Identifying Hemolysis Reduction Strategies by Comparing Specimen Collection Methods at Different Clinical Units

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BACKGROUND:

- Hemolysis, caused by the disruption of red blood cell membranes and the release of hemoglobin and intracellular components, is the most common pre-analytical error in clinical laboratories.

- Poor blood collection techniques frequently result in in vitro hemolysis, interfering with multiple laboratory tests and producing misleading results, most notably pseudohyperkalemia.

- This necessitates repeat testing, delays patient management, and can lead to mistreatment.

- Factors influencing hemolysis frequency have not been studied at Ruby.

SMART OBJECTIVE:

- **Specific**: The long-term goal is to reduce specimen hemolysis frequency. The short-term goal of this study is to identify the steps in the specimen collection process that could be standardized across different clinical units.

- **Measurable**: Monitoring and comparing specimen hemolysis frequency at different clinical units.

- **Achievable**: Using the available patient results stored in laboratory information system to identify the clinical units with relatively lower hemolysis frequency.

- **Relevant**: These units may have better workflows or processes that can be standardized across different clinical units.

- **Time-bound**: The timeline depends on the engagement of clinical units.

ACTIONS TAKEN (This is a pre-study to formulate the following QI project):

– Data from 184,550 metabolic panel results (January 1, 2024 – June 30, 2024) were retrieved from the laboratory information system (Epic Beaker).

– This dataset included potassium levels, hemolysis indices (graded as negative, 1+, 2+, 3+, and 4+, corresponding to hemoglobin concentrations of 0–29, 30–99, 100–199, 200–499, and ≥500 mg/dL, respectively), specimen draw types, collector credentials, and collection units. Specimens were analyzed using an Abbott Alinity c chemistry analyzer integrated into an automated laboratory track system. Hemolysis indices were photometrically determined.

– Potassium results were compared across hemolysis grades.

– Frequencies of hemolysis were further stratified by specimen draw types, collectors, and clinical units.
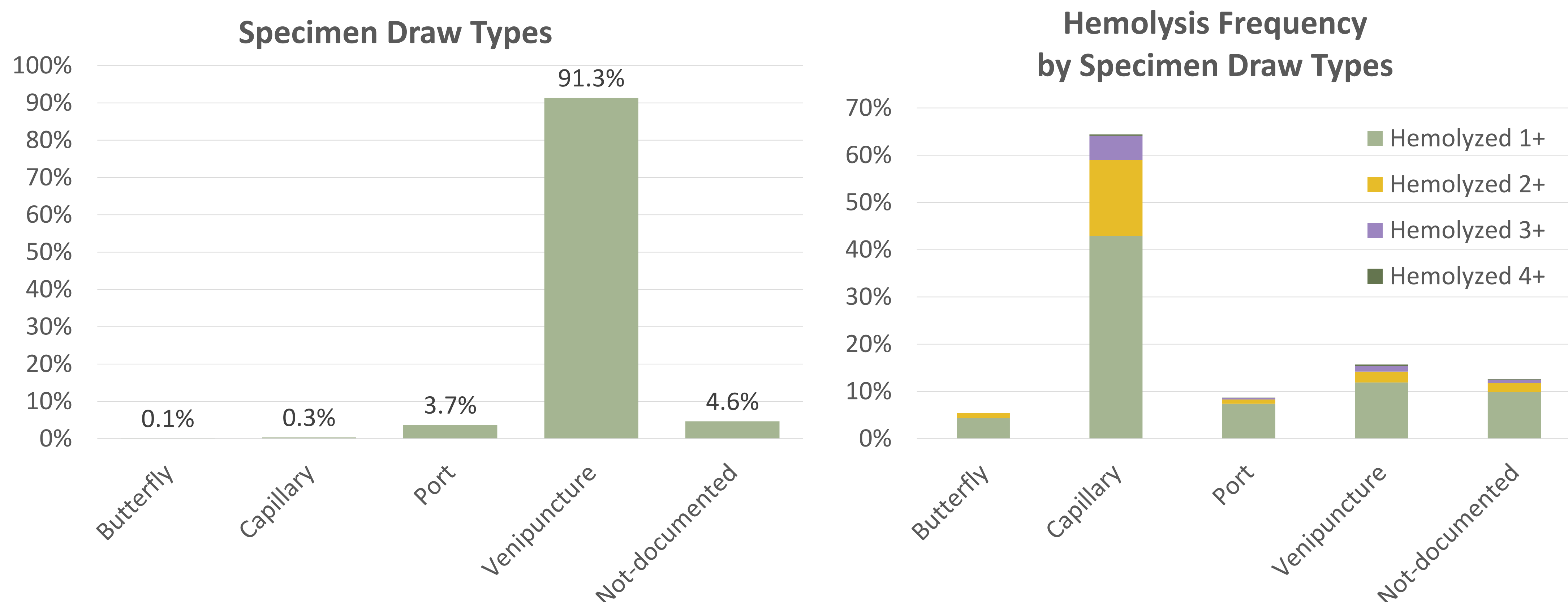
RESULTS:

Figure 1. The charts show that venipuncture is the most common draw method (91.3%), while capillary specimens have the highest hemolysis rate, followed by venipuncture, port, and butterfly, with 4.6% of draws not documented.
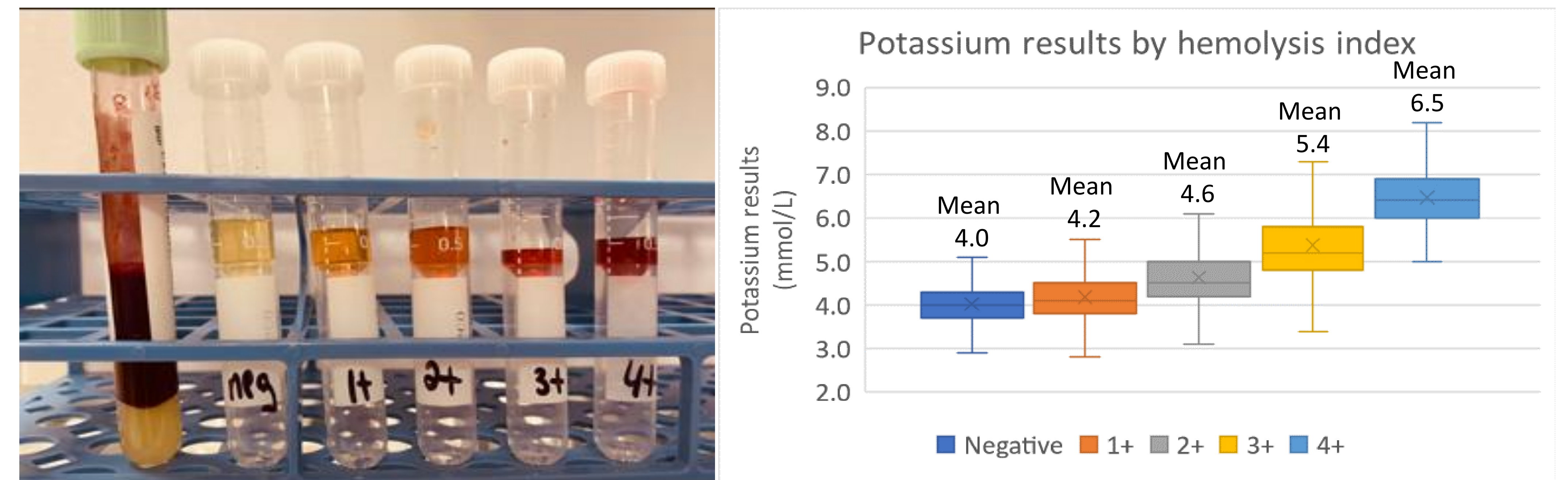
RESULTS:

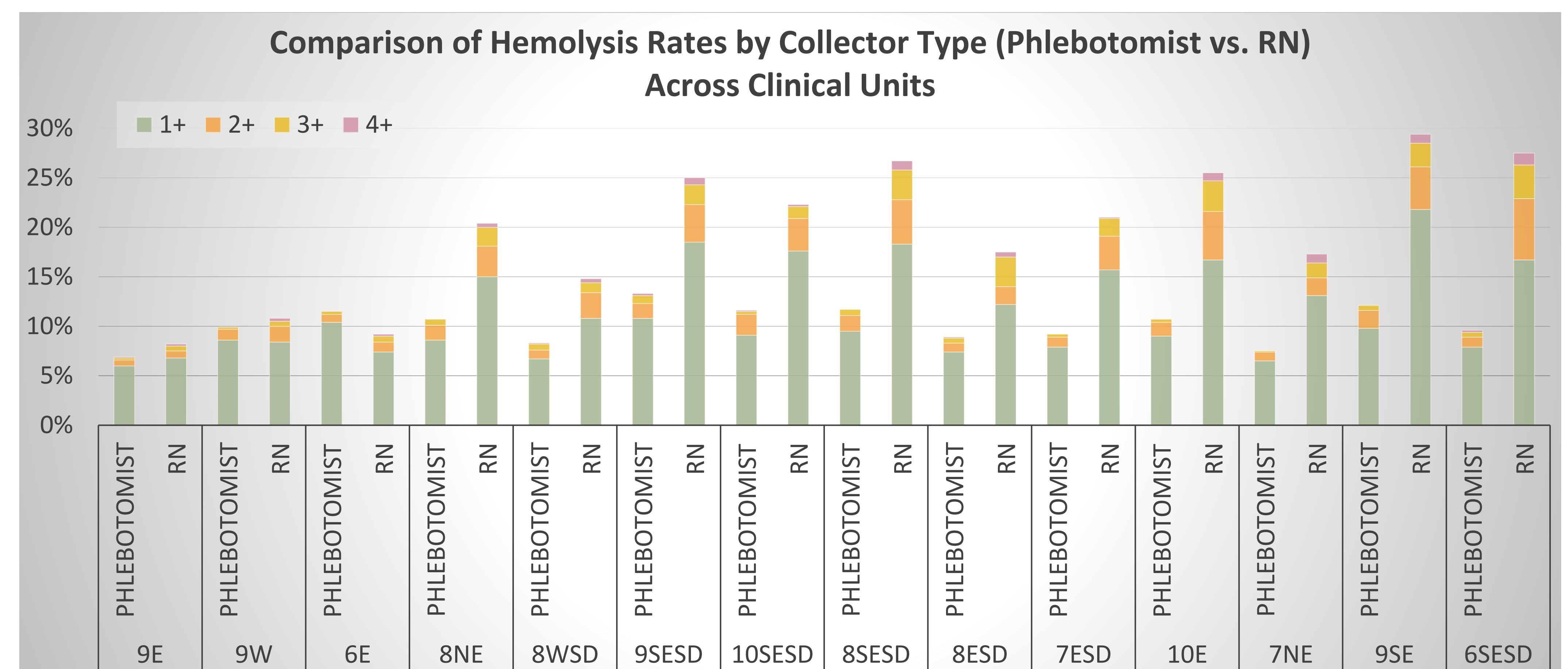**Figure 2**. Potassium results were falsely elevated in hemolyzed specimens.

Figure 3. When adjusted for patient differences, RN collections had lower hemolysis rates at 9E, 9W, and 6E, while phlebotomists outperformed RNs in other clinical units.

SCALE UP OR FOLLOW UP PLAN:

- Engage with at least two of three better-performing units (9E, 9W and 6E) and at least two of other units.
- Identify the potential differences in specimen collection process that may contribute to hemolysis:
  - Collection techniques or tools, prevalence of collection through intravenous line
  - Time from specimen collection to transportation
  - Specimen volume collected in each tube, number of specimen tubes placed in pneumatic tube carrier,

LESSONS LEARNT:

1. Potassium results were falsely elevated in specimens with hemolysis indices of 2+ and 3+, although the lab only rejected specimens with hemolysis index of 4+ at J.W. Ruby Memorial Hospital.

2. At several clinic units, 9E, 9W and 6E, the RN collections and phlebotomist collections showed similar hemolysis frequencies. Other clinic units may learn from their practice to improve RN collections.