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Pre-Anesthetic Medical Evaluations: Criteria Considerations for Telemedicine Alternatives to Face to Face Visits

Kushal D. Khera[1], Joseph D. Blessman[1], Mark E. Deyo-Svendsen[1], Nathaniel E. Miller[1], and Kurt B. Angstman[1]

Abstract

Background: The number of pre-anesthetic medical evaluations (PAMEs) being conducted in primary care is increasing. Due to the COVID-19 pandemic, the use of telemedicine has surged, providing a feasible way to conduct some of these visits. This study aimed to identify patient-related factors where a face to face (FTF) evaluation is indicated, measured by the need for pre-operative testing.

Methods: A retrospective chart review was conducted on patients age ≥ 18 years who had a PAME between January 2019–June 2020 at a rural primary care clinic in Southeast Minnesota. Data collected included age, gender, Charlson Comorbidity Index Score, medications, revised cardiac risk index (RCRI), smoking status, exercise capacity, body mass index, and pre-operative testing. Logistical regression modeling for odds ratios of outcomes was performed.

Results: 254 patients were included, with an average age of 64.1 years; 43.7% were female. Most were obese (mean BMI 31.6), non-smoking (93.7%) with excellent functional capacity (87.8% ≥ 5 METs). 76.8% of the planned surgeries were intermediate or high risk. 35.0% ($n = 89$) of visits resulted in medication adjustments and 76.7% ($n = 195$) in pre-operative testing. Age ≥ 65 years, ≥7 current medications, and diabetes all significantly increased the odds of requiring pre-operative testing ($P < .05$).

Conclusions: This study was able to identify patient-related factors that increased the likelihood of requiring pre-operative testing. Patients who are age ≥ 65 years, ≥7 current medications, and those with diabetes could be scheduled for a FTF evaluation. Others could be scheduled for a telemedicine visit to minimize health-care exposures.

Keywords

telemedicine, eHealth, pre-anesthetic medical evaluations, healthcare access

Background

With the rising number of surgical procedures being performed in the US, increasing numbers of pre-anesthetic medical evaluations (PAMEs) are conducted in primary care.[1] These visits involve performing a history and examination, focusing on a patient's medications and comorbidities, and evaluating cardiac, pulmonary and functional status.[2,3] Based on this assessment and relevant pre-operative testing, a patient is either deemed medically optimized for surgery or referred for further evaluation or consultation if necessary.

There is currently no standard protocol for determining which patients have PAMEs; the decision often varies with surgical provider. In some practices, only higher risk patients are referred, whereas others require all patients to have a PAME. In otherwise young, healthy, asymptomatic individuals, these visits rarely lead to changes in medication or the ordering of pre-operative testing. Evidence suggests that performing routine laboratory screening tests does not often change surgical management or clinical outcomes.[4–7] Additionally,

[1] Mayo Clinic Rochester, Rochester, MN, USA

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Corresponding Author:
Kushal D. Khera, Department of Family Medicine, Mayo Clinic Rochester, 200 First Street SW, Rochester, MN 55905, USA.
Email: Khera.kushal1@mayo.edu

the anesthesia team may also conduct a pre-anesthetic assessment prior to surgery, leading to duplicate evaluations.

Although there are expert recommendations on the need for PAMEs, research supporting this practice is limited.[8,9] One trial reported PAMEs reduced the frequency of unnecessary admissions after surgery and reduced length of hospital stay.[10] Other studies have reported an increased length of stay, costs and post-operative complications in patients who had a PAME.[11] This data may be biased if patients who were referred for a PAME were higher risk or had poorer functional capacity. Regardless, PAMEs continue to be an essential part of surgical care, often due to practice tradition, medico-legal concerns, and to avoid any potential delays.[12–14]

PAMEs traditionally have been performed face to face (FTF), usually within 30 days prior to the scheduled procedure. The exact timing is variable, although some research has shown improved outcomes when PAMEs were carried out within 11 days from the procedure.[15] During the COVID-19 pandemic, the use of telemedicine has surged across the USA to provide care while minimizing visits.[16] Telemedicine includes telephone and video visits, where real-time audio/video communication is possible. During the pandemic, it has been essential to minimize visits to reduce health-care related exposures. Even in a post-pandemic setting, minimizing unnecessary clinic visits could help improve clinic access. This highlights the need of assessing whether PAMEs could be performed through alternatives to the traditional FTF visits.

This study aimed to identify patient-related factors where an FTF PAME would be indicated, as measured by the need for pre-operative testing. Excluding these patients identifies characteristics which support a PAME performed through telemedicine. The hypothesis for this study was that the current necessity of a FTF PAME in primary care in some cases could be transitioned to telemedicine visits while retaining the medical decision making abilities needed to provide safe and efficient care.

Methods

A retrospective chart review was conducted on patients aged ≥ 18 years who had a PAME between January 2019–June 2020 at a rural primary care clinic in Southeast Minnesota. A keyword search was conducted to identify these visits in the electronic medical record (EMR), as standardized ICD-10 diagnosis codes were not always associated with PAME visits. Keywords searched were "RCRI" and "Mayo ABCDEFGHINO", which are found in the standardized EMR templates for these visits. Variables collected included age, gender, comorbidity burden measured using

Table 1. Clinical and Demographic Variables for Patients Undergoing pre-Anesthetic Examinations, Sorted by Those Having Further Testing Order and Those who did not.

	Total Cohort N = 254	Any testing ordered after PAME N = 195	No testing ordered after PAME N-59	*P*
Age: mean years (SD)	64.1 (62.4 to 65.9)	67.4 (65.9 to 68.9)	53.3 (48.8 to 57.8)	<.001
Gender:% female (N)	43.7% (111)	37.3% (22)	45.6% (89)	.258
BMI: mean (SD)	31.6 (30.7 to 32.5)	31.9 (30.9 to 32.9)	30.4 (28.6 to 32.2)	.162
Current smoking status: % (N)				
Yes	6.3% (16)	7.7% (13)	5.1% (3)	.545
Former	45.7% (116)	47.2% (92)	40.7% (24)	
No	48.0% (122)	46.2% (90)	54.2% (32)	
Functional capacity : METs				
A: >7	29.1% (74)	26.2% (51)	39.0% (23)	.204
B: 5 to 7	58.7% (149)	60.5% (118)	52.5% (31)	
C: 2 to 5	10.6% (27)	11.3% (22)	8.5% (5)	
D: <2	1.6% (4)	2.1% (4)	0.0% (0)	
Number of current medications: Mean (SD)	9.8 (9.1 to 10.5) (range 0-31)	10.6 (9.8 to 11.4)	7.2 (5.7 to 8.7)	<.001
On anticoagulation medication: % yes (N)	45.3% (115)	49.7% (97)	30.5% (18)	.009
Diagnosis of diabetes: % (N)	24.4% (62)	29.2% (57)	8.5% (5)	.001
RCRI risk score				
0	68.5% (174)	63.1% (123)	86.4% (51)	.003
1	21.3% (54)	25.1% (49)	8.5% (5)	
2	8.3% (21)	9.2% (18)	5.1% (3)	
3	1.6% (4)	2.1% (4)	0.0% (0)	
4	0.4% (1)	0.5% (1)	0.0% (0)	
Surgery risk				
Low	23.2% (59)	20.5% (40)	32.2% (19)	.063
Intermediate/high	76.8% (193/2)	79.5% (153/2)	67.8% (40/0)	
Any adjustments to medications prior to surgery: % yes (N)	35.0% (89)	37.9% (74)	25.4% (15)	.078

Abbreviations: BMI: Body Mass Index; RCRI: Revised Cardiac Risk Index; PAME: Pre-anesthetic medical evaluation; MET: Metabolic Equivalents.

the Charlson comorbidity index, number of medications, Revised Cardiac Risk Index (RCRI) score,[17] smoking status, functional capacity (in metabolic equivalents),[18,19] and body mass index (BMI). After excluding patients who did not give authorization for review of their medical records, the study cohort was 254 adult patients.

The type of surgical procedure was classified into three categories: low, intermediate, and high risk.[20] Low risk procedures included superficial procedures, endoscopies, cataracts, and/or breast surgery where the cardiac risk was <1%. Intermediate risk procedures included head/neck surgery, intra-abdominal or intra-thoracic surgery, orthopedic surgery or prostate surgery where the cardiac risk was <5%. High risk procedures included aortic or major vascular surgery, or anticipated major fluid shifts where cardiac risk was >5%. Pre-operative medication adjustments were defined as any medication adjustment that was listed within the clinic note (either a dose adjustment or a held medication). If medications were continued at their current doses, this was not classified as an adjustment.

Pre-operative testing was any laboratory test, imaging, or any study obtained for the purposes of pre-operative clearance (eg electrocardiogram, chest x-ray, cardiac stress testing, pulmonary function tests etc) Given the variable timing of these tests, these were only included if mentioned in the clinic note. This helped limit the inadvertent inclusion of unrelated tests that may have been performed around the same time.

Data was analyzed utilizing MedCalc Statistical Software version 19.5.3 (MedCalc Software Ltd, Ostend, Belgium; https://www.medcalc.org; 2020). All categorical variables were evaluated by Chi-squared testing. Student independent t-tests were utilized for the continuous variables. Logistical regression modeling for odds ratio of outcomes was performed initially with all the variables, with backward elimination for variables with a P value of >.30. Statistical significance was determined at $P < .05$. The organization's review board approved the investigation for research study.

Results

The cohort of 254 patients reviewed had an average age of 64.1 years, 43.7% were female, majority were obese (average BMI 31.6), non-smokers (93.7% non-smokers) and with excellent functional capacity (87.8% ≥ 5 METs). The study cohort had an average of 10 medications, 24.4% were diabetic, and had low RCRI risk scores (89.8% had an RCRI score of 0-1). 76.8% of the planned surgeries were at an intermediate or high risk (Table 1). 35.0% ($n = 89$) of visits resulted in

Table 2. Types of Testing Completed After pre-Anesthetic Medical Evaluations.

	Adjusted odds ratio	95% CI	*P*
Laboratory blood testing *N* = 144			
Age ≥ 65	6.02	3.30 to 10.96	<.001
BMI	1.05	1.004 to 1.10	.032
Current medications ≥ 7	1.55	0.82 to 2.95	.178
Diabetes	1.62	0.80 to 3.31	.182
Surgical risk > Low	2.78	1.40 to 5.51	.003
Area under curve (ROC)	0.78	0.73 to 0.83	R-squared = 0.304
Electrocardiogram ordered *N* = 173			
Age ≥ 65	1.64	0.94 to 2.90	.089
BMI	1.04	0.99 to 1.08	.087
Current medications ≥ 7	2.57	1.42 to 4.64	.002
Surgical risk > low	1.60	0.85 to 3.03	.146
Area under curve (ROC)	0.66	0.60 to 0.72	R-squared = 0.122
Chest x-ray ordered *N* = 16			
Age ≥ 65	11.35	1.40 to 91.79	.023
BMI	1.10	1.03 to 1.17	.004
RCRI risk score ≥ 1	2.55	0.82 to 7.95	.106
Area under curve (ROC)	0.82	0.77 to 0.86	R-squared = 0.241
Any other testing (stress tests, pulmonary function testing, echocardiogram, etc) *N* = 14			
All variables			>.30
Any investigations ordered *N* = 195			
Age ≥ 65	2.58	1.35 to 4.96	.004
Current medications ≥ 7	2.55	1.33 to 4.90	.005
Diabetes	2.94	1.08 to 8.04	.035
Surgical risk > Low	1.84	0.91 to 3.73	.089
Area under curve (ROC)	0.74	0.69 to 0.80	R-squared = 0.200

Abbreviations: BMI: Body Mass Index; RCRI: Revised Cardiac Risk Index.

medication adjustments and 76.8% ($n = 195$) had pre-operative testing conducted.

Table 1 shows the results of the cohort of patients with testing pre-procedure (TPP cohort) after the PAME ($n = 195$, 76.8%) versus those who did not have any pre-procedure testing ($n = 59$, 23.2%), the NoT cohort. The TPP cohort was significantly older, on a higher number of medications, specifically anticoagulants, was more likely to have diabetes and had a higher RCRI risk score than those in the NoT cohort.

Using logistic regression modeling for the outcomes of pre-procedure testing, Table 2 demonstrates that for any testing, the variables of age ≥ 65 years, the number of current medications ≥ 7, and the diagnosis of diabetes all contribute significantly to the odds of requiring pre-procedure testing (Table 2). An electrocardiogram was more likely done if the medication count was ≥ 7. Similarly, the odds of a chest x-ray being conducted increased with age ≥ 65 and with an elevated BMI (Table 2). Specialized testing (such as echocardiography, cardiac stress testing, or pulmonary function testing) was completed on only 14 patients and no variable was associated statistically with increased testing.

Discussion

This study evaluated the need for a FTF PAME based on the need for pre-operative testing. There are clear limitations to this approach as this does operate under the assumption that pre-operative testing is the primary indicator of requiring a FTF visit, which is certainly not the only variable. However, the rationale is that if a patient needs to come into the clinic to obtain testing, this could be done in conjunction with a FTF visit. If no such testing is required, the PAME could be completed through telemedicine, thus limiting patient exposure. The need for pre-operative testing was utilized as a proxy for increased medical acuity, although pre-operative testing could be obtained without a FTF visit. The data demonstrated increasing odds of requiring pre-operative testing with patients who were on seven or greater medications, 65 years or older and had diabetes.

Telemedicine encompasses various methods, including chart reviews, telephone visits, and video consultations. With increasing patient complexity, video visits would be the most viable option to provide safe and efficient care. This would allow dedicated time to review the patient's history, risk factors, assess functional capacity, and accurately review medications, when compared to a chart review without patient interaction. Even if during the video visit, it is determined that further testing is indicated, these investigations could be obtained independently of a FTF PAME, thus limiting clinical exposure. Telephone visits would allow review of the same information but limit assessment of non-verbal cues.

From a practice management perspective, patients who are more likely to require pre-operative testing using identified significant factors (age 65 or greater, diabetes, on 7 or more medications) could be scheduled for a FTF encounter, whereas others could be scheduled for a video visit. In the circumstances where a FTF PAME is scheduled, the scheduling team could contact the provider to determine if a video visit could provide the care they need. A proposed algorithm is provided in Figure 1. This approach may help limit the number of telemedicine visits that need to be converted to a FTF visit. Other variables that were associated with increased odds of requiring pre-operative testing included RCRI risk scores and anticoagulation status, however these would be difficult to interpret by scheduling teams.

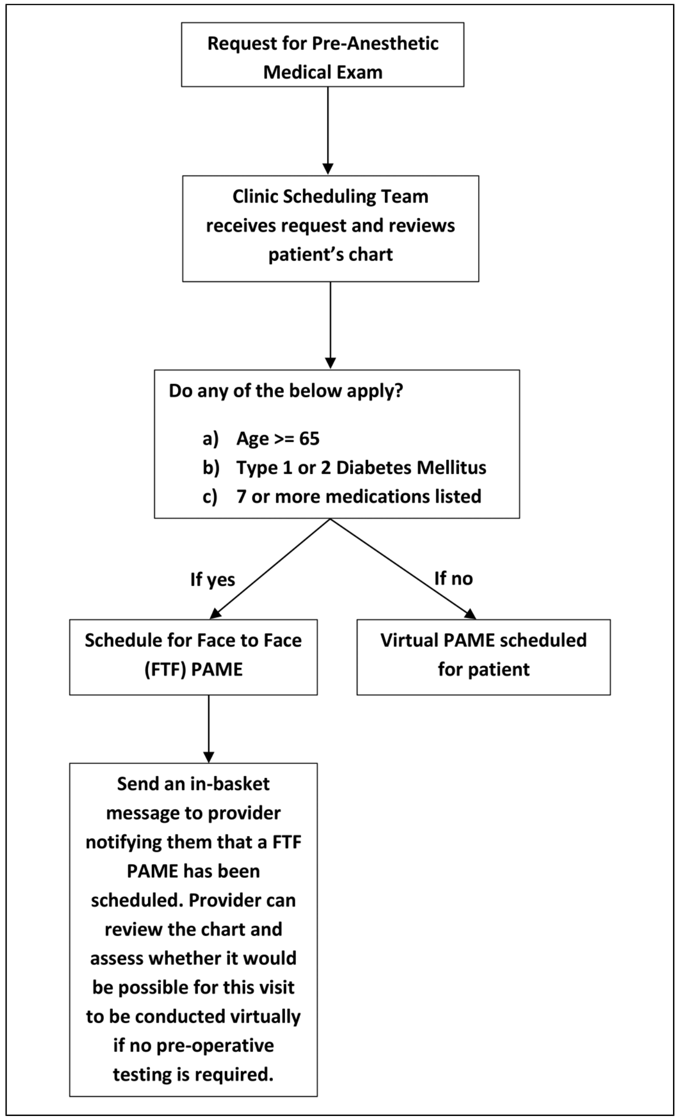

Figure 1. Proposed clinical scheduling algorithm. Abbreviations: PAME: Pre-anesthetic medical evaluation; FTF: Face to Face.

While virtual visits can provide a significant amount of data, there are limitations. Objective data such as vital signs, including optimal blood pressure control, cannot be assessed virtually, though if required may be accomplished by a nurse visit. Additionally, a nutritional assessment is difficult to conduct without measuring weight. There is evidence to suggest that malnourishment increases surgical morbidity and mortality especially in the elderly.[21] To minimize these limitations, a

FTF visit is recommended in patients aged 65 or greater in the proposed algorithm in Figure 1.

Primary care providers may initially be reluctant to embrace telemedicine for PAMEs, given practice guidelines recommending physical examinations.[8,9] However, these guidelines are based off of expert recommendations and practice tradition, without clinical data of their effectiveness. The proposed approach favors triaging patients using the identified variables, obtaining a comprehensive history through telemedicine and ordering pre-operative testing as indicated, in efforts to safely limit FTF encounters.

This study may have limited external validity as this retrospective chart review was conducted at a small rural clinic in Southeast Minnesota and given practice pattern variability, including surgeon preference in required pre-operative testing, may influence outcomes. While pre-operative testing was only included if mentioned within the associated clinical note, this may have included routine testing obtained for health maintenance reasons. Additionally, if pre-operative had been completed near the PAME visit and not ordered during that encounter, this may have led to missed data. This study also was not able to assess for medication changes or lab testing that may have taken place by the Anesthesiology team prior to surgery.

If this approach is implemented in clinical practice, there are many opportunities for further research. Future studies could assess the effectiveness of this scheduling strategy in a prospective manner by measuring how many telemedicine visits did not require follow up FTF visits, analyzing cost-efficacy, and assessing post-operative outcomes including hospital length of stay and associated complications. Additionally, future prospective studies could also assess the appropriateness of ordered investigations and whether FTF visits could have eliminated certain testing requirements. Another area of research could be focused on assessing specific key history variables that would support a telemedicine PAME. For example, a functional capacity assessment offers a useful cardiovascular fitness proxy which may help further delineate the need for a FTF visit. Additionally, incorporating the surgical procedure risk (low, intermediate, high) into a scheduling triage algorithm for assessing the need for a FTF PAME could be explored.

Conclusions

This study was able to identify patient-related factors that increased the likelihood of requiring pre-operative testing. These factors could be used by Primary Care clinics to screen patients who would benefit from a FTF PAME versus those who could have a telemedicine visit. This data could be utilized to safely transition the traditional FTF PAME to alternative telemedicine options while providing safe and efficient care. Further studies can be conducted on the outcomes of this approach.

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Author Contributions

All authors reviewed and approved the manuscript. KK and KA were involved in project design, obtaining IRB approval, data collection, and statistical interpretation of results. KK prepared the main manuscript text. KA prepared Tables 1 and 2. JB was involved in data collection and manuscript review. NM and MDS were involved in project design and manuscript review.

Declaration of Conflicting Interests

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Ethics Approval and Consent to Participate

This study was approved by our institution's research ethics board. Chart review was conducted on patients who had provided written informed consent for the use of their medical records for research purposes. All protocols were carried out in accordance with our institutional research ethics board guidelines and regulations.

Consent for Publication

Not Applicable.

Availability of Data and Materials

The data supporting the conclusions of this study are available in the article and attached tables. Additional data, if needed, is available upon request from the corresponding author.

ORCID iDs

Kushal D. Khera https://orcid.org/0000-0002-2156-4687
Mark E. Deyo-Svendsen https://orcid.org/0000-0001-6446-630X

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Author Biographies

Kushal D. Khera, M.B., B.Ch., B.A.O. is a third year academic chief resident at the Mayo Clinic Family Medicine Residency Program in Rochester, Minnesota. As his role as academic chief resident, he has a desire to improve residency education while making a difference in clinical practice through Quality Improvement and research.

Joseph D. Blessman, M.D. is a third year resident in the Mayo Clinic Family Medicine Residency Program in Rochester, Minnesota. He is currently serving as one of the chief residents for the residency program. Clinical interests include sports medicine and upon graduation will be completing a sports medicine fellowship at the University of Kentucky for the upcoming 2022-2023 academic year.

Mark Deyo-Svendsen, M.D. is an Assistant Professor in the Department of Family Medicine at the Mayo Clinic. He is the Vice Chair of Practice and Quality for the Mayo Clinic Family Medicine Midwest practice. He is the physician lead for the Student Education Team in Eau Claire Wisconsin and adjunct facility for the Mayo Clinic Eau Claire Family Medicine Residency program. His clinical interests include addiction medicine and diabetes care.

Nathaniel E. Miller, MD is an Assistant Professor in the Department of Family Medicine at the Mayo Clinic. He is currently serving as the Medical Director for Mayo Family Clinic in Kasson, MN where he is also a core faculty member of the Family Medicine Residency Program. Dr. Miller actively precepts residents in full-spectrum family medicine and leads quality initiatives. Dr. Miller's interests include: quality, preventive medicine, and education.

Kurt B. Angstman MS, MD is a Professor of Family Medicine at Mayo Clinic Rochester, Minnesota. His research interests include collaborative care management for depression and practice changes in primary care. He was in full spectrum private practice for 15 years in Redwood Falls, Minnesota until 2004 when he returned to Mayo Clinic. He currently is faculty and associate program director at the Rochester (Minnesota) Mayo Family Medicine Residency.