Peer Review File
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First Round Peer Review

Reviewer A

Comment 1:
This is a very thoughtful review and an interesting quality improvement project. The authors followed appropriate QI steps to obtain buy in at the beginning and obtain diverse feedback throughout the project. However, the authors state many times that the program was successfully implemented but they provide no data. Please provide data for the implementation - frequently done via a run chart and you can refer to interventions (or PDSA cycles) in the chart. Then, it would also be important to see what impact the protocol had on patient experience (pain, hospital stay), length of stay, readmission, etc...

Reply 1:
The authors understand the reviewers point about claiming the implementation was successful without objective quantitative data on patient outcomes. However, the purpose of this study was not to evaluate the changes of the postoperative outcomes within this patient population. While we are currently collecting data to ascertain possible changes to these outcomes, that remains outside of the scope of this particular manuscript and will require at least several more months of data collection to properly power that study. Our study's purpose was to describe the implementation process scientifically over an entire healthcare system (lines 112-114). This has not been previously reported in the literature, over such a diverse healthcare system simultaneously, using the evidence-based European Society of Thoracic Surgery protocol within our target patient population. Moreover, there are several single center studies describing thoracic ERAS programs with various levels of success. Some have shown benefits, while others show no statistical changes in outcomes. In many cases, it is not possible to determine whether these results were consequences of differences in implementation strategies at those institutions that may have been less effective than implementation strategies used elsewhere. By describing a scientifically sound way to implement this protocol using D&I science, this manuscript could provide a blueprint towards implementation at large healthcare centers, and we hope that using D&I science will help improve implementation techniques at other institutions. However, because of the understandable comment by the reviewer, we have removed that word from the manuscript text when describing the implementation.
Changes in the text:
We have removed the term "successful" from the manuscript text where it describes the implementation of the ERAS protocol (throughout manuscript).

Reviewer B

Dyas et al presents a narrative of how they implemented their ERAS protocol across the multi-hospital health system in their manuscript "Development of a Universal Thoracic Enhanced Recovery After Surgery Protocol for Implementation Across a Diverse Multi-Hospital Health System."

Comment 1:
This is a very descriptive paper without data. Need to know what percentage of the ERAS protocol was present at individual hospital before implementation and what percentage was present after the implementation as well as outcome of such intervention. Without results, this is not helpful for the reader.

Reply 1:
We thank the reviewer for this comment. While we agree that before and after results are important, this was outside the scope of this particular manuscript. Our study's purpose was to describe the implementation process scientifically over an entire healthcare system (lines 112-114). In the healthcare climate of enlarging major hospital systems comprised of various hospital types, the authors believe that this description of an evidence-based protocol using D&I scientific techniques is valuable to the surgical literature. It will be necessary for surgeon scientists to be familiar with D&I science and the methods used to implement techniques as hospital metrics continue to focus on quality of patient care. While we agree that implementation compliance is of utmost importance to see changes in patient postoperative outcomes, early adherence to newly implemented protocols are usually low. Our early implementation data showed adherence was poor but has improved with use of additional techniques that we plan to publish in a separate manuscript. Additionally, measurement of the individual components of the ERAS components across the hospitals prior to ERAS implementation are very difficult to measure because: 1) there was no specific perioperative patient care protocol in place prior to this implementation; 2) the healthcare system incuded hospitals with different patient populations and capabilities; and 3) most importantly, surgeons practice patterns were unique and based on individual surgeon prior experience rather than a patient care protocol (lines 107-110). Many of the important tenants of the protocol were changes from prior practice patterns at all locations. Despite these limitations, we believe that this manuscript and its purpose are valuable, contributory, and helpful for the surgical audience.

Changes in the text:
n/a

Reviewer C

Comment 1:
Thank you for the opportunity to review your paper! You have described an impressive effort to implement an ERAS protocol for anatomical lung resection patients. In my opinion, it is very important to publish implementation science in "clinical" journals, just to show that coming up with a new protocol or process is not enough: we have to make it work!

Reply 1:
Thank you for your kind comments. We agree- it is important to expose the surgical community to this type of work, especially in the setting of more standard operating protocols and a focus on quality improvement in the surgical field. This belief has driven us to pursue publication of this manuscript.
Changes in the text:
n/a

Comment 2:
However, I have some questions/advice that might help to clarify the purpose of your paper.

Several checklists for publication of implementation science have been available: the StaRI or the SQUIRE statement for reporting quality improvement research (https://www.equator-network.org/reporting-guidelines/), as well as the Recover checklist for reporting on implementation of ERAS guidelines. These might be helpful in structuring your paper and defining its purpose. The way this paper is presented, the STROBE checklist does not fit.

Reply 2:
We agree with your assessment and have added a SQUIRE statement which more accurately reflects the purpose and description of the manuscript. We have also updated the text of the manuscript to reflect that we completed a SQUIRE statement.
Changes in the text:
We changed the reporting checklist to reflect the addition of the SQUIRE statement and attached this in the manuscript submission. (page 19 lines 431-432).

Comment 3:
Apart from the statement that a variety of perioperative care protocols existed in the participating hospitals, do you have data on differences in clinical or patient reported outcomes? In short: do you have data on where you started? Why was this effort necessary?

Reply 3:
When reviewing our healthcare system wide outcomes data for the target population,

we observed that we were high outliers for several postoperative outcomes. This data was a significant driver for change and implementation of this protocol. However, we felt important to not discuss specific hospital or system wide outcomes metrics in a published journal for medicolegal purposes. Instead, we have made changes to the introduction to discuss these results as a driver for change.

Changes in the text:

We edited the introduction to mention this driver for change (page 6 lines 110-112)

Comment 4:

While you describe an impressive effort, it is not completely clear what type of paper you aim to write: development of a quality improvement project? A problem analysis into facilitators and barriers for thoracic ERAS implementation? An implementation trial?

Reply 4:

Thank you for your commendation. We felt that it was important to describe the implementation of the entirety of the dissemination and implementation process scientifically so that it could be used as a blueprint and replicated by other hospital systems while implementing their own standard operating procedures and protocols. That includes both the steps towards development and the evaluation of problems, facilitators, and barriers as they arose. We changed the phrasing of the study purpose sentence to reflect this point more clearly.

Changes in the text:

We edited the purpose statement (page 6, lines 112-114)

Comment 5:

You conclude that you successfully implemented a thoracic ERAS protocol, but outcome measures are lacking. Why is it successful? Did protocol adherence rise because of your implementation? Did all hospitals follow all implementation strategies? Did practice variation decrease? Did clinical outcome improve?
If you don't have these data (yet) it might be better to restructure this paper as a quality improvement paper and publish your clinical data in relation to protocol adherence in a future hybrid publication.

Reply 5:

We considered it was successful because the implementation process was achieved in a way that previously had not been well described in the surgical literature- across a healthcare system, simultaneously, with universal agreement to comply and adhere to the components, within hospitals that are different in culture, practice patterns, and referral base. The implementation itself was challenging, especially when convincing several surgeons, several dozen anesthesiologists, even more advanced practice providers, and other staff to follow this protocol, which may be different than ways they have practice for years to decades. While initial adherence was low, this is expected during the implementation of a new protocol and is beyond the scope of this

manuscript. We are currently studying methods to improve adherence - this is the topic of an upcoming manuscript where we will discuss the measures implemented to increase the adherence of our newly implemented thoracic ERAS protocol. While we hope and anticipate that protocol adherence will show a significant change in postoperative outcomes, we will likely require several more months if not a year to enroll enough patients in thoracic ERAS to acquire the power required to detect this change. We plan to evaluate postoperative outcomes at that time. While we did mention that postoperative outcomes measurement will be a topic of future study in our conclusion, we have now clarified the language in the conclusion to mention that we plan to evaluate methods to improve protocol adherence.

Changes in the text:

We edited the conclusion paragraph (page 18 line 404-407).

Comment 6:

In methods you refer to the steps of Kotter. Could you elaborate on why you chose this framework for your project?

Reply 6:

Kotter's 8 step program for implementing change is validated and easy to follow the steps in ERAS implementation. We adapted this from Kotter to develop figure 1 outlining the steps of ERAS implementation.

Changes in the text:

n/a

Comment 7:

You have managed to mobilize a wide variety of healthcare professionals to get a wide base of support. I did miss patient representatives in table 1. Could you elaborate on patient participation in this project?

Reply 7:

While we do value the patient input in areas like inpatient experience, clinic timeliness, and satisfaction measures, we did not feel it was appropriate to include patient input in the development of this protocol. The tenants of the protocol were scientific, studied in the literature, and based on recommendations from world experts. The local stakeholders included in table 1, from the leadership to the key stakeholders, are experienced and experts in their various phases of patient care and have an invaluable breadth of experience necessitating their inclusion in development of the protocol. However, we have engaged patient partners in our past research, and appreciate your suggestion to re-engage them in this moving forward. We can foresee their engagement may help with some of the challenges we have been facing in patient buy-in to taking perioperative immunonutrition supplements, for instance. Additionally, we are studying patient reported outcomes since the implementation of thoracic ERAS at our healthcare system, the topic of a future manuscript.

Changes in the text:

n/a

Comment 8:
Could you rephrase your methods section to show the timeline order? To me it is not clear whether you performed a problem analysis in step three. Did you perform a problem analysis, informing you beforehand about facilitators and barriers, helping you to select corresponding implementation strategies? If so, how did you do this? Questionnaires? Interviews? Focus groups? Or did you discover these barriers during the process? If you based your implementation strategies on the scarce literature, could you elaborate why?

Reply 8:
We began the implementation process with a focus group of stakeholders where we reviewed the goals of implementation of a thoracic ERAS protocol, reviewed the current care processes at the different hospitals, introduced the proposed thoracic ERAS protocol and discussed facilitators and barriers. This helped us select corresponding implementation strategies. We have added this to the manuscript. While not obvious in the manuscript, the methods were listed in timeline order as written. We elaborated on this by add the step numbers next to italicized header. The barriers and facilitators were almost all discovered during the implementation process. The development of an international pandemic was certainly unforeseen but also a major contributor to barriers across several phases of implementation. We did use the literature to base our implementation strategies (references 10 and 11) and modeled those scientific methods to our specific implementation needs. We felt that using scientifically studied methodology would be important because it not only provided evidence behind our steps, but also could be replicated by other programs within our healthcare system or other healthcare systems,
Changes in the text:
Steps 1 through 8 added to the Methods subheadings.
Text added to second paragraph of the methodology: “Concurrently, we began the implementation process with a focus group of key stakeholders (subsequently expanded) where we reviewed the goals of implementation of a thoracic ERAS protocol, reviewed the current care processes at the different hospitals, introduced the proposed thoracic ERAS protocol (based on the ERAS society/ESTS thoracic ERAS guidelines) and discussed facilitators and barriers. This helped us select corresponding implementation strategies.” (page 7 lines 135-140)

Comment 9:
If you limit yourself to the description of your quality improvement project, this paper will serve as a solid basis for your future publications on implementation outcome and clinical and patient reported outcome.

Reply 9:
Thank you again for your kind comments. We agree with this conclusion, and as we

referenced in your prior comments, there are several other studies we have begun since this implementation, and we plan to publish several manuscripts on various topics surrounding our thoracic ERAS program in the future. Thus, we have not presented data on the implementation's success in this manuscript.
Changes in the text:
n/a

Reviewer D

Thank you for giving me the opportunity to review this paper. This study assessed the implementation of enhanced recovery after surgery (ERAS) in all types of institutions.
I understand the difficulty of standardization of ERAS protocol due to the different systems among institutions. I have a few comments before publication.

Comment 1:
The word anatomic lung resection is vague. The authors should clearly define anatomic lung resection.

Reply 1:
We agree with this statement and have added the operations included under that classification after the first time it was mentioned in the manuscript.
Changes in the text:
We described operations that are anatomic pulmonary resections (page 6 line 105-106)

Comment 2:
The description of barriers and challenges should be mentioned in discussion.

Reply 2:
Under the SQUIRE reporting guidelines for quality improvement projects (our SQUIRE reporting checklist is submitted with this revised manuscript), the occurrence of unexpected benefits, problems, or failures should be reported in the results section (item 13e.). We currently discuss the barriers and challenges in the results, so we feel that rediscussing in the discussion would be redundant. While the authors are not opposed to moving those sections to the discussion, it would be in contrast to the SQUIRE reporting guidelines and therefore, we would prefer to leave them in the results.
Changes in the text:
n/a

Comment 3:
Why did the authors focus on thoracic surgery? The explanation of this point is needed.

Reply 3:
The authors are all either thoracic surgeons, thoracic anesthesiologists, manage thoracic surgery patients, or are experts in quality improvement and protocol implementation. Thus, it made sense that thoracic patients were the target population chosen. While there are further plans for other ERAS programs within our healthcare system, we felt it important to successfully implement one program prior to beginning another. We have added a sentence in the discussion to explain the rationale for including this patient population.
Changes in the text:
We added a sentence at the end of paragraph one of the discussion (page 15 lines 346-348)

Reviewer E

Comment 1:
Excellent work on how to implement an ERAS pathway. This is a very useful article and I would like to congratulate your team for this great effort!

Reply 1:
Thank you for your kind feedback, we agree that this information will be contributory to the literature.
Changes in the text:
n/a

Comment 2:
I have just one comment on the role of the clinical nurse who is in my experience the main person of such program. It is not mentioned whether or not the patient is seen in outpatient clinic by the clinical nurse. I think you should mention how you obtained the budget for a clinical nurse, was it difficult?

Reply 2:
We agree, both the clinical nurse and our quality improvement specialist nurse were integral to implementing this protocol. We previously had clinical nurses that staffed our outpatient clinics, and these nurses were educated on the implementation protocol and became assets to implementation. A quality improvement nurse employed by the healthcare system served as a major contributor to implementation especially when engaging our hospital administration. Because these nurses were already employed by the hospital and their roles did not significantly change because of this protocol implementation, no additional funds were required to hire more staff. Both of these people are included in the table of key stakeholders, but we added clinical staff as facilitators in the manuscript.
Changes in the text:
We have included clinical staff as a facilitator in the results (page 13 line 288)

Comment 3:
Do you think that the implementation of an ERAS pathway in other specialties in your hospital facilitates the implementation of your program in thoracic surgery by obtaining budget for the different elements (database, clinical nurse, etc..)

Reply 3:
The presence of prior ERAS programs certainly was a facilitator to implementation for our program, especially with the resources that were available as a result of prior implementation. We have added this point as a facilitator in the results of the manuscript.
Changes in the text:
We added text in the facilitators section to discuss this point (page 12 lines 274-276)

Second Round Peer Review

Thank you for addressing my questions and concerns.

Comment 4:
While you describe an impressive effort, it is not completely clear what type of paper you aim to write: development of a quality improvement project? A problem analysis into facilitators and barriers for thoracic ERAS implementation? An implementation trial?
Reply 4:
Thank you for your commendation. We felt that it was important to describe the implementation of the entirety of the dissemination and implementation process scientifically so that it could be used as a blueprint and replicated by other hospital systems while implementing their own standard operating procedures and protocols. That includes both the steps towards development and the evaluation of problems, facilitators, and barriers as they arose. We changed the phrasing of the study purpose sentence to reflect this point more clearly.
Changes in the text:
We edited the purpose statement (page 6, lines 112-114)

Comment 4 follow up:
Thank you. However, I think a term like “structured” rather than “scientifically” is more appropriate. The implementation science has informed your effort, but the science really comes in when you will evaluate this structured effort in terms of successful implementation and reduced practice variation as well as subsequent improvement of patient outcomes.

Reply:
The authors agree with this point. We have changed the word scientifically to structured where it appears in the manuscript introduction.
Changes in the text:
We have changed the word “scientifically” to “structured” on page 6 line 111.

Comment 6:
In methods, you refer to the steps of Kotter. Could you elaborate on why you chose this framework for your project?
Reply 6:
Kotter’s 8 step program for implementing change is validated and easy to follow the steps in ERAS implementation. We adapted this from Kotter to develop figure 1 outlining the steps of ERAS implementation.
Changes in the text:
n/a

Comment 6 follow up:
Could you add your reply to the text? Important to show your audience why and how you chose a framework.

Reply:
We agree and have added that a sentence to elaborate on why we chose this framework to the text.

Changes in text:
We added a sentence explaining why we chose this framework (page 7 lines 127-129).

Comment 7:
You have managed to mobilize a wide variety of healthcare professionals to get a wide base of support. I did miss patient representatives in table 1. Could you elaborate on patient participation in this project?
Reply 7:
While we do value the patient input in areas like inpatient experience, clinic timeliness, and satisfaction measures, we did not feel it was appropriate to include patient input in the development of this protocol. The tenants of the protocol were scientific, studied in the literature, and based on recommendations from world experts. The local stakeholders included in table 1, from the leadership to the key stakeholders, are experienced and experts in their various phases of patient care and have an invaluable breadth of experience necessitating their inclusion in development of the protocol. However, we have engaged patient partners in our past research, and appreciate your suggestion to re-engage them in this moving forward. We can foresee their engagement may help with some of the challenges we have been facing in patient buy-in to taking perioperative immunonutrition supplements, for instance. Additionally, we are studying patient reported outcomes since the implementation of

thoracic ERAS at our healthcare system, the topic of a future manuscript.

Changes in the text:

n/a

Comment 7 follow up:

I understand your arguments, but patients, in the end, are the ones that need to benefit from our efforts. More often than not, they will shift the focus or nuances of our work to address the biggest problems from their perspective. Could you add the essence of Reply 7 to your discussion?

Reply:

We do agree that going forward their input will be of vital importance to improving outcomes. We have added text to discuss these points in the discussion of the manuscript.

Changes in the text:

We have added several sentences in the discussion to talk about future patient involvement and to discuss the collection of patient reported outcomes for this project (page 16 lines 360-366).