TIMI Reliance in a General Emergency Department Chest Pain Unit (TRIAGED CPU)

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ABSTRACT

Objective

Several studies have attempted to demonstrate that the Thrombolysis in Myocardial Infarction (TIMI) risk score has the ability to risk stratify Emergency Department (ED) patients with potential acute coronary syndromes (ACS). Most of the studies we reviewed relied on trained research investigators to determine TIMI risk scores rather than ED Providers functioning in their normal work capacity. We assessed whether TIMI risk scores obtained by ED providers in the setting of a busy ED differed from those obtained by trained research investigators.

Methods

This was an ED-based prospective observational cohort study comparing TIMI scores obtained by 49 ED providers admitting patients to an ED chest pain unit (CPU) to scores generated by a team of trained research investigators. Provider type, patient gender, and TIMI elements were examined for their effects on TIMI risk score discrepancy.

Results

Of the 501 adult patients enrolled in the study, 29% of TIMI risk scores determined by ED providers and trained research investigators were generated using identical TIMI risk score variables. In our low risk population the majority of TIMI risk score differences were small, however 12% of TIMI risk scores differed by two or more points.

Conclusion

TIMI risk scores determined by ED providers in the setting of a busy ED frequently differ from scores generated by trained research investigators who complete them while not under the same pressure of an ED provider. ED providers should not be expected to produce TIMI scores identical to those of trained research investigators.

Keywords: acute coronary syndrome; standard of care; cardiology; TIMI score; chest pain unit

INTRODUCTION

Chest pain is the second most common complaint of patients presenting to emergency departments (ED) in the United States, accounting for approximately seven million visits annually.[1] Early determination of whether a patient's chest pain origin is cardiac versus noncardiac is imperative. Patients diagnosed early with acute coronary diseases (ACS) may benefit from early interventions.[2-6] A missed diagnosis of ACS may result in wrongful discharge, myocardial infarction and sudden death. Despite utilization of ECG results, biomarker assays, patient history and clinical acumen, 0.4-5% of patients with acute myocardial infarction are inadvertently discharged from the ED.[7-14] Absence of ECG changes, biomarker assays, or history of heart disease does not entirely exclude the diagnosis of Non-ST-elevation ACS.

In an effort to improve outcomes in patients with acute coronary syndromes, researchers have developed numerous risk stratification tools.[15-57] Of all the risk stratification systems developed, the Thrombolysis in Myocardial Infarction (TIMI) risk score is the most studied, supported and utilized.[3,7,58,59]

A patient's TIMI risk score is determined by assigning a value of 1 for each of seven equally weighted prognostic variables with the total score determining a patient's risk of adverse cardiac outcome (death, MI, severe recurrent ischemia requiring revascularization) within 14 days of presentation. TIMI risk score variables include a patient's age, presence of known coronary artery stenosis, aspirin use in the past week, frequency of angina episodes, ECG and cardiac marker changes, and risk factors for coronary artery disease (hypertension, diabetes, family history of premature coronary artery disease, elevated cholesterol, and smoking).

The TIMI risk score was originally derived from a retrospective analysis of a relatively high-risk population of patients with known unstable angina/NSTEMI.[15] In this patient population the TIMI risk score was associated with 4.7% to 40.9% (or greater) risk of adverse cardiac outcome (Figure 1).[15] Following the development of the TIMI risk score tool, several studies were performed validating the tool's ability to stratify risk among patients with cardiac disease.[16,60-62]

Figure 1. TIMI risk score.

TIMI risk score	Risk at 14 days of death, MI, or severe recurrent ischemia requiring urgent revascularization
0-1	4.7 %
2	8.3 %
3	13.2 %
4	19.9 %
5	26.2 %
6-7	at least 40.9 %

(*Table adapted from Antman et al.)*[15]

Though not originally designed for ED use, several additional studies have attempted to demonstrate the TIMI risk score's ability to stratify risk among real-world ED populations.[7,17-21,63-68] As a result of these studies, the TIMI risk score tool has made its way into the protocols of Emergency Departments and hospitals around the world, often determining whether a patient is admitted to a hospital, observation unit or discharged home.[64]

The TIMI risk score is promoted for being simple to remember, easy to determine using data readily available during an acute presentation, and for its ability to be applied early in a clinical course.[4,64,69] In addition to assisting with triage and disposition decisions, the TIMI risk score improves the exchange of information between ED physicians and cardiologists.[65,70]

Importance

For many reasons, complete and accurate TIMI risk scores can be difficult to obtain when patients present with chest pain to a busy ED. Several studies have demonstrated how interruptions, distractions, and workload affect an ED provider's ability to maintain thought flow

and increase the likelihood of errors occurring.[71-74] Pines et al[75] suggest that patients presenting to the ED during times of increased ED crowding are at greater risk for adverse cardiovascular outcomes. Inaccurate TIMI risk scores may result in inaccurate risk stratification, as well as ineffectual or inappropriate management of patients with nonspecific chest pain.

Most studies validating the utility of the TIMI risk score among ED populations utilized trained research investigators or a combination of trained researchers and ED providers to generate TIMI risk scores.[7,17,18,20,23,63] Trained research investigators do not work under the same time constraints and in the same distracted environment as a working ED Provider. Trained research investigators have the benefit of spending more time interviewing patients, reviewing medical records, scrutinizing ECG patterns, and reviewing their own scores for errors and clarification.[7,17] Unfortunately, the ED provider does not usually have a trained research investigator at his or her disposal to determine accurate TIMI risk scores. Our review of the literature found very few prospective studies utilizing ED Providers exclusively as assessors for the TIMI risk score. In the select studies where ED providers assessed TIMI risk scores, their scores were not compared against those of trained study investigators for accuracy or validity.[64,65]

Current guidelines from the American College of Cardiology, American Heart Association, and National Institute for Health and Clinical Excellence strongly encourage the use of early risk stratification tools such as the TIMI risk score when patients present to health care providers with chest pain.[2-4,76] In addition, Gallegher et al[77] suggests the possibility of medicolegal pitfalls by providers not utilizing risk stratifying tools when assessing patients for evidence of ACS. As a result, the TIMI risk score tool is increasingly being used by ED providers as a basis for therapeutic decision-making despite a lack of supporting studies using ED provider-obtained data.

Outcomes of Interest

The primary goal of our study was to determine if TIMI risk scores obtained by ED providers in the setting of a busy ED differ substantially from those obtained by trained research investigators who complete them while not under the same pressure of a working ED provider. In addition, we evaluated whether ED provider type or patient gender had any effect on TIMI risk score discrepancy, which aspects of the TIMI risk score most frequently differ between assessors, and whether lower TIMI risk scores (i.e., 0-3) or higher TIMI risk scores (i.e., >3) more frequently match research investigator scores.

This is the first study we are aware of that evaluates how closely TIMI risk scores generated by ED Providers obtained in the normal course of their work match those obtained by trained research investigators, specifically when applied to patients admitted to a hospital's chest pain unit (CPU).

METHODS

Study Design

This was a prospective observational cohort study comparing TIMI scores obtained by ED providers admitting patients to the CPU at Lakeland Regional Medical Center (LRMC) to scores generated by trained research investigators. The Lakeland Healthcare Institutional Review Board

approved the study without need for written informed consent because the data collected was normal data already being obtained and charted during the normal course of an ED provider's work, and could be collected anonymously.

Study Setting and Population

LRMC is an academic-based community hospital with an annual ED census of approximately 50,000 patients. The hospital's 6 bed CPU opened in 2010 and is situated adjacent to the ED. The CPU is under the direct supervision of ED providers. All ED providers admitting patients to the CPU from October 27, 2012 until July 28, 2013 were included in the study. Participating ED providers included 18 Attending Physicians, 21 Resident Physicians and 10 Midlevel Providers (Physicians Assistants and Nurse Practitioners). No ED providers were excluded from the study. Patient inclusion criteria included all comers presenting to the ED with non-traumatic chest pain suggestive of ACS who were admitted to our hospital's CPU, irrespective of age. At our institution, ED providers independently determine who is to be placed in the CPU. TIMI risk scores are not typically used in the decision to place patients in the CPU. Patient exclusion criteria for study enrollment mirrored CPU exclusion criteria as set by the hospital's Chest Pain Center Door-to-Balloon Committee in accordance with recommendations from the Society of Cardiovascular Patient Care (Figure 2). The CPU is open 24 hours a day, 7 days a week and on holidays, with research investigators available 24 hours a day to enroll patients.

Figure 2. LRMC Chest Pain Unit exclusion criteria.

- Patients with ST-elevation acute myocardial infarction (STEMI)
- Positive Cardiac Biomarkers suggestive of myocardial injury
- ECG changes
- Unrelenting chest pain
- Coronary Revascularization in the last 60 days
- Abnormal vital signs
- New dysrhythmia (any run of ventricular dysrhythmia is not a candidate for the CPU)
- Aortic dissection
- Pneumothorax
- Pneumonia
- Esophageal rupture
- Pulmonary Embolism
- Pericardial tamponade
- CHF
- Uncontrolled diabetes
- Electrolyte abnormalities that cannot be cared for with PO electrolyte replacement
- Psychiatrically unstable
- Patients unable to perform activities of daily living
- Pleural effusions
- Renal failure requiring dialysis during their time in the CPU
- Any diagnosis meeting admission criteria

Study Protocol

Research investigators consisted primarily of nurses already trained to care for CPU patients. Prior to data collection, these research investigators received additional training on how to obtain TIMI risk scores. Their standardized training involved handouts, Microsoft Office PowerPoint presentations, and one-on-one training with clarification to ensure unambiguous collection of data. Research investigators were instructed to use all resources available to them including a patient's hospital record, accessible outside records, labs, prior cardiac catheterization reports, cardiology notes, and patient reported responses. Research investigators routinely evaluated the patient and assessed TIMI risk score variables within 24 hrs of a patient's presentation to the ED (Figure 3). In situations where patients were unaware or unable to answer questions concerning pertinent medical history (for example, an adopted patient unaware of his or her family history), patients were not given any points for those variables.

Our goal for the research investigator was not to obtain 100% infallible TIMI scores, but rather to generate scores as close as possible to scores assigned by research investigators performing similar TIMI risk score validation studies.

Separately, ED providers assigned TIMI risk scores to all patients admitted to the CPU at the time of CPU admission per hospital protocol and the ED provider's normal routine (typically following the results of initial ECG and biomarker tests). No additional TIMI training or education was provided to ED providers prior to data collection. ED provider TIMI scores were recorded electronically in the patient's EpicCare electronic health record in a location research investigators were told not to access. In addition, research investigators confirmed blindness by recording whether or not they had prior knowledge of the ED provider's TIMI risk score for each patient. Research investigator data was hand written on a standardized data collection form and placed in a secure folder in the CPU area inaccessible to ED providers. In this way, research investigators and ED Providers were blinded to one other's TIMI risk scores throughout the study.

Figure 3. Variables assessed by research investigators.

- Age
- Presence of known coronary artery stenosis ≥50%*
    - Prior cardiac catheterization with known disease
    - Prior MI, CABG, angioplasty, or stent
- Aspirin use in the preceding 7 days
- At least 2 episodes of severe chest pain within last 24 hrs
- ST changes ≥0.5mm on admission ECG
- Initial serum cardiac biomarker elevation (Troponin I above normal range)
- At least 3 of the following risk factors for Coronary Artery Disease (CAD):
    - High blood pressure (≥140/90 or on antihypertensive medicine)
    - Diabetes, prediabetes, or hyperglycemia
    - Family history of premature CAD or MI (CAD in male 1st-degree relative, or father <55, or female 1st-degree relative or mother <65)
    - Elevated LDL (≥100), reduced HDL (≤40for men, <50 for women), elevated triglycerides (≥150)
    - Smoking in the past 5 years**
- ED provider type (Attending Physician, Resident Physician or Midlevel Provider)
- Confirmation of blinding to ED provider TIMI risk score

* Similar to Pollack et al[65], this parameter was expanded in our study because actual cardiac catheterization reports were not always available in the ED.
** 5 years was chosen as a cut-off because risk associated with smoking has been found to diminish after 5 years.[78-80]

Data Analysis

Upon completion, the pertinent data was extracted from patient charts and data collection forms and entered into a database using Microsoft Office Access 2007. The data was then exported into a Microsoft Office Excel 2007 spreadsheet. We used SPSS software to make comparisons of TIMI risk scores obtained by research investigators and ED providers. Where significance testing was reported, variables were analyzed using the Pearson Chi-Square test.

RESULTS

The patient population consisted of 543 patients who presented to the ED with symptoms suspicious for cardiac chest pain and were admitted to the CPU. Research investigators provided all variables used to form the TIMI risk score for 543 patients. ED providers provided the necessary variables for 501 patients. Because some ED providers did not record TIMI scores for every patient, we only have complete data for 501 patients. Of these 501 patients, 277 were female and 224 were male. The mean age of the patient study population was 59 (ages 18 to 94), median age 57.

Though the frequency distributions for research investigators and ED providers were similar, the two scores often did not match for a given patient (Table 1). In fact, of the 501 patients in the study with complete data, ED provider and researcher TIMI risk scores matched for only 213 patients (42.5%). Of the 213 patients with the same TIMI scores, only 147 scores were determined using identical TIMI variables. For example, one patient was given a TIMI score of 1 by both the research investigator and ED provider. On further analysis, however, the research

investigator gave a point for aspirin use over the past 7 days, while the ED provider gave a point for having 3 or more risk factors for CAD.

Table 1. Research investigator and ED provider TIMI scores.

TIMI Score	Researcher *n*	ED provider *n*	ED provider score matches researcher score
0	96	99	54 (56.3%)
1	130	121	48 (36.9%)
2	92	109	34 (37.0%)
3	89	88	33 (37.1%)
4	71	70	38 (53.5%)
5	22	12	5 (22.7%)
6	1	2	1 (100%)
7	0	0	0 (100%)
Total Patients	501	501	213 (42.5%)

Further breakdown of TIMI scores revealed that scores differed by 1 point for 228 patients (45.5%), 2 points for 52 patients (10.4%), and 3 points for 8 patients (1.6%). No scores varied by more than 3 points (Table 2).

Table 2. Discrepancy between ED Provider and Researcher TIMI scores.

Range of TIMI Discrepancy	*n*	% of Total scores
-4	0	0
-3	4	0.8
-2	27	5.4
-1	125	25.0
0 (Matching)	213	42.5
+1	103	20.6
+2	25	5.0
+3	4	0.8
+4	0	0
Total	501	100

Table 3 shows the incidence of TIMI variables as reported by research investigator and ED provider. The frequencies of several variables were similar, such as "Age ≥65", "Aspirin use", "ECG changes", and "Elevated Troponin". Research investigators reported a greater incidence of "Known CAD" and "Angina", while ED providers reported a greater prevalence of "CAD Risk Factors".

Table 3. Incidence of TIMI variables.

	Researcher *n* (%)	ED provider *n* (%)

Age ≥65	166 (33.1%)	167 (33.3%)
Known CAD	149 (29.7%)	118 (23.6%)
ASA use	239 (47.7%)	254 (50.7%)
Angina	207 (41.3%)	126 (25.1%)
ECG changes	9 (1.8%)	7 (1.4%)
Elevated Trop	21 (4.2%)	10 (2.0%)
CAD risk factors	190 (37.9%)	274 (54.7%)

Our analysis shows that salient disagreements in TIMI variables exist between ED providers and research investigators. For example, ED providers reported the incidence "Angina" in only 59 of 207 patients (28.5%) determined by research investigators to have had "Angina". Additionally, ED providers reported "Angina" as being present in 67 patients not reported by research investigators. Table 4 shows how often research investigators and ED providers agreed on reported variables, with their relative significance.

Table 4. TIMI variable agreement (ED provider variable matched research investigator variable for the same patient).

	Positive *n* *(ED/R)*	**Negative *n*** *(ED/R)*	***p* value**
Age ≥65	166/166 (100%)	334/335 (99.7%)	0.000
Known CAD	104/149 (69.8%)	338/352 (96.0%)	0.000
ASA use	181/239 (75.7%)	189/262 (72.1%)	0.000
Angina	59/207 (28.5%)	227/294 (77.2%)	0.147
ECG Changes	2/9 (22.2%)	487/492 (99.0%)	0.000
Elevated Trop	7/21 (33.3%)	477/480 (99.4%)	0.000
CAD Risk Factors	173/190 (91.1%)	210/311 (67.5%)	0.000

(ED= ED provider, R=Research Investigator)

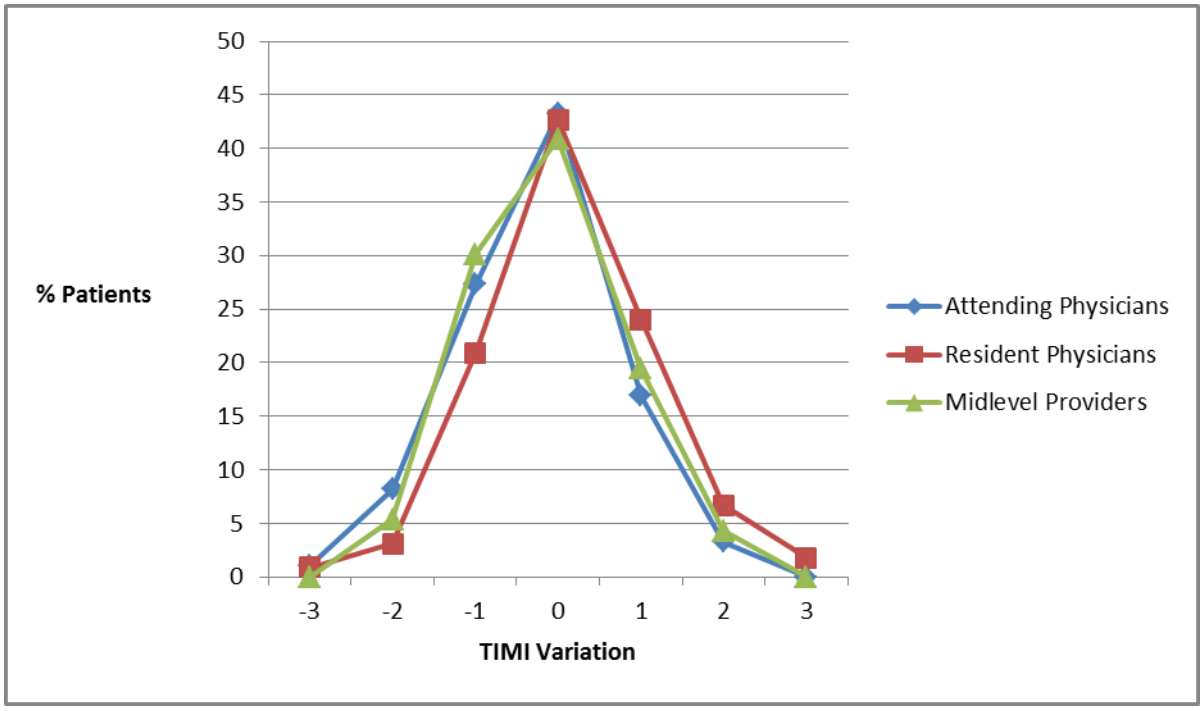
Additional analysis was performed based on ED provider type assessing the TIMI score (Attending Physician, Resident Physician or Midlevel Provider). Attending Physicians determined the scores for 183 patients, Resident Physicians scored 225 patients, and Midlevel Providers scored 93 patients. Overall TIMI risk score determinations were similar across all provider types. TIMI scores matched 43.2% of researcher scores for Attending Physicians, 42.7% for Resident Physicians, and 40.9% for Midlevel Providers (Table 5). When discrepancies occurred, Attending Physicians and Midlevel Providers reported slightly lower TIMI scores, while Resident Physicians reported slightly higher TIMI scores (Figure 4).

Table 5. Range of TIMI score discrepancy from research investigator by ED provider type.

Range of TIMI Discrepancy	**Attending Physician** ***n***	**Resident Physician** ***n***	**Midlevel Provider** ***n***

from Researcher Score			
-3	2 (1.1%)	2 (0.9%)	0 (0.0%)
-2	15 (8.2%)	7 (3.1%)	5 (5.4%)
-1	50 (27.3%)	47 (20.9%)	28 (30.1%)
0 (Matching)	79 (43.2%)	96 (42.7%)	38 (40.9%)
+1	31 (16.9%)	54 (24.0%)	18 (19.4%)
+2	6 (3.3%)	15 (6.7%)	4 (4.3%)
+3	0 (0.0%)	4 (1.8%)	0 (0.0%)
Total Patients Scored	183	225	93

Figure 4. Range of TIMI score discrepancy from research investigator by ED provider type.



Further analysis shows that gender has little effect on TIMI score differences. ED provider scores agreed with research investigator scores for 112/277 female patients (40.4%) and for 103/224 male patients (46.0%).

Because the CPU at our institution is utilized to screen a population of patients at low-risk for ACS, far more low TIMI scores (TIMI 0-3) were generated. Based on the scores obtained by research investigators, 407 patients presenting to the CPU had TIMI scores 0-3, while only 94 had TIMI scores >3. There was no difference in the frequency of ED provider scores matching researcher scores on the basis of the number of variables involved (Table 6).

Table 6. TIMI risk score divergence by range.

TIMI risk score Range	Researcher n	ED provider matches researcher TIMI score	Matching TIMI score with identical variables
0 to 3	407	169 (41.5%)	116 (28.5%)
4 to 6	94	44 (46.8%)	31 (33.0%)
Total	501	213	147

DISCUSSION

This study demonstrated that a majority of TIMI scores as determined by ED providers in the setting of a busy ED differ from scores generated by trained research investigators who complete them while not under the same pressure of an ED provider. In our study only 29.3% of TIMI scores were calculated using identical TIMI risk score variables. The majority of TIMI risk score differences were either negligible (same TIMI risk score obtained despite differing TIMI variables used) or diverged by no more than 1 point in our low risk patient population; however, 12% of patient scores differed by two or more points.

We have shown that ED provider type has little effect on the likelihood of TIMI risk scores matching TIMI scores obtained by trained research investigators. Neither the patient gender nor the quantity of positive variables had a significant effect on TIMI risk score differences.

Patient age was the variable most agreed upon by TIMI risk score assessors with only one instance of an ED Provider incorrectly giving a point to a 57 y/o for being ≥65 y/o. TIMI variables requiring more active investigation showed greater variation. Researchers reported greater incidence of known CAD, possibly due to having more time available to review patient records and interview the patient. ED providers were apt to report a greater incidence of ≥3 CAD risk factors. Confirmation bias (or myside bias) is one potential reason for this. For example, in ascertaining the presence of multiple CAD risk factors (a time consuming task), an ED provider might assume that when one or two risk factors are present, such as smoking and hypertension, other risk factors are likely present as well. Unfortunately, the TIMI risk score recorded in the electronic medical record by our ED providers simply shows when ≥3 CAD risk factors are present and does not further categorize which CAD risk factors were recognized by the ED provider.

ECG changes and biomarker elevations were seldom present in our study, likely reflecting the low-risk nature of our CPU study population. Research investigators reported a few more instances of ECG and biomarker changes than were reported by ED providers, though not statistically significant ($p = 0.000$).

Both ED providers and research investigators reported similar numbers of aspirin users among our population, however only 75.7% of these patients matched. 73 patients recognized by ED providers as having taken aspirin went unrecognized by our research investigators. Likewise, research investigators reported an additional 58 patients who ED providers said had not taken aspirin. Similar to aspirin, there was a discrepancy in the reporting of angina episodes. Researchers, who had the benefit of spending more time with patients, reported far more occurrences of angina than ED providers (207 to 126 occurrences). ED providers only

recognized 59 of the 207 patients (28.5%) designated as having had angina by research investigators. Interestingly, ED providers reported angina as being present in 67 patients who research investigators did not feel met criteria for angina.

There are many barriers to obtaining accurate histories from patients.[81-83] Patients who present to the ED in chest pain often do so under great duress, likely compounding the already difficulty job of extracting accurate history. Studies have shown that patients in stressful situations have impairments in cognition, memory and verbal recall.[84-85] Many clinicians recognize the phenomenon of the contradictory account, where the second person to interview a patient obtains an entirely different story. Perhaps in recognition of this, Hess et al[17] excluded patients with unreliable history from his prospective study on TIMI score validity in the ED. The variability of patient reported responses in the ED suggests a need for risk stratification tools which place greater weight on objective variables which can be assessed independent of interviews with the patient.

Many ED providers support the idea of utilizing a clinical prediction rule for the identification of ACS among patients with chest discomfort in hopes of offering early discharge to low risk patients.[86] A few recent studies have suggested that a rapid TIMI risk score protocol can be employed to safely discharge low risk ED patients with chest discomfort home from the ED.[22,23,86] Though the TIMI risk score device has the potential to stratify risk among ED populations, our study suggests that it may depend on how and by whom the TIMI risk score data is obtained. It is important that these studies, as well as any study suggesting validity and broad applicability of a risk stratification tool for regular use in the ED, be examined closely to determine if the working data was obtained by ED providers while working in their normal environment. We commend validation studies such as Chase et al[64] and Pollack et al[65] for using ED providers to determine risk scores and call for more similar studies. We also question the applicability of studies which rely on data largely obtained by trained research investigators in place of ED providers.

LIMITATIONS

Some researchers have suggested that ECG and biomarker indices should carry greater weight in risk stratification scores.[17,40] Modified TIMI risk scoring tools have been developed which assign more points to ECG and biomarker variables.[17,40] Because so few ECG and biomarker changes were present in our study it is difficult to make generalizations on the ED provider's ability to recognize and assign a proper TIMI risk score for those variables. Though not significant, the few ECG and biomarker changes recognized in our study were slightly underreported by ED providers, which may reflect a degree of selection bias or simply differences in interpretation. It is possible that ED providers under-report some aspects of the TIMI risk score (such as angina, ECG and biomarker changes) since they have already deemed a patient low risk and not likely suffering from true ACS by virtue of placing the patient in the CPU. In addition, ED providers may be less likely than research investigators to report a Troponin I level at the very edge of the cutoff as "positive", especially in a patient with known chronic renal insufficiency, for example.

We asked our research investigators to obtain scores within 24 hours of patient presentation. This was done in order to improve the likelihood of obtaining complete data for the majority of

patients. We recognize that research investigators in other studies may have had additional time to perform their investigations.

While CPU nurses are capable and trainable, most CPU nurses have minimal experience participating in research and may not have performed to the same standard as professional research investigators. Research investigator TIMI risk score ECG interpretation was performed by our trained research investigators and not physicians well-versed in ECG interpretation.

Many TIMI risk score validation studies include a patient cut-off age for enrollment, such as ≥30 years old.[15] Because we were performing a comparison of risk scores and not examining patient outcomes, we did not feel that excluding patients by age was necessary.

Although pertinent patient history was occasionally obtained directly from a patient's cardiologist by phone or when visiting the CPU, we did not routinely obtain data in this manner. Most data was acquired using information readily available to the research investigator in the CPU setting, which is similar to what is available to the ED provider. Midway through the project some cardiologists released online access to their outpatient clinical electronic medical records including catheterization lab reports, providing additional means of data acquisition to researcher investigators. Prior to obtaining access to these records, data in question could sometimes be obtained via fax or telephone during regular business hours.

As mentioned earlier, our researchers were not focused on obtaining infallible data. Where data was unknown and could not easily be produced we gave no points for those variables.

Patient demographics may have also contributed to some study variation. Though predominantly English-speaking, our geographic area does contain some non-English speaking individuals which could have impeded an assessor's ability to obtain a reliable history.

Our study examined a specific cohort of low risk patients presenting to the ED with chest pain. CPU patients do not make up the entirety of patients presenting to the ED complaining of chest pain. Many times high risk patients with ACS are admitted directly to the hospital or cath lab, and patients with noncardiac etiologies of chest pain (such as trauma or rash) are discharged home. The results of our study may not be generalizable to all populations of patients presenting with chest pain to the ED, however there clearly exists a discordance of TIMI risk scores between ED providers and trained research investigators.

CONCLUSION

Several studies and guidelines have been published suggesting that TIMI scores obtained in ED populations are valid.[2-4,7,63,65,66,68,76] Our study demonstrates that there is discordance between TIMI scores generated by trained research investigators and busy ED providers. Our study questions the reliability, validity, and applicability of TIMI risk score validation studies where scores were ascertained predominantly by trained research investigators.

ED providers should not be expected to produce TIMI scores identical to those of trained research investigators and until more validation studies are available, should continue to use sound clinical judgment in patients presenting to the ED with evidence of ACS.

Areas for future research may include comparing time spent by ED providers and research assistants determining risk stratification scores, reliability of patient reported history in an ED environment, difficulties associated with access to outside medical records, effects of ED crowding and ED provider staffing on job efficiency, accuracy, and capacity for risk stratification, further risk tool validation studies using ED provider-obtained data, and studies evaluating all patients presenting to the ED with chest pain, not just CPU patients.

Competing Interests

None to declare.

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Contributors

BT and MM were responsible for conception and design of this study. BT conducted the literature search and article review, as well as acquired, managed, analyzed and interpreted the data, trained research investigators, and wrote the manuscript. MM supervised the project, reviewed the manuscript and approved the final version submitted for publication.

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