

## **Online-only Supplemental Material Files**

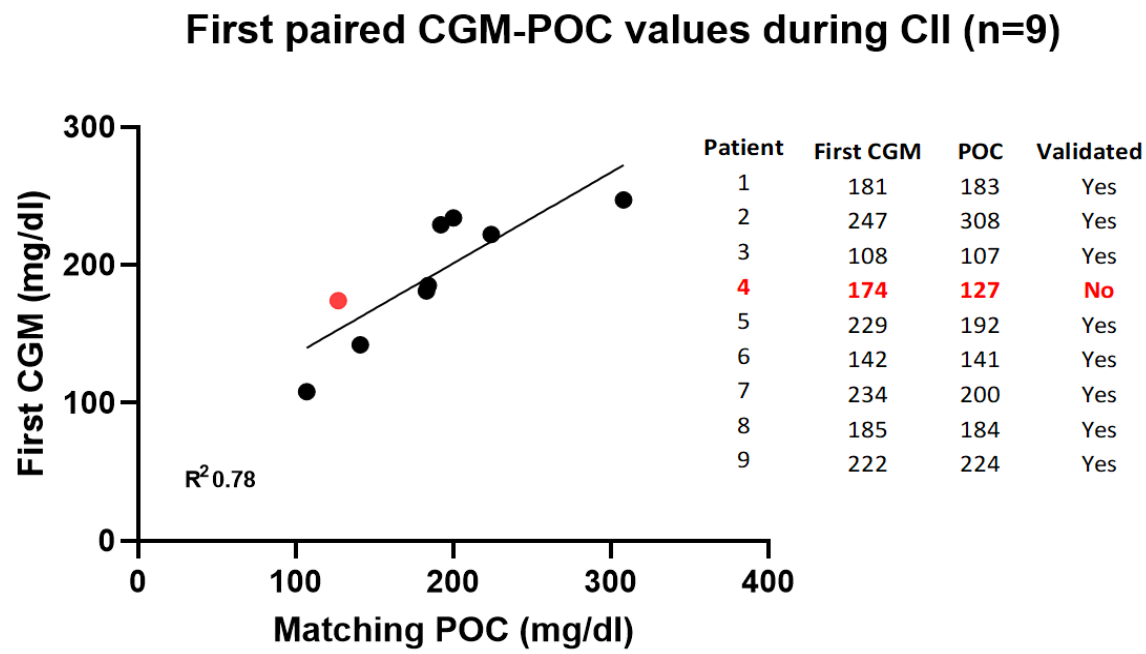
**Supplemental Table 1. Patient characteristics**

Age, years	65.9± 15.2
BMI, m/kg <sup>2</sup>	33.6± 6.2
LVEF, %	48.9± 12.4
A1c, %	7.8± 2.7
eGFR, mL/min/1.73 m <sup>2</sup>	34.7± 27.0
IL-6, pg/mL	268.9± 165.3
CRP, mg/dL	186.1± 57.6
Lactic acid, mmol/L	5.3± 5.5
pH	7.22± 0.10
Time on CII, hours	138.3± 132.9
Insulin rate, units/hour	4.34± 2.81
Male, n (%)	6 (56%)
Black race, n (%)	8 (89)
Type 2 Diabetes, n (%)	9 (100)
Vasopressors, n (%)	8 (89)
Mechanical ventilation, n (%)	9 (100)
Steroids, n (%)	9 (100)
CRRT, n (%)	6 (67)
Heart failure, n (%)	6 (67)

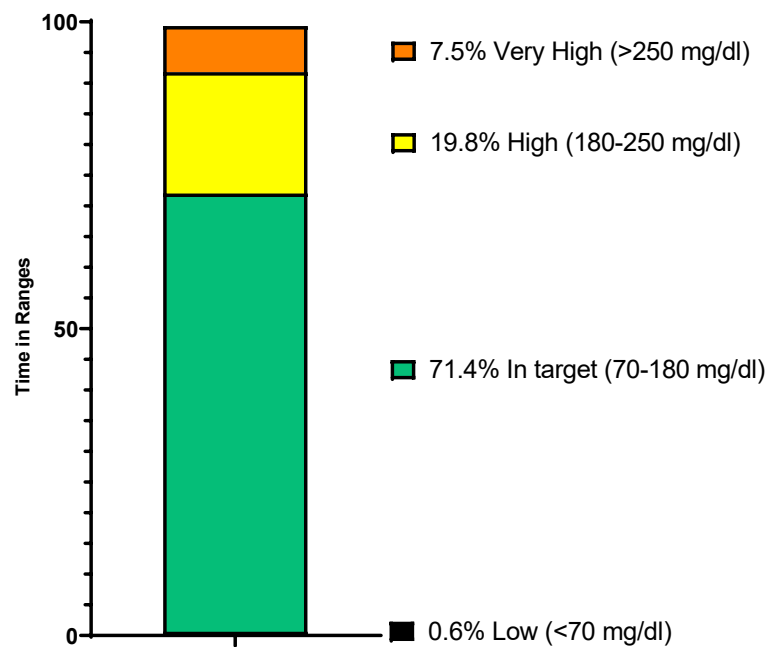
**Supplemental Table 2. CGM Interference in the ICU**

Potential interference	CGM placement	Detected with Alarms	CGM discrepancy
<b>Mechanical (6)</b>			
Pronation (1)	Arm	Yes	Lower CGM values
Positioning bath (1)	Arm	Yes	Lower CGM values
Bleeding around the sensor (1)	Abdomen	Yes	Lower CGM values / sensor error
Hypothermia devices (2)	Abdomen	Yes	Lower CGM values
<b>Shock (2)</b>	Abdomen	Yes	Lower CGM values / no data

Supplemental figure 1. Correlation and validation of Initial CGM sensor values paired with a matching POC



Supplemental Figure 2. Summarized time in glucose ranges in critically ill patients



## Appendix. Protocol Implementation

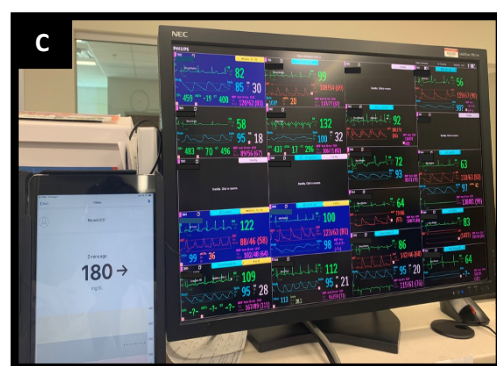
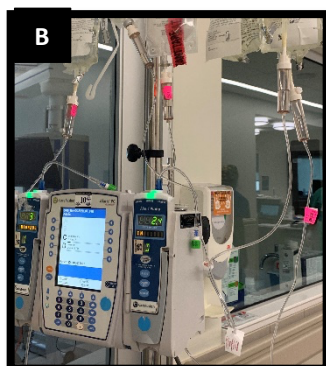
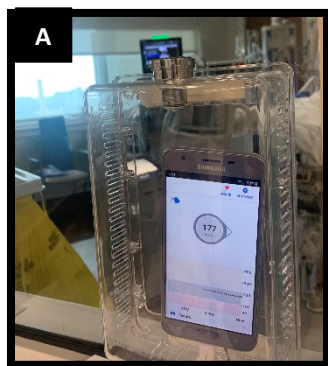
**Protocol Design and implementation:** We modified and adapted a protocol designed at The Ohio State University (OSU) (available at [www.covidindiabetes.org](http://www.covidindiabetes.org)) which was discussed via teleconferences with academic endocrinologists implementing CGM in ICUs. To design and implement a protocol integrating CGM with a computerized algorithm and EHR documentation, the following **key stakeholders were identified:** nursing leadership, Medication Safety Officer, critical care providers, endocrinologists, clinical pharmacists, hospital administration, laboratory staff, biomedical and clinical engineering, and information technology (IT). The protocol was adapted with the feedback from stakeholders after multiple teleconferences via Zoom, with support from OSU (EF). The adapted protocol and flowsheet were integrated in the EHR. To ensure “validation”, confirmation of less than 20% variance in 2 consecutive hourly paired values is obtained using POC values as reference. Upper and lower limits are populated automatically in the EPIC flowsheet to facilitate CGM validation. After validation, CGM can be used for hourly titration (entered in Glucomander hourly at the time of the alarm) with q6hr POC validations to ensure maintained accuracy. The protocol reverts to POC testing only for glucose levels <100 mg/dL or change in clinical status. Alarms are set at <100 mg/dL and >250 mg/dL in the *Follow* app. Glucomander alarms occur every 1-2 hours for glucose data entry. To avoid iatrogenic hypoglycemia, the target glucose range is set at 140-180mg/dL.<sup>15,16</sup>

**Staff training:** Education material was prepared by endocrinologists (GMD, FJP) in collaboration with ICU leadership, IT specialists, and colleagues at OSU (available at [covidindiabetes.org](http://covidindiabetes.org)). Remote and in-person training for nursing staff was conducted during morning and evening shifts. Nurses were trained on: 1) the technology (CGM placement, use of

the G6 App); and 2) protocol for validation of sensor glucose values and documentation in the EHR, as well as situations where POC testing would be indicated.

### Technology set up

- A) Smartphone receiving bluetooth signal within 20 feet from patient
- B) Externalized pump set up for hourly adjustment of insulin (optional), in accordance with the hospital approved protocol for medication pump externalization during COVID-19
- C) Glucose telemetry in nursing station with alarms



### Validation Process and EHR Documentation

- D) Automated calculation of BG range (upper and lower 20% of POC) for validation of sensor value compared to POC glucose (two consecutive hours) before using CGM for CII.

**Paired CGM-POC**

**Confirm validation**

**D**

Search (Alt+Comma)	0200	0215	0316
<b>Point of Care Tests</b>			
POC Blood Glucose (Docked Result)			
POC Blood Glucose (Manual Entry)			136
Continuous Glucose Monitoring (mg/dL)		139	134
CGM 20% High Range			163.2
CGM 20% Low Range			108.8
<b>CGM and POCT Glucose Validation</b>			Yes
Source of Sample			Arterial

**CGM and POCT Glucose Validation**

Yes

---

**Row Information**

**Acceptable range is CGM will equal POCT BG Plus or Minus 20% (Example: POC equals 200 then CGM needs to be between 160 to 240 to be validated).**

**If validated two consecutive times, then monitor CGM only and revalidate Q6 hours with POCT blood glucose.**

**If CGM or POC BG less than 100, proceed into room check patient, apply Glucomander recommended strategies until POC BG greater than 100, then revalidate CGM.**

**Validation range**

**Protocol instructions**

## CGM Validation Protocol

### Point-of-care (POC) glucose testing procedures in patients on Remote Continuous Glucose Monitoring (Dexcom G6 CGM) and Glucomander

Stage	Protocol
<b>Validation</b> (CGM value is within +/- 20% of POC)	<ul style="list-style-type: none"> <li>• Check POC BG every hour until validation criteria are met</li> <li>• When CGM value is available confirm the value is within +/- 20% of POCT and document YES/NO in flowsheet</li> <li>• When <u>2 consecutive hourly readings meet validation criteria (YES x 2) in POC flowsheet, move to checking <b>POC BG every 6 hours (confirm validation with CGM value)</b></u></li> <li>• <u>Document CGM values hourly</u></li> </ul>
<b>When to check POC?</b>	<b>Revert to Q1-2 hour POC BG (per Glucomander protocol)</b> if any POC BG falls outside of the validation criteria above (higher or lower than 20% of POC) or POC is <100 mg/dl <ul style="list-style-type: none"> <li>• <b>Obtain 1-time POC BG if:</b> <ol style="list-style-type: none"> <li>1) No glucose or trend arrow on smartphone screen (signal loss, LOW/HIGH CGM glucose)</li> <li>2) "Urgent low soon" or 2 arrows trending down</li> <li>3) <b>Changes in status: intubation, hemodynamic compromise, altered mentation, or nutrition</b></li> </ol> </li> </ul>

### Computerized algorithm using CGM values

**E)** Open-Loop CII algorithm (Glucomander software) integrated in EPIC: glucose target and trend, multiplier, insulin requirements. CGM sensor values are entered hourly in the software if CGM values meet validation criteria (see D).

E



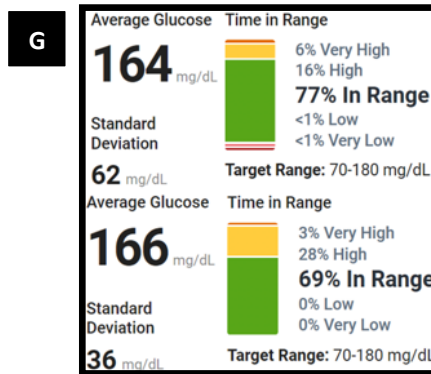
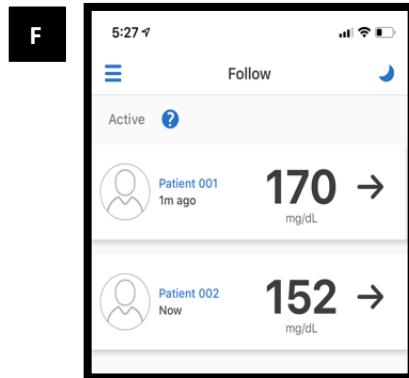
Enter BG

CGM is used if meeting validation criteria.

**POC** is used if CGM outside of range, change in clinical condition, or CGM or POC <100 mg/dL

## Remote monitoring and population management

**F)** Real-time remote monitoring (cellular signal) of multiple patients by Endocrinology team and clinical pharmacist via *Follow App* to receive 24/7 alarms (BG <100 or >250 mg/dL, signal loss). **G)** Summary reports in clarity.dexcom.com (e.g. average, time in range)



With permission from © 2020 Epic Systems Corporation, Dexcom, and Glytec.