## Evidence Statement

Below we summarize the evidence of a performance gap for each component of the Emergency Care Capacity and Quality (ECCQ) measure, as well as associated harms, based on CORE’s prior literature search including systematic reviews (see ECCQ HOQR Environmental Scan\_Literature Review with Search String attachment) related to emergency department (ED) and additional empiric results from other sources including the [Emergency Department Benchmarking Alliance (EDBA)](https://www.edbenchmarking.com/) and CORE preliminary analyses of Electronic Health Record (EHR) data from five EDs within a single health system.

For results based on published literature, we note that most studies are based on single hospitals or single health systems, or systematic reviews of those studies which are limited in their ability to pool results due to study heterogeneity; there are few national or registry-based studies available. In addition, in the published literature the definition of ED throughput metrics can vary. Finally, studies using data during the COVID-19 pandemic may not be representative of future performance.

### Component 1: The patient waited for longer than 1 hour to be placed in a treatment space.

#### **Performance Gap**

There are multiple ways in which people may face quality gaps in emergency care that can be measured through waiting times. There are different definitions of “waiting time,” including the time between arrival and different ED destinations/services, such as triage (door-to-triage), treatment room (door-to-room or ED treatment space), and time between arrival and being seen by a provider (door-to-doctor). The ECCQ measure focuses on “door to room” time.

**Figure 1: Components of the ECCQ Measure Across Five Emergency Departments – Single Health System, Non-Behavioral Health Patients (2022 data**)

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Wait time metrics have been trending upward. For example, according to 2022 EDBA data1 the median “door to bed” (akin to door to ED treatment space) time increased by 6 minutes (from 8 minutes to 14 minutes) between 2021 and 2022, respectively. Likewise, median “door to doctor” times increased from 17 minutes in 2021 to 20 minutes in 2022.

CORE’s preliminary analyses of EHR data across five EDs (labeled A through E) in a health system, shows wide variation (8 percent to 43 percent) in the proportion of visits for all (adult and pediatric) non-behavioral health patients with door to ED treatment space times that were over the proposed threshold of 1 hour for this component ([Figure 1](#Fig1), blue bars).

#### **Association with Harms**

Studies have shown that wait times (which represent delays in timely care) are associated with patient harm. One retrospective study across multiple urban EDs in Canada examined the association between wait times and harm (72-hour ED re-visits) and found that, among other input metrics, mean ED waiting time (defined as ED arrival to physician assessment) had the strongest association with harm2 In addition, a single-site study using data gathered prior to the pandemic showed that the odds of a patient safety event (adverse event, preventable adverse event, and near miss) increased with each additional increase in ED waiting time (time from arrival to being seen by a triage nurse).3

### Component 2: The patient left the ED without being evaluated by a licensed clinical professional

#### **Performance Gap**

The proportion of patients who leave the ED before they are seen or before their treatment was complete has been trending upward. According to EDBA data, in 2018, 2.2 percent of patients left the ED before completing treatment; but that proportion increased to 4.0 percent in 2021 and to almost 5 percent in 2022 ([Figure 2](#Fig2)).1 CORE’s own empiric analyses using EHR data from a single health system with multiple EDs shows that rates range between 2 percent and 5 percent across the five EDs ([Figure 1](#Fig1), dark green bars).

**Figure 2: Proportion of patients who left before completing treatment (2012-2022); Source: EDBA1**

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#### **Association with Harms**

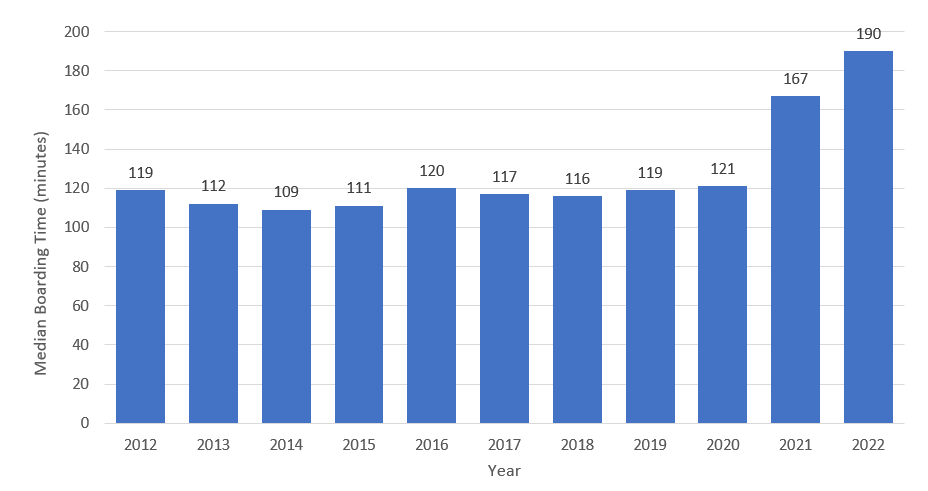
Based on 2022 EDBA data, if 4.9 percent of patients left the ED before their treatment was complete, that means that about 7.6 million patients did not receive the care they needed in the ED. Single ED studies have shown that about half of patients who leave the ED without being seen have a subsequent encounter with the healthcare system; and, of those, more than half (about 68 percent) return to an ED or are admitted to the hospital.4 In addition, one study found that across all patients, 12.6 percent left the ED without being seen; the rate was 30 percent for higher-acuity patients.5

### Component 3: The patient boarded (time from decision to admit order to patient departure from the ED for admitted patients) in the ED for longer than 4 hours.

#### **Performance Gap**

Boarding is typically measured as a time-based metric (time between the decision to admit and ED departure) although studies can differ in their definitions. There are currently no national publicly reported measures that provide current performance of ED boarding-related metrics; ED-2, a publicly reported measure of boarding (median time from admission decision to ED departure) was retired from use in IQR 2021.[[1]](#footnote-2) Data from the EDBA shows that median boarding times between 2012 and 2017 did not change, despite the implementation of ED-2. Lack of improvement could be because ED-2 is specified based on median times, which can obscure poor performance.

More recent data from the EDBA shows a steep increase in median boarding times, from 119 minutes (about 2 hours) in 2020 to 190 minutes (about 3 hours) in 2022 ([Figure 3](#Fig3)).1 One larger study that examined data (January 2020 through December 2021) from 1,769 hospitals using the EPIC EHR system found that, when hospitals were above 85% occupancy, patients remained boarded for more than 4 hours across most months (about 89% of hospital-months); median boarding times were about 6.6 hours during those hospital months.6

**Figure 3: Median ED Boarding Time (2012-2022); Source: EDBA**1

Data from five EDs in one health system from 2022 shows variation between EDs in the proportion of visits where the patient boarded more than four hours (for patients without behavioral health diagnoses), from 5 percent to 19 percent ([Figure 1](#Fig1), bright green bars). For visits for patients with behavioral health diagnoses, the range for the proportion of boarded patients is wider: from 2 percent to 41 percent across the five EDs ([Figure A1](#FigA1), bright green bars).  
Data from these same five EDs shows the distribution of boarding time, demonstrating the how the use of median performance (used by the retired ED-2 measure) can mask variation ([Figure 4](#Fig4)).

**Figure 4: Variation in Boarding Time Across Five EDs (2022 data)**

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Boarding times vary with hospital volume, with larger hospitals having longer median boarding times. For example, in 2017, hospitals with annual ED volumes between 100,000 and 120,000 had boarding times of almost 450 minutes (about 7 and a half hours), compared with less than 250 minutes (about 4 hours) for hospitals with annual ED volume of under 20,000.

Studies have examined a range of ED boarding times; the four-hour threshold is by far the most commonly studied in the literature; it was chosen in part based on prior recommendations from The Joint Commission7 and expert input.

#### **Association with Harms**

ED boarding has been shown to be associated with a wide range of harm, from delays in treatment to increases in mortality, including patients already admitted to the hospital.8 ED boarding also negatively impacts patient experience, as patients are often boarded by being held in hallways in a bed which lacks privacy and can contribute to staff burnout.

Because of the associated harms, CORE’s Technical Expert Panel (TEP) for this measure suggested that boarding itself should be seen as a “never event.” However, empirically, while some studies have shown that longer boarding times are associated with harm, including mortality, others have not found this relationship. For example, one systematic review found that only 4 of 11 studies showed a clear relationship between boarding and mortality.4 Some studies have shown a positive association between boarding time and patient safety events, including adverse events, preventable events, and near misses,3 in addition to delays in care, such as antibiotic administration.9

The evidence suggests there is an impact of boarding on outcomes in critically ill patients, but the evidence for an impact specifically on mortality is inconsistent.For example, a 2020 review article summarized studies related to ED boarding and critically ill patients10 and identified more than ten studies showing worse outcomes for boarded patients, including increased duration of mechanical ventilation, worsening organ dysfunction, and lower probability of neurologic recovery in stroke patients. In addition, the review identified studies showing higher in-hospital mortality for patients boarded for more than six hours11 and a positive association between Intensive Care Unit (ICU) mortality and boarding duration.12 Other studies, however, found impacts on delay in administration of medications without a clear impact on mortality.13 A 2022 study suggested that selection bias may have contributed to an overestimation of the impact of boarding on mortality.14

### Component 4: The patient had an ED length of stay (LOS) (time from ED arrival to ED departure) of longer than 8 hours.

#### **Performance Gap**

ED length of stay (LOS) is defined as arrival time to departure time from the ED. ED LOS varies across EDs and is positively associated with ED volume, with larger hospitals having longer lengths of stay.1 According to 2022 data from the EDBA, between 2009 and 2022, median ED LOS steadily increased from 167 minutes (about 3 hours) in 2009 to 211 minutes (about 3.5 hours) in 2022 ([Figure 5](#Fig5)). CORE’s preliminary analyses of EHR data from a single system with multiple EDs show wide variation (8 percent to 29 percent) in the proportion of ED visits with a LOS over the threshold defined by this proposed measure (longer than 8 hours) ([Figure 1](#Fig1), purple bars).

**Figure 5: Median ED Length of Stay, EDBA-member hospitals, 2012-2022. Source: EDBA**1

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#### **Association with Harms**

The relationship between ED LOS and mortality is unclear. A 2022 systematic review identified 19 studies that examined the relationship between ED LOS and in-hospital mortality and found that 10 of the 19 studies did not find a significant relationship;4 five studies showed an increased risk of mortality with longer ED LOS (studies included a range of thresholds, including 4, 6, 8, 12, and 24 hours).

In terms of harms other than mortality, a 2021 systematic review15 concluded that ED LOS (and total ED occupancy) had the strongest evidence for association with worse timeliness of care (e.g., pain relief, medication administration); and, likewise, a 2023 systematic review identified two studies that found that ED LOS was the strongest predictor of delays in treatment in the ED.16 A 2023 study that examined the impact of the UK 4-hour LOS standard17 found that this policy resulted in a 14 percent relative decrease in 30-day all-cause mortality.18

A 2022 systematic review identified several studies that support an 8-hour threshold.4 Akhtar et al (2015) found that patients with acute stroke were more likely to experience complications and more likely to die in the hospital if they spent more than 8 hours in the ED.19 Berg et al., (2019) found that lower-acuity patients (triage acuity levels 3 to 5) with an ED LOS of at least 8 hours who were discharged from the ED had higher odds of 10-day mortality compared with patients who had a stay of less than 2 hours.20 Dinh et al., (2020) found a significantly higher risk of all-cause 30-day mortality for patients with an ED LOS greater than 4 hours.21 Mitra et al., (2012) found higher odds of death for “general medical” patients with an ED LOS greater than 8 hours after adjusting for age, gender, and acuity.22

### Performance Gap: Measure Score

Results using data from five EDs within a single health system show there is wide variation in measure scores, even among the five EDs that are part of CORE’s initial test data (Figure 6). For patients without behavioral health diagnoses, the facility-range of unadjusted measure scores was 11 percent to 39 percent; for patients with behavioral health diagnoses, the range was 16 percent to 68 percent.

**Figure 6: Unadjusted ECCQ Measure Scores Across Five EDs (all ages, 2022)**

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## Disparities and Special Populations

Patients who are seen in the emergency department for a behavioral health condition or complaint are more likely to experience boarding and, when boarding, to experience long boarding times. For example, one study showed that about 30 percent of psychiatric visits were associated with boarding, compared with about 7 percent of non-psychiatric visits. Pediatric psychiatric visits were somewhat more likely to be associated with boarding compared with adult visits (34 percent vs. 30 percent, respectively). Data from the five EDs within a single health system show that, across all patients who are treated for a behavioral health concern, ED boarding of more than four hours occurred in between 2 to 41 percent of visits ([Figure A1](#FigA1)), compared with 5 percent to 19 percent for non-behavioral health patients ([Figure 1](#Fig1)).

For patients seen in the emergency department for a behavioral health condition or complaint, ED LOS has been shown to be longer compared with patients with non-behavioral health diagnoses among patients who were discharged, admitted, or externally transferred (10.7, 11.4, and 52.6 hours; compared with 8.3, 7.3 and 29.3 hours, respectively).23 Data from the five EDs within a single health system show that, across all patients with a behavioral health condition or complaint, the proportion of visits with an ED LOS greater than 8 hours was much higher for behavioral health patients, ranging from 72 percent to 87 percent of visits ([Figure A1](#FigA1)), compared with non-behavioral health patients (5 percent to 19 percent) ([Figure 1](#Fig1)).

### Race and Ethnicity

There are disparities in ED throughput metrics by race. For example, in one study, Black patients waited longer (arrival time to decision-to-admit time) than white patients even after adjusting for clinical, demographic, and socioeconomic variables.24 Another study found that, while across all patients there was no difference in mean boarding time between Black and white patients, among those with higher acuity (ESI level 1), Black patients boarded significantly longer than white patients; and, for psychiatric admissions, Black patients also boarded significantly longer than white patients.25 Among trauma patients, ED LOS was found to be longer in Black and Hispanic patients, who remained in the ED for about 40 minutes longer compared with white patients.21 Finally, a more recent 2023 study found that Black and Hispanic patients (as well as patients covered by Medicaid), were more likely to leave without being seen, or to be placed in hallway locations for treatment, even when controlling for factors such as acuity.26

### Older Patients

Older patients have been shown to experience longer ED input and throughput, as well as worse outcomes. For example, one study found that older patients who were eventually admitted to the medicine service had significantly longer ED wait times compared with younger patients, and another study found a strong association between patient age (65 or older) and longer ED wait times (time from ED arrival to seeing a provider).27,28 Older patients are more likely to experience worse outcomes from the same type of adverse event (e.g., missed medications) when compared with younger patients. In one study, older patients who stayed overnight in the ED had higher in-hospital mortality and higher odds of adverse events compared with patients admitted to an inpatient bed before midnight.29

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