At high surface-to-volume ratios, extended exposure of a small volume sample (pCO₂ ~40-50 mmHg) to air (pCO₂ ~0.3 mmHg) can rapidly deplete the pool of dissolved CO₂, reducing apparent TCO₂ concentrations. These changes are often incorrectly assumed to reflect metabolic acidosis in the patient, leading to unnecessary additional testing to explain the apparent acidosis. Figure 1 illustrates the magnitude of this phenomenon.

Small volume samples can be collected in reduced vacuum tubes or in microcollection tubes often referred to as “bullets” (Figure 2). These tubes, containing lower quantities of additives, are designed for specimen collection of 0.5-1 mL. However, using these miniature collection tubes poses several obstacles to laboratory workflow, especially for highly automated laboratories. To begin with, bullets do not fit most analyzers and automated robotic systems. Standard labels also are usually too large for bullets, requiring labs to purchase specialized labels and printers. Otherwise, labs have no choice but to manually enter patient information into their laboratory information system and analyzers. Adding these manual processes to lab workflows can introduce errors, prolong turn-around times, and increase the number of employees needed.

One potential solution to this problem is to place bullets into larger tubes that can be barcoded and positioned into instruments. Some manufacturers make false-bottom tubes that fit on some instrument platforms, such as the purple top microtainer tube pictured in Figure 2. More often, labs have to transfer small volume samples into a compatible sample cup prior to analysis. Measures taken to accommodate small volumes, such as false-bottom tubes, sample cups, or tube-within-a-tube, all require validation prior to reporting patient results.

Small volume samples are often obtained via capillary blood collection from a finger or heel. Capillary