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A Geriatrics-Focused Hospitalist Trauma Comanagement Program Improves Survival and Quality Measures for Older Adults: A Propensity Score-Matched Analysis

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Abstract

Background: Given the increasing age and medical complexity of trauma patients, medical comanagement has been adopted as a strategy for high-risk patients. This study aimed to determine whether a geriatrics-focused hospitalist trauma comanagement program improves outcomes.

Methods: A pre- and post-implementation study compared older adult trauma patients who were comanaged by a hospitalist with those prior to comanagement at a Level 1 trauma center. Criteria for comanagement included: age 65+, multiple comorbidities, and use of high-risk medications. Comanagement focused on geriatric trauma management guidelines. One-to-one propensity score matching (PSM) was performed based on age, gender, Injury Severity Score, Charlson comorbidity index, and initial admission to the intensive care unit (ICU). Outcomes included hospital mortality, length of stay (LOS), and orders for geriatrics-focused quality indicators. Differences were compared with the Wilcoxon Rank Sum test for continuous variables and chi- square or Fisher's exact test for categorical variables.

Results: From 792 control and 365 intervention patients, PSM resulted in 290 matched pairs. Three intervention group patients died compared to 14 in the control group ($p=0.0068$). Hospital LOS, 30-day readmission, ICU LOS, and ICU upgrades were not significantly different between groups. There was an overall trend toward improved geriatrics-focused quality indicators in the intervention group. Intervention group was less likely to be restrained ($p=0.04$), received earlier physical therapy ($p=0.01$), more doses of acetaminophen compared to control patients ($p<0.0001$), and more subcutaneous enoxaparin rather than heparin ($p=0.0027$).

Discussion: Our main findings highlight the higher medical complexity and increased risks in older adult trauma patients, as well as the mortality reduction and adherence increase to geriatrics-focused quality indicators. Limitations of our study included use of a single center, the possibility of selection bias in analyzing historical data, and a low sample size, all of which may limit generalizability.

Conclusions: Our study demonstrates that a geriatrics-focused hospitalist trauma comanagement program improves survival and quality of care.

Introduction

The United States population continues to age, with projections that by 2050, 83.7 million Americans will be aged 65 and over.[1] Furthermore, due to advances in diagnosis and treatment, a greater proportion of older people are living with chronic illnesses, the treatment of which can both predispose patients to falls and increase the severity of traumatic complications. These trends have contributed to trauma centers treating an increasing number of elderly patients who often exhibit multimorbidity, medical complexity and polypharmacy. These patients have been shown by previous research to experience higher mortality and complication rates with an overall mortality rate of 14.8% in geriatric trauma patients, and with each 1-year increase in age beyond 65 associated with a 6.8% increase in odds of dying.[2,3]

Simultaneously, medical comanagement of hospitalized surgical patients has become an increasingly common strategy in the U.S.[4,5] Comanagement stands in contrast to the traditional model of consultation in the intensity and consistency of involvement by an internist, who is empowered to manage chronic or acute medical issues that may arise in the perioperative period. Benefits of comanagement by internal medicine practitioners have been documented in a variety of surgical fields, including cardiothoracic surgery, orthopedics, neurosurgery, colorectal surgery, and vascular surgery.[6-14] Specifically, comanagement of trauma patients was associated in prior studies with decreases in length of stay and in-hospital mortality.[15,16]

It is in this context that we created the geriatrics-focused Trauma/Acute Care Surgery-Hospitalist Comanagement Program at our institution, a Level I regional trauma center. The program targeted older, medically complex patients on the trauma and acute care surgery service, with a focus on geriatrics-focused quality indicators. The purpose of this study is to assess the impact of the comanagement program on patient outcomes.

Methods

Program Description

After a collaborative, transparent review of quality metrics, opportunities for improvement in the care of trauma patients were identified, and the Trauma/Acute Care Surgery Hospitalist Comanagement Program was created at our institution at the end of 2016. The focus of the program was based on the American College of Surgeons Trauma Quality Improvement Program (TQIP) Geriatric Trauma Management Guidelines.[17]

A group of five dedicated hospitalists were assembled as members of the comanagement team. A single hospitalist rotates for two weeks at a time and has no other clinical responsibilities. The hospitalist attends daily morning rounds with the trauma and acute care surgery team, at which time the overnight surgical attending, the day surgical attending, residents, advanced care providers, and administrators are present to discuss patients. During this time, patients who are appropriate for comanagement are identified by the team. Inclusion criteria for comanagement include age over 65, presence of multiple chronic medical conditions, and/or being on high risk medications such as anticoagulants, antiplatelets, insulin or psychotropic medications. The most common admitting diagnoses for this population of patients are hip or femoral fracture, intracranial hemorrhage, rib fracture, syncope or fall, other fractures, bowel obstruction, motor vehicle collision, and cholecystitis.

Patients are followed by the hospitalist for the duration of their hospitalization. On average, ten comanagement patients are seen daily from Monday to Friday. On weekends, high-risk patients are identified collaboratively to be seen by the hospitalist, as well as initial evaluations for high-risk patients (i.e., those presenting with acute medical issues). Overnight, patients are primarily managed by the surgical team, with in-house hospitalist coverage available as back-up. After admission by the surgery

team, the hospitalist manages chronic medical conditions and medications, as well as acute medical conditions and perioperative complications. The hospitalist places orders, determines the need for subspecialty consultation, and facilitates transitions of care to the outpatient setting. The hospitalist communicates with the trauma surgery team throughout the day regarding the management of patients. Disagreements in opinion or management are resolved by attending level discussion.

Based on the American College of Surgeons Trauma Quality Improvement Program (TQIP) Geriatric Trauma Management Guidelines, the following assessment and practices were integrated into initial and daily electronic health record notes: 1. Establish and document baseline cognitive and functional status; 2. Perform a comprehensive medication reconciliation to discontinue nonessential medications, dose adjust medications when necessary, continue medications with withdrawal potential, and limit potentially inappropriate medications as per the Beers Criteria; 3. Discuss and document the patient's priorities and preferences, decision making capacity, advance directives and goals of care; 4. Engage and inform family members; 5. Screen for cognitive impairment including delirium; 6. Assess for fall risk, develop a plan for early mobilization and engage physical therapy; 7. Remove any unnecessary lines and devices; 8. Optimize pain management while limiting the use of opiates and ensuring appropriate bowel regimen; 9. Use non-pharmacologic interventions to prevent and manage delirium (maintain sleep-wake cycle, hydration, early mobility, and use of hearing and vision devices); and 10. Ensure there is an early and comprehensive discharge plan. These principles were discussed on daily multidisciplinary rounds.

Study Design

This was a retrospective cohort study of the outcomes of geriatric trauma and acute care surgery patients who were co-managed by a hospitalist (intervention group), compared with propensity score-matched patients admitted to the trauma and acute care surgery service prior to the creation of the comanagement program (pre-intervention control group). The study and design were approved by our institutional review board.

Setting and Patients

This study was conducted at a 738-bed academic tertiary care hospital, a Level I trauma center with more than 1200 admissions to the trauma surgery service annually. The trauma service is staffed by a dedicated group of trauma and acute care surgeons. Patients were included in the study if they were over the age of 59 and were on the trauma surgery service. The comanagement program was developed at the end of 2016 and was implemented in January of 2017. We defined the pre-intervention control group as patients on the trauma surgery service between January 1, 2015 and June 30, 2016. We defined the intervention group as trauma surgery patients who were comanaged by a hospitalist between March 1, 2017 and July 31, 2018. The intervening period was excluded as a period of transition between models of practice.

Outcomes and Measures

Baseline patient characteristics collected included age, gender, race, body mass index, coverage by Medicare and Medicaid, Charlson comorbidity score, initial Injury Severity Score (ISS), and whether patients were initially admitted to the intensive care unit (ICU). The primary outcomes examined were hospital mortality, hospital length of stay (LOS), ICU LOS, 30-day readmissions, and readmissions to the ICU after being discharged to the floor. Secondary outcomes included the proportion of patients receiving an order for geriatric-focused quality indicators, including fall risk, aspiration risk, physical therapy, bed rest, dietary restrictions (nil per os), constant observation, enhanced observation and restraints, as well as the time to these orders or the total duration of such orders outside the intensive care unit (ICU). Duration outside the ICU was chosen due to expected greater impact by the hospitalist outside the ICU setting. Additional secondary outcomes included proportion of patients with a do-not-resuscitate order and a palliative care consult order. We also examined doses of potentially inappropriate medications (PIMs), i.e. benzodiazepines, antipsychotics, and pain medications (acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs), morphine, oxycodone, tramadol, hydromorphone) received, as well as proportion of patients receiving different forms of venous thromboembolism (VTE) prophylaxis.

Data Acquisition and Statistical Analysis

The Charlson comorbidity score was calculated using ICD-9 data as previously described.[18] The ISS was obtained from a trauma registry prospectively populated by a research coordinator. The remaining data were queried from the Allscripts Sunrise electronic health records (EHR) system database, with subsequent processing in Microsoft Excel. Data pertaining to orders were available readily from the EHR database. Medication dosing was extracted from the electronic medication administration record. LOS and ICU LOS were rounded to the nearest number of days. Baseline patient characteristics were compared between pre- and post-intervention groups, which revealed large between-group differences. To create balanced groups with similar characteristics, one-to-one propensity score matching (PSM) was performed based on age, gender, ISS, Charlson comorbidity score, and initial admission to the ICU.

PSM and statistical analysis were performed using SAS release 3.8 (SAS Institute Inc., Cary, NC). Between group differences in continuous variables (hospital LOS, ICU LOS, doses of medications) were evaluated using Wilcoxon Rank Sum tests. Chi-square or Fisher's Exact test was used in univariate analysis to determine whether there was a difference in the distribution of demographics, medical history, and clinical characteristics between treatment groups. Generalized Linear Model with repeated measures was performed to determine whether there was an association between in hospital mortality, 30-day readmission, upgrade to the ICU and group effect. Generalized Linear Model with repeated measures was also performed to determine whether there was an association between each order and group effect. Mixed Linear Model with repeated measures was performed to determine whether there was a difference in the dose of various medications and the time to each type of order between the two groups.

Results

There were significant differences between the control and intervention groups at baseline, with the intervention group significantly older (mean age 82.0 versus 79.6, $p < 0.01$) and with a higher Charlson comorbidity index (mean 2.0 versus 1.2, $p < 0.01$) and ISS (mean 11.0 versus 10.8, $p < 0.01$) (Table 1). From 792 control and 365 intervention patients, high-quality PSM resulted in 290 balanced control-intervention pairs. The matched populations had no significant differences in baseline characteristics (all p-values > 0.05, Table 1).

Table 1. Baseline characteristics of patient population before and after propensity score matching

Characteristic	Prior to propensity score match			After propensity score match		
	Control group n = 792	Intervention group n = 365	p-value	Control group n = 290	Intervention group n = 290	p-value
Age*, mean ± SD	79.6 ± 10.0	82.0 ± 9.9	<0.01	80.8 ± 9.5	81.4 ± 9.8	0.41
Female*, n (%)	351 (56)	160 (59)	0.30	169 (58.3)	176 (60.7)	0.55
Caucasian, n (%)	576 (73)	279 (73)	0.20	212 (74)	216 (73)	0.14
African American, n (%)	62 (8)	27 (7)		26 (9)	16 (6)	
Asian, n (%)	66 (8)	26 (7)		22 (17)	25 (22)	
BMI, mean ± SD	26.0 ± 5.8	25.5 ± 5.1	0.21	26.8 ± 6.4	25.5 ± 4.9	0.07
Medicare, n (%)	692 (87)	350 (91)	0.04	262 (90)	260 (90)	0.78
Medicaid, n (%)	166 (21)	77 (21)	0.73	48 (17)	58 (20)	0.28
Charlson comorbidity score*, mean ± SD	1.2 ± 1.5	2.0 ± 2.0	<0.01	1.4 ± 1.5	1.4 ± 1.4	0.96
Diabetes, n (%)	172 (22)	102 (27)	0.06	82 (28)	67 (23)	0.15
Cerebrovascular disease, n (%)	161 (20)	114 (30)	<0.01	63 (22)	71 (24)	0.43
Congestive heart failure, n (%)	52 (7)	63 (16)	<0.01	24 (8)	31 (11)	0.32
Moderate-severe CKD, n (%)	50 (6)	74 (19)	<0.01	32 (11)	34 (12)	0.79
Injury severity score*, mean ± SD	10.8 ± 7.5	11.0 ± 6.5	<0.01	10.8 ± 7.6	10.6 ± 5.4	0.07
Initially admitted to ICU*, n (%)	345 (38)	143 (32)	0.06	100 (35)	105 (36)	0.32

*Variables used for propensity score matching; Abbreviations - SD: standard deviation; CKD: chronic kidney disease; ICU: intensive care unit

For the primary outcome, three (1.0%) in the intervention group died in the hospital, compared to fourteen (4.8%) in the control group (p=0.0068) (Table 2). There were no significant differences between groups in hospital LOS, 30-day readmissions, ICU LOS, and upgrades to the ICU (p-values > 0.05 for all measures).

Table 2. Primary outcomes

	Control group n = 290	Intervention group n = 290	p-value
Hospital mortality, n (%)	14 (4.8)	3 (1.0)	<0.01
Hospital length of stay, median (IQR)	4 (2-6)	4 (2-6)	0.92
30-day hospital readmission	38 (13.8)	46 (16.0)	0.49
ICU length of stay, median (IQR)	2 (1-4)	2 (1-4)	0.64
Upgrade to ICU, n (%)	10 (3.6)	9 (3.1)	0.81

Abbreviations – ICU: intensive care unit; IQR: interquartile range

For the secondary outcomes, significantly more patients in the intervention group were assessed for falls (32 versus 8, p-value 0.04); physical therapy orders were placed earlier in the hospitalization in the intervention group (mean 15 hours versus 19 hours after admission, p-value 0.01); and intervention patients had significantly fewer hours of restraints ordered outside the ICU (mean 0.8 hours versus 17 hours, p-value 0.04)(Table 3). Intervention patients were given more doses of acetaminophen (mean 17.4 doses versus 6.5 doses, p < 0.01) and tramadol (mean 2.8 doses versus 0.6 doses, p < 0.01) compared to control patients (Table 4). With regard to VTE prophylaxis, a greater proportion of intervention patients received subcutaneous enoxaparin compared to control patients (81% versus 43%, p < 0.01), a greater proportion of whom received subcutaneous heparin (48% versus 10%, p < 0.01).

Table 3. Geriatrics-focused processes

	Control group n = 290	Intervention group n = 290	p-value
Fall risk order, n (%)	8 (3)	32 (11)	0.04
Hours to fall risk order, mean ± SD	38 ± 88	25 ± 53	0.58
Aspiration risk order, n (%)	9 (3)	24 (8)	0.08
Hours to asp. risk order, mean ± SD	102 ± 145	39 ± 68	0.10
Physical therapy (PT) order, n (%)	275 (95)	285 (98)	0.12
Hours to PT order, mean ± SD	19 ± 30	15 ± 17	0.01
Restraints order, n (%)	29 (10)	27 (9)	0.80
Hours of restraints ex-ICU, mean ± SD	17 ± 40	0.8 ± 2.8	0.04
Constant observation order, n (%)	25 (9)	24 (8)	0.89
Hours of constant obs. ex- ICU, mean ± SD	36 ± 34	50 ± 87	0.44
Enhanced observation order, n (%)	14 (5)	20 (7)	0.29
Hours of enhanced obs. ex-ICU, mean ± SD	53 ± 40	99 ± 92	0.06
Bed rest order, n (%)	30 (10)	28 (10)	0.80
Hours of bed rest ex-ICU, mean ± SD	54 ± 72	76 ± 100	0.35
Nil per os (NPO) order, n (%)	137 (47)	132 (46)	0.71
Hours of NPO ex-ICU, mean ± SD	12 ± 19	10 ± 16	0.40
Do not resuscitate (DNR) order, n (%)	22 (8)	34 (12)	0.19
Hours to DNR order, mean ± SD	115 ± 219	71 ± 73	0.29
Palliative consult order, n (%)	5 (2)	11 (4)	0.23

Abbreviations – SD: standard deviation; ICU: intensive care unit

Table 4. Medications and VTE prophylaxis

	Control group n = 290	Intervention group n = 290	p-value
Doses of benzodiazepines, mean ± SD	0.82 ± 3.4	0.47 ± 2.0	0.13
Doses of antipsychotics, mean ± SD	0.92 ± 4.2	0.76 ± 3.6	0.61
Doses of acetaminophen, mean ± SD	6.5 ± 9.1	17.4 ± 17.1	<0.01
Doses of NSAIDs, mean ± SD	4.3 ± 9.3	4.3 ± 8.6	0.88
Doses of oxycodone, mean ± SD	6.0 ± 11.7	6.2 ± 11.7	0.95
Doses of tramadol, mean ± SD	0.6 ± 3.2	2.8 ± 7.5	<0.01
Doses of morphine, mean ± SD	1.7 ± 3.7	1.4 ± 6.7	0.60
Doses of hydromorphone, mean ± SD	4.6 ± 28.0	3.2 ± 12.6	0.58
Mechanical VTE prophylaxis, n (%)	187 (64)	203 (70)	0.25
Subcutaneous heparin, n (%)	139 (48)	30 (10)	<0.01
Subcutaneous enoxaparin, n (%)	124 (43)	236 (81)	<0.01

Abbreviations – SD: standard deviation; NSAID: nonsteroidal anti-inflammatory drug; VTE: venous thromboembolism

Discussion

We created a trauma and acute care surgery-hospitalist comanagement program to address the higher medical complexity and increased risk of morbidity and mortality of older adult trauma patients. Our study demonstrated a reduction in mortality as well as a significant increase in adherence to geriatrics-focused quality indicators. Notably, we achieved this outcome by using non-geriatrics trained hospitalists who focused on geriatric principles. Unlike previous studies, comanagement was not associated with an increase in hospital LOS.

Our findings echo previous findings on the impact of geriatrician or internist comanagement of surgical inpatients, many of which have found significant decreases or trends toward decreases in mortality.[6,9,14-16,19,20] Additionally, several prior studies were able to demonstrate a decrease in medical or post-operative complications in comanaged patients.[7,9,10,12,14,15,19] Our study differs substantially from that of Salottolo et al., which evaluated the management of lower trauma acuity patients on a nonsurgical, hospitalist-led service to offload the trauma surgery service.[23] Mangram et al. studied a geriatric trauma service where all patients 60 years or older with a traumatic injury would be admitted and subsequently managed by a multidisciplinary team which included a hospitalist, with explicit efficiency time-to-care goals targeting earlier evaluation, surgery, and discharge.[15] Their patient population was younger than ours (mean age 77 vs. 81.4), with baseline comorbidity not described, and had a similar severity of injury (mean ISS 10

vs. 10.6). The intervention was associated with efficiency gains as described above, and a decrease in mortality from 5.7 to 3.8%, which did not reach statistical significance. As previously discussed, their younger and possibly less comorbid population may have attenuated benefit from comanagement.

Two other studies found decreased mortality in medically comanaged trauma patients and reinforce our findings. Cipoelle et al. assessed the effect of embedding a hospitalist into the trauma team at a Level I trauma center.[16] The hospitalist then assumed comanagement of trauma patients with multiple comorbidities. When compared to contemporaneous, propensity score-matched controls, they also found a decrease in mortality (2.9 to 0.4%, $p < 0.01$). Unlike our study, they found an increased LOS for the comanaged cohort, as well as increased upgrades to the ICU, which they attributed to greater vigilance of care. Our study shows a significant survival benefit can be achieved without the trade-off of lower efficiency. Singh et al. studied the effect of geriatric trauma comanagement at a Level I trauma center, where trauma service patients 65 and older with multiple rib fractures were comanaged by a geriatrician.[20] When compared to controls, they found a decrease in mortality from 15.0 to 8.7%, with an adjusted odds ratio of 0.40 (p-value 0.03). They similarly found no difference in LOS or readmissions. In contrast to our study and that by Singh et al., Cipoelle et al. were able to demonstrate a decrease in 30-day readmissions (trauma-related – not further defined in the article). We posit that the lack of effect in our study may be due to the unpreventable nature of most readmissions in our older, highly comorbid trauma patient population.

Despite the foregoing, some studies failed to find decreased mortality in comanaged patients.[8-13] In contrast to our patient population, which by design was older (mean age 81.4) and with significant comorbidity, these studies tended to have patients that were younger, with fewer comorbid conditions, and were largely undergoing elective surgeries. This dichotomy was commented on by Siegal in noting that two roughly simultaneous studies involving the same hospitalists and orthopedic surgeons found contrasting patient outcomes, as one study focused on healthier elective arthroplasty patients and the other on hip fracture patients who were older, more comorbid, and at higher risk for complications.[7,8,22] The variable effect on patient mortality highlights the increased efficacy of comanagement in an older patient population with greater comorbidity, as demonstrated in our study where we focused on geriatric care using published trauma guidelines.[17]

Comanagement of trauma surgery patient was not associated with ICU or hospital LOS. This differs from findings in other comanagement studies.[6-8,12,13,15,19] Interestingly, findings of decreased LOS and decreased mortality were largely mutually exclusive. Comanagement programs which were associated with decreased LOS tended to have patients who were younger and who were undergoing elective surgeries.[7,8,12,13,19] Having a dedicated internist comanager likely expedited pre-operative evaluations and streamlined post-operative care, as demonstrated by studies by Rohatgi et al. which found comanagement was associated with decreased use of medical consultants.[12,13] An intervention which saw both mortality and LOS effect was the multidisciplinary geriatric trauma service reported by Mangram et al. which included comanagement by a hospitalist.[15] Their success in lowering LOS may be

attributed to the nature of the intervention which established specific efficiency goals targeting early evaluation, admission to operating room within 36 hours, and discharge within five days, as well as explicitly involved physical therapy, social workers and other ancillary services.

As far as we are aware, ours is the first study to focus on and measure geriatrics-focused processes in the medical comanagement of surgical patients. This stems from our selection of older, medically complex trauma patients and use of the TQIP Geriatric Trauma Management Guidelines, which focus on fall prevention, delirium risk factors, and high risk medications.[17] We found several trends, including greater and earlier use of precautionary measures such as fall risk and aspiration risk orders in the comanaged group; a decreased ordering of restraints and increased ordering of patient observation, which are surrogate markers for delirium management; and greater and earlier use of palliative care consultation and DNR orders. There were also trends toward lower use of sedating medications and higher use of acetaminophen and tramadol in the comanaged group. Additionally, more comanaged patients received enoxaparin rather than heparin for VTE prophylaxis, as well as mechanical VTE prophylaxis. The program also highlights the ability of integrating geriatrics-focused principles to a hospitalist-run comanagement service, which may be more sustainable for hospitals that lack geriatricians.

Our study had several limitations. First, while our study was conducted in a large tertiary center, a single center may limit generalizability. Second, it was a retrospective study that compared comanaged patients to historical controls. This can introduce selection bias, which was mitigated by propensity score matching that produced groups that were balanced in baseline characteristics. Also, as our controls were not contemporaneous, concurrent changes in hospital environment and practices may have led to differences in measures between groups. Our main finding of reduced mortality is based on low event rates (14 deaths in control group versus 3 in the intervention group) and should be verified in larger studies.

Another limitation of our study is that most of the baseline and outcome variables were extracted from the EHR. We were therefore limited in measuring rates of complications, which would have shed light on intermediary outcomes that may contribute to mortality. We also were not able to obtain patient-level data on patient experience and satisfaction. Furthermore, we did not assess long-term outcomes after hospital discharge. We would like to address these limitations in future studies of the impact of our comanagement program.

Conclusion

Our study shows that a geriatrics-focused hospitalist trauma comanagement program can significantly reduce patient mortality and improve geriatrics-focused quality measures, without adverse effect on hospital LOS. When combined with affirmatory evidence from other studies of trauma comanagement, hospitalist comanagement of trauma surgery patients represents an effective and evidence-based practice that can improve the outcomes of older adult trauma patients, who are at high risk of morbidity and mortality.

Abbreviations

- potentially inappropriate medications (PIMs)
- venous thromboembolism (VTE)
- electronic health records (EHR)
- propensity score matching (PSM)

Declarations

Ethics approval and consent to participate

As a retrospective study, a waiver of consent was obtained to collect subject data. The Northwell Health Institutional Review Board (IRB) approved this study (#18-0977) prior to data collection, and all human subjects protocol were followed in accordance with institutional, state, and federal regulations governing research. The Association for Accreditation of Human Research Protection Programs (AAHRPP) has awarded Northwell Human Research Protection Program (IRB) full accreditation (FWA# 00002505).

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

NJZ contributed to the conceptualization and formal analysis of the study, as well as the writing of the original manuscript draft. LS contributed to the conceptualization of the study. TML contributed to the methodology and formal analysis of the study. MQ contributed to the study investigation. CLM contributed to the study investigation. AS contributed to the review and editing of the manuscript. LMK contributed to the review and editing of the manuscript. MAB contributed to the review and editing of the manuscript. CLK contributed to the conceptualization of the study. All authors read and approved the final manuscript.

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