphi technique include anonymity, controlled feedback of opinion, re-iteration of concept and potential for application of statistical analysis techniques. It has been widely used in healthcare in areas such as epidemiology, education and improving clinical practice (15-17).

Expert centres were defined by the ERPP as units with established ERAS programmes over one year, in at least one specialty. The units had displayed measurable reduction in length of stay of at least two days. Experts were selected from these centres based on nomination from their peers within the unit as the leaders of ERAS. 86 experts including 71 consultant clinicians 15 ER multi disciplinary team representatives from 32 different NHS trusts across England were recruited into this study and were invited to complete the first round questionnaire. These represented 41 colorectal surgeons, 18 anesthetists, 8 musculoskeletal specialists, 2 gynaecologists and 2 urologists. The expert group also included 15 other members of the multi-modal team, such as an ERAS facilitator, pre-assessment clinic specialists and primary care specialists.

The first round questionnaire addressed the following themes:

1. Measuring patient experience.

2. Impact of new technologies and techniques on ERAS in the context of the greater use of laparoscopic surgery.

3. Ensuring sustainability including data collection and networking.

Open-ended questions were formulated by the authors in collaboration with key members of the ERPP Advisory Board (listed in Acknowledgments). Experts were invited by e-mail to either complete an on-line questionnaire (Table 1) or to complete a paper version and return by post during
May 2010. The responses to this first round were then grouped together to generate a limited number of statements or choices to form the second round questionnaire in July 2010 (Appendix 1). Experts were then asked to rank their agreement against each statement.

The set of statements/questions comprising the third round were based on analysis of the responses obtained by the first two rounds, backed by a comprehensive review of the literature on the subject matter. Following the presentation of round two results, statements/questions were offered to the participating group using PowerPoint projection slides. Each statement/question had a maximum of 10 options, on which each participant had to express an opinion or rank in order of perceived importance. The responses were collected in real time by use of TurningPoint Audience Response System technology with separate handsets for each participant. Table 3 summarises the level of agreement required to obtain consensus.

The third round was carried out during the first ERAS conference in Bristol in September 2010. It was facilitated by key members of the ERPP advisory board who did not vote but defined the terminology and encouraged group discussion before voting on each and every issue.
RESULTS

26 NHS trusts responded to the first round questionnaire, with a total of 86 experts contributing to these replies (81.2% [26/32]), while 66 experts across 27 NHS trusts contributed to the second round responses (77.1% [27/35]). 32 experts representing 21 NHS trusts attended the third round meeting and contributed to the consensus statements.

1. Patient Experience Data

Round one identified several methods used at present to record and use patient experience data, which were then categorised and voted upon in round two (Figure 1). The preferred methods of recording data were routine patient satisfaction questionnaire, patient diaries, patient reported outcome measures and patient focus groups. There was also agreement in round two regarding how the data should be utilised; to adjust the pathways and complete audit cycles (Figure 2). In this round also, an enhanced recovery facilitator was identified to be responsible for collecting data on patient experience by 63.3% (19/30) of the group (positive verdict), while 33.3% (10/30) preferred clinical governance team.

In round three, 53.8% (14/26) of the expert group supported the current use of routine patient satisfaction questionnaires and 30.8% (8/26) supported patient recorded outcome measures. Finally, a majority positive verdict (96.2% [25/26]) agreed with the following consensus statement:

Patient experience data should be recorded, analysed and reviewed at regular enhanced recovery meetings, where problems are investigated and adjusted where necessary, thus completing the audit cycle.

2. Impact of new technologies and techniques

In the first round, participants described 23 technologies that may positively impact on ERAS in future. These spanned all surgical domains and are shown in Table 4.
The four most popular areas were chosen for further investigation in future rounds. These were post-operative pain management, oesophageal Doppler, CPEX testing and MAS.

a) Post-operative pain management

Round two presented to the participants a range of non-epidural pain management methods. Participants identified regional analgesia, including wound infiltration and spinal anaesthesia, as more likely to have the most impact on ERAS (Figure 3). In addition, with the emergence of regional analgesia participants were asked to comment on the role of epidural analgesia; 36.0% (9/25) suggested open abdominal surgery and a minimal or non-existent role was suggested by 40.0% (10/25) of experts.

In the final round, a majority positive verdict (91.3% [21/23]) agreed with the consensus statement:

> Epidural pain control should be used for specific types of operation (e.g. open abdominal surgery) or for selected patients.

b) Oesophageal Doppler

Round two showed variability among centres in the impact of intraoperative oesophageal Doppler for goal directed fluid therapy with responses ranging from ‘excellent’ to ‘no benefit’. There was no consensus achieved to support its routine use for all cases. Concerns included financial restrictions (76.9% [20/26]) and lack of support from colleagues (57.7% [15/26]). However, a positive verdict (73.1% [19/26]) showed awareness of robust evidence to support its use and benefits in ERAS for selected cases.

c) CPEX Testing

Round two identified that 43.3% (13/30) of the expert teams use CPEX testing for routine pre-operative assessment, with two sites currently piloting its use. Participants stated various key factors that were necessary to successfully introduce CPEX testing such as ensuring funding, integration into the pre-assessment clinic and close liaison with anaesthetists. Of all the experts using CPEX testing,
61.9% (13/21) supported selective use in high-risk patients. There was a majority positive verdict (90.5% [19/21]) on the following consensus statement:

*CPEX should be used selectively for high-risk patients and a multi-disciplinary approach should decide which patients would benefit from this testing.*

d) **Minimal Access Surgery (MAS)**

In round two the impact of MAS to enhance recovery in various specialities is displayed in Figure 4, with the maximum impact on ERAS still being seen in colorectal surgery. In round three, there was discussion on importance of having training schemes, similar to that of the national training programme for laparoscopic colorectal surgery, in other specialties (19). There was no consensus achieved on this topic.

3. **Ensuring Sustainability**

a) **Sustainability**

Table 5 shows proposals on how to sustain the success of ERAS taken from round one responses. The most prevalent suggestions were to hold regular team update meetings, to promote clinical champions, to deliver continual education and feedback teams and to have a designated ERAS facilitator.

Participants in rounds two and three highlighted clinical champions and a motivated team, plus the presence of a dedicated ERAS facilitator, as essential elements to sustain success (Figure 5).

b) **Audit and Data Collection**

Round one generated several ideas for clinical governance issues related to ERAS data collection. These included regular local audits of data and central databases of results/ complications. The issues that emerged here were what to measure and who should have overall responsibility for data collection.
Round two identified measuring patient readmission (97.0% [32/33]) patient experience (97.0% [32/33]), complications (93.9% [31/33]) and length of stay (93.9% [31/33]) as key areas for data collection. However, after discussing outcome measures in round three, it was recognised that there is no current evidence to define the optimum standard of complication rate or patient experience in ERAS. Thus, there was an agreement that there should be national standards for those outcome measures, reflected in the following consensus statement and supported by a majority positive verdict (95.8% [23/24]):

*There should be a national standard written for ERAS to allow benchmarking.*

An ERAS facilitator (85.3% [29/34]) was identified as the person who should have overall responsibility for data collection. However, the group also noted that consultants and the local clinical governance unit should also be involved in collection of data.

c) *Future Networking and Support of Novice Sites*

This section addressed the future of ERAS in England following the ERPP: is there a need for networking and, if so, how can this be achieved? The majority agreed that there is a need for continued networking.

Round one identified online forums and annual meetings as key future strategies to promote networking and to support novice sites. Round two supported the formation of a national network, an annual meeting and web-based forum as preferred format of future networking (Figure 6). This was confirmed at the final round with a unanimous agreement (25/25) with the consensus statement:

*Future networking for the ERAS groups in the UK will be through a national network, an annual meeting and supported by a web-based forum.*

The main functions of the national network are to share experience and knowledge, to share consensus on best practice, to co-ordinate research projects and to support development of recommended standards of practice regarding outcome measures in ERAS (Figure 6). There was a unanimous verdict on the aim of this association:
The Enhanced Recovery After Surgery Society (ERAS-UK) aims to advance research and education across all dimensions of enhanced recovery.

DISCUSSION

The ERPP commenced a spread and adoption of ERAS programmes throughout England from 2009-2011, the current Delphi study examined ways to consolidate this initiative. In addition, this study aimed to examine expert opinion on the benefits of emerging techniques, for which there is currently no robust evidence to support their adoption. Finally, the identification of outcome measures to ensure the quality of ERAS protocols, and methods to sustain the initial benefits of ERPP across different surgical specialities required investigation.

Delphi method was used as a structured, opinion-based technique to reach consensus on a number of areas where clear evidence was lacking. Consensus statements, despite their weak evidence, are still the optimal method in identifying areas to channel further research and development in ERAS, including implementation and future practice. The initial rounds of this study identified many issues and the selection of those most relevant to practice in the UK were chosen for consensus statements.

An expert centre was defined as units with established ERAS programmes over 1 year and at least one specialty with a measurable reduction in length of stay of at least 2 days. Experts were selected from these centres based on nomination from their peers within the unit as the leaders of enhanced recovery in the centre. 86 experts responded to the generic questions in the first round questionnaire, including 71 clinicians and 15 ER multidisciplinary team members, however as the questions became more focused and specialised the number of experts participating has reduced to 66 to round 2. The third round required experts to attend an interactive workshop and each centre nominated representatives to attend and vote.
The ERPP ran the campaign to increase spread of ERAS within the UK. In addition to this, the drive for this research was from the Cancer Action Team on behalf of NHS Improvement initiative and Department of Health in England. For these reasons only centres from within the UK were appropriate for inclusion in the study.

Measuring patient experience has been highlighted as a fundamental aspect of ERAS and has now been supported by a national drive use patient experience as an outcome measure in England (20). Despite this, it remains recognised as an area that is currently not well practised in ERAS. Using patient experience data could benefit patients by illustrating areas of local ERAS pathways which need improvement, such as challenges with compliance. Also, understanding these experiences from the patients’ perspective will help clinicians, managers and commissioners to gain an accurate impression of how ‘useable’ the whole system is by a patient who interacts with it. This will encourage the delivery of more appropriate and more effective ERAS systems.

Although, this study identified patient satisfaction questionnaires, health related quality of life and patient diaries as means of measuring patient experience, further validation studies on their format in ERAS are required (21).

A key component of the ERAS pathway is effective postoperative analgesia, and routine use of epidural analgesia was recommended in the original ERAS pathway (22). However, with the MAS and the rapid emergence of alternative analgesic techniques, such as wound infusion catheters, Transversus Abdominis Plane (TAP) block and spinal opioid analgesia, the role of routine use epidural analgesia has been questioned. This study highlighted the limited role of epidural analgesia in standard post-operative care following abdominal and musculoskeletal surgery, and as such it should potentially be limited to major open surgery. A recent randomised control trial found the failure rate of epidural analgesia for laparoscopic colonic resection to be 11% (23). However, randomised control trials are required in this field to ascertain optimal post-operative analgesia within ERAS and MAS.
The key factor to ensure sustainability was to adopt ERAS as the standard of care in routine surgical practice, which should continue beyond initial trials and funding. A motivated team with clinical leadership and supported by a dedicated ERAS facilitator were the main factors to maintain success of ERAS. Data collection should be carried out by each unit and in line with defined national standards (such as Health Episode Statistics) of clinical outcome measures such as length of stay, re-admission and complication rates in addition to patient experience. ERAS facilitators, local clinical governance and lead consultants should collectively be responsible for gathering and distributing the data.

The only domain with unanimous agreement in this study was towards the formation of a national ERAS network, encompassing all surgical specialties and members of the multidisciplinary team. The aims of this association would be to promote research and education and to encourage developing national standards in ERAS. In response to the findings of this manuscript, “Enhanced Recovery After Surgery-UK” is in the process of registration and aims to fulfil the objectives created in this consensus study.

CONCLUSIONS

Consensus was achieved on the importance of the consistent measurement of outcomes including patient experience within ERAS. Agreement was also reached on the use of regional analgesia after major surgery and selective utilisation of CPEX. This study highlighted the increasing awareness of the evidence to support the use of oesophageal Doppler for intraoperative goal directed fluid therapy. Clinical championship and a dedicated facilitator underpin sustaining success in ERAS. A clear consensus was obtained to support the development of national standards and the formation of an Enhanced Recovery After Surgery Society in the UK (ERAS-UK).
REFERENCES


18. TurningPoint Audience Response System: www.turningtechnologies.com


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TABLES AND FIGURES

TABLE 1: Round 1 Questionnaire:

1. Measuring Patient Experience
   a) How do you measure patient experience of enhanced recovery in your centres?
   b) How do you use this feedback to improve enhanced recovery pathways?

2. Impact of new technologies and techniques
   a) What new technologies or techniques are you aware of that may have a positive future impact on enhanced recovery?

3. Ensuring sustainability
   a) How can the good results from initial adoption of enhanced recovery be sustained overtime?
   b) What ideas do you have for future clinical governance?
   c) Is there a need for expert enhanced recovery sites to continue to communicate/network in the future and what from should this take?
   d) How can expert enhanced recovery sites assist novice groups with adoption and implementation?

TABLE 2: Categorisation of group responses

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TABLE 3: Suggestions of new technologies that may positively impact on ERAS in future

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<td></td>
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<td>Tranexamic acid</td>
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</tbody>
</table>

CPEX – cardiopulmonary exercise, DOSA – Day of surgery admission, CHO - carbohydrate, NOTES - natural orifice transluminal endoscopic surgery, TAP - tranversus abdominis plane. ‘n’ number of teams suggesting technology
TABLE 4: Proposals on how to sustain success in ERAS

<table>
<thead>
<tr>
<th>Proposal</th>
<th>n</th>
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<tbody>
<tr>
<td>Regular staff/team update sessions</td>
<td>10</td>
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<tr>
<td>Feedback positive results to team</td>
<td>9</td>
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<tr>
<td>Continuing education of new team members</td>
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<tr>
<td>Audit of compliance to protocol</td>
<td>6</td>
</tr>
<tr>
<td>Designated ERAS facilitator</td>
<td>5</td>
</tr>
<tr>
<td>Update pathway/programme in line with new evidence</td>
<td>3</td>
</tr>
<tr>
<td>Senior clinical champion plus enthusiastic team</td>
<td>3</td>
</tr>
<tr>
<td>Embed as standard of care</td>
<td>3</td>
</tr>
<tr>
<td>Executive leadership</td>
<td>3</td>
</tr>
<tr>
<td>Ward nurses empowered to take control</td>
<td>2</td>
</tr>
<tr>
<td>Continuously strive to do better</td>
<td>2</td>
</tr>
<tr>
<td>Use positive experiences/results to give team confidence</td>
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<tr>
<td>Driven by enthusiastic clinical nurse specialists</td>
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</tr>
<tr>
<td>Update and review pathway every 6 months</td>
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<tr>
<td>Team members feed suggestions into meetings</td>
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<tr>
<td>Spread ERAS across whole of surgical service</td>
<td>1</td>
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<tr>
<td>Anaesthetic standardisation</td>
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</tr>
<tr>
<td>Need to change whole ward culture</td>
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</tr>
<tr>
<td>Review and update pathway every 3 months</td>
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<tr>
<td>Share patient experiences</td>
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<tr>
<td>Change in management is necessary requirement of implementation</td>
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<td>National publication of results</td>
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<tr>
<td>Research</td>
<td>1</td>
</tr>
<tr>
<td>Challenging and changing perceptions of patients and staff</td>
<td>1</td>
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</tbody>
</table>

'n' number of teams suggesting proposal
FIGURE 1: Methods of recording patient experience data – results of round 2 voting.
FIGURE 2: Preferred methods of using patient experience data – results from round 2 voting

FIGURE 3: Non-epidural analgesic methods that will have the most impact on ERAS
FIGURE 4: Expert opinion of impact of MAS on ERAS specific to specialty.

FIGURE 5: Promoting Sustainability in ERAS – results from round 2 voting

FIGURE 6: Suggestions for future networking methods – round 2 results
FIGURE 7: Suggested roles of a national association for ERAS

This study was commissioned by the Cancer Action Team, on behalf of the Enhanced Recovery Partnership Programme, England

Knott A¹ Senior House Officer
Pathak S¹ Specialist Registrar
McGrath JS² Consultant Urological Surgeon
Kennedy R³ Consultant Colorectal Surgeon
Horgan A⁴ Consultant Colorectal Surgeon
Mythen M⁵ Professor of Anaesthesia
Carter F⁶ Manager of the Southwest Surgical Training Network
Nader K Francis¹ Consultant Colorectal Surgeon

Affiliations

1. Department of General Surgery, Yeovil District Hospital, Higher Kingston, Yeovil, BA21 4AT
2. Exeter Surgical Health Services Research Unit, Royal Devon and Exeter NHS Foundation Trust, EX2 5DW
3. Department of Surgery, St Marks Hospital, Northwick Park, Watford Road, Harrow, Middlesex HA1 3UJ
4. Department of Surgery, Freeman Hospital, Freeman Road, High Heaton, Newcastle Upon Tyne, Tyne and Wear NE7 7DN
5. Department of Anaesthesia, University College Hospital, 235, Euston Road, London, NW1 2BU
6. Yeovil Academy, Yeovil District Hospital, Higher Kingston, Yeovil, BA21 4AT
**Corresponding Author**

Mr N K Francis  
Consultant Colorectal Surgeon, 
Yeovil District Hospital, 
Higher Kingston, 
Yeovil, 
BA21 4AT  
Tel: 01935 384244  
Fax: 01935 384653  
E-Mail: nader.francis@ydh.nhs.uk

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- Perioperative care  
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- Patient feedback  
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- Oesophageal Doppler  
- ERAS-UK

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All authors have completed the Unified Competing Interest form at [www.icmje.org/coi_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) (available on request from the corresponding author) and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.

Contributors

Dr Amy Knott – analysis of results, drafting and editing of paper.
Mr Samir Pathak - analysis of results, drafting and editing of paper.
Mr John McGrath – study design and content, drafting and editing of paper
Mr Robin Kennedy - study design and content, drafting and editing of paper
Mr Alan Horgan - study design and content, drafting and editing of paper
Mr Monty Mythen - study design and content, drafting and editing of paper
Dr Fiona Carter - study design and content, analysis and results, drafting and editing of paper
Mr Nader Francis - study design and content, analysis and results, drafting and editing of paper

Guarantor

Mr Nader Francis

Nader.francis@ydh.nhs.uk
Ethical Approval

Ethical approval was not required

Data Access

All authors, external and internal, had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Data Sharing Statement

Dataset available from the corresponding author, Mr Nader Francis. (nader.francis@ydh.nhs.uk)

Funding

This work was supported by a grant from the National Cancer Action team to facilitate research and networking related to enhanced recovery in England as part of the Enhanced Recovery Partnership Programme.
ABSTRACT

Objective: The Department of Health’s Enhanced Recovery Partnership Programme (ERPP) commenced a spread and adoption scheme of Enhanced Recovery After Surgery (ERAS) throughout England. In preparation for widespread adoption the ERPP wished to obtain expert consensus on appropriate outcome measures for ERAS, emerging techniques being widely adopted and proposed methods for the continued development and sustainability of ERAS in the NHS. The aim of this study was to interrogate expert opinion and define areas of consensus on these issues.

Design: A Delphi technique using three rounds of re-iterative questionnaires was used to obtain consensus.

Participants: Experts were chosen from teams with experience of delivering a successful ERAS programme across different surgical specialties and across various disciplines.

Setting: The first two rounds of the questionnaire were completed online and a final, third round was undertaken in a meeting using interactive voting.

Results: 86 experts took part in this study. Consensus statements agreed that patient experience data should be recorded, analysed and reviewed at regular ERAS meetings. Recent developments in regional analgesia, the increased use of intraoperative monitoring for fluid management and cardiopulmonary exercise testing were the main emerging techniques identified. National standards for those outcome measures would be welcomed. To sustain success in ERAS, the experts highlighted clinical champions and the presence of a dedicated ERAS facilitator as essential elements. For future networking, a unanimous agreement was achieved on the formation a national network to facilitate spread and adoption of ERAS and to promote research and education across surgery.

Conclusions: Consensus was achieved on regular measurement and review of patient experience in ERAS. Agreement was reached on the role of regional analgesia and the use of oesophageal Doppler for intraoperative goal directed fluid therapy. In order to facilitate the further spread and adoption of best practices and to promote research and education, an ERAS-UK network was recommended.
INTRODUCTION

Enhanced Recovery After Surgery (ERAS) protocols aim to reduce the stress response to surgery and optimise postoperative recovery by employing a multimodal approach to perioperative management. The safety of ERAS protocols has been demonstrated in numerous randomised trials (1-4) and a number of studies and meta-analyses have shown the efficacy of ERAS. Reduced length of stay, reduction in morbidity in the elderly, faster return of bowel function, earlier mobilisation and lower pain scores have all been demonstrated (5-9).

Despite the evidence and encouraging results demonstrated by pioneering groups (10, 11), the initial uptake of ERAS across the UK has been slow. In 2009, a collaborative initiative, the Enhanced Recovery Partnership Programme (ERPP), was established in England with aim of promoting spread and adoption of ERAS, in colorectal, musculoskeletal, gynaecology and urology major elective surgical pathways. This initiative successfully raised awareness of the benefits of ERAS and promoted sharing of good practice between expert teams and novice centres (12).

As the ERPP was coming to an end, it became apparent that certain ambiguous issues existed surrounding how to sustain success of ERAS delivery and the measurement of patient experience in ERAS, which are not well addressed in literature. There was also a need to explore the adoption and impact of the emerging new techniques, which are not included in the original ERAS protocol. Examples include preoperative Cardio-pulmonary exercise (CPEX) testing, use of minimal access surgery (MAS), goal directed fluid therapy and alternative analgesic modalities. Hence, the aim of this study was to obtain consensus views on these key elements to ensure continual success of ERAS delivery in England.
METHODS

The Delphi technique was used in this study. This technique involves a re-iterative process of interrogation of a group of experts. Expert opinion from various sources is combined using qualitative then quantitative methods with the aim of converging on a shared consensus result (13,14). Notable characteristics of the Delphi technique include anonymity, controlled feedback of opinion, re-iteration of concept and potential for application of statistical analysis techniques. It has been widely used in healthcare in areas such as epidemiology, education and improving clinical practice (15-17).

Expert centres were defined by the ERPP as units with established ERAS programmes over one year, in at least one specialty. The units had displayed measurable reduction in length of stay of at least two days. Experts were selected from these centres based on nomination from their peers within the unit as the leaders of ERAS. 86 experts including 71 consultant clinicians 15 ER multi disciplinary team representatives from 32 different NHS trusts across England were recruited into this study and were invited to complete the first round questionnaire. These represented 41 colorectal surgeons, 18 anesthetists, 8 musculoskeletal specialists, 2 gynaecologists and 2 urologists. The expert group also included 15 other members of the multi-modal team, such as an ERAS facilitator, pre-assessment clinic specialists and primary care specialists.

The first round questionnaire addressed the following themes:

1. Measuring patient experience.
2. Impact of new technologies and techniques on ERAS in the context of the greater use of laparoscopic surgery.
3. Ensuring sustainability including data collection and networking.

Open-ended questions were formulated by the authors in collaboration with key members of the ERPP Advisory Board (listed in Acknowledgments). Experts were invited by e-mail to either complete an on-line questionnaire (Table 1) or to complete a paper version and return by post during
May 2010. The responses to this first round were then grouped together to generate a limited number of statements or choices to form the second round questionnaire in July 2010 (Appendix 1). Experts were then asked to rank their agreement against each statement.

The set of statements/ questions comprising the third round were based on analysis of the responses obtained by the first two rounds, backed by a comprehensive review of the literature on the subject matter. Following the presentation of round two results, statements/ questions were offered to the participating group using PowerPoint projection slides. Each statement/ question had a maximum of 10 options, on which each participant had to express an opinion or rank in order of perceived importance. The responses were collected in real time by use of TurningPoint Audience Response System technology with separate handsets for each participant. Table 3 summarises the level of agreement required to obtain consensus.

The third round was carried out during the first ERAS conference in Bristol in September 2010. It was facilitated by key members of the ERPP advisory board who did not vote but defined the terminology and encouraged group discussion before voting on each and every issue.
RESULTS

26 NHS trusts responded to the first round questionnaire, with a total of 86 experts contributing to these replies (81.2% [26/32]), while 66 experts across 27 NHS trusts contributed to the second round responses (77.1% [27/35]). 32 experts representing 21 NHS trusts attended the third round meeting and contributed to the consensus statements.

1. Patient Experience Data

Round one identified several methods used at present to record and use patient experience data, which were then categorised and voted upon in round two (Figure 1). The preferred methods of recording data were routine patient satisfaction questionnaire, patient diaries, patient reported outcome measures and patient focus groups. There was also agreement in round two regarding how the data should be utilised; to adjust the pathways and complete audit cycles (Figure 2). In this round also, an enhanced recovery facilitator was identified to be responsible for collecting data on patient experience by 63.3% (19/30) of the group (positive verdict), while 33.3% (10/30) preferred clinical governance team.

In round three, 53.8% (14/26) of the expert group supported the current use of routine patient satisfaction questionnaires and 30.8% (8/26) supported patient recorded outcome measures. Finally, a majority positive verdict (96.2% [25/26]) agreed with the following consensus statement:

*Patient experience data should be recorded, analysed and reviewed at regular enhanced recovery meetings, where problems are investigated and adjusted where necessary, thus completing the audit cycle.*

2. Impact of new technologies and techniques

In the first round, participants described 23 technologies that may positively impact on ERAS in future. These spanned all surgical domains and are shown in Table 4.
The four most popular areas were chosen for further investigation in future rounds. These were postoperative pain management, oesophageal Doppler, CPEX testing and MAS.

a) Post-operative pain management

Round two presented to the participants a range of non-epidural pain management methods. Participants identified regional analgesia, including wound infiltration and spinal anaesthesia, as more likely to have the most impact on ERAS (Figure 3). In addition, with the emergence of regional analgesia participants were asked to comment on the role of epidural analgesia; 36.0% (9/25) suggested open abdominal surgery and a minimal or non-existent role was suggested by 40.0% (10/25) of experts.

In the final round, a majority positive verdict (91.3% [21/23]) agreed with the consensus statement:

_Epidural pain control should be used for specific types of operation (e.g. open abdominal surgery) or for selected patients._

b) Oesophageal Doppler

Round two showed variability among centres in the impact of intraoperative oesophageal Doppler for goal directed fluid therapy with responses ranging from ‘excellent’ to ‘no benefit’. There was no consensus achieved to support its routine use for all cases. Concerns included financial restrictions (76.9% [20/26]) and lack of support from colleagues (57.7% [15/26]). However, a positive verdict (73.1% [19/26]) showed awareness of robust evidence to support its use and benefits in ERAS for selected cases.

c) CPEX Testing

Round two identified that 43.3% (13/30) of the expert teams use CPEX testing for routine pre-operative assessment, with two sites currently piloting its use. Participants stated various key factors that were necessary to successfully introduce CPEX testing such as ensuring funding, integration into the pre-assessment clinic and close liaison with anaesthetists. Of all the experts using CPEX testing,
61.9% (13/21) supported selective use in high-risk patients. There was a majority positive verdict (90.5% [19/21]) on the following consensus statement:

**CPEX should be used selectively for high-risk patients and a multi-disciplinary approach should decide which patients would benefit from this testing.**

d) **Minimal Access Surgery (MAS)**

In round two the impact of MAS to enhance recovery in various specialities is displayed in Figure 4, with the maximum impact on ERAS still being seen in colorectal surgery. In round three, there was discussion on importance of having training schemes, similar to that of the national training programme for laparoscopic colorectal surgery, in other specialties (19). There was no consensus achieved on this topic.

3. **Ensuring Sustainability**

a) **Sustainability**

Table 5 shows proposals on how to sustain the success of ERAS taken from round one responses. The most prevalent suggestions were to hold regular team update meetings, to promote clinical champions, to deliver continual education and feedback teams and to have a designated ERAS facilitator.

Participants in rounds two and three highlighted clinical champions and a motivated team, plus the presence of a dedicated ERAS facilitator, as essential elements to sustain success (Figure 5).

b) **Audit and Data Collection**

Round one generated several ideas for clinical governance issues related to ERAS data collection. These included regular local audits of data and central databases of results/ complications. The issues that emerged here were what to measure and who should have overall responsibility for data collection.
Round two identified measuring patient readmission (97.0% [32/33]) patient experience (97.0% [32/33]), complications (93.9% [31/33]) and length of stay (93.9% [31/33]) as key areas for data collection. However, after discussing outcome measures in round three, it was recognised that there is no current evidence to define the optimum standard of complication rate or patient experience in ERAS. Thus, there was an agreement that there should be national standards for those outcome measures, reflected in the following consensus statement and supported by a majority positive verdict (95.8% [23/24]):

There should be a national standard written for ERAS to allow benchmarking.

An ERAS facilitator (85.3% [29/34]) was identified as the person who should have overall responsibility for data collection. However, the group also noted that consultants and the local clinical governance unit should also be involved collection of data.

c) Future Networking and Support of Novice Sites

This section addressed the future of ERAS in England following the ERPP: is there a need for networking and, if so, how can this be achieved? The majority agreed that there is a need for continued networking.

Round one identified online forums and annual meetings as key future strategies to promote networking and to support novice sites. Round two supported the formation of a national network, an annual meeting and web-based forum as preferred format of future networking (Figure 6). This was confirmed at the final round with a unanimous agreement (25/25) with the consensus statement:

Future networking for the ERAS groups in the UK will be through a national network, an annual meeting and supported by a web-based forum.

The main functions of the national network are to share experience and knowledge, to share consensus on best practice, to co-ordinate research projects and to support development of recommended standards of practice regarding outcome measures in ERAS (Figure 6). There was a unanimous verdict on the aim of this association:
The Enhanced Recovery After Surgery Society (ERAS-UK) aims to advance research and education across all dimensions of enhanced recovery.

DISCUSSION

The ERPP commenced a spread and adoption of ERAS programmes throughout England from 2009-2011, the current Delphi study examined ways to consolidate this initiative. In addition, this study aimed to examine expert opinion on the benefits of emerging techniques, for which there is currently no robust evidence to support their adoption. Finally, the identification of outcome measures to ensure the quality of ERAS protocols, and methods to sustain the initial benefits of ERPP across different surgical specialities required investigation.

Delphi method was used as a structured, opinion-based technique to reach consensus on a number of areas where clear evidence was lacking. Consensus statements, despite their weak evidence, are still the optimal method in identifying areas to channel further research and development in ERAS, including implementation and future practice. The initial rounds of this study identified many issues and the selection of those most relevant to practice in the UK were chosen for consensus statements.

An expert centre was defined as units with established ERAS programmes over 1 year and at least one specialty with a measurable reduction in length of stay of at least 2 days. Experts were selected from these centres based on nomination from their peers within the unit as the leaders of enhanced recovery in the centre. 86 experts responded to the generic questions in the first round questionnaire, including 71 clinicians and 15 ER multidisciplinary team members, however as the questions became more focused and specialised the number of experts participating has reduced to 66 to round 2. The third round required experts to attend an interactive workshop and each centre nominated representatives to attend and vote.
The ERPP ran the campaign to increase spread of ERAS within the UK. In addition to this, the drive for this research was from the Cancer Action Team on behalf of NHS Improvement initiative and Department of Health in England. For these reasons only centres from within the UK were appropriate for inclusion in the study.

Measuring patient experience has been highlighted as a fundamental aspect of ERAS and has now been supported by a national drive use patient experience as an outcome measure in England (20). Despite this, it remains recognised as an area that is currently not well practised in ERAS. Using patient experience data could benefit patients by illustrating areas of local ERAS pathways which need improvement, such as challenges with compliance. Also, understanding these experiences from the patients’ perspective will help clinicians, managers and commissioners to gain an accurate impression of how `useable' the whole system is by a patient who interacts with it. This will encourage the delivery of more appropriate and more effective ERAS systems.

Although, this study identified patient satisfaction questionnaires, health related quality of life and patient diaries as means of measuring patient experience, further validation studies on their format in ERAS are required (21).

A key component of the ERAS pathway is effective postoperative analgesia, and routine use of epidural analgesia was recommended in the original ERAS pathway (22). However, with the MAS and the rapid emergence of alternative analgesic techniques, such as wound infusion catheters, Transversus Abdominis Plane (TAP) block and spinal opioid analgesia, the role of routine use epidural analgesia has been questioned. This study highlighted the limited role of epidural analgesia in standard post-operative care following abdominal and musculoskeletal surgery, and as such it should potentially be limited to major open surgery. A recent randomised control trial found the failure rate of epidural analgesia for laparoscopic colonic resection to be 11% (23). However, randomised control trials are required in this field to ascertain optimal post-operative analgesia within ERAS and MAS.
The key factor to ensure sustainability was to adopt ERAS as the standard of care in routine surgical practice, which should continue beyond initial trials and funding. A motivated team with clinical leadership and supported by a dedicated ERAS facilitator were the main factors to maintain success of ERAS. Data collection should be carried out by each unit and in line with defined national standards (such as Health Episode Statistics) of clinical outcome measures such as length of stay, re-admission and complication rates in addition to patient experience. ERAS facilitators, local clinical governance and lead consultants should collectively be responsible for gathering and distributing the data.

The only domain with unanimous agreement in this study was towards the formation of a national ERAS network, encompassing all surgical specialties and members of the multidisciplinary team. The aims of this association would be to promote research and education and to encourage developing national standards in ERAS. In response to the findings of this manuscript, “Enhanced Recovery After Surgery-UK” is in the process of registration and aims to fulfil the objectives created in this consensus study.

CONCLUSIONS

Consensus was achieved on the importance of the consistent measurement of outcomes including patient experience within ERAS. Agreement was also reached on the use of regional analgesia after major surgery and selective utilisation of CPEX. This study highlighted the increasing awareness of the evidence to support the use of oesophageal Doppler for intraoperative goal directed fluid therapy. Clinical championship and a dedicated facilitator underpin sustaining success in ERAS. A clear consensus was obtained to support the development of national standards and the formation of an Enhanced Recovery After Surgery Society in the UK (ERAS-UK).
REFERENCES


18. TurningPoint Audience Response System: www.turningtechnologies.com


ACKNOWLEDGEMENTS

Thank you to all at the ERPP steering board for their help in the initial direction of this study. Fiona Carter (ERPP Operation Board Member), Andy McMeeking (NCAT), Janine Roberts (ERPP Lead), Monty Mythen (ERPP National Clinical Lead), Alan Horgan (ERPP National Clinical Lead), John McGrath (ERPP Clinical Lead for Urology). Thank you to Mark Coleman the National Lead of Laparoscopic Colorectal national Training Programme for his advice.
TABLES AND FIGURES

TABLE 1: Round 1 Questionnaire:

1. Measuring Patient Experience
   a) How do you measure patient experience of enhanced recovery in your centres?
   b) How do you use this feedback to improve enhanced recovery pathways?

2. Impact of new technologies and techniques
   a) What new technologies or techniques are you aware of that may have a positive future impact on enhanced recovery?

3. Ensuring sustainability
   a) How can the good results from initial adoption of enhanced recovery be sustained overtime?
   b) What ideas do you have for future clinical governance?
   c) Is there a need for expert enhanced recovery sites to continue to communicate/network in the future and what from should this take?
   d) How can expert enhanced recovery sited assist novice groups with adoption and implementation?

TABLE 2: Categorisation of group responses

<table>
<thead>
<tr>
<th>Verdict</th>
<th>% Response (IML system)</th>
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<tbody>
<tr>
<td>Unanimous verdict</td>
<td>100% agreement</td>
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<td>Majority positive verdict</td>
<td>≥70% in favour</td>
</tr>
<tr>
<td>Positive verdict</td>
<td>55-69% in favour</td>
</tr>
<tr>
<td>Split verdict</td>
<td>50-54% in favour</td>
</tr>
<tr>
<td>Negative verdict</td>
<td>55-69% against</td>
</tr>
<tr>
<td>Majority negative verdict</td>
<td>≥70% against</td>
</tr>
<tr>
<td>No opinion</td>
<td>&lt;50%</td>
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### TABLE 3: Suggestions of new technologies that may positively impact on ERAS in future

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<th>n=</th>
<th>Postoperative</th>
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<tr>
<td>CPEX testing</td>
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<td>Oesophageal Doppler</td>
<td>13</td>
<td>Pain buster®</td>
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<tr>
<td>Correction pre-op anaemia</td>
<td>1</td>
<td>Increased laparoscopic surgery</td>
<td>5</td>
<td>(wound infusion catheter)</td>
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<tr>
<td>Streamlined DOSA</td>
<td>1</td>
<td>Wound infiltration</td>
<td>5</td>
<td>Chewing gum</td>
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<tr>
<td>CHO loading</td>
<td>1</td>
<td>Rectus sheath catheters</td>
<td>5</td>
<td>New anti-emetic drugs</td>
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<tr>
<td></td>
<td></td>
<td>TAP blocks</td>
<td>4</td>
<td>Oral opiate antagonist</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local blocks (laparoscopy)</td>
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<td></td>
<td></td>
<td>Robotics</td>
<td>3</td>
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<tr>
<td></td>
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<td>LiDCO™ monitoring</td>
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<td>Local anaesthetic infiltration (knee)</td>
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<td></td>
<td></td>
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<td>Energy devices for haemostasis</td>
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<td>Magnesium as analgesic</td>
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<tr>
<td></td>
<td></td>
<td>Peripheral MU antagonists</td>
<td>1</td>
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<td>Tranexamic acid</td>
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<td>Designated ERAS facilitator</td>
<td>5</td>
</tr>
<tr>
<td>Update pathway/ programme in line with new evidence</td>
<td>3</td>
</tr>
<tr>
<td>Senior clinical champion plus enthusiastic team</td>
<td>3</td>
</tr>
<tr>
<td>Embed as standard of care</td>
<td>3</td>
</tr>
<tr>
<td>Executive leadership</td>
<td>3</td>
</tr>
<tr>
<td>Ward nurses empowered to take control</td>
<td>2</td>
</tr>
<tr>
<td>Continuously strive to do better</td>
<td>2</td>
</tr>
<tr>
<td>Use positive experiences/ results to give team confidence</td>
<td>2</td>
</tr>
<tr>
<td>Driven by enthusiastic clinical nurse specialists</td>
<td>1</td>
</tr>
<tr>
<td>Update and review pathway every 6 months</td>
<td>1</td>
</tr>
<tr>
<td>Team members feed suggestions into meetings</td>
<td>1</td>
</tr>
<tr>
<td>Spread ERAS across whole of surgical service</td>
<td>1</td>
</tr>
<tr>
<td>Anaesthetic standardisation</td>
<td>1</td>
</tr>
<tr>
<td>Need to change whole ward culture</td>
<td>1</td>
</tr>
<tr>
<td>Review and update pathway every 3 months</td>
<td>1</td>
</tr>
<tr>
<td>Share patient experiences</td>
<td>1</td>
</tr>
<tr>
<td>Change in management is necessary requirement of implementation</td>
<td>1</td>
</tr>
<tr>
<td>National publication of results</td>
<td>1</td>
</tr>
<tr>
<td>Research</td>
<td>1</td>
</tr>
<tr>
<td>Challenging and changing perceptions of patients and staff</td>
<td>1</td>
</tr>
</tbody>
</table>

‘n’ number of teams suggesting proposal
FIGURE 1: Methods of recording patient experience data – results of round 2 voting.
FIGURE 2: Preferred methods of using patient experience data – results from round 2 voting

FIGURE 3: Non-epidural analgesic methods that will have the most impact on ERAS
FIGURE 4: Expert opinion of impact of MAS on ERAS specific to specialty.

![Pie charts showing impact of MAS on ERAS by specialty.]

Colorectal surgery: No impact 60%, Little impact 30%, Moderate impact 5%, Essential 5%
Gynaecology: No impact 33%, Little impact 27%, Moderate impact 7%, Essential 33%
Musculoskeletal surgery: No impact 50%, Little impact 13%, Moderate impact 38%

FIGURE 5: Promoting Sustainability in ERAS – results from round 2 voting

![Bar chart showing results of round 2 voting.]

Clinical champion & enthusiastic team
Employing ER facilitator
Embed as standard of care
Empower ward nurses to control
Feedback success to team
Audit of compliance to protocol
Continuing education new staff
Regular team update sessions
Senior management leadership
Challenging negative perceptions

First choice, Second choice, Third choice

FIGURE 6: Suggestions for future networking methods – round 2 results

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FIGURE 7: Suggested roles of a national association for ERAS
FIGURE 1: Methods of recording patient experience data – results of round 2 voting.

- Routine patient satisfaction questionnaire
- Routine use of Patient Recorded Outcome Measures
- Quality of life type questionnaires
- Patient panel or focus group
- Patient diary
- Structured discussion between patient and MDT member
- Occasional or interval patient satisfaction questionnaire
- Informal discussion between patient and MDT member

- First choice
- Second choice
- Third choice

126x90mm (300 x 300 DPI)
FIGURE 2: Preferred methods of using patient experience data – results from round 2 voting

113x90mm (300 x 300 DPI)
FIGURE 3: Non-epidural analgesic methods that will have the most impact on ERAS

131x90mm (300 x 300 DPI)
FIGURE 4: Expert opinion of impact of MAS on ERAS specific to specialty.

Colorectal surgery

- 30% No impact
- 5% Little impact
- 60% Moderate impact
- 5% Essential

Gynaecology

- 27% No impact
- 7% Little impact
- 33% Moderate impact
- 33% Essential

Musculoskeletal surgery

- 13% No impact
- 50% Little impact
- 33% Moderate impact
- 18% Essential

123x90mm (300 x 300 DPI)
FIGURE 5: Promoting Sustainability in ERAS – results from round 2 voting

Clinical champion & enthusiastic team
Employing ER facilitator
Embed as standard of care
Empower ward nurses to control
Feedback success to team
Audit of compliance to protocol
Continuing education new staff
Regular team update sessions
Senior management leadership
Challenging negative perceptions

First choice  Second choice  Third choice

125x90mm (300 x 300 DPI)
FIGURE 6: Suggestions for future networking methods – round 2 results

121x90mm (300 x 300 DPI)
FIGURE 7: Suggested roles of a national association for ERAS

137x90mm (300 x 300 DPI)