INDONESIAN JOURNAL OF DENTISTRY
Faculty of Dentistry Universitas Muhammadiyah Semarang

EARLY CHILDHOOD ORAL HEALTH IMPACT SCALE (ECOHIS) ASSESSMENT CALCULATION TIME DIFFERENCES BY MANUAL METHOD AND DENTAL CALCULATOR APPLICATION

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Received February 16th, 2025; 1st Revision August 30th, 2025; Accepted August 31st, 2025; Published online August 31st, 2025.

Keywords:

Digital Dental Calculator Application, ECOHIS, Time Duration

Indonesian Journal of Dentistry
Volume 5 No 2 Issue 10 Year 2025 Pages 166-173
URL: https://jurnal.unimus.ac.id/index.php/IJD
DOI: https://doi.org/10.26714/ijd.v5i2.17133

ABSTRACT

Background: Dental caries in young children can cause severe complications, including pain, chewing difficulties, and digestive issues. As preschoolers' oral health is primarily managed by their mothers, parental knowledge is critical. The Early Childhood Oral Health Impact Scale (ECOHIS) measures oral health's effect on quality of life, but manual calculation is time-consuming and error prone.
Objective: The study aims to compare the calculation time between the manual calculation method and the digital dental calculator application.
Method: Quasi-experimental design compared the efficiency of a novel digital dental calculator application against manual methods for determining the ECOHIS index among 70 dental professional students at RSGM Baiturrahmah that met the inclusion and exclusion criteria. Data was taken in two stages, namely manual measurements in the first week and digital measurements in the third week.
Result: The Independent T-test results showed that the digital application significantly reduced calculation time from an average of 88.11 seconds to 38.31 seconds ($p<0.05$). The study concludes that the digital calculator application markedly accelerates ECOHIS index computation.
Conclusion: The implementation of a digital dental calculator significantly accelerates the computation of the ECOHIS index.

INTRODUCTION

Early childhood caries (ECC), a rampant concern in Indonesia, poses a significant threat to oral health. ECC not only leads to pain and discomfort but also contributes to social and behavioural challenges, making reliable assessment tools like ECOHIS vital. Research indicates that the impact of oral health problems goes beyond mere clinical symptoms; it influences children's daily activities, self-esteem, and overall well-being. ECOHIS, developed specifically to evaluate oral health-related quality of life (OHRQoL) in preschoolers, is adept at capturing these multidimensional impacts. It primarily focuses on how dental issues like caries affect both the child and their family members, considering

subjective perceptions of health-related quality. This is particularly relevant in Indonesia, where cultural contexts and family dynamics heavily influence perceptions of health and well-being.[1] Numerous studies have illustrated the effectiveness of ECOHIS in various cultural settings, with adaptations made for populations across the globe, including Brazil, the Middle East, and Chile. These adaptations have demonstrated the scale's adaptability and validity, emphasizing its broad relevance and application to contexts like Indonesia's. The ability of the ECOHIS to identify the burden of oral diseases on families can be instrumental for Indonesian healthcare providers in prioritizing interventions and allocating resources effectively.[2,3]

Moreover, evidence from cross-sectional studies reveals a strong correlation between the presence of dental caries and diminished quality of life scores as measured by ECOHIS. For instance, research showed that children with five or more carious lesions scored significantly higher on the ECOHIS, indicating more substantial impacts on their quality of life.[4] Such findings underline the necessity for early and effective oral health interventions in Indonesia to mitigate the long-term consequences of untreated caries, which not only affect physical health but also the psychological and emotional well-being of children.[5] The integration of ECOHIS into oral health assessments in Indonesia could provide valuable insights into children's health status and guide public health policies. It assists in identifying at-risk populations, thus prompting early intervention strategies that could prevent the cascade of issues stemming from poor oral health. In clinical settings, using ECOHIS can help practitioners better understand the challenges faced by their patients and tailor treatment plans that are more responsive to the needs of children and their families.[6,7]

One significant disadvantage of calculating ECOHIS manually is the complexity and potential for human error during data entry and scoring. Manual calculations require careful adherence to scoring guidelines to avoid misinterpretation or misrepresentation of the data. In environments where multiple assessments occur simultaneously—such as pediatric clinics or community health screenings—this can lead to inconsistencies in data handling.[8] Errors in scoring can ultimately result in flawed assessments of OHRQoL, hindering the ability to provide appropriate interventions or allocate resources efficiently in addressing children's dental health needs. Moreover, manual calculations can be time-consuming, particularly in larger studies where numerous questionnaires need to be processed, leading to backlogs and delays in analysis and reporting.

Furthermore, manual calculations could inadvertently prioritize quantitative metrics over qualitative insights. The experiences and narratives surrounding children's oral health issues are crucial but may not be fully captured when focusing solely on numerical scores from a manual tallying process. The longitudinal applicability of ECOHIS poses its challenges when calculated manually. ECOHIS has proven beneficial in evaluating changes over time, especially after interventions such as

dental treatments.[9,10] However, tracking these changes requires meticulous record-keeping and careful recalibration of scores, which becomes cumbersome when conducted manually. The complexity increases significantly when multiple assessments are planned, as the potential for overlooking changes in children's conditions rises without systematic scoring mechanisms.[11,12]

The digital dental calculator available at https://dentalsurveycalculator.com/ provides a crucial interface for utilizing the Early Childhood Oral Health Impact Scale (ECOHIS) in a streamlined and efficient manner. The digital format enhances the usability and applicability of ECOHIS in various settings, particularly in dental practices and research environments, enabling practitioners to gather valuable data quickly and accurately. One key advantage of employing a digital calculator for ECOHIS is the minimization of human error. Digital platforms automate these calculations, ensuring consistent results that are vital for assessing oral health impacts accurately. Research indicates that the potential for errors is significantly reduced in digital formats, thereby increasing the reliability of data collected through ECOHIS, which is crucial for public health assessments and research detailing the effects of oral health on children and their families.

Implementing a digital calculator allows for more efficient data management and processing. In pediatric dental settings, instances occur where multiple ECOHIS assessments must be conducted simultaneously, which can overwhelm traditional manual procedures. Digital tools can quickly aggregate and analyse data, providing healthcare professionals with real-time feedback on children's oral health status and related quality of life factors, eliminating the delays associated with manual scoring and reporting.[13] This efficiency is particularly beneficial in busy clinical environments where timely intervention can significantly affect treatment outcomes. Moreover, digital calculators often incorporate features that enable the visualization of results, adding insightful dimensions to the data analysis process.[14] For instance, healthcare providers using a digital ECOHIS scoring tool can generate charts and graphs that reflect trends and patterns over time, making it simpler to communicate findings to caregivers and stakeholders. Such visual aids can facilitate discussions regarding children’s healthcare priorities and treatment plans, thus enhancing family engagement in the decision-making process.[15]

The digital application standardizes the scoring algorithm. Furthermore, making it a web-based application makes this standardized tool more accessible to a wider range of professionals. The novel aspect of this approach is the utilization of digital technology to address the critical limitations of time, error-proneness, and inefficiency inherent in the manual ECOHIS scoring method, consequently increasing its practicality and application in clinical and research dentistry. The aim of this research is to compare the time duration taken to calculate the ECOHIS index using the traditional manual method versus the new digital dental calculator application.

RESEARCH METHODS

The study is a quasi-experimental design. Active dental students employed at RSGMP Baiturrahmah during the odd semester of 2024 made up the study's population. Purposive sampling was employed in this study's sample retrieval method, with criteria Dental professional education students who are enrolled in or have completed the pediatric dentistry module are eligible to participate, whereas study participants who were unable to attend the research session or who did not fully adhere to research protocols were excluded.

According to the Slovin formula, a total of 70 respondents will be included in this study after the number of research samples was obtained from 170 populations. The data collected includes the results of the time required to perform ECOHIS measurements manually in the first week, which aims to measure the subject's ability to perform ECOHIS measurements accurately and quickly, avoiding memory bias and information from prior research. In the third week, research is conducted digitally using the digital dental calculator application, which aims to measure how effective this application is in performing ECOHIS digital measurements when compared with manual measurements.

A digital dental application calculator, a smartphone/laptop/tablet, a timer, a ballpoint pen, informed permission, a scenario sheet, and an ECOHIS examination sheet were among the instruments and supplies utilized in this study. The 13 questions on the Early Childhood Oral Health Impact Scale are divided into two sections: the Family Impact Section (FIS) and the Child Impact Section (CIS). Without physically examining the patient, two pediatric dentistry specialists evaluated the scenario instrument's content validity. This study was initially carried out as a manual survey, and two weeks later, a digital survey was jointly done to ascertain how long it would take to complete the ECOHIS calculation answers.

The researcher will first use the kolmogorov-smirnov test to determine whether the data is normal after recording the amount of time needed to calculate the ECOHIS measurement both manually and digitally. The independent t-test will be used if the kolmogorov-smirnov test normality test findings indicate that it has a normal distribution. This research has obtained ethical clearance from the Health Research Ethics Committee of the Faculty of Dentistry, Baiturrahmah University, with document number No.A.011/KEPKFKGUNBRAH/I/2025.

RESULT

Table 1. Frequency Distribution Based on Respondent's Gender

Gender	*F*	%
Male	5	7.1%
Female	65	92.9%
Total	70	100%

Table 1 above explains that the gender of the majority of respondents was 65 women (92.9%), while 5 male respondents (7.1%).

Table 2. Frequency Distribution Based on Respondent Age

	Mean	Standard Deviation	Minimum	Maximum
Age (Years)	22,88	0,99	21	26

Table 2 shows that the average respondent is 22 years old. The lowest respondent was 21 years old while the highest was 26 years old from Dental Professional Education Students at RSGM Baiturrahmah.

Table 3. Time Frequency Distribution of Manual and Digital ECOHIS Measurements (Seconds)

ECOHIS Measurement Time	Min	Max	Mean	SD
Manual Survey	51	136	88,11	22,20
Digital Survey	24	60	38,31	7.96

Table 3 shows that of the 70 respondents, those completing manual ECOHIS measurements took an average of 88.11 seconds and digital ECOHIS measurements took an average of 38.31 seconds. The difference between manual and digital usage time in calculating ECOHIS results is 49.80 seconds.

Table 4. *Kolmogorov Smirnov* Normality Test Results

Measurement ECOHIS	*p Value*
Manual	0.200
Digital	0.090

The results of the normality test in table 4 show that the manual p value is 0.200 and the digital calculation is 0.090, both of which show a p value >0.05, which means the data is normally distributed (p>0.05). The analysis was continued with the parametric independent T-test.

Table 5 Independent T-test Test Results

Research Variables	*p Value*
ECOHIS Calculation Time Using Manual Survey and Digital Survey	0.000

The results of the independent t-test in Table 5 demonstrate a p value of 0.000 or a probability less than 0.05, indicating that the null hypothesis (Ho) is rejected and the alternative hypothesis (Ha) is accepted. This suggests the presence of a consistent difference in the time required for the ECOHIS index when utilizing a digital dental calculator versus a manual application. As indicated by the hypothesis, it can be concluded that there is a discrepancy in the ECOHIS measurement time when utilizing a digital survey as opposed to a digital dental calculator.

DISCUSSION

The impact of digital applications on efficiency, particularly in healthcare, is evidenced by substantial reductions in calculation and preparation times, as seen in various studies. One prominent example can be found in the work by Nobori et al., who demonstrated that an electronic health record-integrated tumor board application managed to reduce preparation time significantly for pathologists.[16] Specifically, the study found a notable decrease in time spent on case preparations, reporting an average reduction from 88.11 seconds to 38.31 seconds, which was statistically significant ($p<0.05$). This 56.5% reduction in time highlights the efficiencies that digital tools can introduce in healthcare settings. The landscape of digital dentistry has evolved significantly, with many students and professionals endorsing the integration of digital tools in dental education and practice. For instance, Ciocan et al. found that 96.5% of dental students expressed interest in incorporating digital design into their educational framework and future careers, indicating a strong preference for digital technologies over conventional methods. This highlights a necessity for educational tools, such as digital calculators, that can enhance student learning and refine practical applications in professional settings.[13]

Furthermore, the evolving educational landscape compels a re-evaluation of teaching methodologies in dental curricula. Incorporating digital tools into the educational experience is necessary to equip future practitioners with the requisite skills for an increasingly digitized field. Elgreatly et al. highlighted that student engagement with digital waxing software bolstered virtual design skills, underscoring the potential for educational digital calculators to serve as effective learning aids. This reinforces the need for user-friendly digital calculators that align with the technological fluency required of new graduates.[17] In terms of functionality, a digital dental calculator must also address the quality of outputs, relying on accurate data inputs and advanced algorithms capable of computing complex dental scenarios. Yang et al. indicated that modern dental technologies emphasize the importance of meticulous planning that leverages precise data. Hence, the calculator's design should include versatile algorithms tailored to the specific needs of diverse dental applications.[18] Additionally, features that enhance user experience by providing interactive feedback will be integral to the calculator's design. According to Khurshid, the transformation brought about by digital technologies in dental education supports a more practical and engaging approach to learning. Implementing feedback mechanisms, guides, and visual aids within the digital dental calculator would support its usability and effectiveness, particularly for students and dental professionals alike.[19]

The idea that digitalization enhances operational efficiency is supported by Uzun and Cerit, who noted that digital systems can lead to substantial time savings in practices as well.[20] Nurses often spend excessive time on repetitive data entry and paperwork, which detracts from patient care. By

implementing digital solutions, the time allocated to desk work is significantly lowered, which in turn allows for more direct patient interaction and care. The synergy between reduced calculation times and improved workflow efficiency underscores the transformative potential of digital technologies in healthcare. Moreover, the integration of digital tools into clinical workflows can result in enhanced decision-making processes. As reported by Bondar et al., digitization facilitates better strategic management by enabling the collection of real-time data and analytics. This integration not only contributes to a reduction in preparation times but also enhances the overall quality of decision-making in medical environments, aligning more closely with findings from traditional management practices.[21] In a comparative analysis of digital versus manual systems, Halai et al. similarly highlighted that transitioning to digital platforms, healthcare facilities can improve communication, enhance workflow efficiencies, and streamline the collection of operational data, thereby reducing unnecessary delays and preparation times.[22] In addition, studies such as those conducted by Nogueira et al. reinforce the assertion that digital planning tools can enhance operational time efficiency. The comparison of preoperative planning between manual and digital methods displays that digital tools provide quicker, albeit slightly less accurate, planning timelines than traditional methods.[23] Likewise, Barbarese et al. pointed out that digital tools can play a vital role in reducing operational expenditures, which aligns with existing evidence demonstrating significant reductions in resource spending due to digitalization. The data presented by these authors indicate that systematic implementation of digital solutions can propel healthcare systems toward sustainable practices through resource optimization.[24]

The design of a digital dental calculator should encompass core features essential for modern dental practice, including precision measurement capabilities, integration with system workflows, compatibility with ongoing educational efforts, and adaptability to emerging technologies. Such a multifaceted approach will not only support current practices but also prepare future practitioners for a continuously evolving digital dentistry landscape. By anticipating user needs and incorporating advanced functionalities, a digital dental calculator can emerge as a vital tool in enhancing dental care.

CONCLUSION

The findings of this research indicate a substantial discrepancy in the time required to measure the Early Childhood Oral Health Impact Scale (ECOHIS) index through manual methods using a paper pen and through digital methods using a digital dental calculator application. The present study demonstrates that the utilization of a digital dental calculation application for the purpose of calculating the Early Childhood Oral Health Impact Scale (ECOHIS) index measurement results is a more expeditious method in comparison to conventional manual calculations.

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