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Water Quality Testing Kits for Community-Engaged Research

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Groundwater serves as the primary source of self-supplied water for over 40 million households in the United States. In this study, we conducted a market analysis of water test kits and assessed their performance in evaluating well water quality within local communities. We used a community-engaged research (CEnR) framework to establish bidirectional communication about well water quality and water testing. Participants viewed lab-based testing as expensive, and many participants did not know where or how to test their water. Commercial water test kits offer an alternative. They are relatively cheap, offer expedited results, but their lowered sensitivity and innate ambiguity in the results raise questions about their suitability for CEnR.

First, a market assessment was performed. Twenty-seven test kits capable of measuring four or more water quality parameters were purchased from online vendors and categorized into two groups: all-in-one test strips and combination test kits incorporating various testing principles. The three main test principles in the combination test kits are binary tests, dip-strips, and reagent methods. Next, two sampling campaigns were conducted in Baldwin and Mobile Counties, Alabama, USA, with over 50 participants to assess the applicability of these kits for CEnR. The reported values from test kit manipulations by participants were compared with laboratory measurements to evaluate kit performance.

Results indicated that all-in-one test kits lacked sensitivity to concentrations below maximum concentration levels (MCLs) for most parameters or were not responsive to the concentration in laboratory tests and were thus excluded from further analysis. The suitability of combination test kits for CEnR varied based on concentration ranges, assay increments, and limit of detections of the assays. Binary tests and reagent colorimetric tests were generally easier for community interpretation compared to dip-strip colorimetric tests. This study highlighted challenges concerning the sensitivity and precision of individual tests within commercial groundwater monitoring kits. Future research directions could involve integrating the most sensitive and accurate tests into comprehensive kits, developing new reliable tests for groundwater monitoring, and investigating the matrix effect on tests across different geological settings.