RESEARCH ARTICLE

Assessment of cost of illness and quality of life in chronic rhinosinusitis patients with surgical treatment

LuyenDinh Pham,[1] Trung Quang Vo,[2] HoanBich Nguyen,[3] An Thanh Pham,[4] Nga ThiKieu Dang,[5] Thuy Tran Chung Phan[6]

Abstract

Objective: Chronic rhinosinusitis (CRS) is a popular and tiring disease with significant impacts on the economy and on the Health-related Quality of Life (HRQOL) of patients. This study aims to estimate the cost of illness (COI) and to assess the Health-related Quality of Life (HRQOL) in patients with CRS who underwent surgery in Vietnam and to analyse the relationship between socio-demographic characteristics and the COI as well as the HRQOL.

Methods: A cross-sectional study was conducted in Ear, Nose, Throat Hospital in Ho Chi Minh City (ENT Hospital HCMC), Vietnam between August and October 2018. The direct medical and non-medical costs, the indirect costs (productivity loss), and the HRQOL of patients with CRS were measured. A subjective assessment of quality of life (QOL) using EuroQol 5 Dimensions 5 Levels (EQ-5D-5L) was used to evaluate the health status of these patients after surgery. Characteristics related with the COI and the HRQOL were identified by multiple regression.

Results: A total of 264 inpatients with CRS participated in the study. The mean COI for inpatients with CRS was $812.83 and direct costs accounted for a major proportion (89.32%) of the total cost. In addition, the surgery represented the most significant direct medical cost with 58.57% of the total cost. Most of the patients reported no problems with mobility (89.1%), self-care (93.9%), usual activities (77.2%), and anxiety/depression (64.0%). The mean EQ-5D-5L utility score was 0.76 (SD = 0.17), and the mean Visual Analogue Scale (EQ-VAS) score was 76.57 (SD = 13.34). The results of multiple regression showed that gender, occupations, monthly income, prior surgery and family history of CRS affected the total cost while the HRQOL of patients were related to education, smoking behaviour, exercise behaviour and family history of CRS.

Conclusion: This study showed that although endoscopic sinus surgery (ESS) accounted for the largest expense in the COI, this surgical treatment helped to improve the HRQOL in patients with CRS. The findings provided a reference for policy makers in CRS management as well as for adjustment of costs for patients so as to reduce disease burden and to enhance their QOL.

Keywords: Chronic rhinosinusitis, Cost of illness, EQ-5D-5L, Health-related Quality of Life, Vietnam. (JPMA 69: S-10 (Suppl. 2); 2019)

Introduction

Rhinosinusitis is considered one of the most prominent health concerns around the world. The European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS) has defined rhinosinusitis (including nasal polyps) as an inflammation of the nose and the paranasal sinuses which was described by two main symptoms including nasal blockage and nasal discharge over 12 weeks. Chronic rhinosinusitis (CRS) is discriminated from acute rhinosinusitis (ARS) by the persistence of symptoms for at least 12 weeks, without resolution. CRS affects approximately 5% of the population around the world.[1] In 1996, a National Health Interview Survey found that CRS influenced 12.5% of the United States (US) population, or 31 million patients, each year.[2,3] According to the result of a European postal survey, the general proportion of patients with CRS was 10.9% among 57,128 adults in 12 countries and ranged from 6.9% to 27.1% in 19 centres.[4] CRS is also known as one of the most popular upper airways diseases throughout Asia. Based on symptoms and positive endoscopic findings in two Korean nationwide surveys, the prevalence of CRS was estimated as 6.95%[5] and 8.4%.[6]

According to the results of nasal endoscopy, CRS has been divided into two types, CRS with nasal polyposis (CRSwNP) and without polyps (CRSsNP).[7] The most common causes that lead to CRS were allergic and non-allergic rhinitis and occasionally anatomic factors, such as a deviated nasal septum.[7,8] Patients with CRS were treated by antibiotics, corticosteroids, and nasal saline irrigation in order to reduce the inflammation and to boost the clearance of the paranasal sinuses. Also, the most important therapy is the treatment of underlying

[1,4,5]Department of Pharmacy Administration, Faculty of Pharmacy, University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam, [2]Department of Economic and Administrative Pharmacy, Pham Ngoc Thach University of Medicine, [3,6]Ear-Nose-Throat Hospital, Ho Chi Minh City, Vietnam.
Correspondence: Trung Quang Vo. Email: trungvq@pnt.edu.vn

disease processes, such as environmental allergies. However, when this treatment is not effective for patients, finally endoscopy sinus surgery is required to improve the control of CRS symptoms and the quality of life (QOL).

Symptoms of CRS have been determined to have negative effects on the quality of life of patients as well as on the cost of treatment. Several studies have calculated the overall direct cost of CRS, and a study in 2016 adjusted estimates appear to between $10 and 13 billion annually in the US.[9] Meanwhile, the indirect cost of CRS is estimated to be over $20 billion per year. Even though not all patients with CRS need surgery, it is true that endoscopic sinus surgery (ESS) can bring numerous benefits to patients with refractory CRS. Therefore, it is essential to identify the cost of ESS to guide economic evaluations.

The overall cost of ESS is different among countries worldwide. The cost of ESS in the Canadian healthcare system ($3,500 per case) is lower than half of the cost in the US ($8,00 per case). The results of studies in the Taiwan and India depicted that the overall procedural cost of ESS was $1,800, and $1,000 in 2014, respectively.[10] Numerous studies around the world have analyzed the effects of this disease on the social economy. In 1999, Ray et al. used the 1987 Medical Expenditure Panel Survey (MEPS) database to analyse the direct costs of sinus disease. They suggested that the financial burden of sinus disease was nearly $5.6 billion per year.[11] In 2007, Bhattacharyya identify the incremental health care use and expense associated with CRS in the US by MEPS.[12] The study performed a dramatic increase in the expense for the health care of CRS patients from 1996 by approximately $8.6 billion per year. According to a recent systematic review that evaluated the available literature about the COI of CRS, Smith et al. (2015) concluded that the overall cost of CRS was $22 billion in US society.[10]

QOL is increasingly used to evaluate treatment effectiveness. The World Health Organization (WHO) has provided a definition of the QOL as a perception of individuals about their position in the background of the culture and the tradition in which they live. Moreover, it incorporates the physical state, mental condition, level of independence, social relationships, personal beliefs of a person, as well as the relationship between humans and the environment in a complicated way. EuroQol 5 Dimensions 5 Levels (EQ-5D-5L) has been widely used to assess the Health-related Quality of Life (HRQOL) of CRS patients. This questionnaire describes the health status of respondents on five dimensions, including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, and there are five levels of response: no problem, slight problems, moderate problems, severe problems, and extreme problems. Additionally, a visual analogue scale (EQ-VAS) is another part of EQ-5D-5L, which can be used by patients to evaluate their health themselves by using a range of score between 0 (the worst health you can imagine) and 100 (the best health you can imagine). Results from the questionnaire not only analyse the patients' HRQOL but also translate into health utility scores.

A study by Remenschneider et al. (2014) described the role and applicability of the EQ-5D-5L questionnaire for the assessment of the general HRQOL in patients with CRS.[13] Furthermore, in order to determine the different impacts of CRS symptoms on the general QOL in patients, a study in the US (2015) used responses to three questionnaires, including the Sino-nasal Outcome Test (SNOT -22), the EQ-5D, and the EQ-5D- VAS.[14]

The purpose of this study was two-fold. Firstly, we analyzed the economic impact of surgical treatment on patients with CRS in Ear, Nose, Throat Hospital in Ho Chi Minh City (ENT Hospital HCMC), Vietnam, by estimating the cost of illness. Secondly, we evaluated the QOL of these patients using the EQ-5D-5L questionnaire. By defining accurate costs, physicians may enhance the value of treatment by appropriately utilizing health care resources for the correct patient within an optimal time. In addition, the outcome of this study can inform patients before they consent to an operation.

Patients and Methods

Ethical approval was obtained from ENT Hospital HCMC and University of Medicine and Pharmacy at Ho Chi Minh City. Written informed consent was acquired from inpatients and their caregivers who were involved in the study, before the specimen collection and the questionnaire survey began. In the beginning, participants were informed that they could withdraw their consent at any moment during the study and that this would not influence to their care in the hospital. Additionally, all participants were managed appropriately following the guidelines applied at ENT Hospital HCMC.

ENT Hospital HCMC is a primary specialty hospital with a total of 150 inpatient beds. This hospital performs medical examinations, treatments and reception, and it handles all emergency cases related to ear, nose and throat. It is also the place to intern for medical schools such as University of Medicine and Pharmacy at Ho Chi Minh City and Pham Ngoc Thach University of Medicine.[15] According to the data at the hospital, the total number of CRS inpatients who underwent surgery was estimated at between 1,500 and 1,700 people in the three years from 2015 to 2017.

We carried out a cross-sectional study enrolling inpatients with CRS after they underwent the endoscopic sinus surgery (ESS) at ENT Hospital HCMC, Vietnam, between August and October 2018. The study assessed two aspects, the cost of illness (COI) and the Heath-related Quality of Life (HRQOL). The scope of COI can cover the incidence or prevalence of the disease, and financial issues, including direct and indirect costs that result from premature death, disability, or injury due to the corresponding disease. The goal of a COI study to explore and calculate all the costs of a particular disease. The output provides the total burden of a specific disease in countries around the world. The cost of illness estimates follow the sum-all costs and the prevalence-based approach from a societal perspective in Vietnam. We also used the HRQOL to evaluate the health status of patients with CRS after sinus surgery at ENT Hospital HCMC.

This study collected resource data from ENT Hospital HCMC and estimated direct medical costs based on the primary resource. The data were taken from the patients' medical records, which were located in the hospital's electronic database. We also determined the costs that patients and their families had to pay during the time at hospitalization and analysed their HRQOL after surgery. The data from patients with CRS after surgery and their caregivers (if any), including socio-demographic characteristics on direct costs and indirect costs before registering ENT Hospital HCMC and after discharge, and direct nonmedical costs and indirect cost at this hospital, were collected by using a structured questionnaire. The social characteristics of patients were gender, age, living area, marital status, educational level, occupations, monthly income, CRS duration, prior surgery, smoking behaviour, exercise behaviour, and family history of CRS. The occupations and monthly income of the caregivers were also reported. We asked patients about indirect costs based on the number of lost working days and about direct medical costs besides the costs of the course of treatment at ENT Hospital HCMC, namely, direct non-medical costs, including the costs of food, transportation (except ambulances), accommodation, and hiring carriers. Similarly, we asked about the indirect costs of patients for treatment at the hospital and direct non-medical costs.

In addition, six questions from the EQ-5D-5L questionnaire were used to evaluate the QOL of patients on the day of the assessment. The Vietnamese version of the EQ-5D-5L was validated and used in a study.[16] The results of all questions were converted to utility scores, between 0 (death) and 1.0 (perfect health). Moreover, values less than zero represented states worse than death.

Face-to-face interviews were conducted by trained undergraduate students from the Faculty of Pharmacy at University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam. The interviewer collected personal information about patients and their caregivers, direct costs, and indirect costs. Subsequently, we interviewed these patients again seven days after discharge. The interviewer collected information on the costs if patients received a follow-up examination.

The sample consisted of inpatients at ENT Hospital HCMC who underwent endoscopic sinus surgery for CRS. To evaluate the representativeness of the study population, individuals with CRS were identified with the disease diagnosis code J32 in the 10threvision of the International statistical classification of diseases and related health problems (ICD-10 code).[17] This study included patients who met the following two criteria: inpatients who had been assigned an ICD-10 code of J32 and had received surgical treatment for CRS. The information came from medical records of patients in the hospital's electronic database. Patients who were foreigners and those who could not communicate in Vietnamese due to physical or mental handicaps were taken off the study. We also excluded patients who declined participation in the study or refused treatment at ENT Hospital HCMC or transferred to other healthcare facilities.

The cost categories included two parts which were direct costs and indirect costs. Direct costs comprised direct medical costs and direct non-medical costs. For specifically evaluating CRS, direct medical costs tended to be in several domains of resource consumption, such as diagnostic tests, physician visits, prescribed medical therapy, surgery, and hospitalizations. We summarized medical resources from the data at ENT Hospital HCMC and then undertook the total direct medical cost.

In contrast, direct non-medical costs were directly related with the treatment but were not medical in nature. These were estimated by adding the cost of meals, transportation (except ambulances), accommodation, and informal care service for patients and their family members. Indirect costs were lost resources which are commonly considered as "productivity costs" since they result from lost work in two forms including absenteeism from one's job (missed work) and presenteeism (reduced productivity while at work).[9] To estimate the indirect costs, we recorded the total number of days off for routine medical visits based upon information provided by patients and their caregivers, and we multiplied this by the daily income. Regarding daily income, we asked

participants to report the amount of money they earned from employment monthly, and then the average daily income was calculated by dividing the monthly income by the number of days worked per month (30 days).

The QOL of CRS patients was measured using the EQ-5D-5L questionnaire. The five domains contain mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. There were five responses in a domain and each response represented a level of health state, from no problems (level 1) to extreme problems (level 5). It is advantageous to transform five levels of the response into "no problems" (level 1) and "problems" (from levels 2 to level 5). Hence, we changed the analysis the result of five levels of the response into of reported problems. Five levels of each domain can be combined with 3,125 possible health states, from 11111 (best health) to 55555 (worst health) (18). Each health state can be converted into a single utility score by an interim scoring for the EQ-5D-5L questionnaire. The utility scores are presented in country-specific value sets. In our study, we explored utility scores by using the Thailand value set, from -0.452 to 1, because of the unavailability of a Vietnamese crosswalk value set. The EQ-5D-5L questionnaires also included a VAS to measure the patient's self-reported health state on the day when the survey was completed.

Statistical Analysis

Data were collected in coded form from the questionnaire and entered into Microsoft Excel 2016 for Windows®. Subsequently, data was cleaned and imported to SPSS® (Statistical Package for the Social Sciences) 20.0 software for analysis. For the socio-demographic characteristics such as age groups, gender, and living area, categorical variables were statistic summarized by valid frequencies and percentages. All costs were measured in terms of the Vietnamese currency (dong [d]) and were presented in US dollars ($) by using the August 2018 exchange rate of $1 = 23,200 d.[19] We estimated direct medical costs direct non-medical costs, and indirect costs, according to each patient's medical diagnosis before admission, at hospitalization and after discharge.

For QOL assessments, we obtained EQ-5D-5L profiles according to age groups, and calculated utility scores and VAS scores based on all of the characteristics. The EQ-5D-5L profile was described as the frequency and the percentage of patients reporting no problem and problem in each domain. Five levels of health status in each domain of the EQ-5D-5L questionnaire along a Likert scale converting into categorical values (problems vs. no problems) has been illustrated in previous studies.[20,21] Due to the normal distribution of utility scores and VAS scores, the differences between average scores in each characteristic were tested by using t-test (for gender, living area, marital status, prior surgery, exercise behavior, and family history of CRS) and Analysis of Variance (ANOVA one way) (for age groups, education, occupations, monthly income, and smoking behavior). Furthermore, we used multiple regression analysis to explore relationships between characteristics and the total costs as well as the HRQOL. It is considered to show a statistical significance if a P-value is less than 0.05.

Results

Table-1 shows the social-demographic characteristics of inpatients with CRS at ENT Hospital HCMC.

Table-2 presents the amounts of the direct and indirect costs among patients with CRS undergoing surgery at ENT Hospital HCMC.

Table-3 illustrates the cost of illness (COI) per patient and the proportion of direct costs of CRS by social-demographic characteristics.

Table-4 shows the frequencies of reported problems for each domain by age groups.

Table-5 summarizes the mean EQ-5D utility scores and VAS scores by the different characteristics of patients.

Table-6 depicts the results of multiple regression on the factors related to the cost of treatment and the HRQOL of patients with CRS at ENT Hospital HCMC.

Discussion

CRS is an inflammatory disease of the of the nose and the nasal sinuses with the high prevalent that often influences negatively to the QOL of patients. Additionally, this disease also produces a significant financial issue on health systems around the world. In this study, we have assessed the COI and HRQOL of patients with CRS undergoing surgery using a questionnaire survey of 264 patients at ENT Hospital HCMC.

The total COI for patients with CRS was $214,587.11 and the mean cost was $812.83 per respondent. Of the total, direct costs accounted for $191,663.26 (89.32%), while indirect costs amounted to $ 22,923.85 (10.68%). Food was the most significant item of direct nonmedical costs at $ 8,156.68 and it accounted for 3.80% of the total cost (Table-2). Among direct medical costs of inpatients at ENT Hospital HCMC, surgery took the largest share with 58.77%. In contrast, Caulley et al. (2015) found that the office-based spending ($1,615 per person per year) was

Table-1: Social-demographic characteristics of patients with chronic rhinosinusitis (N=264).

Characteristics	Number (n)	Percentage (%)
Gender		
Male	121	45.8
Female	143	54.2
Age (years)		
<15	10	3.8
15-24	28	10.6
24-64	203	76.9
≥65	23	8.7
Mean (SD)*	43.3 (15.3)	Median 46.0
Living area		
Urban	176	66.7
Rural	88	33.3
Marital status		
Single	46	17.4
Married	218	82.6
Education		
Illiterate	10	3.8
Primary school	39	14.8
Secondary school	101	38.3
High school	57	21.6
Vocational training/College	22	8.3
University	21	8.0
Postgraduate education	14	5.2
Occupations		
Students	23	8.7
Farmers	34	12.9
Workers	41	15.5
Public servants	25	9.5
Businessmen	37	14.0
Housewives	44	16.7
Unemployed	6	2.3
Retired	23	8.7
Others[(a)]	31	11.7
Monthly income ($)		
< 215	58	22.0
215 - <430	85	32.2
430 - < 645	16	6.1
≥ 645	13	4.9
No response	92	34.8
Disease duration (years)		
Mean (SD)	11.2 (12.0)	Median (7.0)
Prior surgery		
No	205	77.7
Yes	59	22.3
Smoking		
No	220	83.3
Yes	20	7.6
Used to smoke	24	9.1
Exercise		
No	91	34.5
Yes	173	65.5
Family history		
No	185	70.1
Yes	79	29.9

Abbreviation: SD: Standard Deviation
Note: [(a)]: Others include accountants, mechanics and foremen.

the largest component of expenses for patients with CRS and contributed 32.4% of the total expense.[22]

Various international studies have analyzed the economic burden of CRS. In 1994, Murphy et al. described the annual expenditure for managing the CRS of patients in the US was nearly $4.3 billion (about $7.3 billion in 2018 dollars).[23] In 2011, Bhattacharyya et al. evaluated the overall direct US healthcare expenditure of patients with CRS to be approximately $8.6 billion in 2008 (about $9.9 billion in 2018 dollars).[12] By conducting a cohort study with the participation of patients with refractory CRS in the US, Rudmik et al. represented the indirect costs equally $10,077 per patient per year in 2015 (approximately $10,662 in 2018 dollars).[24] The overall cost estimated for the treatment of patients with CRS from our study was much lower than the results from the studies above. The reason was the difference in the design of our study compared with other studies, such as the overall cost of facility charges, including government payment and the payment in part by patients.

It is essential to identify the cost of ESS because ESS is a wide-used treatment for CRS patients. In addition, the overall cost of ESS was not unified in the globe because it depended on the country. A study of Friedman et al. showed the cumulative cost of ESS was estimated to be $13,574.35 per patient in 2008 ($15,622.71 in 2018 dollars).[25] In 2011, Bhattacharyya et al. undertook a claims-based study and they calculated the cost of outpatient ESS and of the post-procedure care during forty-five days (debridement and medical therapy) as a ranged of $7,554 and $7,898 (from $8,408 to $8,791 in 2018 dollars).[26] Gliklich et al. (1998) yielded the most accurate cost analyses and presented this cost between $6,490 and $7,550 (from $10,015 to $11,651 in 2018 dollars).[27] The study by Au et al. (2012) evaluated the cost of patient ESS from the perspective of the Canadian government payer using a time-driven activity-based costing (TD-ABC) model. This study identified the overall cost of ESS for the patient to be $3,510.31 ($5,125.13 in 2018 dollars).[28] Our study calculated the average cost of surgical treatment for the patient to be $477.70 and it was lower than that of other countries.

Generally, symptoms of CRS may have a significant impact on the HRQOL of patients. The EQ-5D-5L questionnaire is a general health measure tool that can be supported to use for monitoring outcomes of patients of CRS.

In 2015, Remenschneider et al. highlighted the fact that ESS led to a lower percentage of patients reporting problems in the domains of usual activities (30.6% to

Table-2: Direct and indirect costs among patients with chronic rhinosinusitis undergoing surgery (N=264).

Cost components	Cost ($)	Total	Mean	SD	Median	%
Direct Costs		191,663.26	726.00	333.15	726.98	89.32
Direct medical costs		168,283.01	637.44	320.20	636.46	78.42
	Before admission	17,160.09	65.00	129.11	6.47	8.00
	At hospitalization	144,705.16	548.13	286.56	562.92	67.43
	Physician visits	32.81	0.12	0.40	0.00	0.02
	Diagnostic test	4,531.48	17.16	12.05	21.82	2.10
	Prescribed medical therapy	3,263.65	12.36	5.56	11.45	1.52
	Surgery	126,112.41	477.70	275.42	491.38	58.77
	Medical supplies	321.89	1.22	3.57	0.77	0.15
	Hospitalization	2,909.77	11.02	22.57	0.00	1.36
	Other costs[a]	7,533.15	28.53	23.61	26.29	3.51
	After discharge	6,417.76	24.31	33.93	8.62	2.99
	Direct non-medical costs	23,380.25	88.56	44.25	86.01	10.90
	Before admission	2,407.57	9.12	13.74	4.42	1.12
	At hospitalization					
	Food	8,156.68	30.90	19.66	25.86	3.80
	Transportation	3,941.75	14.93	14.55	9.66	1.84
	Carrier fees	4,949.14	18.75	15.60	20.69	2.31
	After discharge	3,925.11	14.87	14.27	10.34	1.83
Indirect costs		22,923.85	86.83	68.35	86.21	10.68
	Before admission	1,745.69	6.61	13.87	0.00	0.81
	At hospitalization	19,220.55	72.81	61.30	64.66	8.96
	After discharge	1,957.61	7.42	9.22	3.59	0.91
Total Costs		214,587.11	812.83	343.03	793.06	100.00

Abbreviation: SD: Standard Deviation
Note: [a]: Other costs include high technical services, ambulance fees and so on.

Table-4: Profile of EQ-5D-5L by age groups (N=264).

Domains	<15		15-24		25-64		≥65		Total	
	n	%	n	%	n	%	n	%	n	%
Mobility										
No problems	10	100.0	22	78.6	183	90.1	20	87.0	235	89.1
Problems	0	0.0	6	21.4	20	9.9	3	13.0	29	10.9
Self-care										
No problems	10	100.0	28	100.0	187	92.1	23	100.0	248	93.9
Problems	0	0.0	0	0.0	16	7.9	0	0.0	16	6.1
Usual activity										
No problems	10	100.0	22	78.6	149	73.4	23	100.0	204	77.2
Problems	0	0.0	6	21.4	54	26.6	0	0.0	60	22.8
Pain/Discomfort										
No problems	4	40.0	7	25.0	64	31.5	17	73.9	92	34.8
Problems	6	60.0	21	75.0	139	68.5	6	26.1	172	65.2
Anxiety/Depression										
No problems	10	100.0	16	57.1	129	63.5	14	60.9	169	64.0
Problems	0	0.0	12	42.9	74	36.5	9	39.1	95	36.0

19.4%), pain/discomfort (74.3% to 43.4%), and anxiety/depression (48.6% to 31.4%). Meanwhile, only a small minority of CRS patients reported problems with mobility and self-care (9% and 1%, in turn), and this distribution did not change after ESS.[13] Compared to that study, our findings depicted the majority of patients with CRS at ENT Hospital HCMC reporting no problems in the four domains of mobility (89.1%), self-care (93.9%), usual

Table-3: Cost of illness (COI) and proportion of direct costs in chronic rhinosinusitis by patient characteristics (N=264).

Characteristics	COI per patient ($)	Proportion of direct cost (%)
Gender		
Male	886.75	90.0
Female	750.29	88.6
Age (years)		
< 15	1,101.11	92.7
15 - 24	851.09	93.1
25 - 64	805.79	88.6
≥ 65	703.10	88.7
Living area		
Urban	793.32	89.1
Rural	851.86	89.7
Marital status		
Single	897.67	92.6
Married	794.93	88.5
Education		
Illiterate	628.87	85.0
Primary school	818.19	93.3
Secondary school	777.59	88.4
High school	893.16	89.6
Vocational training/ College	754.62	91.3
University	887.76	86.6
Postgraduate education	835.57	87.2
Occupations		
Students	1,127.89	93.4
Famers	675.22	88.7
Workers	749.23	89.0
Public servants	898.36	86.7
Businessmen	969.14	89.0
Housewives	685.35	91.9
Unemployed	608.61	90.3
Retired	817.89	92.1
Others[(a)]	775.29	83.1
Monthly income (USD)		
< 215	634.11	91.1
215 - <430	882.02	87.1
430 - < 645	727.97	76.1
≥ 645	1155.67	80.7
No response	827.90	94.3
Prior surgery		
No	862.65	90.4
Yes	639.74	84.2
Smoking		
No	790.36	88.9
Yes	823.50	92.6
Used to smoke	1,009.89	90.4
Exercise		
No	785.11	90.0
Yes	827.41	89.0
Family history		
No	785.03	87.9
Yes	877.94	92.3

Note: [(a)]: Others include accountants, mechanics and foremen.

activities (77.2%) and anxiety/depression (64.0%) (Table-4). By contrast, a majority of patients reported that they had problems in the pain/discomfort domain (65.2%). The higher frequencies of reporting problems in the pain/discomfort and anxiety/depression domains than in other domains can be explained by the negative effect of CRS and of the surgery on patients.

Overall, the mean EQ-5D utility score and EQ- VAS score were 0.76 (SD = 0.17) and 76.57 (SD = 13.49), respectively (Table-5). These results were consistent with the utility scores of different patients with CRS from a recent study by Bewick et al. In 2017, they reported that the mean utility score of patients from UK centers was 0.75.[29]

Moreover, our scores were lower than the utility score for the general Vietnamese population (0.91) in the Nguyen et al. study.[30] In addition, Hoehle et al. (2016) carried out a prospective cross-sectional study of 131 US adult patients. They showed that the mean HUV was 0.86 (SD = 0.14),[14] which was higher than our finding. Meanwhile, their mean EQ-VAS score was 73.7 (SD = 19.2)[14] not much lower than our result. The difference occurred because of the difference in cultural and social distinctions as well as the cross-walk value set used among different countries. The major reason was the use of the cross-walk value from Thailand instead of from Vietnam because the value set for the Vietnamese population was not available at the time we were conducting this study. Therefore, further studies should use a direct value set of Vietnamese preferences in order to evaluate the HRQOL of Vietnamese people accurately.

Our study demonstrated high utility scores, high VAS scores, and high frequencies of patients with no problems in their daily life after surgery. This related to the good QOL of patients because of the significant improvement in patients with CRS who underwent ESS.

The results of the multiple regression showed that gender (P=0.04), occupations (P=0.02), and prior surgery of CRS (P<0.01) were negatively associated with the total cost. Meanwhile, the total cost was found to increase positively with among monthly income (P=0.03) and family history of CRS (P=0.04) (Table-6). The most significant factors affecting the HRQOL of patients with CRS were smoking behaviour (P<0.01), followed by a family history of CRS (P<0.01), while education (P=0.02) and exercise behaviour (P=0.01) had the least effect on HRQOL.

This study has several limitations. Firstly, we performed a cross-sectional study in one ENT hospital during a short period of time and the sample was small. Thus, results cannot be generalized to the whole CRS patient

Table-5: EQ-5D-5L utility scores and EQ-VAS scores by characteristics (N=264).

Characteristics	EQ-5D-5L utility scores			EQ-VAS scores		
	Mean	SD	P - value	Mean	SD	P - value
Gender						
Male	0.80	0.16	<0.01	78	14	0.04
Female	0.73	0.17		75	13	
Age (years)						
<15	0.87	0.11	0.02	79	7	0.34
15 - 24	0.76	0.17		79	10	
25 -64	0.75	0.17		76	14	
≥ 65	0.83	0.17		73	18	
Living area						
Urban	0.76	0.16	0.70	77	13	0.48
Rural	0.75	0.18		76	15	
Marital status						
Single	0.77	0.16	0.75	77	11	0.67
Married	0.76	0.17		76	14	
Education						
Illiterate	0.86	0.23	<0.01	77	18	<0.01
Primary school	0.74	0.20		69	12	
Secondary school	0.78	0.15		77	14	
High school	0.78	0.17		83	13	
Vocational training/ College	0.65	0.13		73	8	
University and more	0.67	0.12		76	12	
Postgraduate education	0.82	0.12		76	4	
Occupations						
Students	0.82	0.15	<0.01	81	9	<0.01
Famers	0.71	0.16		74	14	
Workers	0.77	0.14		85	8	
Public servants	0.73	0.14		79	11	
Businessmen	0.79	0.18		81	16	
Housewives	0.76	0.18		70	14	
Unemployed	0.86	0.15		73	3	
Retired	0.85	0.16		73	16	
Others[(a)]	0.65	0.16		71	11	
Monthly income (USD)						
< 215	0.73	0.16	0.39	78	14	<0.01
215 - <430	0.76	0.14		79	10	
430 - < 645	0.80	0.19		83	9	
≥ 645	0.73	0.22		83	19	
No	0.78	0.18		71	14	
Prior surgery						
No	0.77	0.17	0.11	76	13	0.49
Yes	0.73	0.17		78	16	
Smoking						
No	0.73	0.16	<0.01	76	13	0.12
Yes	0.91	0.14		76	14	
Prior	0.89	0.13		82	13	
Exercise						
No	0.72	0.15	<0.01	75	12	0.13
Yes	0.78	0.17		77	14	
Family history						
No	0.79	0.16	<0.01	79	13	<0.01
Yes	0.69	0.17		72	14	
Overall	0.76	0.17		76.57	13.49	

Note: [(a)]: Others include accountants, mechanics and foremen.

Table-6: Multiple regression models for cost of illness and quality of life in patients with chronic rhinosinusitis.

Variables	Total cost		Quality of life	
	β	P- value	β	P -value
Gender	-0.14	0.04	-0.07	0.28
Living area	0.01	0.97	-0.10	0.09
Marital status	0.07	0.31	-0.01	0.93
Education	0.10	0.12	-0.14	0.02
Occupations	-0.15	0.02	-0.12	0.05
Monthly income	0.14	0.03	0.07	0.24
Prior surgery	-0.27	<0.01	-0.10	0.09
Smoking	0.10	0.13	0.33	<0.01
Exercise	0.06	0.29	0.16	0.01
Family history	0.12	0.04	-0.24	<0.01

population in Vietnam. Secondly, participants might have come from varied areas and used different health service before entering to the hospital. Thirdly, we based the direct costs before admission and after discharge from ENT Hospital HCMC on patients' opinions. Their opinions may have been incorrect. Lastly, the direct medical costs at ENT hospital HCMC were estimated using a source of unit cost reference that may lead to bias.

As the Vietnamese EQ-5D-5L aimed to assess the HRQOL of the general population possible, we did not use specific instruments validated for patients with CRS. Further researches related to CRS should be recommended to use disease-specific instruments. Additionally, our study contributes important observations that will be useful for the economic evaluation of health services and a better understanding of the burden of CRS across different countries. In spite of the limitations of studies on the COI and QOL, the governments of many countries continue to encourage researchers to perform them. The reason is that policy-makers concern with information about the economic impact of diseases to be a helpful input for a treatment programme in the future.

Conclusion

Our study presents information about the burden of disease in patients with CRS and their HRQOL after ESS at ENT Hospital HCMC, Vietnam. Investigation of the COI showed that surgical treatment was the largest expense. Moreover, this present study confirms previous findings and contributes additional evidences that suggest ESS can enhance the HRQOL of patients with CRS. Because chronic patients incur many kinds of cost in healthcare systems, the definition of the long-term cost of treatment for patients with CRS should be considered in future researches. Also, this may possibly identify patients who are at high risk of incurring high costs in the future. Policy-makers need to understand and should notice the design, the implementation, and the evaluation of support programmes for patients with CRS and for their families, especially in the field of financial evaluation of treatments. This solution is not only to reduce the burden of disease but also to improve the HRQOL of patients.

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