



A comparison study of patients attendance to klinik rawatan keluarga pergigian (krkg) hospital universiti sains malaysia (Hospital USM): A study from the year 2017 to the year 2020

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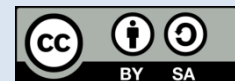
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ABSTRACT

The study aimed to compare the patient's attendance to Klinik Rawatan Keluarga Pergigian (KRKG), Hospital Universiti Sains Malaysia (Hospital USM) from the year 2017 to the year 2020. Data was collected starting from January 2017 till December 2020. Data was plot according to the trendline for each year, and the mean of patient's attendance is being calculated, recorded, and present using a simple bar means. The equation for the particular year is being estimated and compared to the reference category using multinomial regression. From the analysis, it was found that the year 2020 having a decreasing [F-Stat (df)=6.786(1.759,19.349); $p < 0.05$] in the trendline of patients who attended KRKG, this is due to the global coronavirus pandemic. The finding had found that the year 2020 having has a significant decrease as compared to the previous year [F-Stat (df)=6.786(1.759,19); $p < 0.05$]. In the multinomial regression analysis, the estimates for the parameter can be identified compared to a baseline category. The finding had shown that the patient's attendance to KRKG is less due to the Covid-19 pandemic.

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1. INTRODUCTION

Dental care and hygiene are important daily routine tasks by the dentist. The episodes of a patient visiting the dentist are frequently monitored by dental care throughout the world. The events related to this visiting exploring and answering the new knowledge regarding dental care. The dental clinic visiting is shaped by several factors. Economical status determines the outcome of dental clinic visits. In the USA, evaluation of patients showed more than 50% of the high-income patient visited the dental clinic compared to around 20% of the poor income group [1]. The type of disease the patient may influence the frequency of dental checking. A 10-year analysis of diabetes mellitus patients showed the reduction of the group visiting a dental clinic which is different from the increasing trend of the pre-diabetic group [2]. The pre-diabetic group which is associated with periodontitis may be forced for frequent dental visiting [3]. The reasons for the patient visit their dentist are varied. The increasing trend toward restorative treatment is increasing especially using for stainless steel crown procedure [4]. Comparing the anesthetic technique used showed more sedative procedure is preferred than general anesthesia [4]. The usage of general anesthesia among the younger age group is increasing in style due to dental caries and teeth extraction [5]. Psychological factor such as fear contributes to the dental clinic visiting. The equipment used in the dental clinic is the main contributing factor for this psychological feeling. Most of the fear is derived from the needle that uses for the anesthetic procedure in terms of seeing and the experience from it [6]. The drilling procedures and painful experience are two factors added to this anxiety [6]. Trauma to the dental area is important in dentistry. The open wound to the face and mouth contributes to the dental emergency [7]. Cellulitis, abscess, and periodontitis are the reasons for non-traumatic emergency dentistry [7]. In Malaysia, dental check-ups together with toothache (20%-40%) are the most reason patient seek their dentist [8]. The other reason includes prosthetic treatment and dental trauma. Female (60%) attends dental clinic higher than male (40%) and some of them showed symptoms of anxiety [8]. In the epidemic COVID-19, several protocols are applied such as usage of personal protective equipment, and clinical disinfection procedures are applied [9]. These measures aim to limit the spreading of the virus and reduce patient's anxiety.

Dental health care facilities provide various dental management to entertain one's dental needs. The patient must have regular dental attendance so that the dentist can deal with the oral disease early, or even better prevent the disease from developing in the first place. Economical status of the patients had been perceived to have a significant outcome on dental attendance with the low-income patients having less utilization on dental health care [1]. Nevertheless, the recommendation for the frequency and interval of a dental visit is still debatable. Traditionally, the recommendation of once a year dental visit is advocated for preventive strategies [10]–[12]. A recent review concluded that a six-monthly check-up or at personalized intervals based on the dentist's assessment of the risk of dental disease, does not influence caries occurrence, gingiva disease, or patient's quality of life [13]. Nice [14] recommends dental visit interval is based on the patient's tailored needs and risk assessment of the related oral disease.

Pain is the most common reason for dental attendance followed by tooth restoration, mobile tooth, staining tooth surfaces, dental trauma, missing teeth, and others [15]. The medically compromised patient, for example, diabetes mellitus, had shown less dental attendance than those with the pre-diabetic condition [2]. Demand for restorative treatment is increasing, as shown by the acceptance trend of stainless steel crown placement among pediatric patients [4]. The usage of general anesthesia among the younger age group is increasing in style due to dental caries and tooth extractions [5]. Cellulitis, abscess, periodontitis, soft, and hard tissue injuries are common reasons for emergency dental treatment [7]. Similar to another aspect of human life, the COVID-19 pandemic surge since the end of the year 2019 had also affected the delivery and attendance of dental care. WHO soon declared the COVID-19 outbreak a public health emergency worldwide. Several protocols are applied such as usage of personal protective equipment, and clinical disinfection procedures [9]. Apart from other abrupt measures to minimize the risk of exposure to COVID-19, the UK like many other countries, had put a pause to routine and non-emergency dental visits [16]. These measures were aimed to limit the spreading of the virus and reduce patient's anxiety. Overall dental attendance even for emergency treatment reduces by 38% compared to the previous time interval [17]. While the majority of patients prefer to delay getting dental treatment or seeing the dentist at the peak period of the COVID-19 pandemic [18]. Based on our limitation reviews, there is still a lack of data regarding dental attendance in dental health care facilities, particularly in Malaysia. Hence this study aims to compare the patient's attendance to KRKG, Hospital USM from the year 2017 to the year 2020, and also to assess the influence of COVID-19 on the attendance trend.

2. METHOD

The study was carried out retrospectively by examining the medical records of Klinik Rawatan Keluarga Pergigian (KRKG), Universiti Sains Malaysia (USM), Kelantan, Malaysia from January 2017 to December 2020. All related variable is being collected and summarized in Table 1.

Table 1. Attendance of patients to klinik rawatan keluarga pergigian (krkg) since year 2017 till year 2020

Month	The Year 2017	The Year 2018	The year 2019	The Year 2020
January	805.00	1022.00	946.00	878.00
February	816.00	842.00	847.00	789.00
March	890.00	753.00	856.00	554.00
April	902.00	926.00	955.00	205.00
May	925.00	680.00	552.00	265.00
June	438.00	594.00	580.00	581.00
July	1040.00	1034.00	1015.00	689.00
August	955.00	801.00	775.00	697.00
September	692.00	711.00	710.00	819.00
October	778.00	863.00	1059.00	516.00
November	768.00	569.00	672.00	507.00
December	955.00	965.00	952.00	818.00

Phase I

At this phase, the trendline of the patient's attendance to KRKG, Hospital Universiti Sains Malaysia (Hospital USM) will be plotted, according to the year 2017 till the year 2020. Besides that, the simple bar means also provided in this case, this is to show clearly the changing trend from the year 2017 to the year 2020. To obtain the result from the scientific point of view, the repeated-measure design method was used to measure the dependent variable which changes over time under different conditions. In this article the application of One-way Repeated Measure ANOVA has been demonstrated by using the software IBM SPSS (Statistical Package for Social Sciences) Version 26.0 on the data collected at four-time points year 2017, the year 2018, the year 2019, and year 2020. The repeated measure ANOVA model is given as follows:

$$Y_{ij} = \mu_j + S_i + \epsilon_{ij} \tag{1}$$

Where:

- μ_j = The fixed effect, $j=1, \dots, k$
- S_i = The random effect of subject i , $i=1, \dots, n$
- ϵ_{ij} = The random error independent of S_i

with the normality assumption, therefore we have $S_i \overset{iid}{\sim} N(0, \sigma_s^2)$, and $\epsilon_{ij} \overset{iid}{\sim} N(0, \sigma_\epsilon^2)$, which are independent of each other [19]. Let say $Y_i = (Y_{i1}, Y_{i2}, \dots, Y_{ik})$, and have $Y_i \overset{iid}{\sim} N_k(\underline{\mu}, \Sigma)$, $i=1, \dots, n$,

where $\underline{\mu} = (\mu_1, \mu_1, \dots, \mu_k)$ and $\Sigma = \begin{bmatrix} \sigma_s^2 + \sigma_\epsilon^2 & \sigma_s^2 & \dots & \sigma_s^2 \\ \sigma_s^2 & \sigma_s^2 + \sigma_\epsilon^2 & \dots & \sigma_s^2 \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_s^2 & \sigma_s^2 & \dots & \sigma_s^2 + \sigma_\epsilon^2 \end{bmatrix} \sigma^2 = \begin{bmatrix} 1 & \rho & \dots & \rho \\ \rho & 1 & \dots & \rho \\ \vdots & \vdots & \ddots & \vdots \\ \rho & \rho & \dots & 1 \end{bmatrix}$ with $\rho =$

$\frac{\sigma_s^2}{\sigma_s^2 + \sigma_\epsilon^2}$ and $\sigma_{\square}^2 = \sigma_s^2 + \sigma_\epsilon^2$. This particular structure of the variance-covariance matrix is known as ‘‘compound symmetry’’ and for each subject, it assumes that the variance of the k Regions of Interest (k -ROI) are equal (σ_{\square}^2) and the correlation between each ROI pair is constant. At the ‘‘Univariate Repeated Measure ANOVA’’, the compound symmetry assumption is met, and the model is at the fewer parameters. One way repeated measures ANOVA is equivalent to a two-way mixed effect ANOVA for a Randomized Block Design (RBD) with subject as the block and ROI’s as the ‘‘treatments’’. The degree for the ANOVA F-test of the equal treatment effect is $(K-1)$ and $(n-1)(k-1)$ respectively [13]. That is $F_0^{H_0} \sim F_{k-1(n-1)(k-1)}$. Therefore, the rejection of the null hypothesis is set at the significance level of α , if $F_0 > F_{k-1-1, (n-1)(k-1)}^\alpha$.

Phase II

The goal of the multinomial logistic regression is to construct a model that explains the relationship between the independent variables and the dependent variable. When using this regression, one category of the dependent variable is selected as the reference category. Multinomial Regression is used when the dependant variable is nominal and for which the number of categories is more than two. There is no natural ordering in the independent variables. One of the assumptions of MLR is that the dependent variable cannot be perfectly predicted by the independent variables for any case. It is an extension of the Binomial Logit model.

Multinomial Regression uses the maximum likelihood ratio to determine the probability of the (categorical membership of the dependent variable. One of the reasons why Multinomial Logistic Regression is a good choice for this data is that it does not assume normality, linearity, or homoscedasticity [20], [21]. Multinomial logit models for a response variable with c categories have $c-1$ response functions. In this study, we have four years of categories, which were the year 2017, the year 2018, the year 2019, and the year 2020. The year 2020 was set as a reference category. The multinomial model generates $j-1$ sets of parameter estimates, comparing different levels of the DV to a base level. This makes the model considerably more complex, but also much more flexible. The multinomial model generates $j-1$ sets of parameter estimates, comparing different levels of the DV to a base level. The model can be written as:

$$Pr(y_i = 1|x_i) = \frac{1}{1+\sum_{j=2}^J exp(x_i\beta_j)} \text{ for } \vec{\epsilon} \vec{\epsilon} m = 1 \tag{2}$$

$$Pr(y_i = m|x_i) = \frac{exp(x_i\beta_j)}{1+\sum_{j=2}^J exp(x_i\beta_j)} \text{ for } \vec{\epsilon} \vec{\epsilon} m = 1 \tag{3}$$

3. RESULTS AND DISCUSSIONS

The analysis was divide into two categories, Phase I and Phase II. In Phase, I, data was an analysis based on the trend analysis according to the year, which starting from the year 2017 till to the year 2020.

Phase I

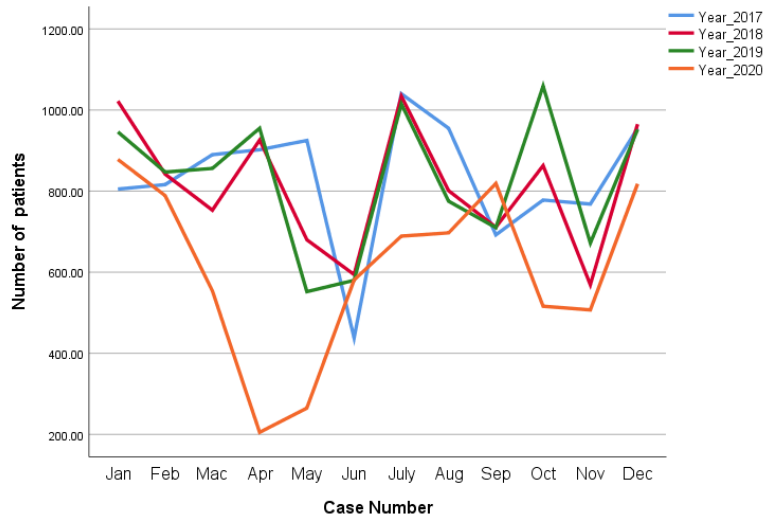


Figure 1. Plot of the trend line for the year 2017-year 2020

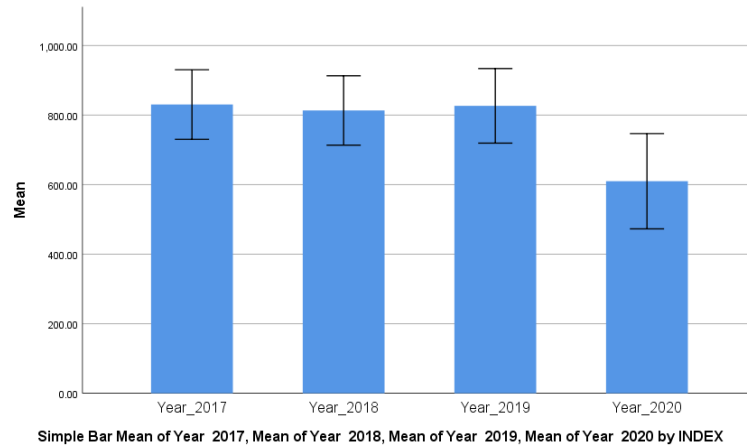


Figure 2. Simple bar mean for year 2017-year 2020

Figure 1 and Figure 2 show the trendline and the bar mean for the patients' attendance to Klinik Rawatan Keluarga Pergigian (KRKG). From the plot, it is clearly stated that the Year 2020 having a lower attendance to KRKG compared to the Year 2017, the Year 2018, and Year 2019. It was estimated that around 600 patients attend KRKG in the year 2020.

Table 2. Result for repeated measure anova table
Total number of patients : F-Stat (df)=6.786(1.759,19.349); $p < 0.05^a$

	Mean (SD)
Number of patients in the year 2017	830.33(157.60)
Number of patients in the year 2018	813.33(156.97)
Number of patients in the year 2019	826.58(168.85)
Number of patients in the year 2020	609.83(215.55)
Multiple Comparison (Year 2017)vs. (Year 2018) : $p > 0.05^a$	
(Year 2017)vs. (Year 2019): $p > 0.05^a$	
(Year 2017)vs. (Year 2020): $p < 0.05^a$	
(Year 2018)vs. (Year 2019) : $p > 0.05^a$	
(Year 2018)vs. (Year 2020): $p < 0.05^a$	
(Year 2019)vs. (Year 2020): $p < 0.05^a$	

*Significant at level 0.05
Repeated Measures Analysis
Multiple Comparison: LSD Procedure.
Normality assumption is met.

Table 1.1 shows the result of repeated measure ANOVA. Number of patients found to be significant different [F-Stat (df) = 6.786(1.759,19.349); $p < 0.05$]. Multiple comparison through the LSD procedure was conducted, it was found that there is no significant different in mean of patients attendance to KRKG for the i) Year 2017[Mean(SD)= 830.33(157.60)] vs. Year 2018 [Mean(SD)= 813.33(156.97)], ii) Year 2017[Mean(SD)= 830.33(157.60)] vs. Year 2019[Mean(SD)= 826.58(168.85)], iii) Year 2018 [Mean(SD)=813.33(156.97)] vs. Year 2019[Mean(SD)= 826.58(168.85)]. The pair which having the significant different can be summarizes as follows i) Year 2017 [Mean(SD)= 830.33(157.60)] vs. Year 2020 [Mean(SD)= 609.83(215.55)], ii) Year 2018[Mean(SD)=813.33(156.97)] vs. Year 2020 [Mean(SD)= 609.83(215.55)], iii) Year 2019 [Mean(SD)= 826.58(168.85)]vs. Year 2020 [Mean(SD)= 609.83(215.55)].

Phase II

A phase II, the multinomial regression was performed and Table 1.2 summarized the output.

Table 3. Model fitting information for nominal regression

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	130.887			
Final	119.617	11.270	3	0.010

Table 3 shows the model fitting information for nominal regression. The obtained p -value was 0.008. This indicates that the proposed model is well fit.

Table 4. Parameter estimates for multinomial regression

Year ^a		B	Std. Error	Wald	Df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
2017	Intercept	-4.938	2.145	5.297	1	0.021			
	Number_of_patient	0.007	0.003	5.783	1	0.016	1.007	1.001	1.012
2018	Intercept	-4.346	2.031	4.579	1	0.032			
	Number_of_patient	0.006	0.003	4.993	1	0.025	1.006	1.001	1.011
2019	Intercept	-4.802	2.119	5.135	1	0.023			
	Number_of_patient	0.007	0.003	5.604	1	0.018	1.007	1.001	1.012

a. The reference category is 2020.

Table 4 shows the parameter estimate for multinomial regression, it was found that the patients' attendance to KRKG. For the year 2017, the estimated coefficient is given as 0.007. The value of OR is obtained by taking an exp (0.007) = 1.007. This indicates that one unit increase in the patients' attendance to KRKG by the year 2017, will most probably increase the patient's attendance around one time as compared to the year 2020. The estimate equation for Patients' attendance to KRKG in 2017 compared with patients' attendance to KRKG 2020 is given as follows.

$$g(x) = -4.938 + 0.007 (\text{Num_patient}) \quad (4)$$

The estimated coefficient for the year 2018 is given as 0.006. The value of OR is obtained by taking an exp (0.006) = 1.006. This indicates that one unit increase in the patients' attendance to KRKG by the year 2018, will most probably increase the patient's attendance around one time as compared to the year 2020. The estimate equation for Patients' attendance to KRKG in 2018 compared with patients' attendance to KRKG 2020 is given as follows.

$$g(x) = -4.346 + 0.006 (\text{Num_patient}) \quad (5)$$

The estimated coefficient for the year 2019 is given as 0.006. The value of OR is obtained by taking an exp (0.006) = 1.006. This indicates that one unit increase in the patients' attendance to KRKG of the year 2019 unit increase in the total number of 2019, will most probably increase the patient's attendance around one time as compared to the year 2020. The estimate equation for Patients' attendance to KRKG in 2019 compared with patients' attendance to KRKG 2020 is given as follows.

$$g(x) = -4.802 + 0.007 (\text{Num_patient}) \quad (6)$$

Economic status influences dental clinic visiting in a developed country like the USA [1]. The premium price of dental service could influence or prevent visiting. The poor income group possibly visit the dental clinic less frequent than richer person based on their economic factors. The increasing trend of the pre-diabetic group could be attributed to the concern of the group of the patient in avoiding the damage to their teeth [2]. The pre-diabetic group may have more information about health care compared to the diseased group. The diseased group such as diabetic may due to the negative habit of own body care including the teeth [2]. The relationship between periodontitis and the diabetic group should give advantages to the dentist-patient relationship [3]. The education and awareness about dental care must be emphasized among the pre and diseased groups. Other factors such as COVID-19 also prevent the patient from attending dental clinic which may due to fear of infectious virus spreading. This can be seen last three years which showed a steady flow of patients seeking dental treatment. Fear of the types of equipment such as needle, drilling, and painful experience can be altered in the future [6]. Proper advice and preparation may reduce the anxiety of the patient. The experience of psychological effects such as anxiety was also reported in Malaysian dental clinic [8]. Restorative is one of the reasons the patient seek their dentist nowadays [4]. This reason is gaining attention possibly contributed to dental education. The increasing knowledge or the awareness of beauty care may influence the dental business. The emergency visits due to facial and dental trauma are important in repairing a patient's face [7]. The work of the dentist not only to cure but crucial to maintain and preserve facial integrity. The usage of general anesthesia which is lesser than the sedation may attribute to the preference of the patient [4]. In the COVID-19 epidemic, changes in the protocol of patient visiting the dental clinic are changed where

the body temperature needs to be monitored for re-schedule or acceptance for treatment [22]. However, the main reasons are to give a good psychological impression toward the safety of dental treatment even in the epidemic season.

4. CONCLUSION

This paper analyzes the changes in the number of patients' attendance to KRKG, Hospital Universiti Sains Malaysia, the starting year 2017- the year 2020. This paper provides only a preliminary overview of the patient's attendance. The main objective is to assess the changes in the patient's attendance to Hospital Universiti Sains Malaysia (Hospital USM) during the season with and without Covid-19. Repeated-measure design is a research design in which subjects are measured two or more times on the dependent variable. In phase I of analysis, we are assessing the changing trend from the year 2017 to the year 2020 by using a repeated-measure technique. The finding had found that the year 2020 having has a significant decrease as compared to the previous year [F-Stat (df)=6.786(1.759,19); $p < 0.05$]. Phase II of analysis is focusing on modeling multinomial regression. The model gained from this analysis is being summarized in equations (i), (ii), (iii). Through this model of estimation, it can be concluded that the number of patients attending KRKG decrease by the year 2020, this is due to the Covid-19 pandemic. Malaysia is one of the country having infected by Covid-19. There is increasing evidence that patients are avoiding hospitals for fear of contracting COVID-19. A study found that in patients who did not attend their appointments, 85% stated the reason was that they were afraid of getting COVID - 19 [11, 12]. In this article, an attempt has been made to demonstrate the use of repeated measures ANOVA and Multinomial regression analysis toward patients' attendance to KRKG data. This may provide us with an improved understanding of the process, relative contributions of the obtained result, and the underlying fundamental theory of the conducted study.

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