

ORIGINAL ARTICLE

ANALYSIS OF CONSULTATION LENGTH IN KHYBER
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Background: Consultation length is considered as direct measure of quality healthcare service and patient satisfaction. We analysed data collected from five different hospitals to infer the effects of sub-factors on consultation length. These factors have positive contribution in predicting the behaviour of consultation length. **Methods:** We performed cross-sectional study on first hand data collected from 386 participants using snow ball sampling method. The survey instrument was questionnaire and face to face interviews. We considered null hypothesis ($H_0=0$) as means are equal against alternative hypothesis ($H_1 \neq 0$) for factors of time consumed by overall consultation, patient's history, physical examination, and prescription writing. Data was also analysed by non-parametric univariate tests and multiple linear regression model. **Results:** Mean of consultation length is 22.466 minutes [CI: 21.420–23.512 and $\alpha=0.01$]. Null hypothesis ($H_0=0$) was rejected in favour of alternative hypothesis ($H_1 \neq 0$) by all factors due to sufficient evidence in data except prescription writing which failed to reject H_0 . **Conclusion:** We found factors had high spread in mean values and rejected null hypothesis indicating the duration of health workforces' consultation is varying in different setups. Multiple factors contributed in formation of consultation length of doctors. Similar studies related to conservation of variation in consultation length must consider these factors. Eventually, such studies reporting this variation and its factors will add up in its efficacy and provisioning of appropriate consultation time totting up in patient's satisfaction positively.

Keywords: Consultation Length; History; Prescription Writing; Doctors; Patients; Tertiary Hospitals

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INTRODUCTION

Healthcare system evolves mainly around two human pillars, doctors and patients. To achieve quality of service and patient satisfaction in healthcare system, consultation (short ≤ 10 minutes, intermediate 11–30 minutes, long > 30 minutes) is considered as binding force.^{1,2} It plays an important role in healthcare promotions covering all activities which increases health status of communities and individuals.¹ Consultation length are usually of intermediate length (Sweden 20 minutes).² Sufficient variance is observed internationally, due to divergences in healthcare systems depending upon country under study, patient gender, age and number of problems discussed.^{2,4} Most influenced factor that increases consultation length involves patients having psychological problems, long term Comorbidity and psycho-social problems.^{5,6}

Consultation provides patient satisfaction and care by the doctor.³ Short consultation becomes challenging to provide good care, patient satisfaction and doctors may not clearly explain prognosis to patients properly.⁷ Shorter consultations usually lacks large number of preventive activities and general

practitioners urges that either medium or large consultations must be accommodated to provide greater prospects and opportunities for health promotions.¹ Moreover, shorter consultations pay less attention to psychological and psycho-social problems.⁸ Whereas longer consultation provides ample room for recording different notes, health education and making prescribing decisions.^{1,7,8}

Consultation length can be subdivided into three factors, i.e., history, physical examination and writing prescription. In history, enquiry about smoking or alcoholic habits, blood pressure, previous health status, exercise, medical record, nutritional and dietary habits are noted.¹ In physical examination, patient screening procedures like cytology procedures, health screening, multiphasic or multiple screening, prescriptive screening, Omaha screening are performed and recorded.⁹ Prescription writing is therapeutic transaction between patient and physician which is an instrument of instruction from prescriber to dispenser rendering highest professional services.¹⁰ Prescription can be proprietary or non-proprietary consisting of superscription, inscription, subscription, signature,

labelling and refills.¹¹ It reflects decision, authoritative approach and doctors' competence.¹⁰

To our knowledge, consultation length has not been investigated in Khyber Pakhtunkhwa till date. Therefore, it is significant to analyse first hand data obtained from five different tertiary units in light of mentioned factors.

MATERIAL AND METHODS

The sample data is collected from five different hospitals across two major cities, Peshawar and Abbottabad of Khyber Pakhtunkhwa to analyse the average length of consultation and to infer difference

across the reported setups. In this study, 386 male and female participants were invited from Ayub Teaching Hospital Abbottabad (ATH), Hayatabad Medical Complex Peshawar (HMC), Khyber Teaching Hospital Peshawar (KTH), Lady Reading Hospital Peshawar (LRH) and Rehman Medical Institute Peshawar (RMI). The hospital, gender and designation wise contribution of the participants is depicted in figure-1. These hospitals are tertiary care institutes providing multidisciplinary healthcare services. This study abided the Declaration of Helsinki and informed consent was obtained from all the participants included in the study

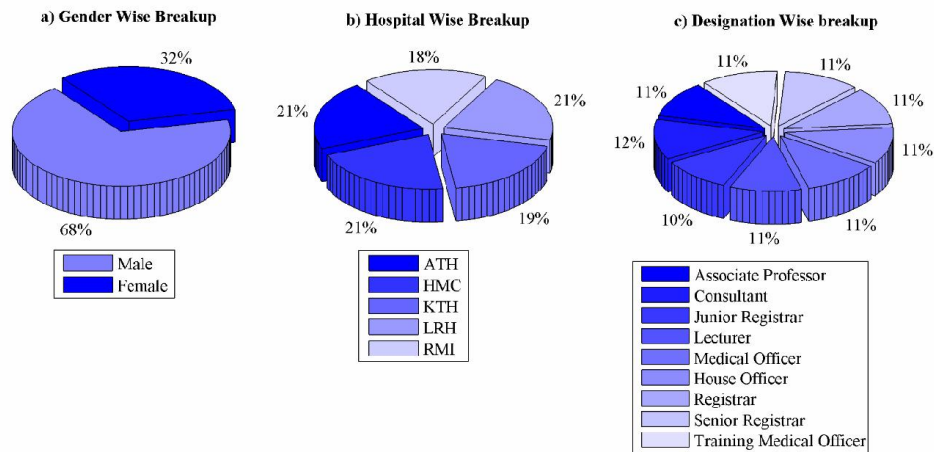


Figure-1: Percentage wise breakup of correspondent's doctors based on a) gender, b) hospital, and c) designation of doctors and the patients who visited them

The questionnaire has 21 questions to collect information regarding number of patients and consultation length primarily. These were categorized in three section 1) Personal Information, 2) Questionnaire, and 3) Telemedicine. Data is collected using Snowball Sampling (Chain Referral Sampling) methodology.¹² This sampling method is used to overcome the conflict including lack of trust, suspicion that arises due to uncertainty and to obtain unbiased estimates.¹³ The sample was collected using different ways, i.e., distributing questionnaire to doctors and patients; face to face interview with doctor and patient.

Snowball Sampling uniquely identifies sociological problem¹⁴ but two issues are associated in sample collection stage. First is "controlling types and number of cases in chain" and second is "pacing and monitoring referral chains and data quality". To overcome the first problem "s stage k" Snowball sampling procedure was adopted with "s = 3 and k = 5". Thus, sample size of 155 is collected from health professionals and patients each via questionnaire distribution. While, 76 correspondents (healthcare professionals and their visiting patients) were

interviewed and observed in these setups. To overcome pacing referral and assure quality of data, monitoring and evaluation via cross questioning was adopted. Moreover, outlier detection¹⁴⁻¹⁶ as well as Cronbach's alpha test¹⁷⁻¹⁹ are performed to prove authenticity of data. The sample size of 386 provides assurance that it will represent true population proportion with 5% margin of error and 95% confidence in the collected sample.²⁰

We divided our statistical analysis in four sections which includes data validity testing (outlier detection and Cronbach's Alpha test), collection of univariates (mean, standard deviation (SD), confidence interval (CI) and hypothesis testing of mean), bivariate (Pearson Correlation) and multivariate (Regression analysis) test. The data validity and bivariate Pearson Correlation tests are performed on whole sample. Univariate and multivariate tests are performed on gender, designation and hospitals. Consultation length is further split into recording patient history, physical examination, writing prescription. Data validity, bivariate, univariate and multivariate tests are performed using SPSSv19.²¹

RESULTS

Data traits of the sample were validated for reliability and consistency during pre-and post-collection to overcome the limitation of snowball sampling. Internal constancy in data was checked via Cronbach’s Alpha (α) (coefficient alpha and/or coefficient of reliability) test was performed on whole sample.^{17,18,22} Alpha significance ($\alpha = 0.835$) shows 83.5% internal consistency among data contents and considered good ($0.8 \leq \alpha < 0.9$).²³ Outliers are considered noise culminating anomalies in data, consequently, leading to inappropriate results, postulates model or process incorrectly and may cause biased parameter estimation.²⁴ To check data validity, Univariate Outlier Detection test is adopted based on Z score for each factor in sample data.^{15,24,25} The Z score methodology is selected because sample is normally distributed and sample size is greater than 30.^{20,26,27} The basic methodology of two tailed outlier detection is used in which maximum and minimum of Z-value of each parameter is compared with SD.^{15, 25} We found only 5 (1.29%) outliers in prescription writing (T_P), which is negligible whereas, no outliers were detected in history (T_{Hx}), physical examination (T_{PE}) and total consultation length (T_{cnslt}). These results are summarized in Table-1.

The result of univariate statistics is divided into two phases. In first phase, we calculated confidence for mean T_{Hx} , T_{PE} , T_P and T_{cnslt} . Error bar graphs are depicted in figure-2.

In the second phase, we performed hypothesis testing. We considered null hypothesis (H_0) as “two means are equal” against alternate hypothesis (H_1) “means are not equal”. The results of hypothesis testing performed on gender, hospital and designation for considered parameter is given in the table-2.

In bivariate analysis, we performed Pearson’s Correlation to evaluate continuous variables recorded in

clinical studies.²⁸ The results of Pearson’s Correlation and its significance (p-value) are summarized in table-3. To proceed further, we considered T_{cnslt} as dependent variable whereas T_{Hx} , T_P and T_{PE} as regressors or independent variable. As a result, group of regressors parameters (T_{Hx} , T_P and T_{PE}) have a high degree of correlation with dependent variable (T_{cnslt}) at both 95% ($p < 0.05$) and 99% ($p < 0.01$) confidence level in positive direction. But if variables are highly correlated then simple linear regression can generate spurious results, if statistical theory is not cautiously apprehended.²³ Therefore, we have to first check collinearity and/or multi-collinearity so that proper regression model can be selected otherwise, it can garble model development process due to deceptive interpretation causing an eminent risk of Type I error (false positive error).²⁹ First step to confirm the existence of multi-collinearity is the existence of high correlation theoretically. In our case, covariates T_{Hx} and T_P are highly correlated having R values of 0.856 and 0.844 with predictor T_{cnslt} . Therefore, multi-collinearity among regressors seems to exist. In second theoretical confirmation, any regressor can be expressed via combination of other factor.²⁹ In our case T_{cnslt} is sum of the covariates T_{Hx} , T_P , T_{PE} thus indicating existence again. The third method of practically confirming multi-collinearity is adoption of iterative process to extract Variance Inflation Factor (VIF).²⁹ We performed multiple linear regression on whole sample data to extract collinearity factor (VIF value). We found that model fitness is 100% ($R=1$) with maximum VIF value 1.625. Here the VIF value is in conflict with existence of multi-collinearity. Therefore, it shows that multi-collinearity does not exist and multiple linear regression can be adopted as prediction model.²⁶ The generic structure of prediction model and there corresponding coefficient values are recorded in table-4.

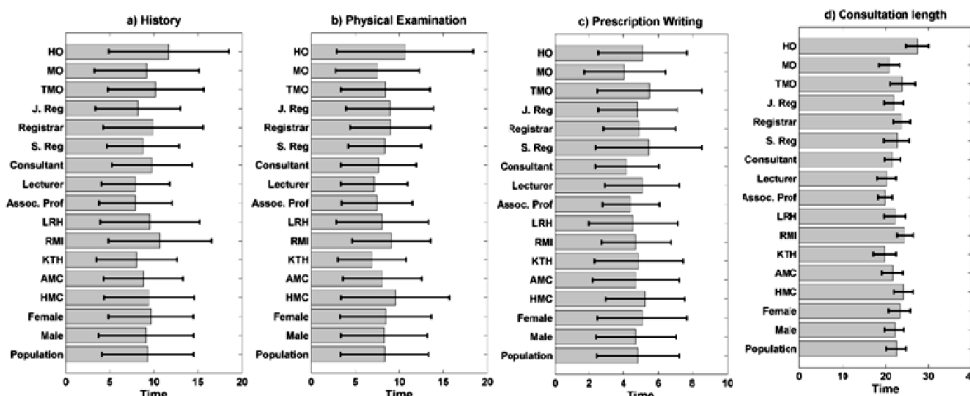


Figure-2: Results of first phase of univariate analysis. Graphs (a-f) represent error bars showing 95% confidence intervals on the mean using each parameter for the entire sample, hospitals and designation independently

Table-1: Testing of Outlier Detection for each parameter over full collected sample

Selected Parameter	Mean±SD	Minimum Z-value	Maximum Z-value	*No. of Outliers	Percentage
T_{HX}^a	9.301±5.202	-1.548	3.979	0	0
T_{PE}^b	8.534±4.994	-1.673	4.334	0	0
T_P^c	4.833±2.416	-2.001	4.208	5	1.29%
T_{cnslt}^d	22.466±10.264	-1.848	3.657	0	0
T_{FU}^e	8.939±5.953	-1.502	5.638	0	0
T_S^f	6.851±6.312	-1.085	5.648	0	0

Outliers detected via Ztest

^a T_{HX} is time taken to enquire history.
^b T_{PE} is time taken to perform physical examination.
^c T_P is time taken to write prescription for the patients.
^d T_{cnslt} is single patient consultation length.
^e T_{FU} is consultation time taken by follow-up patient.
^f T_S is Switching time, i.e., time taken to shift from one patient to another patient.

Table-2: Second phase of univariate statistical analysis. The results of hypothesis testing based on gender, hospitals and designations wise distribution

Group	Null Hypothesis ($H_0: \rho = 0$)	Alternate Hypothesis ($H_0: \rho \neq 0$)	†P Value
Gender	Mean of T_{HX}^{da} Concerned Gender are equal	Mean of T_{HX} Concerned Gender are not equal	0.325
	Mean of T_{PE}^c Concerned Gender are equal	Mean of T_{PE} Concerned Gender are not equal	0.752
	Mean of T_P^f Concerned Gender are equal	Mean of T_P Concerned Gender are not equal	0.164
	Mean of T_{cnslt}^g Concerned Gender are equal	Mean of T_{cnslt} Concerned Gender are not equal	0.313
Hospital	Mean of T_{HX}^a Concerned Hospital are equal	Mean of T_{HX} Concerned Hospital are not equal	0.033
	Mean of T_{PE} Concerned Hospital are equal	Mean of T_{PE} Concerned Hospital are not equal	0.009
	Mean of T_P Concerned Hospital are equal	Mean of T_P Concerned Hospital are not equal	0.451
	Mean of T_{cnslt} Concerned Hospital are equal	Mean of T_{cnslt} Concerned Hospital are not equal	0.026
Designation	Mean of T_{HX}^c Concerned Designation are equal	Mean of T_{HX} Concerned Designation are not equal	0.012
	Mean of T_{PE} Concerned Designation are equal	Mean of T_{PE} Concerned Designation are not equal	0.041
	Mean of T_P Concerned Designation are equal	Mean of T_P Concerned Designation are not equal	0.040
	Mean of T_{cnslt} Concerned Designation are equal	Mean of T_{cnslt} Concerned Designation are not equal	0.019

^a the Concerned Gender are male and Female
^b the Considered Hospitals are Ayub Teaching Hospital (ATH), Hayatabad Medical Complex Peshawar (HMC), Khyber Teaching Hospital Peshawar (KTH), Lady Reading Hospital Peshawar (LRH) and Rehman Medical Institute Peshawar (RMI)
^c the Concerned Designations are associate professors, lecturers, consultants, senior registrars, registrars, junior registrars, training medical officers, medical officers and house officers

^d T_{HX} is time taken to enquire history.
^e T_{PE} is time taken to perform physical examination.
^f T_P is time taken to write prescription for the patients.
^g T_{cnslt} is single patient consultation length.

†One way ANOVA Test is applied for hypothesis testing significance at $p < 0.05$.

Table-3: Pearson Correlation and Significance (p-value) values of Collected Sample

		T_{HX}	T_{PE}	T_P	T_{cnslt}
T_{HX}^a	Correlation Coefficient (r)	1	.512**	.432**	.856**
	Sig. (p value)		<0.01	<0.01	<0.01
T_{PE}^b	Correlation Coefficient (r)	.512**	1	.418**	.844**
	Sig. (p value)	<0.01		<0.01	<0.01
T_P^c	Correlation Coefficient (r)	.432**	.418**	1	.657**
	Sig. (p value)	<0.01	<0.01		<0.01
T_{cnslt}^d	Correlation Coefficient (r)	.856**	.844**	.657**	1
	Sig. (p value)	<0.01	<0.01	<0.01	

*. Correlation is significant at $p < 0.05$ (2-tailed)
 **. Correlation is significant at the $p < 0.01$ (2-tailed).

^a T_{HX} is time taken to enquire history.
^b T_{PE} is time taken to perform physical examination.
^c T_P is time taken to write prescription for the patients.
^d T_{cnslt} is single patient consultation length.

Table-4: Main Equation for prediction and their corresponding coefficient values using multiple linear regression model

Main Eq.	$T_{consult} = C_{Hx}T_{Hx} + C_{PE}T_{PE} + C_P T_P + + \alpha C$			
Parameters	C_{Hx} ^a	C_{PE} ^b	C_P ^c	α ^d
Sample				
Overall	0.999	1.000	1.001	0.001
Gender				
Male	0.998	1.000	1.000	0.02
Female	1.000	1.000	1.000	-1.68×10 ⁻¹⁴
Hospitals				
ATH	0.993	1.002	1.007	-0.01
HMC	1.000	1.000	1.000	6.39×10 ⁻¹⁶
KTH	1.000	1.000	1.000	2.05×10 ⁻¹⁵
LRH	1.000	1.000	1.000	-2.73×10 ⁻¹⁵
RMI	1.000	1.000	1.000	1.00×10 ⁻¹⁵
Designation				
Associate Professor	0.983	1.004	1.033	-0.07
Consultant	1.000	1.000	1.000	6.16×10 ⁻¹⁵
Junior Registrar	1.000	1.000	1.000	3.04×10 ⁻¹⁵
Lecturer	1.000	1.000	1.000	-6.37×10 ⁻¹⁶
Medical Officer	1.000	1.000	1.000	-3.42×10 ⁻¹⁵
House Officer	1.000	1.000	1.000	-8.26×10 ⁻¹⁵
Registrar	1.000	1.000	1.000	-1.63×10 ⁻¹⁵
Senior Registrar	1.000	1.000	1.000	4.76×10 ⁻¹⁵
Training Medical Officer	1.000	1.000	1.000	-1.86×10 ⁻¹⁵
^a T_{Hx} , T_{PE} and T_P are the explanatory variable and $T_{consult}$ is the dependent variable. The slope are C_{Hx} , C_{PE} and C_P and α is the intercept ^a C_{Hx} is regression coefficient for time taken to enquire history (T_{Hx}) ^b C_{PE} is regression coefficient for time taken to physical examine (T_{PE}) ^c C_P is regression coefficient for time taken to write prescription (T_P) ^d α is regression coefficient for follow-up consultation (T_{FU})				
ATH = Ayub Teaching Hospital HMC = Hayatabad Medical Complex KTH = Khyber Teaching Hospital LRH = Lady Reading Hospital RMI = Rehman Medical Institute				

DISCUSSION

This article provides a systematic study to perform data validity testing, collecting univariate, bivariate and multivariate statistics to infer, extrapolate and strengthen the gargantuan difference in consultation time. This was three arm study, conducted in five tertiary units of Khyber Pakhtunkhwa, Pakistan. We focused on consultation length of various health professionals, future trends and analyse whether the results are inline internationally.

We collect data by snowball sampling method. In our study Cronbach’s alpha and outlier detection tests shows that data is internally consistent and reliable with very low percentage of outliers, thus suitable for further testing and plotting inferences.

The mean of T_{Hx} spans between (7.915±3.86 to 11.69±6.805) minutes. It was found inline (6.1±2.5 to 9.6±5.9 min) with a study conducted by Perry *et al.*³⁰ This indicates that appropriate time is given to enquire history and medical records, signifying that nearly systematic history is taken with consideration of patient to patient status while laying grounds to rejection of H_0 .

The SD and CI ([6.68–9.092], [9.632–13.748]) of T_{Hx} observed are highly diverse.

The mean of T_{PE} [6.889±3.795 to 10.667±7.768] stipulates that doctors adopt and apply screening procedures including cytology procedures, multiphasic, prescriptive, and Omaha screening to diagnose and assess requirements for specialist care.⁹ While in a study conducted in ophthalmic setup demonstrated the length of physical examination varies between 3.9±2.1 ~ 6.2±3.8.³¹ Whereas, Masahiko et al reported this examination length to be a short one.³¹ The values of SD and CI ([6.004–7.773], 8.317–13.016) observed for T_{PE} have high variation specifically SD, signifies systematic physical examination procedures are adopted and patient to patient status is considered as T_{PE} may increase or decrease depending upon patients’ condition.²

We also observed that mean of T_P has a minor variation of 1 minute and 26 seconds [4.063 5.494] approximately (Figure 2). The mean indicates that proper procedure for prescription writing is adopted^{10,11} with mild variation in means indicate difference in doctors’ writing power. The SD and CI of T_P is not

diverse too. Moreover, this limited spread in our data paves path towards acceptance of H_0 .

The mean of T_{cnslt} spans between 19.869 to 24.539 minutes (Figure-2), reflects the decision, authoritative approach and competence of doctor.³² Moreover, these values lie in upper boundary of intermediate consultation length. The healthcare consultation length can be short (10 minutes or less), intermediate (11–30 minutes) or long (greater than 30 minutes).^{2,33,34} Literature suggests that healthcare professionals' or General Practitioners' consultation length are usually of intermediate length (20 minutes).^{2,33} This infers exuberant prescribing skills and covering psychological and psycho-social problems of patients.³² The SD shows that internal spread of data has diverse nature, therefore, it can be inferred that there is high divergence in healthcare system and doctors deals with patients having multiple health problems.

As in the second phase, i.e. hypothesis testing, we considered null hypothesis (H_0) as "at least two means of T_{Hx} , T_{PE} , T_P and T_{cnslt} are equal" whereas alternative hypothesis (H_1) as "at least two or more than two means of T_{Hx} , T_{PE} , T_P and T_{cnslt} are not equal". Considering doctors' gender, we found that considered parameters failed to reject H_0 ($p>0.05$) due to lack of sufficient evidence at 95% significance level. This study is consistent with other studies found in this direction with slight difference of hardly maximum two minutes.³⁵ Therefore, it is concluded that time consumed to serve patient by male or female healthcare professional is significantly same. Moreover, doctor's gender does not cause effective outcome on consultation length whereas the Hungarian female practitioners has documented positive effect.³⁶

We found that T_{Hx} , T_{PE} and T_{cnslt} rejected H_0 in favour of H_1 ($p<0.05$) for hospitals, while, T_{Hx} , T_{PE} , T_P and T_{cnslt} rejected H_0 in favour of H_1 ($p<0.05$) for designation of doctors due to sufficient evidence in data at 95% significance level. This is in consistent with international studies supporting the notion that variation of difference in time exists consumed by T_{cnslt} , T_{Hx} and T_{PE} .^{2,3,6,33}

The two tailed Pearson's Correlation test revealed positive correlation between T_{Hx} , T_{PE} , T_P and T_{cnslt} at 95% ($p<0.05$) as well as 99% ($p<0.01$) significance level. This makes T_{Hx} , T_{PE} and T_P competitor to be regressors for regression model. Moreover, T_{cnslt} , T_{Hx} , T_{PE} and T_P has direct inter relationship with each other because T_{Hx} , T_{PE} and T_P are sub-factors of T_{cnslt} .^{29,37}

Strong correlation among T_{Hx} and T_{PE} made a fluctuating and impulsive situation to decide predictor model indicating existence of multicollinearity.^{26,29,38} VIF value of regressors is the most common tool to confirm the existence of multicollinearity.^{29,39} In our

case VIF is 1.625 maximum indicating no effective multicollinearity between regressors. Therefore, we opted for Multiple Linear Regression instead of Ridge Regression to predict future values of consultation length.^{23, 26} Alpha (α) constant has negligible value outcome whereas T_{Hx} , T_{PE} and T_P has unity or near coefficient values, thus has no evident effect on predictor variable T_{cnslt} . Therefore, there will be no positive or negative effect of regressors on predictor with passage of time. Hence current consultation length is at optimum level.

CONCLUSION

This study has demonstrated that consultation length lies in intermediate range in tertiary hospitals of Khyber Pakhtunkhwa. Thus, it can be concluded that multiple health issues of patients are discussed with doctors. Similarly, ample proportion of difference in the length is recorded in hospitals and designation of doctors whereas not in gender. The variation in average consultation length indicates that patient current health status, psychological and psycho-social problems play important role in providing consultations. The more complex health status of patient is, greater time is consumed and vice versa. Moreover, the explanatory variables of regression analysis indicate that consultation length is at optimized level.

This difference of timing can be helpful in proper utilization of health care professionals via scheduling of patients, adopting procedures for patients' load balancing and helping in strengthening skill mix of healthcare professionals.

Although, this study is conducted over a wide range of directions but, the direction of doctors' speciality is missing to record the average consultation length, internal and external variation and influence of time span required to achieve optimized level. Our future goal is to extend the current study in this direction, and to devise appointment rules that will further strengthen up skill mix policy, capable to perform load balancing, properly utilize health workforce and provide monetary benefits to doctors.

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AUTHORS' CONTRIBUTION

MI: Literature search and study design, data collection. WI, FB: Data analysis. MI, SAB: Write-up. SNAS: Proof reading.

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