Introduction:
Digitization of health data enables development of virtual care providers. In early sepsis care, development of such technologies, through reinforcement learning and other strategies, first requires understanding the sequence of vital sign or laboratory measurements and treatments. Thus, we explored patterns of data availability and intravenous (IV) fluid/vasopressor administration in a sepsis cohort.

Methods:
We analyzed a retrospective cohort of electronic health records from adult sepsis patients at 12 UPMC hospitals from 2010 to 2014. We defined Sepsis-3 by i.) suspected infection (e.g., administration of antibiotics or body fluid culture) & ii.) organ dysfunction (e.g., 2 or more SOFA points) in the first 6 hours of care. Data were organized by hour and included vital signs, lab values, and treatments (e.g., total hourly IV fluids (mL) and norepinephrine equivalent dose). For each hour we describe, i.) available data elements, ii.) presence of Sepsis-3, and iii.) treatment patterns.

Results:
We studied 71,272 sepsis patients (median age 68, [IQR, 56-81] years; 34,384 [48% male]. During Hour 1, vital signs were measured in 70% (n=49,890), lab values (e.g. complete blood count) in 51% (n= 36,348), fluid culture in 46% (n=32,785) and serum lactate in 10% (n=7,172, Fig 1A). By Hour 6, most patients had vital signs (99%; n=70,559), basic labs (88%; n=62,719), fluid cultures (94%, n= 66,995), while serum lactate was completed in 24% (n=17,818). These data contributed to Sepsis-3 criteria in Hour 1 in 78% (n=55,592) and 100% by hour 5 (Fig1B). Amidst this changing background, IV fluids were given in 17% (mean volume, 166 mL [SD, 411]) and vasopressors in 1% (n=712) in Hour 1. By Hour 6, all received fluids, (mean volume., 1170 mL [SD, 979]), and 80% (n=57,018) received a vasopressor (Fig1C).

Conclusion:
Early sepsis care patterns are variable. IV fluids were given during early hours, when uncertainty about sepsis was greatest, while vasopressors were administered after Sepsis-3 elements were present.

Image:

(A) Heatmap of available data elements per hour. X-axis represents hour after hospital arrival; y-axis represents physiologic or laboratory variable. Dark blue corresponds to no missing variables; white corresponds to 100% missing. (B) Time-to-event plot of Sepsis-3 elements, overlaid on cumulative proportion of patients with Sepsis-3. X-axis is hour after hospital arrival. (C) Patterns of IV fluid and vasopressor prescriptions per hour. X-axis represents hour after hospital arrival. Left y-axis corresponds with line graph and purple.
bars, which represent the cumulative density of sepsis patients and proportion of patients receiving vasopressors, respectively. Right y-axis corresponds with blue bars and represents mean IV fluid volume administered per hour; error bars represent standard deviation.