

Prioritizing elective cardiovascular procedures during the COVID-19 pandemic: The cardiovascular medically necessary, time-sensitive procedure scorecard

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Abstract

Background: Following the surge of the coronavirus disease 2019 (COVID-19) pandemic, government regulations, and recommendations from professional societies have conditioned the resumption of elective surgical and cardiovascular (CV) procedures on having strategies to prioritize cases because of concerns regarding the availability of sufficient resources and the risk of COVID-19 transmission.

Objectives: We evaluated the use of a scoring system for standardized triage of elective CV procedures.

Methods: We retrospectively reviewed records of patients scheduled for elective CV procedures that were prioritized ad hoc to be either performed or deferred when New Jersey state orders limited the performance of elective procedures due to the COVID-19 pandemic. Patients in both groups were scored using our proposed CV medically necessary, time-sensitive (MeNTS) procedure scorecard, designed to stratify procedures based on a composite measure of hospital resource utilization, risk of COVID-19 exposure, and time sensitivity.

Results: A total of 109 scheduled elective procedures were either deferred ($n = 58$) or performed ($n = 51$). The median and mean cumulative CV MeNTS scores for the group of performed cases were significantly lower than for the deferred group (26 (interquartile range (IQR) 22–31) vs. 33 (IQR 28–39), $p < .001$, and 26.4 (SE 0.34) vs. 32.9 (SE 0.35), $p < .001$, respectively).

Conclusions: The CV MeNTS procedure score was able to stratify elective cases that were either performed or deferred using an ad hoc strategy. Our findings suggest that the CV MeNTS procedure scorecard may be useful for the fair triage of elective CV cases during the time when available capacity may be limited due to the COVID-19 pandemic.

KEYWORDS

appropriate use, healthcare policy, risk stratification

1 | INTRODUCTION

The coronavirus disease 2019 (COVID-19) global pandemic has created the need to put forth strategies to rationalize healthcare resources that extend to the catheterization laboratory setting.^{1,2} This is due to concerns regarding the availability of hospital beds and personal protective equipment (PPE), skilled personnel, the risk of COVID-19 transmission to patients and providers, and the need for hospitals to provide safe care for patients with and without COVID-19 infection concomitantly, which may further strain healthcare systems.

At the peak of the pandemic, federal and state orders limited the performance of elective procedures to conserve human and material resources.³ Prachand et al.⁴ used the term of medically necessary, time-sensitive (MeNTS) procedures to stress the fact that most outpatient surgeries and procedures are in fact, clinically necessary, and that the term “elective” usually refers to the timing of such procedures that can be “elected” without having a negative impact on the outcome of the procedure or the disease process, as opposed to urgent or emergent cases. They designed a scoring system to prioritize and triage surgical cases that are medically necessary but still elective, incorporating elements that reflect on the use of limited resources and risk of COVID-19 transmission. Although such a prioritization system would also be helpful in the Catheterization Laboratory setting, some of the variables used were not applicable to cardiovascular (CV) procedures, where other patient and procedural factors may be more relevant. Having a triaging tool that can be applied specifically to CV procedures remains timely as government regulations and recommendations from professional societies have conditioned the resumption of elective procedures on the availability of strategies to prioritize cases.⁵⁻⁷ We proposed and evaluated the use of a CV MeNTS procedure scoring system for standardized triage of procedures performed in the Catheterization Laboratory.

2 | METHODS

The study was approved by our Institutional Review Board. We retrospectively reviewed records of patients that were scheduled to have a CV procedure performed in the catheterization laboratory at two hospitals, Newark Beth Israel Medical Center (Newark, NJ) and Saint Barnabas Medical Center (Livingston, NJ) between April 15, 2020 and May 10, 2020. During this period, Executive Order 109 was in place in the state of New Jersey,⁸ which directed the suspension of all adult elective surgeries and invasive procedures and applied to all medical and dental operations that could be delayed without undue risk to the current or future health of the patient, as determined by the patient's physician. Some of these patients underwent their procedures at the discretion of their physician after discussion with and approval by the respective directors of the catheterization laboratories and prioritized ad hoc to be performed during this period. Thus, we had two groups of elective patients: (a) those who had been scheduled but deferred (deferred group), and (b) those who had been scheduled and still

allowed to proceed during this period based on perceived medical need and tolerable impact on resource utilization and risk of COVID-19 transmission.

We scored patients in both groups utilizing our proposed CV MeNTS procedure scorecard, which is designed to stratify procedures based on a composite measure of hospital resource utilization, risk of procedural complications and COVID-19 exposure and transmission to patients and staff, and time sensitivity and medical need. For purposes of our study, a comparison between deferred and performed groups would serve as proof of concept of the score's ability to stratify patients based on the composite measure above, and thus to be utilized as an objective prioritization tool if the demand for procedural services exceeds capacity due to the pandemic.

Similar to Prachand's tool for surgical procedures,⁴ we included three groups of variables: procedure, patient, and disease factors (Figure 1). Within each group, a four-point scale was assigned for each independent variable; the sum of points of all variables generates the cumulative CV MeNTS procedure score.

Procedure factors included variables that in our opinion would reflect on the amount of human and material resources utilized, including use of PPE and critical care services, with higher scores being associated with higher resource consumption. Among these variables were: (a) estimated procedural time in the Cath Lab, (b) estimated length of stay, (c) need for recovery in an intensive care unit, (d) need for anesthesia services, (e) time to ambulation, and (f) need for trans-esophageal guidance during the procedure. The range of cumulative points for procedural factors is 6–24 points.

Patient factors included variables that in our opinion would reflect the risk of procedural complications and of COVID-19 transmission for patients and staff, with higher scores associated with higher risk. Variables in this group were: (a) age, (b) renal function, (c) immunocompromised state, (d) symptoms of influenza-like illness in the preceding 2 weeks, (e) diagnosis of or known exposure to COVID-19 in the preceding 2 weeks, and (f) peripheral vasculopathy risk (diabetes mellitus, active smoking, history of stroke, or peripheral vascular disease). The range of cumulative points for patient factors is 5–24 points.

Disease factors were meant to reflect the time sensitivity of any given procedure based on options for medical therapy and the impact of a delay in the procedure, with higher scores associated with the availability of temporizing medical alternatives and less clinical urgency. These variables included the availability of medical therapy as an option, and the possible impact of a delay in the outcome of the procedure of 2, 4, or over 6 weeks. The cumulative score for disease factors ranges from 4 to 16 points.

The sum of points of all variables generates the cumulative CV MeNTS procedure score (range 15–64), with lower scores indicating lower utilization of resources, lower risk of complications/exposure to COVID-19, and a higher time-sensitivity, and vice versa. The composite measure is illustrated as a spectrum (Figure 2). Disease factors were weighed lower than procedure and patient factors to avoid over-representing clinical need and urgency at a time that utilization of resources and risk of exposure to patients and staff are almost as critical in the decision to prioritize elective procedures.

RWJBarnabas Health
Cath ILG Procedure Prioritization Scoring System

CV MeNTS Procedure Prioritization Form

Patient name:

MRN:

Procedure:

Prioritization Point:	1	2	3	4	Score:
Procedure factors (6-24 points)					
Cath Lab time	< 1hr	1-2 hrs	2-4 hrs	> 4 hrs	
Estimated LOS	Outpatient	< 23 hrs	24-48 hrs	> 48 hrs	
Need for ICU recovery	No	Unlikely	Possible/Probable	Yes	
Need for Anesthesia Services (during procedure)	No		MAC	General	
Time to Ambulation (complexity of vascular access)	< 1hr	1-4 hrs	4-8 hrs	> 8 hrs	
Need for TEE	No			Yes	
Prioritization Point:	1	2	3	4	Score:
Patient factors (5-24 points)					
Age	<65	65-79	80-89	90+	
Renal function/HD	No	Low AKI Risk	Mod-Sev AKI Risk	On HD	
Immuno-compromised	No			Yes	
Influenza-like symptoms in past 2 weeks (SOB, fever, cough, sore throat, body aches)	No			Yes	
COVID Positive PCR test or known exposure (in past 2 weeks)	No			Yes	
Peripheral Vasculopathy	PVD (1 pt each)	Stroke (1 pt each)	Active Smoking (1 pt each)	DM (1 pt each)	
Prioritization Point:	1	2	3	4	Score:
Disease factors (4-16 points)					
Medical therapy as an option	Not available or Recommended	Can be optimized for short-term benefit only	Can be optimized for modest mid-long term benefit	Clinical equipoise	
Impact of 2-4 week delay in outcome	Can't wait	Probable harm	Possible harm	Unlikely to harm	
Impact of 4-6 week delay in outcome	Can't wait	Probable harm	Possible harm	Unlikely to harm	
Impact of >6 week delay in outcome	Can't wait	Probable harm	Possible harm	Unlikely to harm	
Total					0

Other Clinical Information or Justification:

FIGURE 1 The cardiovascular (CV) medically necessary, time-sensitive (MeNTS) procedure scorecard. The scorecard is designed to stratify CV procedures based on a composite measure of hospital resource utilization, risk of procedural complications and coronavirus disease 2019 (COVID-19) exposure, and time sensitivity based on medical need. It includes three groups of variables: procedure, patient, and disease factors. *Procedure factors* included variables that reflect on the amount of human and material resources utilized, including use of personal protective equipment (PPE) and critical care services. *Patient factors* included variables that reflect on the risk of procedural complication and of COVID-19 exposure/transmission for patients and staff. *Disease factors* reflect the time sensitivity based on the availability of alternative medical therapy and impact of a delay in the procedure

2.1 | Statistical analysis

The cumulative score for individual patients was reported as a continuous variable between 15 and 64 points as described above. Mean

(SE) and median (interquartile range (IQR)) score values were calculated categorically (procedure, patient and disease factors) and cumulatively for both performed and deferred groups. Data were also stratified by type of procedure (i.e., cardiac catheterization, heart

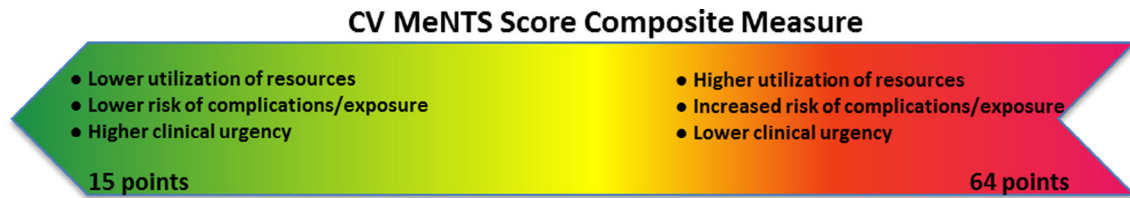


FIGURE 2 The cardiovascular (CV) medically necessary, time-sensitive (MeNTS) composite measure. Within each group, a four-point scale is assigned for each independent variable; the sum of points of all variables (range 15–64) generates the cumulative MeNTS procedure score, with lower scores indicating lower utilization of resources, lower risk of complications/exposure to coronavirus disease 2019 (COVID-19), and a higher time-sensitivity, and vice versa. The composite measure is illustrated as a spectrum where two or more scores can be compared against each other

failure, electrophysiology, endovascular, and structural). Scores between the two groups were compared using independent *t* tests for means and Mann–Whitney *U* tests for medians. Analyses were performed using SPSS version 23.

3 | RESULTS

A total of 109 scheduled outpatient procedures were either deferred ($n = 58$) or performed ($n = 51$) during the study period. The types of procedures included electrophysiology ($n = 23$), cardiac catheterization ($n = 39$), endovascular ($n = 18$), heart failure ($n = 17$), and structural heart disease ($n = 12$). Table 1 describes categorical and cumulative scores stratified by procedure type within deferred and performed categories. No patients in the deferred group required unanticipated admission to the hospital.

The distribution of cumulative CV MeNTS procedure scores for deferred and performed cases is described in Figure 3. The median and mean cumulative CV MeNTS procedure scores for the group of

performed cases were significantly lower than for the deferred group (26 (IQR 22–31) vs. 33 (IQR 28–39), $p < .001$, and 26.4 (SE 0.34) vs. 32.9 (SE 0.35), $p < .001$, respectively).

4 | DISCUSSION

We report a CV MeNTS procedure scoring system that can be used to prioritize elective CV procedures during the COVID-19 pandemic based on a composite measure of resource utilization, risk of procedural complications and transmission of COVID-19 infection, and time sensitivity and clinical need. In our study population, the cumulative CV MeNTS procedure score was significantly lower in the group of elective cases that were performed compared with those that were deferred during a period of time when New Jersey's Executive Order 109 was in effect.⁸

Our findings suggest that the CV MeNTS procedure scorecard may be a useful tool for the triage of elective cases during the time that many states in the country relax restrictions on the performance

TABLE 1 Categorical and cumulative CV MeNTS procedure scores stratified by procedure type within deferred and performed categories

Procedure type		Procedure factors median (range)	Patient factors median (range)	Disease factors median (range)	Cumulative score median (range)
Cardiac catheterization	Performed ($n = 16$)	10 (10–12)	7 (6–10)	8 (6–12)	25 (23–30)
	Deferred ($n = 23$)	11 (10–13)	9 (7–11)	14 (11–15)	33 (30–37)
Structural	Performed ($n = 6$)	15	8 (7–9)	7 (7–8)	30 (29–31)
	Deferred ($n = 6$)	18 (17–18)	8 (6–10)	11.5 (10–12)	37 (35–39)
Heart failure	Performed ($n = 10$)	8 (7–8)	9 (7–11)	10 (8–10)	27 (24–28)
	Deferred ($n = 7$)	8 (7–8)	9 (8–12)	12 (11–14)	29 (28–30)
Endovascular	Performed ($n = 6$)	12.5 (12–13)	8 (8–11)	6 (5–8)	26 (26–30)
	Deferred ($n = 12$)	13 (11–14)	9 (7–11)	11 (9–13)	33 (31–37)
Electrophysiology	Performed ($n = 13$)	8 (8–14)	7 (5–10)	8 (6–11)	24 (22–30)
	Deferred ($n = 10$)	14 (8–17)	8 (6–13)	12 (10–13)	33 (31–37)

Note: Overall, the cumulative CV MeNTS score was lower in the performed group compared to the deferred group across all procedure types. Cardiac catheterization procedures included coronary angiography with possible intervention. Structural procedures included transcatheter aortic valve replacement, left atrial appendage closure, and patent foramen ovale closure. Heart failure procedures included right heart catheterizations and endomyocardial biopsies. Endovascular procedures included lower extremity angiograms with possible intervention. Electrophysiology procedures included catheter ablations, generator changes, and new pacemaker or intracardiac defibrillator placement.

Abbreviations: CV, cardiovascular; MeNTS, medically necessary, time-sensitive.

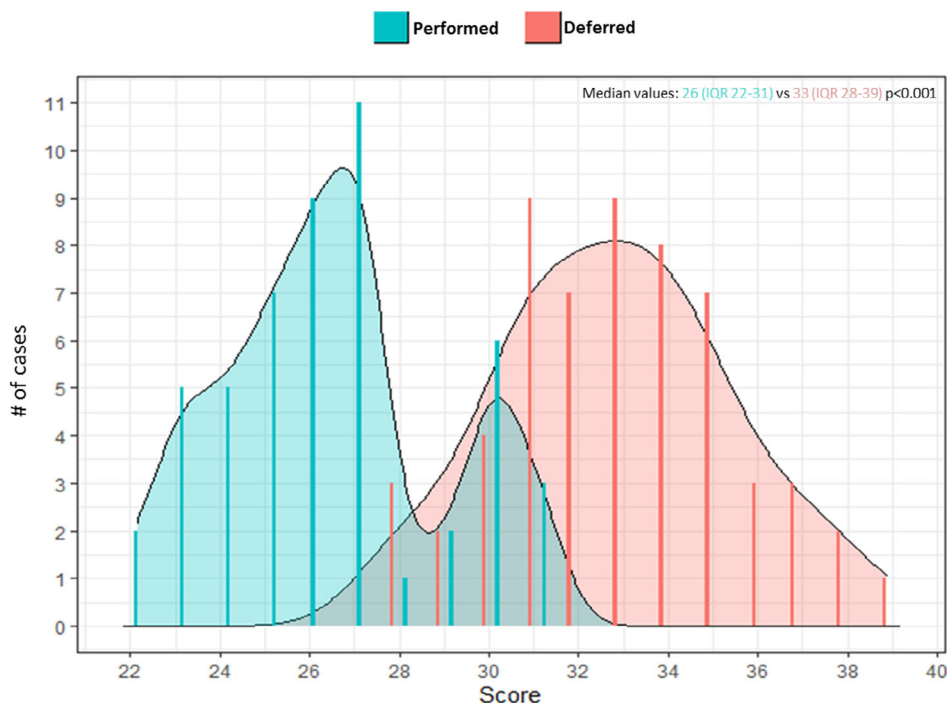


FIGURE 3 Distribution of cumulative cardiovascular (CV) medically necessary, time-sensitive (MeNTS) procedure scores for deferred and performed cases. Cumulative CV MeNTS procedure scores were calculated for elective procedures that were either deferred ($n = 58$) or performed ($n = 51$) based on ad hoc prioritization. Median and mean cumulative scores were significantly lower in the performed group compared with the deferred group, demonstrating the utility of the CV MeNTS procedure score to stratify procedures according to the composite measure of resource utilization, risk of exposure to coronavirus disease 2019 (COVID-19), and time sensitivity based on medical indication

of elective surgeries and procedures. The CV MeNTS procedure score, much like Prachand's for surgical procedures,⁴ requires providers to consider factors that up until now were not part of any decision process when scheduling cases. By providing a more objective and quantifiable way of assessing these factors, the CV MeNTS procedure scorecard can be incorporated into a transparent prioritization process that mitigates the moral and ethical burden of decision-makers when put in the difficult situation of having to rationalize resources during the pandemic and may minimize the possibility of conflict among healthcare providers competing for such resources.

The importance of having and utilizing such prioritization tools is underscored by state executive orders that direct the efforts to resume elective procedures and require mechanisms to prioritize cases, like New Jersey's Executive Order 145.⁹ The guidance of various professional societies to safely reintroduce CV services during the COVID-19 pandemic¹⁰ also highlights the need to have plans in place that balance the benefits of offering treatment with the risk of exacerbating the spread of COVID-19 while ensuring reserve capacity in the event of a second surge following the values of fairness and consistency. Introducing a standardized and objective approach to any prioritization process using the CV MeNTS procedure scorecard is a step in this direction.

Our study has a number of limitations. The variables included in the CV MeNTS procedure scorecard were chosen based on supposition of relevance derived from clinical experience and plausibility, and are not the product of any systematic or statistical analysis. Likewise, in this first iteration, weighing of each variable or group of variables as contributors to the cumulative score may not be proportionate to what could be if a rigorous quantitative method was applied to understand their impact on the composite measure of resource utilization, risk of COVID-19 exposure/transmission, and clinical urgency. As

such, it is possible that some variables may be under or over-represented. Given the lack of historical context and data from which to identify other relevant factors, it is possible that important variables have been omitted. Further iterations of this scorecard could refine the variables used and their respective weight as we gather more experience in managing resources during a pandemic. The utility of the CV MeNTS procedure scorecard resides in its ability to rank cases based on the composite measure described above. It is not a substitute for clinical judgment, which should always prevail, and should not be used as a punitive tool to justify not allowing the performance of elective cases that are medically indicated. Rather, it should be used as part of a transparent process of prioritizing the proper timing of cases based on the availability of resources, the risk of COVID-19 transmission, and the clinical need.

5 | CONCLUSION

In summary, resuming CV procedures during the COVID-19 pandemic will require taking into account strategies that allow for the rational use of resources while protecting patients and staff from exposure to the virus, factors that are newly introduced into scheduling decisions of every Cardiac Catheterization Laboratory. We propose that the CV MeNTS procedure scorecard can be a useful tool to assist clinicians and administrators in the prioritization of CV procedures in a consistent and fair manner at a time when available capacity may be limited.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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