



## Quality Improvement Study

## Evaluation of the implementation of a quality improvement program through morbidity and mortality reviews in a developing country

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## ABSTRACT

**Background:** Morbidity and mortality reviews represent an opportunity to discuss adverse events and healthcare issues. Aim: Report the first experience of implementing a procedure of MMR, and assess its impact on quality improvement.

**Methods:** From July 2019 to December 2019, members of the surgical and ICU departments designed and implemented a regular procedure of MMR. Cases of severe postoperative complications after curative resection for digestive cancer were selected to be presented by a surgical resident and discussed in an interdisciplinary conference following a standardized presentation based on an analysis tool adapted from the ALARM framework. Process was assessed by the number of MMRs held, number and type of recommendations issued and implemented.

**Results:** Among 13 serious complications during the study period, 10 were discussed. The “Tasks” category was activated in 90% of the cases where lack or misuse of protocols was identified in 90% of the events discussed. Test results availability or accuracy were incarnated in 30% of cases. Poor communication was a contributing factor in 60% of the cases. Written medical records were defective in 40% of the cases. From 16 recommendations for improvement emitted, 87.5% (14/16) were translated into projects and successfully implemented.

**Conclusions:** a standardized and regular procedure of morbidity and mortality reviews in a tertiary care facility in a developing country allowed a significant improvement in patient care through quality initiatives implementation. MMRs might be a strong tool for the improvement of surgical care particularly for low-mid income countries.

## 1. Introduction

Morbidity and mortality reviews (MMRs) are a forum to discuss adverse events associated with patient care. MMRs represent a unique opportunity to identify deficiencies in an organization or patient care that potentially contributed to a complication or death. They have the potential to improve patient outcomes, quality of care, attitudes towards patient safety and they contribute to the education of clinical staff [1].

MMR can be traced back to the early 20th century. They became an integral component of surgical education when Ernest Amory Codman, a surgeon from Massachusetts, introduced the end result system in 1900,

whereby he systematically recorded patient demographics and linked treatment decisions to subsequent outcomes [2], end-result cards were employed to publicly document individual surgeon's outcomes [3]. Although this blame assigning system was faced by intense opposition, it laid the foundation for current MMRs and diffusion to other medical specialties.

Overtime, the focus has shifted towards incorporation of quality improvement (QI) objectives within the framework of the traditional MMR [3–6]. This was achieved by identifying system-related issues, and implementing improvement initiatives aimed at avoiding the recurrence of adverse events and improving the quality and safety of care [7]. The

*Abbreviations:* MMR, Morbidity and mortality reviews; QI, Quality improvement.

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quality and safety movement also introduced new expectations for training programs and clinical departments that must provide exposure to these concepts early during medical training. In this context, MMRs may be a valuable tool not only to provide general medical education through learning from identified errors, but also to teach residents to analyze clinical practice situations using patient safety QI methods in a non-punitive environment [8,9].

In high-income countries, patient safety issues receive huge attention from the public and the governments, and healthcare facilities are required to analyze the root causes and contributing factors when adverse events occur. The Royal College of Surgeons of England emphasized the central role of MMR in supporting services to achieve and maintain high standards of care, and established in 2015 guidelines to standardize the procedure [10]. In the USA, MMRs have been incorporated in training programs since 1983, and hospitals are required to hold regular MMR in order to maintain accreditation [11]. Since 2005, the majority of French healthcare facilities have a program integrating health professionals in safety management called experience feedback committees (EFC) [12]. The National Health Authority in France (Haute Autorité de Santé HAS), has required root cause analysis as the reference method to investigate adverse events within EFC, and introduced it as a standard in accreditation programs [13].

In developing and emerging countries, investigation of patient safety has been scarce and limited in scope [14,15]. In a large study conducted by the World Health Organization (WHO) where 26 hospitals from Africa and the Eastern Mediterranean were included, adverse events occurred at a range of 2.5%–18.4% per country. Of these events, 83% were judged to be preventable [16]. The WHO also recognized that patient safety improvement in emerging and developing countries require strategies adjusted to the limited capacity and infrastructure of these countries while taking into account the lack of regulations within such health systems [17].

The aim of this study is to describe and assess the impact of implementing regular morbidity and mortality reviews in the context of an academic surgical oncology department in an emerging country.

## 2. Methods

This study took place at the Digestive Surgical Oncology Department at the National Institute of Oncology (NIO) in Rabat Morocco, between January and December 2019. This study being retrospective, approval by the Ethics Committee of Biomedical research was not necessary according to the local regulations (Law 28.13, article 2).

The manuscript was written according to the SQUIRE reporting guidelines [18].

### 2.1. Setting

The National Institute of Oncology is an academic anti-cancer center that is part of the Ibn Sina University Hospital in Rabat (Morocco). Since 1984, the NIO has been the only public national facility that offers care involving medical oncology, radiotherapy and surgery, all on the same site [19]. The NIO treats nearly 6000 new patients each year, with almost 12% of those for digestive cancers [15]. In 2014, a dedicated pathway for digestive cancer surgery was created for patients by a multidisciplinary team of digestive surgery specialists, anesthesiologists/intensivists, gastroenterologists/endoscopists and nurses [20,21]. Before 2018, two surgical oncology departments existed in NIO. In 2018, they were merged into a single surgical department with a main focus on digestive surgical oncology.

Prior to this intervention, morbidity and mortality conferences didn't exist in our institution. Also, the concepts of quality improvement or MMR are not part of the surgical curriculum nor are required by national regulations. However, in 2018 there was an institutional implementation of a continuous quality improvement program revolving around quality of care and patient safety. The first project was

a training program on quality management methodology. Four attending surgeons and 3 senior anesthesiologists as well as head nurses from both departments carried out this training which represented an initiation to quality improvement and patient safety culture. Consequently, an initiative came from the Digestive Surgical Oncology to implement department specific regular MMRs. One senior surgeon (AB) launched the process by a preliminary literature review. The French National Health Authority's (HAS) methodological guidelines and documents were chosen as the main resource as they offer training on case selection and the systemic root cause analysis, as well as technical recommendations and advice on MMRs' conduction [22]. Root cause analysis of adverse events is a standard quality approach in French healthcare facilities that allows identifying and addressing harmful system conditions. The ALARM framework is a recognized and structured protocol [23] that extends and deepens the analysis of adverse events through several elements that combine to explore 7 areas of possible contributory factors: "Patient", "Tasks", "Individual staff", "Team", "Work environment", "Organizational and management factors" and "Institutional context factors". Its objective is to search for the root causes, the factors contributing to the occurrence of errors, in order to correct them by installing defenses or barriers and thus creating a safer environment.

Table 1 shows the essential contributory factors of the framework as described by Vincent et al. [24].

The second step of the intervention consisted of engaging interprofessional members with whom the surgical department collaborates tightly, namely anesthesia attendings and nurses.

The third step was disseminating lessons learned: all surgery residents, nurses, senior surgeons and anesthesiologists were introduced to the procedure through a detailed presentation describing the systematic approach to analyzing adverse events followed by a mock MMR.

Based on HAS guidelines and ALARM framework, senior physicians prepared educational and e-learning content about MMR for all new arriving residents. Also, a toolkit was prepared containing a PowerPoint template (annexes) to standardize case presentations along with the commented ALARM grid which delivered explanations and examples to each category for contributing factors [22]. MMRs were routinely held in the conference room of the surgical department, on Mondays at 2h30 pm.

### 2.2. Description of the intervention

Since July 15th, a team of physicians and nurses from both the surgical and the anesthesiology departments held regular MMR discussing

**Table 1**  
ALARM categories and essential contributory factors.

Category	Contributory factors
Patient	General condition; case complexity; language and communication; personality and social factors; Conflictual relations.
Tasks	Availability and use of protocols; task design and clarity of structure; availability and accuracy of test results; Decision aids (specific equipment, decision-making algorithms, recommendations)
Individual staff Team	Knowledge and skills; physical and mental health Communication (written; verbal); supervision and seeking help; team structure (consistency, leadership, etc); task distribution
Work environment	Staffing levels and skills mix; workload and shift patterns; design, availability; Premises and equipment (functionality, maintenance, hygiene); administrative and managerial support; Delays
Organizational and management	Financial resources and constraints; organisational structure; policy standards and goals; safety culture and priorities
Institutional context	Economic and regulatory context; national health service executive; clinical negligence scheme for trusts

all sever adverse events defined as postoperative morbidity > 3a according to the Clavien Dindo grading system [25], occurring within the first 90 postoperative days of surgery. The quorum included senior surgeons, at least one senior anesthesiologist, surgery residents and nursing staff.

The MMR procedure was held as following:

- 1- Case selection: each week the surgery team collectively identifies from discharged patients' list, all cases with severe adverse events.
- 2- Case assignment: The selected case is assigned to the surgical resident who were involved in the patient care when the event occurred, assuming that he may have better insight of the postoperative course and the background and decision-making surrounding the complication. The resident who had already completed the e-learning content, has one to two weeks prior to the MMR to prepare the meeting.
- 3- Case preparation according to the following steps:
  - Establishing a non-interpretative chronological sequence of events describing: detailed case history, and physical examination, results and copies of documented preoperative medical imaging, pre-anesthetic consultation reports, treatment plan decisions, procedure reports, and the proof of monitoring of all the clinical, biological and radiological items of the postoperative course as well as the treatment regimen. Residents were highly encouraged to conduct one-to-one interviews with any physician, nurse, patient or his family in order to complete the chronological sequence of events.
  - Detecting the healthcare related issue: identification of the adverse event, namely the diagnosis of the complication and its management.
  - Identifying possible causes and contributory factors: this analysis was based on the commented ALARM reporting tool from HAS [22].
  - Identifying recovery factors: analyzing all the actions undertaken, purposely or not, by the medical and paramedical staff to prevent the event from happening or lessen its severity.
- 4- Case presentation: All these data were presented using the pre-prepared powerpoint template (Supplementary Material). All the contributing factors and recovery factors were presented on an Ishikawa diagram designed to assign all identified factors to one of seven ALARM framework categories: Patient, tasks, individual staff, equipment, environment of work, management and policy.

MMRs were led by a senior surgeon to encourage discussion and reflection in a 'blame-free' environment.

- 5- Case and care issue discussion: After the presentation, the multidisciplinary team discussed the case and agreed on the healthcare issue. From all the identified contributory factors, root causes were determined by the 5 whys technique.
- 6- A brainstorming of possible improvement measures to implement was carried out. The measures to implement were agreed upon by consensus.
- 7- Declaration of identified factors: the identified healthcare issue, the contributing and recovery factors were collectively and publicly discussed and directly notified on the powerpoint template used for the presentation. All the modified presentations were stored in a shared folder that was used as a database for the process evaluation.
- 8- Protocol proposal: The same resident is tasked to elaborate an actionable plan utilizing SMART criteria (Specific, Measurable, Attainable, Relevant, and Timely) in accordance with the issued recommendations and literature evidence. This protocol proposal was presented to the staff in the next MMR, where it was discussed to be either accepted or modified. Once these modifications were completed, the protocol was approved to be implemented and shared via our department's website for maximal diffusion.

### 2.3. Outcomes' definitions

Our main outcome was to assess the process: through the evaluation of the number of MMRs, numbers and categories of identified contributing factors, number and types of recommendations and number and types of implemented recommendations.

## 3. Results

### 3.1. MMR description

Between July 15th, 2019 and December 30th, 2019, among 13 MMR scheduled, 10 (76.9%) were held at the Digestive Surgical Oncology Department at the National Institute of Oncology. Table 2 describes cases included and discussed in the meetings.

Table 3 presents an overview of the contributing factors identified. On average, complications were associated with more than one factor (aside from case complexity), and 50% of cases were associated with two or more factors.

The "patient category" was activated in all the cases presented. The complexity of the case and coexisting comorbidities were identified as contributing factors in 80% and 60% of the cases respectively. "Tasks" category was activated in 90% of the cases. The lack or misuse of protocols were identified as a contributing factor in 90% of the events discussed. Test results availability or accuracy were incriminated in 30% of cases. "Healthcare personnel" category was triggered in two cases where technical and judgement errors were attributed to inadequate training and supervision. Examples implicating a technical error were suboptimal management of respiratory complications (early extubating resulting in reintubation) after an esophageal surgery and delayed diagnosis of a Wernicke's encephalopathy after cytoreductive surgery with hyperthermic intraperitoneal chemotherapy.

**Table 2**  
Patients, interventions and complications' description.

Patient description	Intervention	MMR inclusion criteria
F 46, PS1 ASA1 Appendicular peritoneal pseudomyxoma	Complete cytoreduction + hyperthermic intraperitoneal chemotherapy	Wernicke's encephalopathy POD42; CD5.
M 52, PS1 ASA 1 Adenocarcinoma of the splenic colic flexure	Left colectomy extended to the stomach and caudal pancreas	Profuse haematemesis at POD17; CD5
M 75, PS2 ASA 1 Rectal adenocarcinoma	Partial mesorectal excision + colostomy	Pelvic collection, hyperkalemia, pneumopathy; CD 4a
M 51, PS1 ASA1 Malignant degeneration of colorectal polyposis	Coloproctectomy + ileo rectal anastomosis	Postoperative peritonitis POD18; CD3b
F 60, PS2 ASA1 Obstructive left colon adenocarcinoma	Left colectomy + colo-colic anastomosis	Postoperative peritonitis POD4; CD3b
M 46, PS1 ASA1 Adenocarcinoma of the ascending colon	Right colectomy + end to side ileocolic anastomosis iliac lymphadenectomy	Postoperative abdominal abscess at POD6; CD3b
M 60, PS1 ASA1 Rectal adenocarcinoma	Total mesorectal excision + delayed colo anal anastomosis	Anastomotic leak + pelvic abscess at POD 15; CD3b
M 55, PS1 ASA2 Hepatocellular carcinoma	Segment 5 hepatectomy	Decompensated cirrhosis (hemorrhage) at POD3. CD5
M 63, PS1 ASA1 Rectal adenocarcinoma	Total mesorectal excision + delayed colo anal anastomosis	Pelvic collection at POD14. CD3b
M 53, PS1 ASA1 Esophageal adenocarcinoma	Lewis-Santy esophagectomy mecanic end to side anastomosis	Pneumopathy POD4. CD4a

PS = Physical Status score ASA = American Society of Anesthesiologists score, F = female, M = male, CD= Clavien Dindo score, POD = post operative day.

**Table 3**  
Identified contributing factors.

Adverse event		Contributing factors	
Alarm categories	n (%)		
Patient	10/10 (100)	Case complexity	8/10 (80)
Tasks	9/10 (90)	Comorbidities	6/10 (60)
		Lack or misuse of protocols	9/10 (90)
		Test results	3/10 (30)
Healthcare personnel	3/10 (30)	Technical error	2/10 (20)
Team	6/10 (60)	Communication	6/10 (60)
		Patient file	4/10 (40)
		Supervision	1/10 (10)
Work environment	3/10 (30)	Patient transfer	1/10 (10)
		Equipement	1/10 (10)
		Workload	1/10 (10)
Management/Organization	3/10 (30)	Medication shortage	3/10 (30)

Poor communication was a contributing factor reported in 60% of the cases. We identified 2 levels of communication failures: poor communication during critical events between the surgery staff (seniors/residents), and a lack of routine daily communication between surgery ward and ICU. Inaccuracy or incompleteness of written medical records was identified in 4 cases (40%).

### 3.2. Process assessment

Every morbidity and mortality review issued at least one recommendation for improvement. By the end of the study period, sixteen recommendations were suggested. Nine of them concerned protocol proposals, one continuing education proposal, one technical proposal, one proposal for a research study to evaluate a newly implemented surgical technique, and two proposals to improve communication between healthcare professionals. Among them, 14 improvement measures were successfully implemented 87.5% (Table 4).

## 4. Discussion

This study took place in an emerging low/middle income country at an institutional setting with no prior experience in quality improvement nor morbi-mortality reviews. Among 13 cases of severe complications selected for presentation in a MMR, ten were discussed following the same structured and reproducible method. The analysis tool used was inspired from the commented ALARM framework which was then transcribed to an Ishikawa diagram, allowing investigation of underlying contributing factors using a root-cause analysis approach. This allowed to suggest 16 recommendations, among them 14 were translated into action plans and protocols.

One of the main strengths of this implementation, is that MMR were held according to a structured procedure, from selection criteria, to standardized format and visual aids for case presentation, analyzing root causes of adverse events and organizing the implementation and follow up of improvement measures. Identifying system-based issues allows for shifting MMR towards a quality improvement scope. In order to efficiently reach the described outcome, Xiong et al. [4] [[5,7] recommended in their systematic review that MMRs should be conducted at a regular frequency, through a standardized procedure with clearly

**Table 4**  
Recommendations and implemented protocols.

Recommendations issued	Implemented actions
Attending physician call protocol	Protocols for better communication between nurses, juniors and attending physicians on call
Training in the management of hemorrhagic shock	Courses were programmed for ICU and surgery residents
Abdominal wall closure protocol in the OR (closing tools and glove change).	Establishment of a protocol in the OR to change abdominal wall closing instruments with change of gloves and dedicated suture box
Protocol for nutritional preparation	Establishment of a standardized nutritional evaluation to all candidates to a major surgery, and protocol of preoperative nutritional preparation
Protocol for diagnosis and management of thiamine deficiencies.	Creation of a protocol of thiamine deficiency diagnostic and supplementation to all patients undergoing major or gastrointestinal surgery and malnourished patients.
Protocol for perioperative antibiotic use.	Systematic coordination with the ICU in matters of peri operative antibiotic use and prescription.
Indications for abdominal drainage	Two specific protocols: management of thoracic drain and indication of drainage in HB surgery.
Protocol for the management of acute bowel obstructions.	Development of local protocols for management of obstructive colorectal cancer and postoperative bowel obstruction.
Protocol for management of fistulas after rectal surgery.	Protocol elaborated and implemented
Evaluation study of delayed colo-anal anastomoses.	A study was conducted to evaluate this technique [39]
Establish criteria for transferring patients from the ICU to the ward.	Protocols to optimize patients' transfer from the ICU to the surgical ward.
Protocol for perioperative management of patients with cirrhosis.	Not done
Protocol for postoperative biliary fistula management.	Not done
Improved communication about protocols on the wards.	An intranet site was created and made available to all the personnel in the ward and is routinely updated to encompass all established protocols
Protocol for perioperative assessment of elderly patients	A Protocol was elaborated and is regularly used for assessment of elderly patients.
Preoperative workup for esophageal surgery.	Protocol of preoperative workup before esophageal surgery

defined goals (e.g. quality improvement and education). Cases should be selected based on predefined criteria and discussed using a standardized presentation format that is succinct, limiting both clinical history and literature review to only pertinent details to ensure ample time for discussion and analysis of the root causes of the adverse events [26]. Bal et al. [4,5,7] confirmed that a well-structured and well-documented presentation allows to bring up all possible underlying contributing factors as a preliminary step to a systematic approach allowing a deep-dive into the root causes of adverse events identified. In contrast, Orlander et al. found the lack of a structured method to be an obstacle to the quality of MMR [4,5,7].

From the ten cases discussed, three items of ALARM categories were most frequently triggered: Patients (100%), Tasks (90%) and Team (60%). From the first category, the item 'case complexity' was activated in 90%, but was never considered to be an actionable contributing factor. The fact is, the main objective of MMRs is to identify system-based issues for improvement, besides, our institute is a tertiary cancer care facility that recruits patients with inherently complex cases.

From the "Task" category, lack or misuse of protocols was identified as a key contributing factor in 90% of the cases. Inadequate processes and poor utilization of protocols has been linked to decreased level of care whereas a change and adherence to processes potentially prevents complications [27]. Ineffective communication in the team and lack of

written medical records was incriminated in 60% and 40% of the cases respectively. This was a recurrent contributing factor in many studies [27–29] where poor communication represents an extremely common cause of inadvertent patient harm.

Sixteen recommendations derived from our conferences. To better reflect patient safety culture, this knowledge must be translated into meaningful QI initiatives through specific and detailed action plans [30]. In our study, implementation rate was at 87.5% with 14 improvement measures successfully enforced. Francois et al. in their observational study reported that implementation of improvement initiatives relates to MMR characteristics [31]. This achieved rate was a result of a rigorous process from patient selection to improvement measures implementation. MMRs are consequently a platform for regular training in patient safety that allows to convert lessons learned from errors into measures of improvement. These conferences hold a powerful educational value and are an opportunity to discuss technical aspects and decision making in clinical situations [8]; Moreover, assigning MMR cases to residents and junior doctors facilitates the understanding of systems and processes' vulnerabilities and being aware of common adverse events. This represents a chance to develop their presentation skills, reflection skills, analysis of serious incidents, and finally stimulate ideas for quality improvement projects [1]. The incorporation of safety and quality content in MMRs is linked to a higher reported satisfaction with the educational experience as reported by Singh and Kwok [32–35]. In general, well-structured and blame-free MMRs allow residents to analyze complications systematically and identify steps for potential changes in clinical practice and thus, are considered to deliver clear educational messages regarding surgical complications and are well perceived by the participants as effective in reducing future error [36,37].

However, MMRs should not be just an opportunity to deliver theoretical knowledge, strategies need to be developed to translate error analysis into meaningful QI initiatives [26]. This includes setting clear goals and measuring implementation which provides quantitative assessment of the quality improvement achieved by MMRs. To improve patient safety in emerging low/middle income countries, Carpenter et al. recommends a focus on structural and process-oriented aspects as the most efficient way (such as a unique identifier for each patient, standardized documentation of medical treatment, implementation and documentation of safe medication administration processes, and credentialing of healthcare providers) [14]. In a South African setup, MMRs were used to better understand the contribution of errors to adverse surgical events while reporting that translating this insight into improvement measures remained challenging [38].

The first main limitation to the study was the inability to complete the evaluation in 2020 because of the covid 19 pandemic [19], therefore we couldn't complete the impact evaluation. Secondly, this was a retrospective study that took place in a single university affiliated institute, and results obtained may not apply in other settings. However, this study allowed us to establish a prospective methodology with the objective of re assessing results in the future and evaluate the clinical effect of this quality improvement approach on clinical care and patients' outcome. Furthermore, we aim to evaluate the educational benefit of our program through a self-reported attendees' form assessing satisfaction and perceived knowledge obtained.

## 5. Conclusion

This study showed that the implementation of a standardized and regular procedure of morbidity and mortality reviews in the context of a developing country is feasible and may allow a significant improvement in patient care through quality initiatives implementation. MMRs may be a strong tool for the improvement of surgical care particularly for low-mid income countries.

## Provenance and peer review

Not commissioned, externally peer reviewed.

## Please state any sources of funding for your research

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## Ethical approval

The study was agreed by the institutional review board of the National Institute of Oncology. No authorization from the ethics committee was mandatory since it is a retrospective observational study, according to the Moroccan reglementation (Law 28.13, article 2).

## Consent

Studies on patients or volunteers require ethics committee approval and fully informed written consent which should be documented in the paper.

Authors must obtain written and signed consent to publish a case report from the patient (or, where applicable, the patient's guardian or next of kin) prior to submission. We ask Authors to confirm as part of the submission process that such consent has been obtained, and the manuscript must include a statement to this effect in a consent section at the end of the manuscript, as follows: "Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request".

Patients have a right to privacy. Patients' and volunteers' names, initials, or hospital numbers should not be used. Images of patients or volunteers should not be used unless the information is essential for scientific purposes and explicit permission has been given as part of the consent. If such consent is made subject to any conditions, the Editor in Chief must be made aware of all such conditions.

Even where consent has been given, identifying details should be omitted if they are not essential. If identifying characteristics are altered to protect anonymity, such as in genetic pedigrees, authors should provide assurance that alterations do not distort scientific meaning and editors should so note.

## Author contribution

LO collected and analyzed data and wrote the manuscript. MMA designed the study and revised the manuscript. BA participated in the study design and critically reviewed the manuscript. SA, BZ, EB, GA, AL and RM critically reviewed the manuscript. All authors agreed on the final version of the article.

## Registration of research studies

- 1.Name of the registry: clinical trials
- 2.Unique Identifying number or registration ID: NCT05286411
- 3.Hyperlink to your specific registration (must be publicly accessible and will be checked): <https://www.clinicaltrials.gov/ct2/show/NCT05286411?term=NCT05286411&draw=2&rank=1>

## Guarantor

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## Declaration of competing interest

All authors declare no conflict of interest.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.103987>.

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