# CORRELATION BETWEEN 22-ITEM SINONASAL OUTCOME TEST AND HEALTH UTILITY SCORE IN PATIENTS WITH CHRONIC RHINOSINUSITIS

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**Summary**

**Background:** Chronic rhinosinusitis (CRS) is a widespread inflammatory condition with significant health and economic impacts. The health utility score (HUS) is used to evaluate patients' perceptions of their overall health; however, data on the HUS specifically for CRS is still limited.

**Materials and methods:** A prospective study was conducted with 57 patients with CRS scheduled for endoscopic sinus surgery (ESS). The preoperative (baseline) demographics, 22-item sinonasal outcome test (SNOT-22), and endoscopic and CT scores were recorded. The HUS was assessed through four methods: the EuroQoL-5 Dimension-5 level (EQ-5D-5L), Visual Analog Scale (VAS), and Short Form Health Survey-6-Dimension(SF-6D), conducted at baseline and three months following surgery.

**Results:** The mean baseline HUS scores by EQ-5D-5L, VAS, and SF-6D were 0.77, 0.67, and 0.71, respectively. The postoperative HUS significantly improved to 0.94, 0.89, and 0.92 at three months. The overall improvement in HUS scores ranged from 0.14 to 0.22 after the operation. VAS consistently recorded the lowest HUS values across all time points among the three methods. There were moderate correlations between SNOT-22 and HUS values assessed by EQ-5D-5L, VAS, and SF-6D. The coefficients were -0.60, -0.57, and -0.56, respectively.

**Conclusion:** The HUS of patients with CRS improved significantly after receiving ESS. The SNOT-22 consistently correlated strongly with HUS, regardless of the method used.

***Keywords**:* Chronic rhinosinusitis, quality of life, health utility, cost-effectiveness, EQ-5D.

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## 1. Introduction

Chronic rhinosinusitis (CRS) is a persistent inflammatory condition affecting the nasal passages, significantly reducing patients' quality of life (QoL) by causing breathing challenges, discomfort, and a reduced sense of smell [1]. Clinical studies use general and disease-specific QoL tools to evaluate quality of life (QoL). General QoL is assessed with questionnaires like the Short Form Health Survey-6-Dimension (SF-6D) and the EuroQol-5-Dimension-5-Level (EQ-5D-5L). These tools generate a Health Utility Score (HUS), reflecting the patient's view of their overall health. Policymakers frequently use the HUS to compare the QoL effects of different diseases and guide healthcare decisions.

The term HUS can also be referred to as health utilities, utility values, or health utility index. It provides a summary measure of QoL on a scale from 0 to 1.00, with 0 indicating death and 1.00 indicating perfect health [2]. The HUS is crucial in cost-utility analysis, which evaluates if a treatment's quality-of-life benefits justify its costs. Direct methods for determining health utilities involve patients evaluating their health states against alternatives, like time trade-off or standard gamble [3]. In contrast, indirect methods use general preference instruments like EQ-5D-5L or SF-6D to assess health utilities [4, 5].

HUS can vary based on factors like assessment method, disease severity, geographic location, living standards, healthcare system, or personal perception of the condition. In clinical studies using the SF-6D, CRS patients' HUS ranged from 0.65 to 0.72 [4, 6, 7]. Meanwhile, U.S. studies using the EQ-5D-5L reported scores between 0.81 and 0.86 [5, 8, 9], and Bewick et al. found a score of 0.75 for British patients using the same tool [10]. Sangubol et al. report the HUS of Thai patients with CRS using different methods ranging from 0.75 to 0.85 [11]. Endoscopic sinus surgery (ESS) has been shown to enhance QoL, as reflected in increased HUS scores [5, 7, 8].

The 22-item sinonasal outcome test (SNOT-22) is a disease-specific QoL questionnaire for CRS [12]. This can aid routine clinical practice by emphasizing the impact of CRS on a patient's QoL and can also serve as a measure of the outcomes of surgical intervention.

Our main goal was to compare health utility scores obtained through different assessment methods and examine the correlations between HUS and clinically related scores, including SNOT-22.

## 2. Materials and methods

### Study design

A prospective study was carried out at Hue University of Medicine and Pharmacy Hospital, adhering to the principles of the Declaration of Helsinki. The study received approval from the University's Ethics Committee (IRB Trial No. H2023/472) on May 10, 2023. The reporting followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines [13]. All participants provided informed consent by voluntarily completing questionnaires and participating in interviews.

**Participants**

Adults aged 18 and over with primary CRS scheduled for ESS were invited to join the study. Primary CRS was identified according to the standards outlined in the 2020 European Position Paper on Rhinosinusitis and Nasal Polyps [1]. Patients who opted for ESS following unsuccessful medical treatment were included, while those with underlying conditions other than asthma or allergic rhinitis (AR) were excluded. This patient cohort was followed until three months post-ESS. The surgeries in this study were either limited ESS or Fullhouse ESS. Postoperative care included 250 mL isotonic nasal saline irrigation, daily mometasone furoate 200 μg spray for Type 2 CRS, and a two-week course of oral antibiotics.

**Evaluations**

Patients completed questionnaires for the EQ-5D-5L, Visual Analog Scale (VAS), and the Vietnamese version of the 22-item Sino-Nasal Outcome Test (SNOT-22) during the preoperative visit. Collected demographic data included age, sex, education level, employment status, presence of comorbid conditions like AR or asthma, duration of CRS, previous ESS history, disease status, and CRS phenotypes.

The Lund-Mackay CT score [14], the Kennedy Osteitis Score [15], and the modified Lund-Kennedy endoscopic score (MLKES) [16] were assessed by well-trained physicians. The SG and TTO assessments were conducted through in-person interviews. Follow-up evaluations for EQ-5D-5L, VAS, SF-6D, SNOT-22, MLKES, and the Modified Lund-Mackay Endoscopic Score (MLMES) [17] were performed for three months post-ESS.

**HUS Instruments**

The Vietnamese version of the EQ-5D-5L questionnaire (authorized by the EuroQol Group, tracking number 68631) includes five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Patients rated their health in each dimension on a five-point scale, ranging from 1 (no limitations) to 5 (most severe limitations/problems). This EQ-5D-5L allows for 3,125 unique health states, which can be converted into health utility scores (HUS) using the Vietnamese value set developed by Mai et al. [18].

The Visual Analog Scale (VAS), a component of the EQ-5D-5L, asked patients to assess their state of health by marking a point on a scale from 0 (worst health imaginable) to 100 (perfect health). This scale reflected patients' perception of their current health status and could be converted to a health utility score (HUS) ranging from 0 to 1.00.

The 36-item Short Form Health Survey questionnaire (SF-36) is a widely used, well-studied, self-reported tool for evaluating health-related QoL [19]. SF-36 assesses eight dimensions: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health. The SF-6D generates a single index value for economic evaluations or calculating quality-adjusted life years (QALYs). It is derived from seven of the eight health domains of the SF-36, excluding the general health domain, with the role physical and role emotional

domains merged into a single domain.

**Data processing and analysis:**

Demographic data were presented as numbers (%), mean ± standard deviation (SD), or median (interquartile range, IQR), as applicable. HUS and clinical scores were shown as mean ± SD. Differences in scores across time points were expressed with mean and 95% confidence intervals (95% CI). We used a paired T-test or Wilcoxon signed rank sum test to compare scores across time points. The correlation between clinical-related scores and HUS from each method was examined using Spearman's rank correlation analysis. Statistical significance was defined as a p-value <0.05 for all tests. All analyses used Stata version 18 (College Station, TX: StataCorp LLC).

The sample size calculation was based on the study by Sangubol et al. [11], which reported a preoperative HUS of 0.75 (95% CI: 0.70, 0.80) that improved by 0.22 (95% CI: 0.15, 0.28) following ESS. An alpha level of 0.05 and a power of 0.8 were selected. To account for incomplete data and potential loss to follow-up, a 20% adjustment was applied, resulting in a required sample of 56 patients for this study.

## 3. Results

Sixty patients were enrolled in the study, with 57 ultimately included in the final analysis. Three patients with incomplete data were removed from the study. Of the participants, 40 (70.2%) reported no comorbid conditions. Additionally, 11 patients (19.3%) had AR, and 6 (10.5%) had asthma. No serious or long-term complications, such as orbital injuries, skull base injuries, or internal carotid artery injuries, were reported post-surgery. Minor short-term complications, including postoperative bleeding and pain, were resolved by the three-month follow-up. All demographic details are presented in Table 1.

**Table 1.** Demographic and clinical characteristics at baseline

| Characteristics (N = 57) | Results |
|---|---|
| Age (year), mean (SD) | 45.4 (15.7) |
| Male, n (%) | 36 (63.2) |
| Education, n (%) | |
| Undergraduate | 30 (52.6) |
| Bachelor's degree | 24 (42.1) |
| Postgraduate degree | 3 (5.3) |
| Comorbid, n (%) | |
| None | 40 (70.2) |
| Allergic rhinitis | 11 (19.3) |
| Asthma | 6 (10.5) |
| Disease duration (year), mean (SD) | 6 (3.2) |
| Type of ESS, n (%) | |
| Limited | 17 (29.8) |
| Full-House | 35 (61.4) |
| Extended | 5 (8.8) |
| Previous sinus surgery (time), n (%) | |
| None | 43 (75.4) |
| 1 | 7 (12.3) |
| 2 | 5 (8.8) |
| 3 | 2 (3.5) |
| Disease status, n (%) | |
| First diagnosis | 23 (40.4) |
| Exacerbation | 34 (59.6) |
| CRS phenotypes, n (%) | |
| CRSsNP | 19 (33.3) |
| CRSwNP | 38 (66.7) |

Abbreviation: SD, standard deviation; ESS, endoscopic sinus surgery; CRS, chronic rhinosinusitis; CRSsNP, chronic rhinosinusitis without nasal polyps; CRSwNP, chronic rhinosinusitis with nasal polyps.

### Clinical-Related Scores

The preoperative SNOT-22 score averaged 44.95 ± 22.51, with significant improvements postoperatively to 15.52 ± 14.9 at three months. The CT and Kennedy Osteitis scores were 12.91 ± 5.73 and 11.22 ± 9.54, respectively. The preoperative MLKES was 6.2 ± 3.1, significantly decreasing to 4.2 ± 3.1 at three months post-surgery. The postoperative MLMES scores were 13.11 ± 15.72 at three months.

**Table 2.** Changes in outcomes from baseline to three months

| | Baseline | 3 months Postoperative | Difference, 3 months-Baseline |
|---|---|---|---|
| Clinical-Related Scores | Mean ± SD, 95% CI | | |
| SNOT-22 (0-110) | 44.95 ± 22.51 | 15.54 ± 14.9 | **-29.41 (-35.17, -23.65)** |
| CT score (LM, 0-24) | 12.91 ± 5.73 | NA | NA |
| KOS (0-20) | 11.22 ± 9.54 | NA | NA |
| MLKES (0-12) | 6.23 ± 3.18 | 4.21 ± 3.12 | **-2.02 (-3.57, -0.47)** |
| MLMES (0-100) | NA | 13.11 ± 15.72 | NA |
| HUS | | | |
| EQ-5D-5L | 0.77 ± 0.16 | 0.94 ± 0.09 | **0.14 (0.11, 0.17)** |
| VAS | 0.67 ± 0.27 | 0.89 ± 0.08 | **0.22 (0.19, 0.25)** |
| SF-6D | 0.71 ± 0.21 | 0.92 ± 0.06 | **0.21 (0.17, 0.25)** |

Numbers in bold signify statistical significance ($p < 0.05$).

Abbreviation: SD, standard deviation; SNOT-22, 22-item sinonasal outcome test; LM, Lund-Mackay CT score; MLKES, modified Lund-Kennedy endoscopic score; MLMES; modified Lund-Mackay endoscopic score; HUS, health utility score; EQ-5D-5L, EuroQol group questionnaire-5 dimensions-5 levels; VAS, EuroQol visual analog scale; SF-6D, Short Form Health Survey-6-Dimension.

### Health Utility Scores

The initial HUS assessed by EQ-5D-5L, VAS, and SF-6D scores were 0.77, 0.67, and 0.71, respectively. Three months after surgery, the postoperative HUS scores showed a notable improvement, reaching 0.94, 0.89, and 0.92, respectively. The overall improvement in HUS scores ranged from 0.14 to 0.22 after the operation. Detailed results are provided in Table 2. Post-hoc analyses revealed no significant differences in HUS scores at any time point based on the presence or absence of polyps, prior ESS, the extent of ESS (limited, full-house, extended ESS), or comorbidities.

The baseline HUS scores across the three methods revealed that VAS produced significantly lower values than the other two ($p < 0.05$). Similarly, the HUS scores derived from VAS at three months post-ESS remained significantly lower than those obtained through the different methods (all pairwise comparisons, $p < 0.05$).

**Table 3.** Correlation of health utility scores by each method and SNOT-22

| | Spearman's rank correlation coefficient | | |
|---|---|---|---|
| Change from Baseline | EQ-5D-5L | VAS | SF-6D |
| VAS | **0.59** | | |
| SF-6D | **0.45** | **0.47** | |
| SNOT-22 | **-0.60** | **-0.57** | **-0.56** |

Numbers in bold signify statistical significance ($p < 0.05$).

Abbreviation: EQ-5D-5L, EuroQol group questionnaire-5 dimensions-5 levels; VAS, EuroQol visual analog scale; SF-6D, Short Form Health Survey-6-Dimension; SNOT-22, 22-item sinonasal outcome test.

**Correlations**

The SNOT-22 showed significant correlations with HUS across all methods (all $p < 0.05$). SNOT-22 demonstrated moderate correlations with all three methods. Notably, changes in SNOT-22 scores significantly correlated with changes in HUS from baseline across all methods (all $p < 0.05$). Detailed multiple pairwise correlations between SNOT-22 and various HUS methods are presented in Table 3.

**4. Discussion**

Before undergoing ESS, Vietnamese patients had a lower baseline HUS compared to Western studies, except when measured using the SF-6D method. Following ESS, HUS values significantly improved across all measurement methods, highlighting the effectiveness of ESS in patients with CRS. This result aligns with findings from previous studies [7], [11].

The EQ-5D-5L is a commonly utilized tool for assessing quality of life (QoL). Although baseline EQ-5D-5L in our cohort (0.77) was less than the scores reported in previous studies, the postoperative HUS rose to 0.94, surpassing the 0.89 reported in U.S. patients [5]. The clinical benefits of ESS were evident through significant reductions in SNOT-22 score. These improvements were reflected in the notable HUS increases of 0.14 at three months post-ESS. The reason for the more significant HUS improvement observed in this study compared to the 0.08 increase reported in the previous research requires further investigation. After ESS, most patients can resume their regular routines, with only a few follow-up visits needed, and they can conveniently obtain medications at local primary care facilities.

The HUS measured by VAS was 0.67, lower than the 0.73 reported in a U.S. study [5]. In practice, VAS is a straightforward method using a 0–100 scale, allowing most patients to complete it without assistance. VAS consistently recorded the lowest HUS points of all time points among the three methods. This trend, where VAS scores are lower than EQ-5D-5L, aligns with findings from previous CRS studies. Similarly, Ference et al. reported the lowest HUS using VAS compared to SG, TTO, and SF-6D [4]. A comparable pattern has also been observed in other conditions, such as head and neck cancer and peritoneal dialysis. At three post-ESS, while the HUS score by EQ-5D-5L approached greater conditions, VAS scores remained slightly lower at 0.89. This discrepancy suggests the presence of an unidentified QoL disturbance that can only be detected using the VAS method.

The correlation between SNOT-22 and HUS was consistent with findings from Western studies. A reduction in SNOT-22

scores was associated with a corresponding increase in HUS, as observed in other studies [11, 20-22]. However, the correlation between LMKES and HUS was generally weak, with changes in LMKES showing no association with changes in HUS across any measurement method. Unlike SNOT-22, the endoscopy score was overly specific and did not adequately reflect overall QoL. Similarly, a study by Soler et al. demonstrated that the DSQoL, rather than the endoscopy score, strongly correlated with HUS [7].

The study had several limitations. First, the patient cohort was restricted to those who consented to surgery, meaning it primarily represented individuals with severe CRS who had not achieved sufficient relief from appropriate medical therapy. This may limit the generalizability of the findings. Second, the durability of disease control beyond the three-month follow-up period remains uncertain, as CRS is a chronic condition. This uncertainty also applies to the long-term assessment of HUS beyond three months. Last but not least, changes in HUS during medical treatment are possible, and the inclusion of a control group could help isolate the actual effect of ESS. However, since ESS was not performed upfront, and the cohort had already failed appropriate medical therapy without receiving new medications or interventions, it is reasonable to assume that the observed HUS changes closely reflect the true impact of ESS.

Future studies are needed to explore the underlying reasons for the lower preoperative HUS observed in this study compared to Western reports and the factors that influence HUS, specifically in Vietnamese patients.

## Conclusion

The baseline HUS of our patients was generally lower than that reported in Western studies, except when assessed using the SF-6D method. Factors such as lower socioeconomic status, challenges in accessing healthcare, or other indirect costs may account for these lower preoperative scores. Following ESS, HUS significantly improved at three months. The SNOT-22 consistently correlated strongly with HUS, regardless of the method used.

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