Emergency Departments (EDs) represent a crucial component of any healthcare infrastructure. In today’s world, healthcare systems face growing challenges in delivering efficient and time-sensitive emergency care services to communities. Overcrowding within EDs represents one of the most significant challenges for healthcare quality that adversely impacts clinical outcomes, patient safety, and overall satisfaction. Research in this area has resulted in creating several ED crowding indices, such as National Emergency Department Overcrowding Scale (NEDOCS) and Emergency Department Work Index (EDWIN) that have been developed to provide measures aimed at mitigating overcrowding. Recently, efforts made by researchers to examine the validity and reproducibility of these indices have shown that they are not reliable in accurately assessing overcrowding in regions beyond their original design settings. The shortcomings of such indices stem from their reliance upon the perspective and feedback of only clinical staff and the exclusion of other stakeholders. These limited perspectives introduce bias in the results of ED overcrowding indices. This study starts with confirming the inaccuracy of such crowding indices through examining their validity within a new healthcare system. To overcome the shortcomings of previous indices, the study presents a novel framework for quantifying and managing overcrowding based on emulating human reasoning in overcrowding perception. The framework of the proposed study takes into consideration emergency operational and clinical factors such as patient demand, patient complexity, staffing level, clinician workload, and boarding status when defining the crowding level. The hierarchical fuzzy logic approach is utilized to accomplish the goals of this framework by combining a diverse pool of healthcare expert perspectives while addressing the complexity of the overcrowding issue. The innovative design of the developed framework reduces bias in the assessment of ED crowding by developing a knowledge-base from the perspectives of multiple experts, and allows for its implementation in a variety of healthcare settings. Statistical analysis of results indicate that the developed index outperform previous indices in reflecting expert subjective assessments of overcrowding.