ORIGINAL ARTICLE

https://doi.org/10.5125/jkaoms.2021.47.1.25
pISSN 2234-7550 · eISSN 2234-5930

Length of hospital stay among oral and maxillofacial patients: a retrospective study

Fo Yew Tan[1], Kalpana Selvaraju[1], Harshinie Audimulam[1], Zhi Chuan Yong[1], Tassha Hilda Adnan[2], Sathesh Balasundram[1]

[1]*Department of Oral and Maxillofacial Surgery, Hospital Sultanah Nora Ismail, Batu Pahat,*
[2]*Sector for Biostatistics & Data Repository, National Institutes of Health, Shah Alam, Malaysia*

Abstract (J Korean Assoc Oral Maxillofac Surg 2021;47:25-33)

Objectives: Many conditions of the oral and maxillofacial region require hospitalization and in-patient care. The average length of stay (LOS) of these patients varies and is usually affected by multiple confounding variables. However, even with an increasing number of hospital admissions, published evidence on the factors that affect the LOS of oral and maxillofacial patients is lacking. Therefore, this study assessed the LOS of in-patients at the oral and maxillofacial surgery department of a government-funded, multi-specialty hospital in Malaysia, based on their reasons for admission and other factors.

Materials and Methods: Our samples were collected retrospectively over a 5-year period and included patients with maxillofacial infections, post-trauma stabilization, facial bone fracture surgery, benign and malignant lesion surgery, dentoalveolar surgery, and other maxillofacial surgeries as reasons for admission. Factors potentially affecting LOS were also recorded, and their significance was determined using multiple logistic regression analyses. A *P*-value of less than 0.05 was considered to be statistically significant.

Results: A total of 1,380 patients were included in this study. Most (84.5%) of our in-patients were of Malay ethnicity, and males outnumbered females in our sample by 502 subjects. The median LOS of our in-patients was 3 days. Sex, ethnicity, age, reason for admission, and American Society of Anesthesiology (ASA) classification were factors that significantly affected LOS.

Conclusion: The median LOS reported in this study was 3 days. LOS was significantly affected by sex, ethnicity, age, reason of admission and ASA classification.

Key words: Length of stay, Maxillofacial infections, Maxillofacial injuries, Maxillofacial surgery

[paper submitted 2020. 9. 27 / revised 1st 2020. 12. 9, 2nd 2020. 12. 19 / accepted 2020. 12. 24]

I. Introduction

The field of oral and maxillofacial surgery (OMFS) comprises the diagnosis and treatment of a wide array of diseases that affect the face, mouth, jaws, and neck[1]. Because OMFS is a surgical specialty, a significant number of its patients require hospitalization to ensure optimal care. Recent times have seen a rise in the number of admissions to hospitals. However, published evidence reporting the number of in-patients in OMFS units and their length of stay (LOS) is scarce.

The rising number of admissions leads to an increase in healthcare costs and delayed access to care for groups of people in need. Therefore, it would be beneficial to have a standardized method for evaluating the in-patient care provided by different OMFS units and optimizing the care they offer. LOS describes the number of days a patient spends in the hospital. The LOS of OMFS patients varies and can be affected by factors such as a patient's medical status, severity of the disease, and complexity of the surgical procedure done. All other factors being equal, a shorter LOS will reduce the cost incurred, and a longer LOS can be indicative of poor care, such as inefficient hospital processes, and might predispose patients to hospital-acquired infections[2]. For those reasons, the current efficiency of in-patient care in a department should be assessed to identify possible causes for delays

Fo Yew Tan
Department of Oral and Maxillofacial Surgery, Hospital Sultanah Nora Ismail, Jalan Korma, Batu Pahat 83000, Malaysia
TEL: +60-07-4363218
E-mail: tan4u07@gmail.com
ORCID: https://orcid.org/0000-0002-7956-9210

in patient discharge and optimize care without requiring a prolonged hospital stay. The LOS in hospitals has long been regarded as a valid indicator of the efficiency of care to in-patients and is commonly used to identify potential factors that affect the clinical outcomes of OMFS patients[2]. In addition to being used as a prognostic tool, LOS can act as a driving tool to encourage maxillofacial surgeons to adopt strategies that can reduce hospital stays by their patients and optimize resource utilization to improve quality of care.

In this study, we present the LOS of all in-patients managed by our OMFS unit. As a secondary referral center with 516 beds and a bed occupancy rate of 79.05%, we receive patients with various reasons for admission, mainly maxillofacial traumas and infections but also elective oral and maxillofacial surgeries. Our aim in this study is to assess the LOS of patients in our unit based on their reasons for admission and other factors that could affect their LOS. Based on a literature review, we chose factors that could influence the LOS of our patients, such as age and American Society of Anesthesiology (ASA) classification. The spread of infections is facilitated by factors such as impaired host defense and functional abnormalities of the host, as well as systemic hyperglycemia that can derange the immune system. Therefore, underlying comorbidities, which are systemically recorded using the ASA classification, are a factor predicted to influence LOS. For example, diabetic patients are at risk of responding poorly to infections and usually require a longer hospital stay than other patients to achieve adequate glycemic control[3]. The age of patients is also predicted to affect LOS because the presence of chronic disease at older ages can result in the need for longer hospital stays to recuperate[4]. Our research question is, "Is LOS affected by age, sex, ethnicity, ASA classification, or reasons for admission?" The null hypothesis of our study is "LOS is not significantly affected by age, sex, ethnicity, ASA classification, or reasons for admission."

II. Materials and Methods

This is a retrospective study over a 5-year period (January 1, 2014 to December 31, 2018) of all in-patients managed by the Oral and Maxillofacial Surgery Department at Hospital Sultanah Nora Ismail, Batu Pahat, Johor in Malaysia. Our department is located in a government-funded, multi-specialty hospital in a small town in a southern state of Malaysia and serves a population of around 468,000 people. This study was approved in writing by the Medical Research & Ethics Committee, Ministry of Health Malaysia on 25 October 2019 (No. NMRR-19-341-46407 [IIR]). Because our study is retrospective, patient consent was not required. All procedures adhered to the ethical guidelines of the Declaration of Helsinki (2013).

Inclusion criteria:

(1) Admission for conditions requiring in-patient care under the OMFS department

(2) Admission under another department but co-managed by the OMFS department

(3) Admission for elective surgery

Exclusion criteria:

(1) In-patients of other departments referred for conditions that did not necessitate in-patient care under the OMFS department (for example, dental caries, aphthous ulcer)

(2) Advanced oral cancer patients admitted for reasons other than an ablative procedure

The demographic data collected were age, sex, and ethnicity. The ASA classification of the patients was also determined. The reasons for admission were oral maxillofacial infection, post-trauma stabilization (for example, fixation of a fracture site and wound care), facial bone fracture surgery, elective admissions for surgical management of benign or malignant lesions, dentoalveolar surgery, and other maxillofacial surgery.

The primary variable in this study was the LOS, which was calculated as the number of days a patient resided in our facility from admission to discharge. For joint department management, LOS under our unit was counted from our first entry until the day the patient was discharged by our unit; the patient's subsequent stay in the charge of another department was disregarded. The secondary variables were associations between LOS and patients' age, sex, ethnicity, ASA classification, and reasons for admission. Possible confounders were diagnosis by another department, which might delay recovery, and patients' socioeconomic status, which might cause early or delayed discharge due to financial constraints.

In-patients within the study period were identified from the patient registry. The details of these patients were obtained from their clinical records and tabulated using Microsoft Excel 2007 (Microsoft, Redmond, WA, USA). Data were collected in adherence with the Data Protection Act 1998 and Caldicott.

Data analysis was done using IBM SPSS Statistics for Windows (ver. 20; IBM, Armonk, NY, USA). Continuous data are expressed as medians and interquartile ranges (IQRs) to accommodate skewed data. Categorical data are described as frequencies and percentages. Odds ratios (ORs) and their 95% confidence intervals (CIs) were calculated using logistic regressions to determine the associations between LOS and the demographic characteristics, ASA physical classifications, and reasons for admission. A *P*-value of less than 0.05 was considered to be statistically significant.

III. Results

During the 5-year study period, we included 1,380 in-patients from our public hospital. Table 1 shows a general overview of our study population. Other maxillofacial surgeries include salivary gland surgeries, paranasal sinus–related surgeries, biopsies, removal of infected plates, frenectomies, and bone recontouring and bone grafting procedures. Benign lesions for surgical intervention comprised radicular cysts, 14 cases (41.2%); ameloblastoma, 5 cases (14.7%); dentigerous cysts, 4 cases (11.8%); residual radicular cysts, 2 cases (5.9%); odontogenic keratocysts, 2 cases (5.9%); and hemangioma, 2 cases (5.9%); we had 1 case (2.9%) each of sebaceous cysts, giant cell granuloma, soft tissue ameloblastoma, calcifying cystic odontogenic tumor, and adenomatous odontogenic tumor. Malignant lesions for surgery comprise 2 cases (25.0%) of lip squamous cell carcinoma (SCC), and 1 case (12.5%) each of recurrent lip SCC, alveolar ridge SCC, recurrent alveolar ridge SCC, tongue SCC, skin SCC, and sebaceous carcinoma. The median LOS was 3 days, with an IQR of 2-4 days.

Table 2 shows the types of trauma treated at our center that required in-patient care during the study period. Most fracture cases were treated with non-surgical interventions such as closed reduction with intermaxillary fixation or conservative management.

Despite the presence of outliers and significant differences in ranges, the median LOS for all 5 years within the study period was consistently 3 days.(Fig. 1)

Facial bone fracture surgery and malignant lesion surgery had the longest median LOS of 4 days, and post-trauma sta-

Table 1. Demographic characteristics, reasons for admission, ASA classification, and length of stay (n=1,380)

Variable	n (%)
Age group	
≤20 yr	450 (32.6)
21-40 yr	468 (33.9)
41-60 yr	266 (19.3)
>60 yr	196 (14.2)
Sex	
Male	941 (68.2)
Female	439 (31.8)
Ethnicity	
Malay	1,166 (84.5)
Chinese	185 (13.4)
Indian	28 (2.0)
Other	1 (0.1)
Reason for admission	
Infection	301 (21.8)
Post-trauma stabilization	756 (54.8)
Facial bone fracture surgery	92 (6.7)
Benign lesion surgery	34 (2.5)
Malignant lesion surgery	8 (0.6)
Dentoalveolar surgery	148 (10.7)
Other maxillofacial surgery	41 (3.0)
ASA physical status classification	
ASA I	935 (67.8)
ASA II	319 (23.1)
ASA III	121 (8.8)
ASA IV	1 (0.1)
Length of stay (day)	3 [2-4]

(ASA: American Society of Anesthesiology)
Values are presented as number (%) or median [interquartile range 25th-75th percentile].
Fo Yew Tan et al: Length of hospital stay among oral and maxillofacial patients: a retrospective study. J Korean Assoc Oral Maxillofac Surg 2021

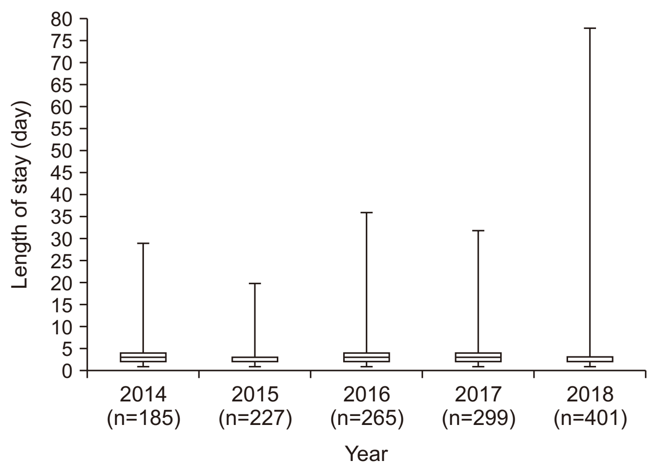

Fig. 1. Length of stay, by year.
Fo Yew Tan et al: Length of hospital stay among oral and maxillofacial patients: a retrospective study. J Korean Assoc Oral Maxillofac Surg 2021

Table 2. Types of trauma being treated in oral and maxillofacial surgery in-patients

	Fracture						Soft tissue injury
	Frontal	Orbital	Nasal	Zygoma	Maxilla	Mandible	
Non-surgical intervention	25	149	37	314	93	119	61
Surgical intervention	0	18	4	27	37	74	

Some in-patients sustained more than one traumatic injury.
Fo Yew Tan et al: Length of hospital stay among oral and maxillofacial patients: a retrospective study. J Korean Assoc Oral Maxillofac Surg 2021

bilization had the shortest LOS of 2 days. All other reasons for admission listed in Table 1 had a median LOS of 3 days.

We used multiple logistic regressions to determine the association between the demographic profiles, ASA classification, and reason for admission and extended LOS, which we defined as an LOS longer than the reported median value of 3 days. Extended LOS was significantly affected by sex, reason for admission, and ASA classification.(Table 3)

The association between demographic factors and ASA classification and LOS varied between groups of patients admitted for different reasons. In cases of maxillofacial infection (Table 4), LOS was significantly affected by age and ASA classification. Among post-trauma stabilization patients (Table 5), a significant association was found between LOS and ethnicity and sex.

We found no significant association between demographic factors and ASA classification and LOS among admissions for facial bone fracture surgery or dentoalveolar surgery. In admissions for benign lesion surgery, malignant lesion surgery, and other maxillofacial surgery, the sample size was insufficient to support a multiple logistic regression analysis.

IV. Discussion

LOS is an easily recorded parameter that can serve as an important indicator of the quality of care given to a patient. This study explored the LOS of patients admitted for different reasons. Our department treats an average of 1,844 new patients every year, of which an average of 15% require hospital admission each year.

As a general overview, the LOS of the in-patients in our unit was 3 days, which is comparable to the study of Ferraro Bezerra et al.[5], which presented a mean LOS of 2.94 days.

Our data analysis revealed that patient LOS differed based on the reason for admission. Patients admitted for a maxillofacial infection had a median LOS of 3 days. Most patients with maxillofacial infections required surgical intervention in the form of incision and drainage during their hospital stay. In life-threatening cases such as impending airway embarrassment, patients are placed on an emergency list and will usually receive surgery within 6-12 hours. If they are coincidental with an OMFS elective operation theatre slot (in the next 24 hours), they are slotted into the elective list. For less severe infections, such as those involving the primary spaces, incision and drainage under local anesthesia will be done

Table 3. Association between length of stay and demographic profiles, ASA classification, and reasons for admission

	Length of stay		Multiple logistic regression	
	≤3 days (n=1,007)	>3 days (n=373)	Adj. OR (95% CI)	*P*-value
Age group				0.863
≤20 yr	336 (33.4)	114 (30.6)	1.00	-
21-40 yr	345 (34.3)	123 (33.0)	0.95 (0.69, 1.30)	0.734
41-60 yr	185 (18.4)	81 (21.7)	0.91 (0.62, 1.32)	0.613
>60 yr	141 (14.0)	55 (14.7)	0.83 (0.53, 1.28)	0.395
Sex				
Male	657 (65.2)	284 (76.1)	1.58 (1.18, 2.12)	0.002
Female	350 (34.8)	89 (23.9)	1.00	-
Ethnicity				0.281
Malay	836 (83.0)	330 (88.5)	1.54 (1.00, 2.37)	0.051
Chinese	152 (15.1)	33 (8.8)	1.00	-
Indian	19 (1.9)	9 (2.4)	1.53 (0.59, 3.96)	0.384
Other	0 (0)	1 (0.3)	NA	NA
Reason for admission				<0.001
Infection	200 (19.9)	101 (27.1)	1.00	-
Post-trauma stabilization	553 (54.9)	203 (54.4)	0.74 (0.55, 1.01)	0.055
Facial bone fracture surgery	41 (4.1)	51 (13.7)	2.37 (1.44, 3.87)	0.001
Benign lesion surgery	29 (2.9)	5 (1.3)	0.38 (0.14, 1.03)	0.057
Malignant lesion surgery	4 (0.4)	4 (1.1)	2.76 (0.66, 11.55)	0.165
Dentoalveolar surgery	143 (14.2)	5 (1.3)	0.08 (0.03, 0.21)	0.000
Other maxillofacial surgery	37 (3.7)	4 (1.1)	0.23 (0.08, 0.66)	0.007
ASA physical status classification				0.001
ASA I	711 (70.6)	224 (60.1)	1.00	-
ASA II	223 (22.1)	96 (25.7)	1.50 (1.09, 2.06)	0.013
ASA III	70 (7.0)	51 (13.7)	2.30 (1.49, 3.58)	0.000
ASA IV	1 (0.1)	0 (0)	NA	NA

(ASA: American Society of Anesthesiology, Adj.: adjusted, OR: odds ratio, CI: confidence interval, NA: applicable)
Values are presented as number (%) or Adj. OR (95% CI).
Fo Yew Tan et al: Length of hospital stay among oral and maxillofacial patients: a retrospective study. J Korean Assoc Oral Maxillofac Surg 2021

Table 4. Association between length of stay and demographic profiles and ASA physical classifications among patients admitted for maxillofacial infections (n=301)

	Length of stay		Multiple logistic regression	
	≤3 days (n=200)	>3 days (n=101)	Adj. OR (95% CI)	*P*-value
Age group				0.019
≤20 yr	68 (34.0)	14 (13.9)	1.00	-
21-40 yr	80 (40.0)	36 (35.6)	2.25 (1.10, 4.63)	0.027
41-60 yr	36 (18.0)	26 (25.7)	2.42 (1.06, 5.54)	0.036
>60 yr	16 (8.0)	25 (24.8)	4.48 (1.69, 11.84)	0.003
Sex				
Male	109 (54.5)	65 (64.4)	1.48 (0.86, 2.55)	0.154
Female	91 (45.5)	36 (35.6)	1.00	-
Ethnicity				0.563
Malay	177 (88.5)	92 (91.1)	2.06 (0.77, 5.53)	0.153
Chinese	19 (9.5)	8 (7.9)	1.00	-
Indian	4 (2.0)	0 (0)	NA	NA
Other	0 (0)	1 (1.0)	NA	NA
ASA physical status classification				<0.001
ASA I	143 (71.5)	42 (41.6)	1.00	-
ASA II	39 (19.5)	24 (23.8)	1.75 (0.87, 3.49)	0.114
ASA III	18 (9.0)	35 (34.7)	4.51 (2.15, 9.47)	<0.001
ASA IV	0 (0)	0 (0)	NA	NA

(ASA classification: American Society of Anesthesiology classification, Adj.: adjusted, OR: odds ratio, CI: confidence interval, NA: applicable)
Values are presented as number (%) or Adj. OR (95% CI).
Length of stay >3 days is coded as 1 (event of interest).
Fo Yew Tan et al: Length of hospital stay among oral and maxillofacial patients: a retrospective study. J Korean Assoc Oral Maxillofac Surg 2021

Table 5. Association between the length of stay and demographic profiles and ASA physical classification among patients admitted for post-trauma stabilization (n=756)

	Length of stay		Multiple logistic regression	
	≤3 days (n=553)	>3 days (n=203)	Adj. OR (95% CI)	*P*-value
Age group				0.154
≤20 yr	149 (26.9)	72 (35.5)	1.00	-
21-40 yr	167 (30.2)	64 (31.5)	0.83 (0.55, 1.25)	0.369
41-60 yr	121 (21.9)	41 (20.2)	0.74 (0.45, 1.19)	0.215
>60 yr	116 (21.0)	26 (12.8)	0.53 (0.30, 0.92)	0.023
Sex				
Male	399 (72.2)	164 (80.8)	1.65 (1.10, 2.47)	0.016
Female	154 (27.8)	39 (19.2)	1.00	-
Ethnicity				0.019
Malay	459 (83.0)	179 (88.2)	1.87 (1.05, 3.35)	0.035
Chinese	87 (15.7)	16 (7.9)	1.00	-
Indian	7 (1.3)	8 (3.9)	4.79 (1.49, 15.43)	0.009
Other	0 (0)	0 (0)	NA	NA
ASA physical status classification				0.726
ASA I	370 (66.9)	136 (67.0)	1.00	-
ASA II	140 (25.3)	53 (26.1)	1.27 (0.85, 1.90)	0.252
ASA III	40 (7.2)	12 (5.9)	1.11 (0.54, 2.26)	0.782
ASA IV	1 (0.2)	0 (0)	NA	NA

(ASA classification: American Society of Anesthesiology classification, Adj.: adjusted, OR: odds ratio, CI: confidence interval, NA: applicable)
Values are presented as number (%) or Adj. OR (95% CI).
Length of stay >3 days is coded as 1 (event of interest).
Fo Yew Tan et al: Length of hospital stay among oral and maxillofacial patients: a retrospective study. J Korean Assoc Oral Maxillofac Surg 2021

once the patient is in the ward. Compared with other studies of maxillofacial infection, which reported a range of mean LOS from 3.86 to 18.4 days[6-10], our patients had a shorter LOS. The rate of readmission for patients with maxillofacial infection in our center was 1%, which is comparable to the readmission rate of 0.4% reported among maxillofacial infection patients in another study[11]. The short LOS of patients admitted for maxillofacial infections in our study can be attributed to the use of exogenous steroids as an adjunct in indicated cases to alleviate infection-related symptoms and thus shorten hospital stay, as supported by Low et al.[12] and Kent et al.[13]. However, conflicting studies have reported adverse effects from steroid use in infectious conditions[14,15]. Therefore, we recommend that further studies be done to validate the use of steroids in infectious conditions. Exogenous steroids in infectious conditions should only be used with careful risk assessment and monitoring prior to administration.

In trauma cases, we report LOS separately for post-trauma stabilization and facial bone fracture surgery because some patients require readmission for definitive treatment after the initial stabilization phase. That decision is supported by a Malaysian study that associated the need for multiple hospital admissions by maxillofacial trauma patients with the unavailability of general anesthesia during the first admission[16]. In our setting, only certain severe trauma cases involving open fractures or active bleeding are intubated in the Emergency Department and taken almost immediately to surgery. Most fractures are stabilized with wiring or intermaxillary fixation during the initial post-trauma admission. Patients indicated for open reduction and internal fixation are usually placed on the elective list and readmitted later to receive their definitive surgical procedure. Elective OMFS operation theatre slots are available once a week. The mean time between the day when a patient is first seen and the day of operation is 10 days.

For comparison, we represented the LOS for maxillofacial trauma as the sum of the LOS for post-trauma stabilization and the LOS of facial bone fracture surgery. In that analysis, the LOS of maxillofacial trauma in-patients in our data was 6 days, which is in keeping with a different Malaysian study that reported a mean LOS of 5.8 days[16]. Our results remain within the range of studies performed worldwide, where the mean LOS was reported to be between 2 days and 10.6 days[4,17-20].

The LOS following an admission for benign lesion surgeries, 3 days, is shorter than that in a Norwegian study that reported a mean LOS of 4.32 days for this category[21]. Similarly, the LOS following an admission for malignant lesion surgery in our unit was 4 days, which is shorter than the mean LOS of 4.8 days presented by an American study of such patients[22]. The shorter LOS for surgical management of benign and malignant lesions in our unit can be explained by the surgical complexity of our cases. As a secondary referral center, patients treated in our unit usually do not require extensive reconstruction procedures and thus have a rapid postoperative recovery rate.

With regard to elective admissions for dentoalveolar surgeries, our study showed an LOS of 3 days. However, a Brazilian study[5] done in 2011 reported a mean LOS of 1.3 days for a similar category of patients. That study noted that admissions for relatively simple dentoalveolar surgeries were usually discharged on the same day or the day after surgery, which likely reduced the LOS in that category[5]. Clearly, day surgeries can reduce LOS and in-patient costs, as supported by other studies[23,24]. During our study period (2013-2018), day surgeries were not provided by the anesthesiology department for oral maxillofacial surgery cases. As a result of our study finding that we had a significantly longer LOS than other centers for dentoalveolar surgeries, we introduced day surgeries in 2019.

Our multiple logistic regression analysis revealed a significant association between LOS and the reason for admission, with admissions for facial bone fracture surgery showing a significantly higher OR for an extended LOS and admissions for dentoalveolar surgery and other surgeries having a significantly lower OR for an extended LOS. Therefore, surgical complexity significantly affects the LOS, in agreement with Ferraro Bezerra et al.[5].

Patients with ASA class 3 who were admitted for maxillofacial infections had a significantly higher OR for an extended LOS than patients in other ASA classes. Our results correlate with the findings of several other studies, which reported that the LOS of patients admitted for maxillofacial infections was significantly prolonged in those with pre-existing medical conditions[6,10,25]. The medical conditions that caused ASA class 3 in our population were usually poorly controlled diabetes mellitus and hypertension, which required longer LOS for stabilization.

We found that patients admitted for maxillofacial infections who were 21 years or older had a significantly higher OR for extended LOS than those aged 20 or younger. Similarly, a study of maxillofacial infections among Americans reported a positive association between an extended LOS and being age 18 years or older[11]. That same study found that all the patients younger than 18 were healthy, whereas only 35.8% of those 18 years or older had no comorbidities[11]. That finding supports our deduction that the shorter LOS in the younger population was due to a low incidence of chronic diseases and immunocompromised states among them.

The LOS for post-trauma stabilization was significantly associated with sex, with males having a higher OR for an extended LOS than females. Most maxillofacial trauma cases in our unit are caused by road traffic accidents involving motorcyclists because motorcycles are a common mode of transportation in Malaysia, especially among young males with low incomes. The severity of injuries sustained by motorcyclists is usually high, as shown by a recent World Health Organization report that indicated that motorcyclists account for 59% of fatalities in road traffic accidents in Malaysia[26].

This, together with the high-risk activities of young men, contributes to their severe traumatic injuries and thus long LOS.

The ethnicity of patients admitted for post-trauma stabilization was also significantly associated with LOS. Patients of Malay and Indian ethnicity showed a significantly higher OR for extended LOS than Chinese patients. This finding can likely be attributed to the geographical distributions of patients of different ethnicities; logistic issues can delay the time of discharge for patients who live far from the hospital. Nevertheless, future research is needed to accurately determine the specific reasons for the significant association between LOS and ethnicity.

Clinical decisions about discharging patients from the hospital are made using a combination of the surgeon's clinical judgment and established discharge criteria, which differ with the reasons for admission. During the study period, all patients were treated by the same surgeon. For patients admitted for facial bone fracture surgery, benign lesion surgery, malignant lesion surgery, dentoalveolar surgery, and other maxillofacial surgery under general anesthesia, the decision to discharge was made by the surgeon based on the discharge criteria adopted by our department: the post-anesthesia recovery (PAR) score and the modified PAR score[27]. Those criteria were supplemented by input from the anesthesiology department. The PAR score and modified PAR score are reliable sets of discharge criteria that are commonly used in OMFS centers[28]. The discharge criteria for patients admitted for post-trauma stabilization are set based on the aim of stabilizing injuries resulting from trauma, i.e., achieving hemostasis for soft tissue injuries, restoring acceptable occlusion, and temporarily fixing fracture segments to achieve reasonable pain control and feeding. Similar practices are used in other Malaysian OMFS departments[16]. The discharge criteria for patients with maxillofacial infections at our center are similar to those proposed by Vytla and Gebauer[29] in 2017: clinical improvement of swelling and trismus, 24 hours with no further drainage, afebrile for 24 hours, stable vital signs within the normal range, improving oral intake and declining pain scores, declining white cell counts and C-reactive protein levels, and confirmation that the isolated organism is sensitive to the antibiotics used.

From an economic standpoint, the ward charges in a government-funded hospital in Malaysia are about USD 28 per night, with approximately 98% or USD 27.5 of that amount being subsidized by the Malaysian government; therefore, overlong LOS results in a significant burden on the public health sector[30]. When we introduced day surgeries, the reduction in LOS from 3 days to 1 day effectively cut the inpatient cost by more than USD 55 per patient. Therefore, the results of this study provide insight into ways to better use public health resources, which rationalizes the importance of conducting similar studies in different healthcare settings to ensure a more economical distribution of resources.

Furthermore, clinicians can use the results of this study to estimate the LOS of patients from factors such as their ASA classification or their reason for admission. Consequently, these data enable an accurate allocation of hospital facilities such as beds in wards and operation theatre slots, resulting in optimized resource utilization.

Our data on LOS following surgical procedures is limited to the types of surgeries performed in our center. Major surgeries such as free flap reconstructions are not done in our unit. Therefore, LOS measured from our data will probably not be reproducible by larger OMFS centers that perform major head and neck surgeries. Another limitation is our limited sample size in certain in-patient categories, such as patients with benign or malignant lesions, which means that our results might not be generalizable to the entire population. We have also identified certain confounding variables. For example, co-existing injuries such as cervical injuries can delay the acquisition of images that require head manipulation, causing delays in diagnosis and definitive treatment and affecting the LOS[31]. Apart from that, patients' socioeconomic status can result in early or delayed discharge due to financial constraints.

In terms of future research directions, we hope that similar studies on LOS in OMFS departments will be carried out worldwide, particularly in centers that specialize in major head and neck surgeries, to provide LOS data for the patients who undergo those procedures. Similar studies should also be conducted in the OMFS departments of private institutes to assess whether variations in LOS exist between hospitals that receive different healthcare funding. Furthermore, multicenter studies within a region could provide larger sample sizes, thus improving the generalizability of the data. Prospective studies that produce higher levels of evidence could also be conducted to assess the association between the LOS of OMFS patients and factors such as the ASA classification.

Patients with uncontrolled medical conditions who are admitted for maxillofacial infections often require in-patient stabilization of their chronic diseases, resulting in prolonged LOS. Better control of comorbidities by primary healthcare providers at the community level could avoid the need for such stabilization and shorten their LOS.

Looking forward, we suggest the practicality of introducing a prospective payment method using diagnosis-related groups, in which payments are set according to the estimated cost of hospital care for different diagnoses prior to service provision[2]. This method has been introduced in several European countries and has been proven to reduce LOS in Switzerland[2].

The provision of more operating theatre slots and anesthetic services during the acute phase of maxillofacial trauma could prevent the need for a second admission for an elective surgical intervention for those patients. The introduction of more day services in ambulatory care centers could also reduce the need for hospital beds for maxillofacial surgery.

V. Conclusion

The median LOS reported in this study was 3 days, with an interquartile range of 2-4 days. LOS was significantly affected by sex, ethnicity, age, reason for admission, and ASA classification, which rejects our null hypothesis.

ORCID

Fo Yew Tan, *https://orcid.org/0000-0002-7956-9210*
Kalpana Selvaraju, *https://orcid.org/0000-0003-2305-8742*
Harshinie Audimulam, *https://orcid.org/0000-0002-5147-0139*
Zhi Chuan Yong, *https://orcid.org/0000-0001-9216-6849*
Tassha Hilda Adnan, *https://orcid.org/0000-0002-4301-1346*
Sathesh Balasundram, *https://orcid.org/0000-0001-9221-3035*

Authors' Contributions

F.Y.T., K.S., H.A., and Z.C.Y. participated in data collection and wrote the manuscript. T.H.A. participated in the study design and performed the statistical analysis. F.Y.T., K.S., and S.B. participated in the study design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

Acknowledgements

We acknowledge Datuk Dr. Noor Hisham bin Abdullah, Dr. Mahfudzah binti Md Dean, and Dr. Azimah binti A. Aziz for their kind support and permission to publish this study. We also acknowledge Dr. Tan Jing Wei, Dr. Joshua Ong Ee Xin, Dr. Wong Jia Hui, and Dr. Siti Nabila binti Sakroni for their help in data collection.

Ethics Approval and Consent to Participate

This study was approved in writing by the Medical Research & Ethics Committee, Ministry of Health Malaysia on 25 October 2019 (No. NMRR-19-341-46407 [IIR]), and informed consent was not required because this study is a retrospective study.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

References

1. Islam MA, Haider IA, Uzzaman MH, Tymur FR, Ali MS. One year audit of in patient Department of Oral and Maxillofacial Surgery, Dhaka Dental College Hospital. J Maxillofac Oral Surg 2016;15:229-35. https://doi.org/10.1007/s12663-015-0822-1
2. OECD (Organisation for Economic Co-operation and Development). Health care activities. In: Health at a glance 2017: OECD indicators. Paris: OECD Publishing; 2017:167-83.
3. Kamat RD, Dhupar V, Akkara F, Shetye O. A comparative analysis of odontogenic maxillofacial infections in diabetic and nondiabetic patients: an institutional study. J Korean Assoc Oral Maxillofac Surg 2015;41:176-80. https://doi.org/10.5125/jkaoms.2015.41.4.176
4. Al-Hassani A, Ahmad K, El-Menyar A, Abutaka A, Mekkodathil A, Peralta R, et al. Prevalence and patterns of maxillofacial trauma: a retrospective descriptive study. Eur J Trauma Emerg Surg 2019. https://doi.org/10.1007/s00068-019-01174-6 [Epub ahead of print]
5. Ferraro Bezerra M, Avelar RL, de Oliveira RB, Studart-Soares EC, Pretto MS. Assessment of the oral and maxillofacial surgery service in a teaching hospital in Brazil. J Craniofac Surg 2011;22:50-3. https://doi.org/10.1097/SCS.0b013e3181f6c436
6. Seppänen L, Lauhio A, Lindqvist C, Suuronen R, Rautemaa R. Analysis of systemic and local odontogenic infection complications requiring hospital care. J Infect 2008;57:116-22. https://doi.org/10.1016/j.jinf.2008.06.002
7. Appelblatt R, Krutoy J, Karlis V. Associated factors involved in presentation and care of severe odontogenic infections. J Oral Maxillofac Surg 2014;72(9 Suppl):E37. https://doi.org/10.1016/j.joms.2014.06.064
8. Yuvaraj V. Maxillofacial infections of odontogenic origin: epidemiological, microbiological and therapeutic factors in an Indian population. Indian J Otolaryngol Head Neck Surg 2016;68:396-9. https://doi.org/10.1007/s12070-015-0823-x
9. Zheng L, Yang C, Zhang W, Cai X, Kim E, Jiang B, et al. Is there association between severe multispace infections of the oral maxillofacial region and diabetes mellitus? J Oral Maxillofac Surg 2012;70:1565-72. https://doi.org/10.1016/j.joms.2011.07.010
10. Jundt JS, Gutta R. Characteristics and cost impact of severe odontogenic infections. Oral Surg Oral Med Oral Pathol Oral Radiol

2012;114:558-66. https://doi.org/10.1016/j.oooo.2011.10.044
11. Wang J, Ahani A, Pogrel MA. A five-year retrospective study of odontogenic maxillofacial infections in a large urban public hospital. Int J Oral Maxillofac Surg 2005;34:646-9. https://doi.org/10.1016/j.ijom.2005.03.001
12. Low LF, Audimulam H, Lim HW, Selvaraju K, Balasundram S. Steroids in maxillofacial space infection: a retrospective cohort study. Open J Stomatol 2017;7:397-407. https://doi.org/10.4236/ojst.2017.79034
13. Kent S, Hennedige A, McDonald C, Henry A, Dawoud B, Kulkarni R, et al. Systematic review of the role of corticosteroids in cervicofacial infections. Br J Oral Maxillofac Surg 2019;57:196-206. https://doi.org/10.1016/j.bjoms.2019.01.010
14. Klein NC, Go CH, Cunha BA. Infections associated with steroid use. Infect Dis Clin North Am 2001;15:423-32, viii. https://doi.org/10.1016/s0891-5520(05)70154-9
15. Aberdein J, Singer M. Clinical review: a systematic review of corticosteroid use in infections. Crit Care 2006;10:203. https://doi.org/10.1186/cc3904
16. Saperi BS, Ramli R, Ahmed Z, Muhd Nur A, Ibrahim MI, Rashdi MF, et al. Cost analysis of facial injury treatment in two university hospitals in Malaysia: a prospective study. Clinicoecon Outcomes Res 2017;9:107-13. https://doi.org/10.2147/CEOR.S119910
17. Khalkhali HR, Samarei R, Alilu SK, Habibzadeh H, Rezaei S. Modeling factors influence stay duration in unit due to maxillofacial fracture. J Adv Pharm Educ Res 2018;8:36-40.
18. Farias IPSE, Bernardino ÍM, Nóbrega LMD, Grempel RG, D'Avila S. Maxillofacial trauma, etiology and profile of patients: an exploratory study. Acta Ortop Bras 2017;25:258-61. https://doi.org/10.1590/1413-785220172506152670
19. Boffano P, Roccia F, Zavattero E, Dediol E, Uglešić V, Kovačič Ž, et al. European Maxillofacial Trauma (EURMAT) project: a multicentre and prospective study. J Craniomaxillofac Surg 2015;43:62-70. https://doi.org/10.1016/j.jcms.2014.10.011
20. Martins JC Jr, Keim FS, de Santa Helena ET. Epidemiological characteristics of trauma patients maxillofacial surgery at the Hospital Geral de Blumenau SC from 2004 to 2009. Int Arch Otorhinolaryngol 2010;14:192-8. https://doi.org/10.7162/S1809-48722010000200008
21. Berge TI. Incidence of large third-molar-associated cystic lesions requiring hospitalization. Acta Odontol Scand 1996;54:327-31. https://doi.org/10.3109/00016359609003546
22. Schwam ZG, Sosa JA, Roman S, Judson BL. Complications and mortality following surgery for oral cavity cancer: analysis of 408 cases. Laryngoscope 2015;125:1869-73. https://doi.org/10.1002/lary.25328
23. Black D, Pearson M. Average length of stay, delayed discharge, and hospital congestion. BMJ 2002;325:610-1. https://doi.org/10.1136/bmj.325.7365.610
24. Jarab F, Omar E, Bhayat A, Mansuri S, Ahmed S. Duration of hospital stay following orthognathic surgery at the Jordan University Hospital. J Maxillofac Oral Surg 2012;11:314-8. https://doi.org/10.1007/s12663-011-0327-5
25. Peters ES, Fong B, Wormuth DW, Sonis ST. Risk factors affecting hospital length of stay in patients with odontogenic maxillofacial infections. J Oral Maxillofac Surg 1996;54:1386-91; discussion 1391-2. https://doi.org/10.1016/s0278-2391(96)90249-9
26. Nordin R, Abdul Rahman N, Rashdi MF, Yusoff A, Abdul Rahman R, Sulong S, et al. Oral and maxillofacial trauma caused by road traffic accident in two university hospitals in Malaysia: a cross-sectional study. J Oral Maxillofac Surg Med Pathol 2015;27:166-71. https://doi.org/10.1016/j.ajoms.2014.01.001
27. Aldrete JA. Discharge criteria. Baillières Clin Anaesthesiol 1994;8:763-73. https://doi.org/10.1016/S0950-3501(05)80109-6
28. Uzumcugil F, Ankay Yilbas A, Akca B, Ozkaragoz DB, Adiloğlu S, Tuz HH, et al. Overnight hospital stay and/or extended recovery period may allow long-duration oral and maxillofacial surgeries in the operating room of a dental hospital in an outpatient setting: a single-center experience. J Korean Assoc Oral Maxillofac Surg 2020;46:125-32. https://doi.org/10.5125/jkaoms.2020.46.2.125
29. Vytla S, Gebauer D. Clinical guideline for the management of odontogenic infections in the tertiary setting. Aust Dent J 2017;62:464-70. https://doi.org/10.1111/adj.12538
30. Fees (Medical) Order 1982 (Amendment 2017) [Internet]. Kuala Lumpur, Malaysia: The Official Portal of Parliament of Malaysia [cited 2019 Jul 2]. Available from: https://parlimen.gov.my/ipms/eps/2019-07-02/ST.84.2019 - 84 - MOH.pdf
31. Galvão-Moreira LV, Cantanhede ALC, de Sousa Neto AC, da Cruz MCFN. Factors affecting hospital discharge in maxillofacial trauma patients: a retrospective study. Braz J Oral Sci 2017;16:e17026. https://doi.org/10.20396/bjos.v16i0.8650491

How to cite this article: Tan FY, Selvaraju K, Audimulam H, Yong ZC, Adnan TH, Balasundram S. Length of hospital stay among oral and maxillofacial patients: a retrospective study. J Korean Assoc Oral Maxillofac Surg 2021;47:25-33. https://doi.org/10.5125/jkaoms.2021.47.1.25