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COMPARISON BETWEENPEAK EXPIRATORY FLOW RATE (PEFR) AND FORCED EXPIRATORY VOLUME IN FIRST SECOND (FEV1) IN MONITORING THE AIRWAY STATUS OF STUDENTS STUDYING IN COLLEGE OF APPLIED MEDICAL SCIENCES, RIYADH

Farhan Alanazi[1], Sreekanth Komath[1], Sami Faleh Almutairi[1], Hasan Salim Alqarni[1], Abdullah Fraih Alharbi[1], Abdulaziz Huraiti Alzahrani[1], Abdulelah Ahmed Alzahrani[1], Winnie Philip[2] and *Shoeb Qureshi[2]

[1]Department of Respiratory Therapy,
[2]Department of Research, College of Applied Medical Sciences, King Saud Bin Abdulaziz University for Health Sciences, Riyadh-Saudi Arabia

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PEFR, peak expiratory flow rate,
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COPD, spirometry.

ABSTRACT

Lung function tests are considered as one of the major diagnostic technique in respiratory care to assess the ventilatory status of patients. Forced expiratory volumes in first second (FEV1) and peak expiratory flow (PEF) are used extensively to measure airway status. The purpose of the study is to evaluate the airway status of students in KSAU-HS.

Objectives: The objective of the study is to find out the variation in FEV1 in proportion to the variation in PEFR, compare the PEFR value in peak flow meter and spirometery and to find out whether there is any relationship with PEFR, FEV1 and vital signs.

Methodology: The study was conducted in respiratory therapy lab. Out of 120 students from COAMS, a sample size of 95 students were fixed but conducted in 71 subjects due to various limitations. The data collected was entered in Microsoft Excel and exported to SPSS version-22 for doing analysis of data.

Result: The subjects were the students from various programs of COAMS, Riyadh. The minimum age of the participant was 20 years old and the maximum was 23 years old (mean age 21.1).Vital signs were recorded prior to study. A comparison of Peak Expiratory Flow Rate (PEFR) using peak flow meter and spirometry showed a statistical significance (p value=.019). A PEFR value in peak flow meter and FEV1 in spirometry also was statistically significant (P=.006).

Conclusion: There are findings in favor and against of this study. This study suggest that PEF value obtained by a peak flow meter cannot substitute for value obtained from FEV1 by a spirometry and cannot predict the accurate reversibility of the airway status in asthmatic and COPD patients. Further peak flow meter can be used as a continuous assessment to determine the diurnal variation of the airway status. There were many limitations in this study.

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INTRODUCTION

Lung function tests have developed as an important weapon in the clinical assessment of respiratory status. It is considered as one of the major diagnostic respiratory technique to assess the ventilatory status and is also significant in the identification and management of respiratory diseases. Forced expiratory volume in first second (FEV 1) and peak expiratory flow rate (PEFR) are the methods of objective assessment of airway status. It is significant and essential in the assessment part of asthmatic subjects as studied recently. Observation of PEFR value is helpful for diagnosing changes in a patient's asthma control.

Corresponding author: **Shoeb Qureshi**
2Department of Research, College of Applied Medical Sciences, King Saud Bin Abdulaziz University for Health Sciences, Riyadh-Saudi Arabia.

Lung function tests permits an exact and reproducible assessment of efficiency of the respiratory system. As lung function tests quantify the severity of disease, it has become easy to assess the natural history and response to the treatment. Since there is a mixed population of students in King Saud bin Abdulaziz university for health scinces (both smokers & nonsmokers) and there are studies in favor and against the correlation between PEFR and FEV1.The purpose of the study is to evaluate the airway status of students in KSAU-HS and to find out the airway status on the basis of values obtained from both FEV1 and PEFR in both smokers and nonsmoker.

Review of Literature

Lung function tests have emerged as an important weapon in the clinical assessment of respiratory status. It is considered as one of the major diagnostic respiratory technique to assess the ventilatory status and is also significant in the identification and management of respiratory diseases (Jamison, 1993). Pulmonary function tests have improved its scope in respiratory medicine in such a way that the clinicians use this as a routine test in health examination in respiratory care. It is widely used in occupational, and sports medicine also (Ray Vaughan, 1989). The interpretation of PFT is on the basis of its reference value which is obtained as per the data given at the time of the maneuver (Ferguson, 2000). The reference data which can help in the management of respiratory disease is based on certain factors such as age, sex, height, and race or ethnic origin which have shown to be important determinants of pulmonary function measurements (Pellegrino, 2005 and Ferguson, 2000). It was also observed that high altitude may account for higher PEFR (Ray Vaughan, 1989). Forced expiratory volumes in first second (FEV1) and peak expiratory flow (PEF) are being used extensively to measure an estimate of airway status in obstructive pulmonary disease. FEV1 is considered as more reliable while compare to PEF throughout the world (Schwartz, 1988). Jamison (Jamison, 1993), found that Peak Expiratory Flow Rate (PEFR) is the rate at which a person can exhale at his maximum effort after full inspiration. Forced Expiratory Volume in one second (FEV1) is the maximal effort of removing complete air from the chest in one second (Oscherwitz, 1972). To measure FEV1, spirometry is required which may be unavailable in each and every clinical setting. So further studies are needed to assess whether the same information is provided by PEF which is easily available and cost effective (Ashutosh, 2006). A study to prove relationship between FEV1 and PEF and their ability to predict one from the other showed that there was a moderate positive correlation existed between these two (Thiaden, 1999). Another study performed to find out the relationship between both absolute & predicted percentage values concluded that in absolute values the co-efficient of co-relation was 0.95 and that of between percentages of predicted values was 0.91 which were very close and indicated that there is no significant improvement in the correlation even when values were expressed in percentages of the predicted values (McCormick, 1995). In the last decade, some new factors influencing lung function have been recognized. In that dyspnea on exertion, asthma, or pneumonia are found to be closely related to a lung disease and others such as hypertension or chronic heart failure point out a heart disease. Moreover it has been found that impaired lung function is considered as a risk factor for glucose intolerance, insulin resistance, and type 2 diabetes (Vaughan, 1989 and Lange, 1982).

The influence of waist size, body weight, body composition, or muscle strength on lung function should be considered as sources of variation in FEV1 and FVC (Lange, 1989). Spirometry is considered to be the single best test for asthma. In this test, after administering a bronchodilator salbutamol a value of FEV1 measured more than 12% and an increases by at least 200 milliliters is considered as a supportive for diagnosing reversible airway disease (Persson, 1986). FEV1 may be normal in some asthmatic patients who are stable without any acute exacerbation (Third Expert Panel on the Diagnosis and Management of Asthma, 2007). Peak flow readings are higher when patients are well, and lower when the airways are constricted. From the changes in values recorded, clinicians can determine lung functionality, the severity of asthma symptoms, and treatment (Murray, 2010). Kelly CA et.al found that a change in FEV1 and PEFR shows areas of airway narrowing (Kelly, 1988). Due to the wide range of normal values and the high degree of variability, peak flow is not the recommended test to identify asthma even though a small portion of people with asthma may benefit from regular peak flow monitoring (Kelly, 1988).

PEFR is more accurate than FEV1 in diagnosing occupational asthma which is proven in a study conducted by Burge P. S. et.al (Burge, 1998). A PEFR value of 80-100% is considered to be normal or in green zone which includes continue the maintenance medication or tapering the dose (Asthma Management and Prevention, 1995). Dekker FW et.al showed that PEFR and FEV1 show a significant correlation with each other in many ways to rule out of airway obstruction (Dekker, 1992). Since there is a mixed population of students in KSAU-HS (both smokers & nonsmokers) & there are studies in favour& against the corelation between PEFR and FEV1[20],the purpose of the study is to evaluate the airway status of students in KSAU-HS and to find out the airway status on the basis of values obtained from both FEV1 and PEFR in both smokers and nonsmokers.

MATERIALS AND METHODS

The study will be conducted on students who are studying in College of Applied Medical Sciences (COAMS) in King Saud bin Abdulaziz University for Health Sciences, KSAU-HS irrespective of their smoking habits. The study will be conducted in Respiratory therapy clinical lab in (COAMS) at KSAU-HS, Riyadh, Saudi Arabia.

Inclusion Criteria: Male students in the age between 20 to 26 years in COAMS, KSAU-HS.

Exclusion Criteria

- Students of age less than 20 years old and more than 26 years old.
- Female students.
- Students studying outside COAMS.

The study was Quantitative prospective cross sectional study.
Sample size = 384.16
New ss = 92 fixed to 95
Population size: 120
Margin of error: 5%
Confidence level: 95%.

Stratified random sampling technique will be used to select the subjects for the study. The data collected will be entered in Microsoft Excel and exported to SPSS version-22 for doing analysis of data .Various tests such as frequencies, percentages and 't' test will be used to analyse the data.

Ethical consideration

Informed consent will be obtained from the subjects before the initiation of the study. The Departmental approval and Institutional Review Board(IRB) approval from King Abdullah International Medical Research Center (KAIMRC) will be sought prior to the study. The study will maintain the confidentiality and anonymity of the respondents. Since it is an observational study, the details of clinical parameters and procedures will be documented and charted.

Cardiovascular Technology (2.8%) respectively (Fig. 1). The minimum age of the participant was 20 years old and the maximum was 23 years old (mean age 21.1). Vital signs such as heart rate (minimum65b/minute and maximum101 b/minute), blood pressure (minimum systolic-107 mmHg and maximum- 146 mmHg and minimum diastolic68mmHgand maximum is 91mmHg) and oxygen saturation (minimum 96% and maximum 100%) were recorded (Table-1). A comparison of Peak Expiratory Flow Rate (PEFR) using peak flow meter and spirometry showed a statistical significance (p value=.019) (Table-2). A PEFR value in peak flow meter and FEV1 in spirometry also was statistically significant (P=.006) (Table-3). A comparison was done to show any correlation between PEFR in spirometry and the vital signs which showed no statistical significance. (Table 4)

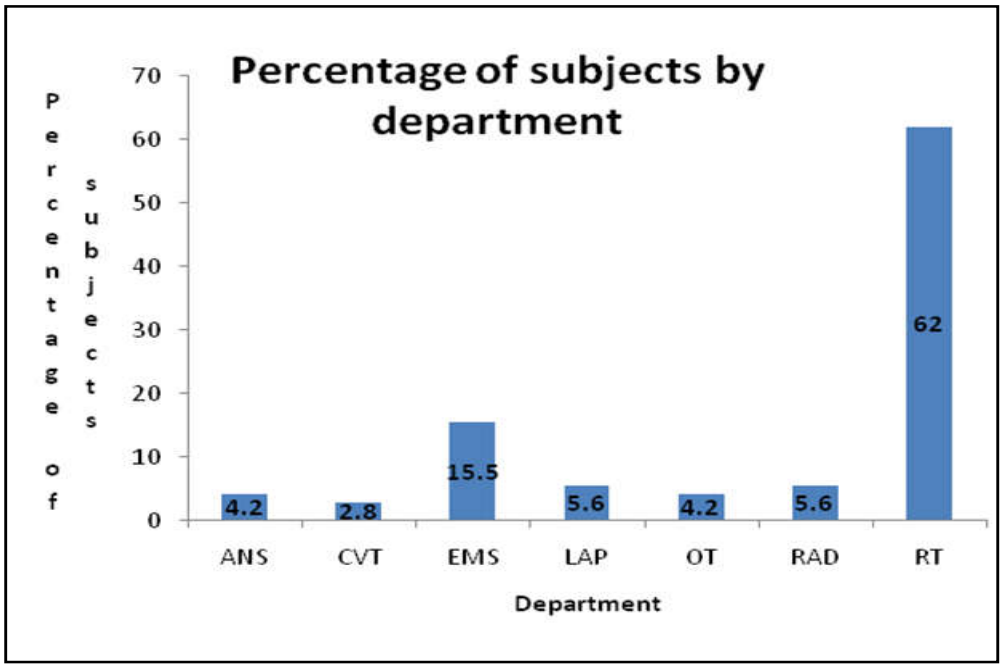

Table 1. Descriptive Statistics with Mean and Standard Deviation

	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	71	20	23	21.15	.768
BMI (kg/msquare)	71	18.00	90.00	26.5634	9.20052
HR (bpm)	71	65	101	80.99	7.032
Systolic BP (mm of Hg)	71	107	146	120.83	6.000
Diastolic BP (mm of Hg)	71	68	91	81.65	4.980
SpO2(%)	71	96	100	98.24	1.007

Table 2. Comparison of PEFR values in Peak flowmeter & Spirometry

Correlations

		PEFR_Peakflowmetre	PEFR_spi
PEFR_Peakflowmeter	Pearson Correlation	1	.278*
	Sig. (2-tailed)		.019*
	N	71	71

RESULTS

The subjects who enrolled in this study was the students from various programs of college of Applied Medical Sciences, Riyadh. Among all programs, students from Respiratory Therapy program was more(62%),followed by emergency medical service(15.5%),laboratory (5.6%), Radiology (5.6%), occupational Therapy (4.2%), Anesthesia (4.2%) and

DISCUSSION

This study investigated the concerns regarding any variation in PEFR value that can influence a variation in FEV1 parameter to detect the airway status. The study was mainly carried out in students studying in college of Applied Medical Sciences who mainly comes in an age between 19 to 23 years old. In this study a PEFR value in peak flow meter and FEV1 in spirometry showed a statistical significance (P=.006).

Table 3. Comparison of FEVI in spirometry and PEFR in Peak flowmeter

Correlations			
		PEFR_Peakflowmeter	FEV1_Spirometry_per
PEFR_Peakflowmetre	Pearson Correlation	1	.324**
	Sig. (2-tailed)		.006*
	N	71	71

*Significant at 5%

Table 4. Descriptive Statistics

	Mean	Std. Deviation	N
PEFR_spi	93.49	17.949	71
HR	80.99	7.032	71
BP_SYS	120.83	6.000	71
BP_DIA	81.65	4.980	71
SpO2	98.24	1.007	71

A comparison of Peak Expiratory Flow Rate (PEFR) using peak flow meter and spirometry was also performed which was also statistically significant with a P value (p value=.019). But there was no significance or any relation between the values obtained from both peak flow meter and spirometry with the vital signs. The values obtained from subjects in this study reveals that there is a proportionate change in FEV1 and PEFR values in relation with a change in PEFR value obtained from peak flow meter. A study conducted by Ashutosh N. Aggarwal et al favors this study by mentioning that there was a moderate correlation betweenFEV1% and PEF%. This finding is different from the findings of Gautrin D, et al, 1994, which says that assessment of airway caliber through PEFR monitoring may not be valid in some asthmatic subjects and can often lead to underestimation or overestimation of changes in FEV1.A study by H Thiadens et al mentioned that the clinical value of PEF measurements in the diagnosis of reversible obstructive airway disease should be revised. A clinical data including medical and social history, symptoms, vital signs, physical assessment, and spirometry in a prospective cohort of adult subjects (N= 129) with asthma exacerbations requiring hospital admission revealed that %PEFR is associated with %FEV1and remain statistically significant (Donald, 2006). There are findings in favor and against of this study. This study suggest that PEF value obtained by a peak flow meter cannot substitute for value obtained from FEV1 by a spirometry and cannot predict the accurate reversibility of the airway status in asthmatic and COPD patients. Further peak flow meter can be used as a continuous assessment to determine the diurnal variation of the airway status. There were many limitations in this study. The main limitation includes the willingness and the unavailability of the participants on time. Apart from that the ancillary materials needed for the machine were unavailable. The subjects who were smokers did not reveal. Some of the subjects had less patience where as some others did not understand the procedure well. Further studies are recommended by including six minute walk test and spirometry and six minute walk test and peak flow meter to check the airway status of the patients.

Acknowledgement

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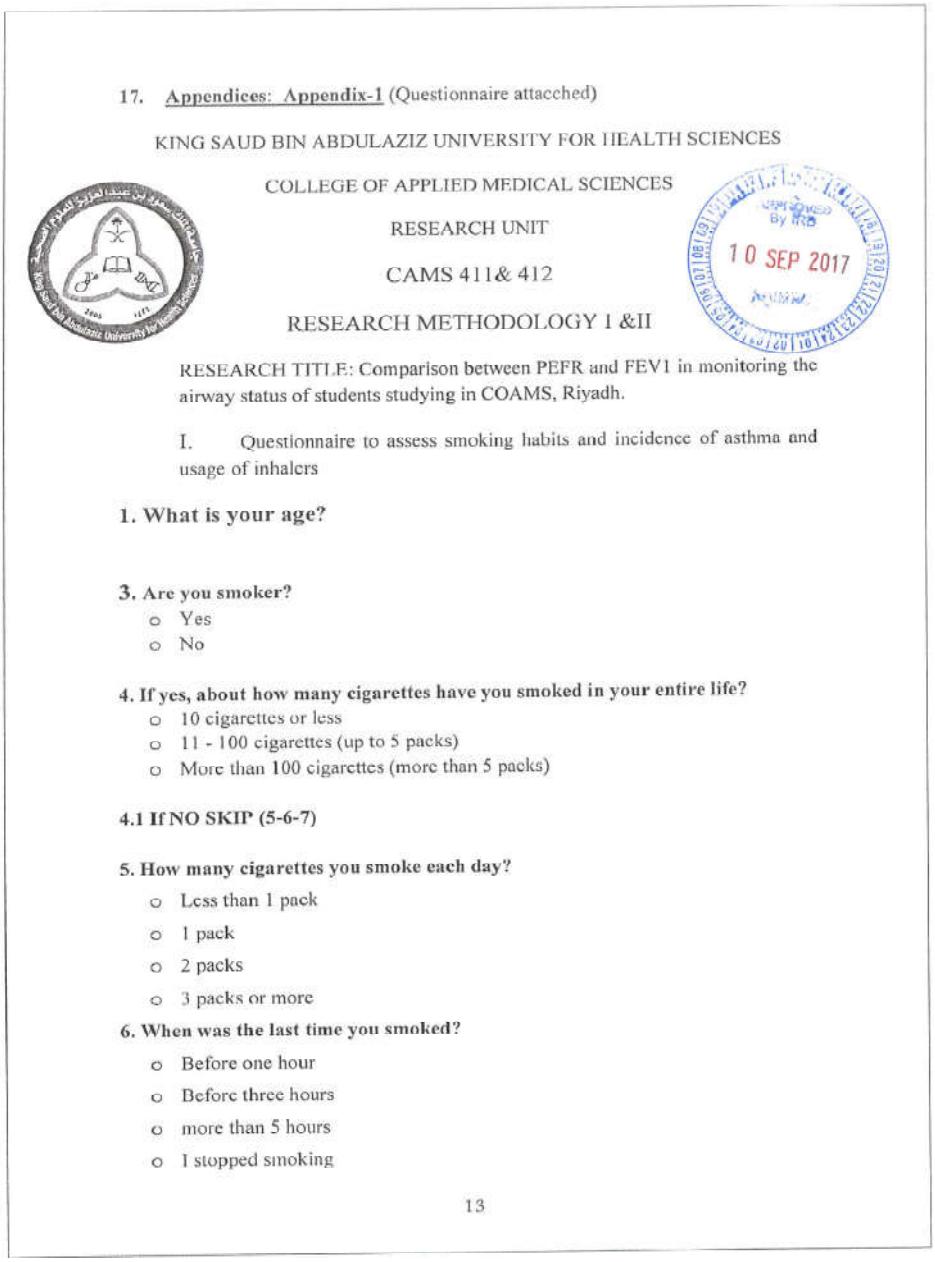
Appendices

Questionnaire approval



17. Appendices: Appendix-1 (Questionnaire attacched)

KING SAUD BIN ABDULAZIZ UNIVERSITY FOR HEALTH SCIENCES

COLLEGE OF APPLIED MEDICAL SCIENCES

RESEARCH UNIT

CAMS 411& 412

RESEARCH METHODOLOGY I &II

10 SEP 2017

RESEARCH TITLE: Comparison between PEFR and FEV1 in monitoring the airway status of students studying in COAMS, Riyadh.

I. Questionnaire to assess smoking habits and incidence of asthma and usage of inhalers

1. What is your age?

3. Are you smoker?
- o Yes
- o No

4. If yes, about how many cigarettes have you smoked in your entire life?
- o 10 cigarettes or less
- o 11 - 100 cigarettes (up to 5 packs)
- o More than 100 cigarettes (more than 5 packs)

4.1 If NO SKIP (5-6-7)

5. How many cigarettes you smoke each day?
- o Less than 1 pack
- o 1 pack
- o 2 packs
- o 3 packs or more

6. When was the last time you smoked?
- o Before one hour
- o Before three hours
- o more than 5 hours
- o I stopped smoking

13

7. **During the past 30 days (1 month) on how many days did you smoke cigarettes?**

- o Every day or almost every day
- o Some days
- o No days

8. **Until now, did your parents/guardians allow visitors and guests to smoke inside your home?**

- o Yes
- o NO

9. **Does your family have history of smoking?**

- o Yes
- o NO

10. **Are you exposed to passive smoking in your home or among close relatives?**

- o Yes
- o NO
- o

10.1 If yes, for how many hours each day are you exposed to passive smoking?

- o Less than 1
- o 3 to 7
- o More than 7

10. **Do you have asthma?**

- o Yes
- o NO

11. **How often did your asthma prevent you from getting as much done at work, school or home?**

- o All of the time
- o Most of the time
- o Some of the time
- o None of the time

12. **How often did your asthma symptoms (wheezing, coughing, chest tightness, shortness of breath) wake you up at night or earlier than usual in the morning?**

- o All of the time
- o Most of the time
- o Some of the time
- o None of the time

13. **How often have you used your reliever inhaler?**

- o All of the time
- o Most of the time
- o Some of the time
- o None of the time

Data Collection Approval

Appendix-II

Data collection sheet to compare PEFR and FEV1 in monitoring airway status of students studying in COAMS, KSAU-HS, RIYADH.

Serial Number	Age	Height	Weight	Vital Signs			FEV1	FVC	FEV!/FVC%	PEF (Spirometry)	PEFR (Peak flow meter)
				HR	BP	SPO_2					
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

ICF Approval

National Guard Health Affairs
King Abdullah International Medical Research Center
الشؤون الصحية بالحرس الوطني
مركز الملك عبدالله العالمي للابحاث الطبية

Cross-sectional surveys

Informed Consent Form

Study Title: Comparison betweenPeak Expiratory Flow Rate (PEFR) and Forced Expiratory Volume in First Second (FEV1) in monitoring the airway status of students studying in College of Applied Medical Sciences (COAMS), Riyadh	
Principal Investigator: Dr.Farhan Al Anezi	**Study No.:**

You are requested to participate in research that will be supervised by **(Dr.Farhan Al Anezi)** in (king Saud bin Abdulaziz university for health sciences, Riyadh, college of applied medical sciences).

This study is about **(the purpose of this project is Comparison betweenPeak Expiratory Flow Rate (PEFR) and Forced Expiratory Volume in First Second (FEV1) in monitoring the airway status of students studying in College of Applied Medical Sciences (COAMS), Riyadh)**.

Your participation is voluntary and you have the right not to accept filling this survey without giving any reason and this will not affect your current or future medical care in MNGHA

You don't have to sign this information sheet only you can choose to agree/disagree; your acceptance to complete the survey will be interpreted as your informed consent to participate.

Your responses will be kept anonymous. However, whenever one works with email/the internet there is always the risk of compromising privacy, confidentiality, and/or anonymity. Despite this possibility, the risks to your physical, emotional, social, professional, or financial well-being are considered to be 'less than minimal'.

If you have any questions about the research, please contact **(Dr. Farhan Al Enezi)** (0555944877/ Farhan03@yahoo.com).

انت مدعو للإنضمام طواعية لدراسة بحثية سوف يشرف عليها (د.فرحان العنزي) في (جامعة الملك سعود بن عبدالعزيز للعلوم الصحية بالرياض, كلية العلوم الطبية التطبيقية).

هذه الدراسة تهدف الى(**الغرض من هذه الدراسة المقارنة بين قيمة PEFR , وقيمة FEV1 في رصد وتقييم حال مجرى هواء طلاب كلية العلوم الطبية التطبيقية, الرياض.**).

ان مشاركتك في هذه الدراسة طوعية و لك الحق التام في عدم قبول تعبئه الاستمارة او الانسحاب في اي وقت تشاء بدون ابداء الاسباب و لن يؤثر ذلك على العناية الطبية المقدمة لك حاليا او في المستقبل في الشؤون الصحية بوزارة الحرس الوطني.

لا يجب عليك التوقيع على ورقة المعلوات هذه، فقط عيلك الاختيار موافق/غير موافق فمجرد قبولك تعبئة هذا الاستبيان يعتبر بمثابة اقرارك بالموافقة على المشاركه في هذا البحث.

ستبقى الردود على الاسئلة سرية. ومع ذلك، فأن العمل عن طريق البريد الالكتروني و الانترنت يبقى حناك احتمال لاختراق خصوصية البيانات و سريه المعلومات و لكن و بالرغم من هذه الاحتمالية تبقى الاخطار البدنية و العاطفية و الاجتماعية و المهنية و المالية المترتبة عليك ضمن الحد الادنى من الخطورة.

إذا كان لديك أي أسئلة حول هذا البحث، يرجى الاتصال (د.فرحان العنزي 0555944877/ Farhan03@yahoo.com).

في حال كان لديك الاستفسارات المتعلقة حقوقك كموضوع بحث يمكنك الاتصال بمجلس المراجعة المؤسسية على هاتف 8011111 تحوينة 14572.

In case you have enquiries related to your rights as a research subject you can contact the Institutional Review Board on Tel. 8011111 Ext. 14572.	

☐Agree to participate

☐Disagree to participate

☐موافق على المشاركة

غير موافق على المشاركة ☐

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