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● **Outcomes of Phototherapeutic Keratectomy To Treat Recurrent Corneal Erosion.**

Khalid M. Alabdulwahhab

**IN THE NAME OF ALLAH,  
THE MOST GRACIOUS,  
THE MOST MERCIFUL**



Kingdom of Saudi Arabia  
Ministry of Education  
Majmaah University



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## About the Journal

# Majmaah Journal of Health Sciences

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### **Vision**

The Majmaah Journal of Health Sciences shall be an international peer reviewed journal, which intends to serve researchers through prompt publication of significant advances, and to provide a forum for the reporting and discussion of news and issues concerning health sciences.

### **Mission**

To lead the debate on health and to engage, inform, and stimulate the academicians, researchers, and other health professionals in ways that will improve outcomes for patients.

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To promote research & evidence based practice in health sciences, so that a firm scientific knowledge base is developed, from which more effective practice may be evolved.

To ensure that the results of the research are rapidly disseminated to the practicing clinicians and educators, in a fashion that conveys their significance for knowledge, culture and daily life.

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## Editorial

From the Editor's Desk.....

Salaam Alaikum,

Once again it is a great pleasure in reaching you through this issue of MJHS. First of all let me thank our beloved Rector- Dr. Khalid bin Saad Al Meqrin and the Vice Rector for Graduate Studies and Scientific Research Prof. Dr. Mohammad Bin Abdullah Al-Shaaya'a for delegating this responsibility to me. I am pleased to acknowledge the contribution of our editorial board members. I also extend my gratitude to the reviewers, authors and the publishing committee.

In this era of technological explosion newer diagnostic methods, newer treatment modalities, academic journals may take this information to the practitioners and students, as knowledge and acquaintance of the same is much essential for better clinical practices. In the present scenario of education, publications are considered as mile stones of academic achievements. MJHS provides such a platform for the students and the teaching faculty inside and outside the Kingdom to exhibit their research. This issue of MJHS comes out with innovative articles belonging to review category, original research and case reports .This journal focuses on the researches on basic science and clinical research including prevention, treatment and prognosis of diseases.

As you may know that MJHS is indexed with index Copernicus, all efforts are being made by the editorial team to get MJHS indexed in other reputed search engines like PUB-MED, SCOPUS and ISI. "Education is the most powerful tool which can be used to change the world". It is a well known fact that learning gives creativity, creativity leads to thinking, thinking provides knowledge and knowledge makes you great. Research is nothing but creating new knowledge. Journals are meant for disseminating the knowledge, ideas and experiences through scientific articles. This issue of MJHS has interesting original articles and case reports, hope it will be greatly appreciated by the readers.

Without the support of the editorial team, panel of reviewers and also the members of MJHS, this mission to bring out this issue would not have been achieved. I take this opportunity to thank the Almighty and all the members of the University for their constant support throughout the process of publishing this journal.

**Editor-in-Chief, MJHS**

**Professor. Dr. Mohammed HS Al-Turaiki**



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ORIGINAL ARTICLE

# Towards a Simple System for Indicating Temporal Variations in Blood Pressure

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## Abstract

Blood pressure is an important physiological parameter to be monitored. For several medical conditions, it is important to quickly know the rise or fall in blood pressure. While researchers are working to evolve a reliable continuous non-invasive arterial pressure (CNAP) monitoring devices based on sophisticated signal processing with various technologies including Peñáz principle & pulse wave velocity (PWV); we present a very simple system to continuously indicate the variations in blood pressure. Using the typical shapes of the pulse wave obtained by infra-red photoplethysmography (PPG) from brachial and radial artery, we estimate the changes in pulse transit time (PTT). This change is effected onto a change in tone of an audio beep. The simple circuit was assembled and tested. The details are presented in the paper.

Keywords— pulse wave velocity, pulse transit time, blood pressure, differential amplifier, photoplethysmography

## الملخص

ضغط الدم هو المعلومة الفسيولوجية المهمة التي يتعين رصدها عند تشخيص اي مرض ، فمن المهم سرعة معرفة ارتفاع أو انخفاض ضغط الدم عند العديد من الحالات الطبية. في حين أن الباحثين يعملون على تطوير أجهزة رصد موثوق بها على أساس إشارات مستمرة و متطورة لقياس الضغط الشرياني. يحتوي جهاز الرصد المطور في هذا البحث علي مختلف التقنيات بما في ذلك مبدأ بيناز وسرعة موجة النبض يقدم هذا البحث نظام بسيط جدا مواصلة رصد الاختلافات في ضغط الدم عن طريق الأشكال النموذجية للموجة النبضية التي تم الحصول عليها عن طريق الأشعة تحت الحمراء (فوتوبشيزموغرافي) من العضد والشريان الكعبري، ومن ثم نقوم بتقدير التغيرات في وقت عبور النبض . يتم تنفيذ هذا التغيير على اختلاف في نغمة صوت صافرة الجهاز . تم تجميع الدائرة البسيطة واختبارها. التفاصيل هي المقدمة في هذه الورقة.

## I. INTRODUCTION

Blood pressure is the pressure exerted by the blood on the walls of vessels it flows through. It can be measured in different parts of the body using invasive or non-invasive techniques depending on the availability of access to vessel or underlying medical requirements. Routinely, it refers to the arterial peak (systolic) and lowest (diastolic) pressures exerted in arteries as the heart pumps the blood. As per WHO guidelines, the blood pressure is measured in the brachial artery held at heart level [1]. The gold standard instrument for non-invasive measurement of blood pressure is sphygmomanometer used in auscultatory method. The auscultatory and the other method, called oscillometric method, both involve inflating a cuff tied around the arm to occlude the brachial artery of the subject. Both the methods are widely used for cardiac screening as well as monitoring for various cardiovascular and other health issues. Intermittent obtaining of blood pressure with either of these methods is, in general, sufficient and good indicator for most cardiovascular diseases. The commonest cardiovascular issue, Hypertension or high arterial blood pressure, is routinely screened and monitored by either of these methods.

The blood pressure of an individual keeps on varying in response to various physiological stimuli. This is an adaptive and necessary response of body. However, there are certain medical conditions [2] like critical pregnancies, certain surgeries, cerebrovascular diseases [3], etc. in which blood pressure is required to be monitored rather continuously. Under certain unstable hydration conditions (due to dialysis or pharmaceutical effects) also, regular and continuous non-invasive blood pressure can avoid acute conditions [4]. Even gross indication of continuous variations in blood pressure can also be useful in most cases. The standard non-invasive method of occluding the artery and measuring blood pressure does not lend itself well to repeated or continuous measurements. Although, some situations may warrant invasive monitoring but, wherever possible, non-invasive (without using the cannula or pricking the skin) monitoring would

be preferable. It not only drastically reduces the chances of infection but also is convenient for both the patient and the caregiver. Researchers have tried several methods towards continuous non-invasive measurement of blood pressure. Finapres equipment [5] works on Peñáz principle based on exerting an opposing force on the finger cuff to prevent physical disruption of blood pulse. The emerging methods based on Pulse wave velocity (PWV) or pulse transit time (PTT) also promise to become more convenient alternatives to the occlusion methods [6].

The blood pumped by heart rushes into the arteries as a pulse. This mechanical wave of pulse spreads into complete vasculature every cardiac cycle. Stiffening of arteries and reduction of radius of arteries leads to increased blood pressure. Higher blood pressures have been related to increased pulse wave velocity [7]. Standard method of pulse wave velocity measurement consists of measuring the pulse wave recorded by one of the several available methods at carotid artery and at femoral artery (ca-PWV) [8]. The PWV is given as the physical distance between the two sites of measurement per unit time elapsed (pulse transit time) between pulse arrival times at two sites. This PWV method of estimating blood pressure and underlying thickening of arteries requires availability of trained technician and a relatively complex hardware. For measuring blood pressures it requires elaborate calibration and does not easily lend itself to automated measurements [7].

For meeting the situations where the objective is only to grossly estimate the temporal variations in blood pressure, we propose a simple technique using conveniently obtained pulse waveforms from the arm of the subject. It avoids precise identification of pulse arrival times and calibration. A simple circuit based on the technique was designed, assembled and tested. The developed system indicates the temporal variations of blood pressure as audio signals. The following paragraphs elaborate this. It can further be developed into an unobtrusive ubiquitous non-invasive blood pressure measurement device.

## II. THEORY

As indicated above, increased blood pressure shows as heightened pulse wave velocity. Also, PWV is

$$PWV = l / PTT \quad (1)$$

Where  $l$  = physical length of the arterial segment and PTT is the pulse transit time. Formally, PTT is given as difference in pulse arrival times at proximal and distal ends of artery. So, the main goal for indicating blood pressure continuously is to continuously monitor the pulse arrival time at two points of an artery. This is either done manually or requires sophisticated processing. To circumvent this, we can exploit the typical shape of pulse waveforms. Using the basic idea of pulse shapes at different body parts from the literature and based on convenience of wearing and maneuverability of device to heart levels, the brachial artery and the radial artery were chosen as two suitable points. Palm and fingers, although equally convenient, were not selected as the pulse waves at these points show significant reflected waveforms and were considered not suitable.

Typical pulse pressure waveforms obtained at brachial and radial artery are shown in fig 1 below. The times corresponding to point A and B indicate the pulse arrival times at respective locations. The time gap between these two time points indicate the pulse transit time. For measuring this PTT, we need to identify and locate the points on the two waveforms. This would evidently require complex signal processing.

We propose to simply take the difference of the two pulse waveforms with a differential amplifier and subject the output to a dynamic threshold, such that the output is

$$V_o = \begin{cases} V1 - V2 & \text{if } (V1 - V2) > 0.3 * \max(V1 - V2) \\ 0 & \text{otherwise.} \end{cases} \quad (2)$$

where,  $V1$  and  $V2$  are the pulse waveforms.

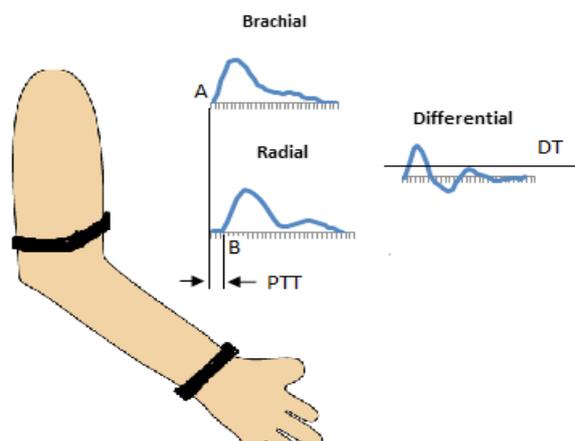


Fig1. Pulse Waveforms

This effectively gives us a clean workable signal which is positive for a time equal to two third of sum of PTT and upstroke time of distal pulse waveform. If  $t_{Vo'}$  and  $t_{Vo''}$  indicate the zero crossing times of the signal  $V_o$ , then the time for which the  $V_o$  remains positive, TVO is given as,

$$TVO = t_{Vo'} - t_{Vo''} = 2/3 ((PTT) + (\text{upstroke time})) \quad (3)$$

Now let the waveforms  $V1$  and  $V2$  shift relatively due to change in blood pressure. The zero crossing Times of  $V_o$  shall vary accordingly. For noting the change in blood pressure we notice the change in TVO. The change,  $\Delta TVO$  from equation (3) above would be

$$\Delta TVO = 2/3 ((\Delta PTT) + (\Delta \text{Upstroke time})) \quad (4)$$

As, the upstroke time of pulse waveform relates to the ventricular compression time, it can be safely approximated to be constant. So,  $\Delta \text{Upstroke time} = 0$ . Thus, we get  $\Delta TVO$  proportional to  $\Delta PTT$ . This fact is exploited for indicating changes in blood pressure. In order to keep the system simple, analog processing was used. The indication is given in terms of an audio tone, the frequency of which varies with the change in TVO times. This scheme is shown in the block diagram (Fig 2) below.

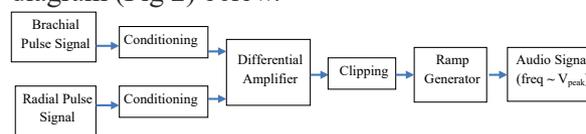


Fig 2. Schematic Diagram of the Technique

### III.IMPLEMENTATION AND TESTING

#### A. Sensor Design

Researchers have used different methods to detect the pulse wave and to analyze the pulse wave velocity [9]. Researchers have also analyzed the contour of pulse wave for different clinical estimates [Predicting Arterial Stiffness From the Digital Volume Pulse Waveform, A knowledge-based approach to arterial stiffness estimation using the digital volume pulse.]. In our design, being primarily interested in arterial pulse waveform, Infra-red PPG was selected for its convenience and suitability based on [6]. Of the two, reflection and transmission modes, reflective sensors are much more unobtrusive and amenable to different body locations. So, two reflective PPG sensors were decided.

We used IR LED (Kingbright KP-1608 with peak  $\lambda$  940nm and viewing angle 120°) and phototransistor (Vishay VEMT-2020X01, 790 to 970nm with half sensitivity angle = 15degrees) mounted on small circuit board. The LED was placed in the middle and photodetector was mounted at a distance from it. This test-sensor was applied to wrist and arm using a band and the signal obtained. This was repeated for different source –detector distances. Based on test data, two identical sensors were then made with a source – detector distance of 8mm.

#### B. System Design

The system was implemented on a specially designed circuit board and assembled using hand soldering. The PPG signals obtained from sensors are band-passed between 0.5Hz to 20 Hz. These were then amplified using Operational Amplifier (LM348 with variable gain resistor). The amplified signals were fed to the two ends of differential amplifier (THS 4121, Texas Instruments). The output of the differential

amplifier is fed to a peak holding circuit and three resistances are used to get one third of the peak signal. Simple comparator

circuit (using LM348) applies this threshold to the signal. Output of the comparator powers (gates) a RC ramp generator. So, longer the PTT the longer the gating and so, greater the ramp output. The peak of the ramp output, with peak holding, decaying circuit and Voltage controlled oscillator (VCO, MAX 038 of Maxim Integrated), is translated into an audio beep whose frequency changes with PTT. The tone of this audio beep was thus indicative of changes in blood pressure of the individual.

#### C. Test Set-up

The two sensors were placed at brachial artery and radial artery at wrist respectively and secured with bands. The sensor outputs were given to the designed circuit assembled on a printed circuit board. The output audio beeps were listened to carefully for testing the system. The amplified sensor outputs and the clipped output were tapped out to a custom built acquisition system consisting of three ADCs sampling at 300 Hz in round robin fashion and of microcontroller (AVR evaluation kit) interfaced to PC via serial port. A software program was made to display the waveforms in real time. The Fig 3 below shows the test set up and fig 4 shows a random screenshot of output.

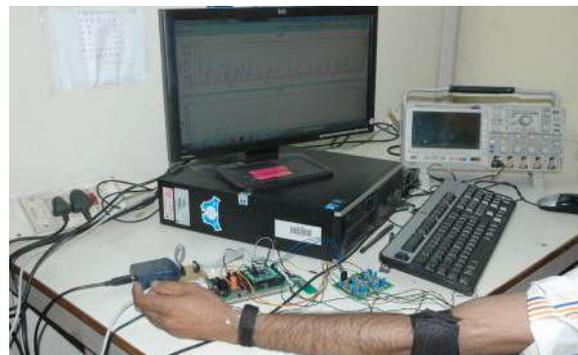


Fig 3. Test Set-up

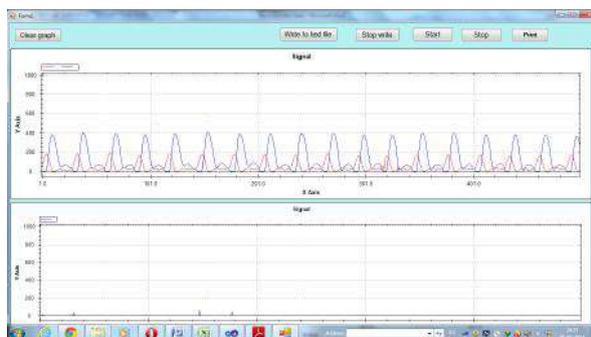


Fig 4 Random Screenshot

The system was applied to a normal healthy volunteer and audio tone listened. His systolic, diastolic and mean blood pressure was also recorded using automatic blood pressure monitor (Omron HEM-7120). The volunteer was then shown a random video clip from the collection of movies in library and the above process repeated. After sufficient rest, he was asked to undertake strenuous exercise and all measurements were repeated. The process was repeated randomly for the same individual without disturbing the sensors attached. This was done for each of ten normal healthy volunteers recruited for the purpose. The results are tabulated in table 1 below.

#### IV. RESULTS AND DISCUSSIONS

The experiment was run for seventy instances of change in blood pressure. Observations by listening to the audio tone have correlated well with the change in systolic blood pressure as measured using standard NIBP instrument. The Fisher's

TABLE I. SUMMARY OF OBSERVATIONS

		No of instances of change in Systolic BP (mm of Hg)				Total
		$\leq 20$	No Change	$\leq 20$	$>20$	
After watching movie	Actual	1	6	3	0	10
	Observed by tone	0	5	5	0	10
After exercise	Actual	0	1	3	6	10
	Observed by tone	0	0	3	7	10

exact test on the results show a  $p=0.0064$  (and total 'unusual tables' probability = 0.952). thus, the results are significantly related. This experiment is an initial result of feasibility and suitability of proposed novel system for indicating changes in blood pressure of the subject. The system has well indicated the changes in systolic blood pressure of an individual. Various possibilities of error and bias of the observer have not been really addressed. So, validation of the system with extensive experiments and on a larger population is imperative. The simplicity of the system comes from the selection of pulse waveforms and the method to estimate changes in PTT. Its suitability in patients with various cardiovascular issues remains to be explored. Nevertheless, it can be further developed and customized to precise measurements of blood pressure for most cases. Further, the application of sensors is prone to lot of errors requires extensive experimentation for standardization. In this experiment we have applied sensors by looking at the real time waveforms and reapplying (or adjusting the pressure) if optimal waveform matched with previously stored waveform is not obtained. In practice, robust method of locating the pulse and applying the sensors need to be worked out.

#### V. CONCLUSION

We have designed a simple circuit that outputs an audio beep indicating changes in blood pressure. It uses the PPG signals obtained from brachial and radial artery of the single arm. By virtue of the typical signal shapes, passing the signals through a differential amplifier gives a waveform indicating current pulse transit time and therefore, the blood pressure. The circuit was assembled and tested. While exact measurements would require rigorous processing and calibration, the presented system was found suitable for gross indication of changes in blood pressure.

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## ORIGINAL ARTICLE

# Medical Waste Management Survey in Primary Health Care Centers, Saudi Arabia

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## Abstract

**Background & Aims:** Primary healthcare services aim to promote health and prevent health problems. However, waste generated from primary healthcare centers (PHC) potentially harmful to public health and the environment. The aim of this study was to assess wastes management of these centers. **Methods:** The data of this observational – cross-sectional study were collected from the available primary healthcare centers in Al-Baha city, Saudi Arabia (N=15 PHC centers). Data collected using standardized questionnaire and observations. **Results:** Contaminated sharp and pharmaceuticals pressurized wastes were generated in all PHC centers. About 14(93.3%) and 13(86.7%) of the centers were generating wastes of live attenuated vaccines vials and articles contaminated with blood, respectively. Eight (53.6%) of the centers generated more than 3 kg per day of contaminated sharps, followed by; live and attenuated vaccines' vials. Eleven (73.3%) and 7 (46.7%) of the PHC centers produces 1 to 3 kg of hazardous wastes per day of articles contaminated with blood and waste contaminated with excretion, respectively. All health centers except one were practicing waste segregation properly, and 2 (13.4%) of the centers lacked waste storage method. A total of 5 (33.5%) centers also did not practice any type of disinfection, 7 (46.7%) and 9 (60.0%) of these centers did not have medical waste **plan, nor specification for the collection** and handling procedures of their medical wastes, respectively. The most common methods used for medical waste packaging were bags (68.8%) and plastic containers (18.8%). **Conclusion:** Medical waste management practices were found to be deficient and their amendment highly recommended.

**Keywords:** Biohazards Wastes, Medical Waste, Primary Health Care, Public Health, Saudi Arabia

## الملخص

**الأهداف:** الهدف من هذه الدراسة هو تقييم ممارسات إدارة النفايات الطبية، وتحديد العوامل التي تؤثر في ذلك بين مراكز الرعاية الصحية الأولية في مدينة الباحة. **المنهجية:** جمعت بيانات هذه الدراسة المقطعية من جملة مراكز الرعاية الصحية الأولية كافة عن طريق المقابلة، الملاحظة باستخدام استبيان موحد. تم تحليل البيانات باستخدام البرنامج الإحصائي للعلوم الاجتماعية.

**النتائج:** معدل إنتاج النفايات في مراكز الرعاية الصحية بالباحة متباين حسب كل مركز. سجلت الأدوات الحادة المعدية أكبر كمية بين النفايات الخطرة المنتجة في مراكز الرعاية الصحية الأولية حيث وجد 8 (56.6%) من تلك المراكز تنتج أكثر من 3 كجم من هذه الأدوات الحادة يوميا، تليها قنينات اللقاحات 10 (62.6%) من المراكز تنتج بين 1 إلى 3 كجم. حوالي 11 (68.8%) من مراكز الرعاية الصحية الأولية تنتج من 1 إلى 3 كجم من النفايات الخطرة يوميا، 7 (43.8%) من المراكز تنتج ما بين 1 إلى 3 كجم من المواد الملوثة بالدم والأدوية الكيميائية وعلب بخاخ الفارغة يوميا. بينما وجد ان جميع مراكز الرعاية الصحية الأولية بالباحة تفتقر إلى عملية فرز النفايات، كان 2 فقط (12.5%) منها يفتقر الى التخزين الملائم للنفايات. 4 (25%) من مراكز الرعاية الصحية لا تمارس أي نوع من التطهير للنفايات الخطرة لقتل جراثيمها، وكذلك وجدت 6 (37.5%) من هذه المراكز لا يوجد لديها أي خطة ولا مواصفات لجمع ومعالجة نفاياتها. الأساليب الأكثر شيوعاً المستخدمة لحفظ وتغليف النفايات الطبية في مراكز الرعاية الصحية الأولية بالباحة كانت أكياس 68.8% والحاويات البلاستيكية 18.8% و 12.4% من هذه المراكز لم تشر إلى أي أسلوب لتغليف وحفظ نفاياتها. **الخلاصة:** خلصت الدراسة إلى أن، إدارة النفايات الطبية تواجه عدة مشاكل ومن المحتمل ان تشكل مخاطر جمة على البيئة وقد تؤدي إلى مشاكل صحية وأمراض في منطقة الدراسة

**Introduction:**

Healthcare services aim to reduce health problems and to prevent potential health risks. However, medical waste is often generated during health-care or diagnostic activities, which are potentially harmful to public health and the environment <sup>(1)</sup>. Health Care Waste (HCW) is defined as the total waste stream from a health care facility that includes both non-infectious waste materials and infectious waste materials. However, World Health Organization (WHO) estimated that 80% from total healthcare waste is not infectious and only (20%) is infectious or poses risk of harm or hazardous to human beings <sup>(2)</sup>. In general, infectious wastes include infectious sharps and infectious non-sharp materials (e.g. needles, blades, infusion sets or other items that can cause direct injury, materials that have been in contact with human blood, bandages, swabs, etc). On the other hand, Non-infectious wastes may include materials that have not been in contact with patients such as paper and plastic packaging metal, or other wastes which are similar to household wastes <sup>(3)</sup>. Most waste generated in healthcare centers consider as general wastes, they are non-

infectious and can be treated as regular with municipal waste. But minimum proportion of healthcare wastes which known as “special healthcare waste”, need special management. Special healthcare wastes include sharps (e.g. needles, razors, and scalpels), pathological waste, other potentially infectious waste, pharmaceutical waste, biological waste, and hazardous chemical waste <sup>(4)</sup>. The special healthcare wastes also include all waste generated under certain circumstances, such as in isolation wards and clinical laboratories, have need of special attention for handling <sup>(3,4)</sup>.

Medical waste mismanagement may expose people inside the healthcare facilities (e.g. staff, employees who handle medical waste, patients and their families), and individuals outside the facility to potential risks.

Moreover, some accidental exposures to these hazardous medical wastes are also probable <sup>(3,4)</sup>.

In general, 75% to 90% of wastes produced by healthcare facilities are general or non-risk wastes comparable to domestic wastes. These wastes come mostly from the administrative and housekeeping functions of healthcare daily duties the remaining 10-25% of wastes is

regarded as hazardous, and may pose a variety of health risks <sup>(5)</sup>. It has been reported that the main reasons for failure of waste management as follow <sup>(5)</sup>; lack of awareness about the health hazards related to health-care waste, inadequate training in proper waste management, absence of waste management and disposal systems, insufficient financial and human resources and the low priority given to the topic are the most common problems connected with health-care waste. However, many countries either do not have appropriate regulations, or do not enforce them <sup>(5)</sup>.

High-income countries generate on average up to 0.5 kg of hazardous waste per bed per day; while low-income countries generate on average 0.2 kg of hazardous waste per hospital bed per day. However, health-care waste is often not separated into hazardous or non-hazardous wastes in low-income countries making the real quantity of hazardous waste much higher <sup>(6)</sup>. Infectious and anatomic wastes together represent the majority of the hazardous waste, up to 15% of the total waste from health-care activities. Nevertheless, sharps materials represent about 1% of the total waste, yet they are among the main causes

of disease transmission. On the other hand, pharmaceuticals and chemicals materials account for about 3% of waste from health-care activities while genotoxic waste, heavy metal content and radioactive matter account for 1% of the total health-care waste <sup>(6)</sup>.

WHO (2011) reported that; injections with contaminated syringes due to unsafe disposing or re-use of disposable syringes and needles for injections is particularly common in African, Asian and Central and Eastern European countries <sup>(6)</sup>. Additional hazards occur in developing countries, from scavenging at waste disposal sites and the manual sorting of hazardous waste from health-care facilities. The waste handlers are at immediate risk of needle-stick injuries and exposure to their toxic or infectious materials <sup>(6)</sup>. Many data from developing countries indicates that the range is essentially similar but the figures are lower i.e. 1 to 2 Kg/day/patient <sup>(7)</sup>.

The effective management process of health-care wastes are segregation, packaging and identification <sup>(8)</sup>. Sorting wastes into color-coded plastic bags or containers is considered the most common and appropriate way of identifying the categories of the healthcare

wastes. However, the recommended color coding of containers are: (a) Yellow-Infectious, highly infectious wastes and sharps; (b) Brown-Chemicals and pharmaceutical wastes; and (c) Black-General healthcare wastes <sup>(8)</sup>.

Inadequate and inappropriate handling of health-care waste may have serious public health consequences and a significant impact on the environment <sup>(9)</sup>. These wastes may enhance environmental pollution and the spread of infectious diseases, including acquired immunodeficiency syndrome (AIDS), hepatitis, tuberculosis, diphtheria, cholera, and many others. Sound management of health-care waste is thus a crucial component of environmental health protection <sup>(10)</sup>. Hossain et al (2011) reported some accidental exposure to blood (AEB) or to other body fluids are examples of accidental exposure to hazardous medical waste <sup>(1)</sup>. Poor conduct and inappropriate disposal methods exercised during handling and waste disposal of health care waste/ medical care waste (HCW/MCW) is increasing significant health hazards and environmental pollution due to the infectious nature of the waste <sup>(11)</sup>. It is, therefore, emphasized

that even very limited waste-management measures can substantially reduce the health risks of these wastes <sup>(12)</sup>. In many countries, knowledge about the potential for harm from health-care wastes has now become more prominent to governments, medical practitioners and civil society <sup>(12)</sup>. Therefore, the aim of this study was to assess the medical waste practices in primary healthcare centers in Al-Baha city, Saudi Arabia.

#### **Material & Methods:**

This observational, cross sectional study was carried out to assess the status of management and handling of healthcare wastes in Baha city. All the primary healthcare centers (N=15 PHC centers) were included in this study. The PHCc were visited between April-May, (2012). The permission for data collection was granted from Department of health affairs at Baha city. The head of each PHC centers were visited to clarify the aim of this study and the importance of participation and to seek their permission to be involved.

Observational checklist, modified from the WHO questionnaire on healthcare waste management, was used to determine waste handling, management and compliance with

WHO and World Bank guidelines on health-care waste management <sup>(13)</sup>. PHCs staffs were interviewed and check list was filled to determine their level of knowledge, practices and following safety measures. Deceptive analysis using frequency tables, bi-chart and par chart were used. Statistical analysis was done using SPSS program.

### Results:

Nearly all of the primary healthcare centers in Baha city were generating some various types of hazardous medical wastes as shown in Table 1. All centers (100%) in Baha were producing contaminated sharp and pharmaceuticals pressurized wastes. About (93.3%) of the centers were generating wastes of live and attenuated vaccines vials. Articles contaminated with blood were found in (80%), and wastes contaminated with excretion generated in (80%) of these centers. Liquid blood elements were generated only in (20%) of the PHC centers.

(Table 1, Table 2) showed the type and average quantity kilogram per day of hazard waste generated in Al-Baha Primary Health Care (PHC) centers. Fourteen (93.3%) of these

centers produced huge quantity of expired live and attenuated vaccines and vaccines' vials of which (66.7%) produce between 1 to 3 kg/day in average and one of the PHC center produces more than 3 kg/day. Liquid blood elements were produced by 3 (20.0%) of PHC centers and two of these three produced over 1 kg to 3 kg/day. Articles contaminated with blood were produced in 13 (86.7%) of the centers, of which 7 (46.7%) produce 1 to 3 kg/day. Contaminated sharps produced from all PHC centers, of which 8 (53.6%) of these centers were producing more than 3 kg per day. Chemicals were produced in 12 (80.0%) of the centers, 10 (66.7%) of these centers produce 1 to 3 kg per day. All surveyed PHC centers were producing pharmaceuticals pressurized. Also 14 (93.3%) of these centers were producing waste articles contaminated with excretion; which included cultures and stocks; tissues; dressings, swabs or other items soaked with blood; syringe needles; scalpels; diapers; blood bags. These quantities of different medical waste were generated as a result of diagnosis, treatment, and immunization.

(Table 3) shows some deficiency of man-

agement measures for the basic elements of healthcare waste program; that (6.7%) of PHC centers in Al-Baha city lacked segregations, 2 (13.4%) without waste storage room, 5 (33.5%) of the centers did not practice any type of disinfection. Considering wastes handling, all responsible personnel or workers of waste handling were using personnel protective equipment's, except one center. Employees in 14 (93.3%) centers were involved and had some level of responsibility in the collection of the medical waste. The majority (60.0%) of the PHC centers of Al-Baha were lacked defined collection coding and handling procedures for their hazard waste.

(Table 4) shows the some personal development measures and other management process in the field of medical wastes, which available at PHC centers in Al-Baha City. Most of the concerned people were had had training sections in the field of medical wastes management, only in 3 (18.8%) of these centers had no sort of worker training regarding medical wastes. Only 10 (66.7%) of these centers were having clear job description for medical wastes workers. Indication check list were used to measure the awareness toward medi-

cal wastes, which reveal that; in 5 (31.2%) of these centers the medical wastes staff were at poor level of knowledge and they also lack awareness about medical wastes hazards and proper medical waste handling. Guideline manuals for medical wastes handling were available in (86.7%) of the PHC centers. (Table 4) shows that nearly half (46.7%) of the centers lacked medical waste management plan; i.e., there were no clear specification for collection, handling and storage procedures of their wastes.

(Figure 1) shows the types of personal protection equipment (PPE) which used by the Handler of medical wastes at (PHC) centers in Al-Baha. Gloves, Masks, Eye Glass, boots and overall were available in all centers, only one of healthcare centers lacked all these types of personal protection equipment (PPE). Gloves were not used in 2 (13.4%) of the PHC centers. Although, masks were present in (93.3%) of the centers but used only in 5 (43.3%) centers. Eye Glass was available in (66.7%) of the centers and although present but not used in (26.8%) of these centers.

The duration of medical waste storage as highlighted in (Figure 2), about 94% of Al-Baha

PHC centers kept their medical wastes for one week inside their building; this reflects the frequency of waste collection from this centers. Except in (6%) of the studied centers due to long period of storage the medical wastes expected to accumulate and create a suitable condition for microorganisms' growth, resting area and breeding sites of vector borne diseases.

Almost all the PHC centers stored their wastes out of the recommended levels of temperatures (Figure 3). Moreover, about 46.7% of the PHC centers have control the temperature level of medical waste storage within 24°C to 32°C, while more than 20% of the centers stored the waste at less than 8°C to 24°C and the same number of the centers their waste at 32°C to 40 °C or even more.

(Figure 4) shows that the most common methods used for medical waste packaging in Baha primary healthcare centers were bags 68.8% and plastic containers 18.8% and about 12.4% of these centers did not determine their method of waste packaging or types of storage containers.

**Tables (1): Type of Medical Waste Available at the primary healthcare (PHC) centers in Al-Baha City Saudi Arabia**

Type of the waste	N. of PHC	%
Live and attenuated vaccines vials	14/15	93.3 %
Liquid blood elements	3/15	20.0 %
Articles contaminated with blood	13/15	86.7 %
Contaminated sharp	15/15	100 %
Chemicals	12/15	80.0 %
Pharmaceuticals Pressurized	15/15	100 %
Waste contaminated with excretion	12/15	80.0 %

**Table (2): Proportional quantity kilogram per day/visitors of hazard waste generated in Al-Baha Primary Health Care (PHC) centers, Saudi Arabia**

Type of the waste	Number of PHC with regard to the average quantity of hazard waste/kg/day/visitors				
	None	Less than 1 kg/day	1 to 3 kg/day	More than 3 kg/day	Total
Live and attenuated vaccines vials	1(06.7)	3(20.0%)	10 (66.7%)	1 (6.7 %)	15(100)
Liquid blood elements	12 (80.0)	1 (06.7%)	2 (13.4%)	0.0	15(100)
Articles contaminated with blood	2 (13.4)	6(40.0%)	7 (46.7%)	0.0	15(100)
Contaminated sharp	0.0	1 (06.7%)	6 (40.0%)	8 (53.6%)	15(100)
Chemical	3(20.0)	2(13.4%)	10 (66.7%)	0.0	15(100)
Pharmaceuticals Pressurized	0.0	14(93.3.0)	1 (06.7%)	0.0	15(100)
Waste contaminated with excretion	3 (20.0)	1(6.7%)	11(73.3%)	0.0	15(100)

**Table (3) Medical waste management parameters practiced in Al-Baha Primary Health Care (PHC) centers, Saudi Arabia**

Parameter	Yes	No	Total
Segregations	14 (93.3%)	1 (6.7%)	15(100)
Storage	13 (86.7%)	2 (13.4%)	15(100)
Disinfection	10 (66.7%)	5 (33.5%)	15(100)
Final treatment at PHC	2 (13.4%)	13 (86.7%)	15(100)
Handler use PPE	14 (93.3%)	1 (6.7%)	15(100)
Collection (Involvement) responsibility	14 (93.3%)	1 (6.7%)	15(100)
Defined collection CODING & handling procedures	6 (40.0%)	9 (60.0%)	15(100)

**Table (4): Personal development and other management process available at (PHC) centers in Al-Baha City Saudi Arabia**

Parameter	Number of PHC		
	Yes Available	Not Available	Total
Training of worker	12 (80.0%)	3 (18.8%)	15(100)
Present of job description	10 (%66.7)	6 (37.5%)	15(100)
MW Staff awareness	11 (73.3.8%)	5 (31.2%)	15(100)
Present guideline manual	13 (86.7%)	3 (20.0%)	15(100)
Present of MWM plan	8 (53.3%)	7 (46.7%)	15(100)

(Table 2), The least produced hazardous wastes was liquid blood elements which was pro

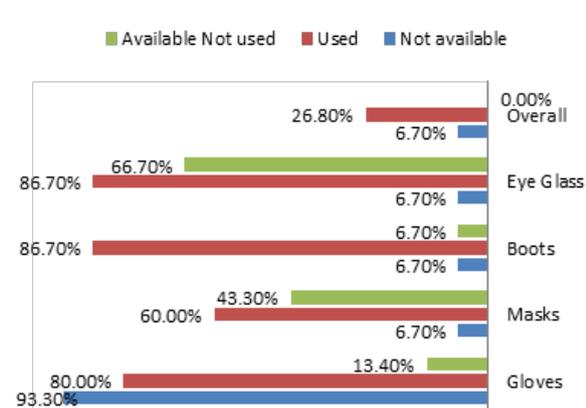


Figure (1): Types of Personal Protection Equipment (PPE) which the Medical Wastes Handler were using at (PHC) centers in Al-Baha City Saudi Arabia



Figure (2) Duration of medical waste storage per day/s in Al-Baha Primary Health Care

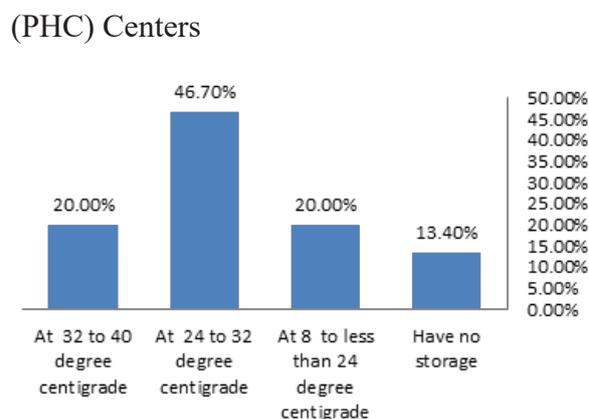


Figure (3) Temperature levels of the storage at which medical wastes were stored in Al-Baha Primary Health Care (PHC) Centers

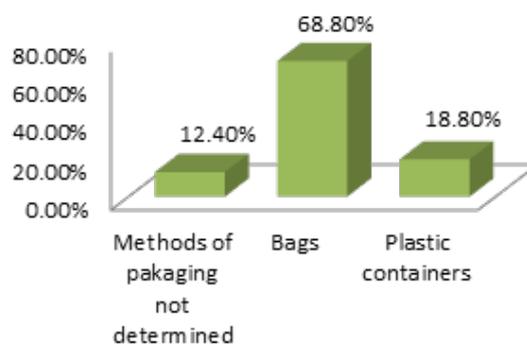


Figure (4) Methods used for medical waste packaging in Al-Baha Primary Health Care (PHC) Centers

**Discussion:**

Primary Healthcare Centers in Baha city generate high quantity of various hazardous medical wastes as shown in (Table 1 and Table 2). Compositions of hazardous waste and the rate of production of the various types of these wastes in Al-Baha primary health care (PHC) centers were the same as those estimated in many research reported by; Pruss et al., (1999) <sup>(5)</sup> and World Health Organization (2014) <sup>(3)</sup>, and also similar to what reported by Lars (2000) <sup>(4)</sup> and International Committee of the Red Cross (2011) <sup>(1)</sup>.

Most of HCW in the surveyed centers have the potential of transmitting infectious agents to humans (Table 1 and Table 2). Also the rate of daily production exceeding which reported by Al-Zahrani et al, (2000), that; the minimum recorded rate was 0.005 kg/visitor/day, and the maximum was 0.34 kg/ visitor/day. The mean rate of generation was 0.08+ kg/visitor/day. The estimated mean amount of all healthcare risk waste generated in the Kingdom of Saudi Arabia is 25,207 tons/year <sup>(14)</sup>.

Table 2, revealed that the least produced hazardous wastes were liquid blood elements which were produced by only by three centers with rate of production between less than one kg to 3kg. Chemical waste was the second least hazard waste after liquid blood elements produced by 12 centers with the same rate.

Contaminated sharps were the highest type among the hazardous wastes produced in the surveyed centers, that was produced from all centers and 8 (53.6%) of those centers produced high rate more than 3 kg/day all these results were within World Health Organization (WHO) estimation that that 80% from total healthcare waste is not infectious and only (20%) is infectious or poses risk of harm or hazardous to human being (2).

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(Table 2), also reported that; Fourteen (93.3%) of these centers produced huge quantity of expired live and attenuated vaccines and vac-

cines' vials of which 66.7% produce between 1 to 3 kg/day in average and one of the PHC center produces more than 3 kg/day. Liquid blood elements produced only by 3 (20.0%) of PHC centers two of these three produced over 1 kg to 3 kg/day. These situation regulating the monitoring of these wastes category as Oke (2008) concluded that; hazardous immunization wastes require proper monitoring for an effective tracking at all times <sup>(16)</sup>. The results of this study also showed that there was lack of some management measures for the basic elements of healthcare waste program as presented in (Table 3). Segregations were practiced in all the PHC centers except one (6.7%) This was similar to what Taghipour, reported in 2009 that; segregation and minimization of waste are not carried out correctly in any of the northwest Iran-Tabriz hospitals <sup>(17)</sup>. (Table 3), also revealed that; 5 (33.5%) of PHC centers did not practice any type of disinfection. Disinfection as Soares et al (2013) reviewed is an efficiency method to inactivation and control *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* bacteria, which are representative of the microorganisms found in HCW <sup>(18)</sup>.

Similar study from Saudi Arabia conducted by Zahrani, *et al*, (2000), reported much care is given by the responsible authorities for the management of that type of waste.

(Table 4), shows some important management process to improve personal aware of medical wastes handler were not available at some of PHC centers in Al-Baha city. Indication of knowledge check list revealed the poor awareness among medical wastes regarding its hazards and handling. These situations will definitely magnitudes the problems of healthcare wastes and increase the exposures of peoples to their hazardous. (Table 4), presented that, 5 (31.2%) of the medical wastes staffs were at poor level of knowledge and neither aware about medical wastes neither hazards nor handling. The lacked of awareness was reported by Alago and Kocasoy (2013), as one of the main reason for the mismanagement of these wastes with other reasons such as the lack of appropriate legislation and effective control; and financial strains <sup>(19)</sup>. Hossain (2011) also reported that; in most cases, the main reasons of the mismanagement of CSW are the lack of appropriate legislation, lack of specialized clinical staffs, lack of awareness and effec-

tive control<sup>(11)</sup>. Gupta et al also recommended that, there is also a need to create awareness among all other stakeholders about the importance of biomedical waste management and related regulations<sup>(20)</sup>.

The result in (Table 4) reported that 7 (46.7%) of the health centers lacked any MWM plan, the same result was reported by Moreira and Gunther in Brazil (2013); they reported that; although it was mandatory to implement the Medical Waste Management Plan (MWMP) according to Brazilian law, but evaluation revealed that such implementation not implemented<sup>(21)</sup>. About 5 (31.2%) of the health care centers staff lacked some knowledge and not fully aware about medical wastes management as reported in (Table 4). Hakim *et al* (2014) in their study reported some lacked of knowledge among physician, nurses and housekeepers towards waste disposal management<sup>(22)</sup>. (Table 4) also show that; guideline manual was not available in 3(20.0%) plus the lack of MWM plan in about 7(46.7%) of Al-Baha PHC centers. The previous results reveal similar to what Mohamed et al (2009) observed in Kingdom of Bahrain that; despite the magnitude of the problem, practices, ca-

pacities and policies in dealing with health-care waste disposal, was inadequate and requires intensification<sup>(23)</sup>.

(Table 4), three of the healthcare centers the workers did not had any training regards medical wastes management. Gupta et al highlight the needs of training that he reported that, it was found that, although the Polyclinic in general abides by the prescribed regulations for the treatment and disposal of biomedical waste, there is a need to further build the capacity of the Polyclinic and its staff in terms of providing state-of-the-art facilities and ongoing training in order to develop a model biomedical waste management system in the Polyclinic<sup>(20)</sup>.

(Figure 1) shows that although personal protection equipment (PPE) was available in nearly all centers, but unfortunately some of them were not used. As presented in (Table 4), nearly all workers and employees in more than (31.2%) of the centers lacked any awareness of medical waste's hazards and handling precautions. Taghipour, (2009) reported the same results that the use of protective measures by staff and temporary storage areas was not in agreement with standards in 70

and 60% of the hospitals in the present study, respectively <sup>(17)</sup>. Carmen et al (2005) reported that; biomedical waste segregation has a direct impact on type and cost of biomedical waste treatment <sup>(24)</sup>.

The duration of medical waste storage as shown in (Figure 2), almost was too long in most of the PHC center facilities, which indicates minimum frequency of collection for these wastes. This condition is expected to flourish microorganism growth and encouraging the presence and breeding of rodents and vectors. Levels of temperature control as shown in (Figure 3), were within the dangers zone and suitable for microbial growth. These entire situations are regarded as hazardous and may create a variety of health risks, may have serious public health consequences and a significant impact on the environment. Add to that the poor management of these wastes increasing the levels of accidents caused by sharps and compromises the healthcare services. These confirm the arguments of Carmen et al (2008) <sup>(24)</sup>; that the health care waste management (HCWM) is a process that helps to ensure proper hospital hygiene and safety of health care workers and communities.

Health care workers have an important opportunity to manage the environmental effects of their practice. Their efforts may seem small, but each step builds a base of sound behavior and thinking that are necessary for the success of the whole as it has been reported <sup>(25)</sup>.

(Figure 4), shows the methods used for medical waste packaging in most of Al-Baha primary healthcare centers were not clearly determined and most are neither suitable and nor properly managed. Some of necessary primary containment vessels for sharps medical waste packaging such as sharps containers (puncture-proof) and metal containers were lacked. The situation of waste storage and packaging might encourage the growth and proliferation of microorganisms which may be present in these wastes, and can increase the risks of the hazardous waste that cause diseases, injuries or contamination to the healthcare center's environment. However, (WHO) published a document entitled: Management of solid health-care waste at primary health-care centers: a decision-making guide. The guide covers the "waste stream" from its generation to its final disposal (e.g. waste minimization, segregation, codification, handling, transpor-

tation, treatment and disposal) <sup>(2)</sup>. The results of our study implies that hazardous medical wastes from these centers may compromise the quality of patient care, the wastes also can present occupational health risks to workers and employees of these healthcare centers at handle, package, store, transport, treat, and dispose of them. Add to that these hazardous wastes may enhance environmental pollution and increase the spread of infectious diseases among the workers, customers and community around these centers.

#### **Conclusion:**

Primary Health Care Centers face a lot of problems with regards to medical waste management such as lacked segregations, some essential method of waste storage and lack of disinfection (e.g. pre-treatment) for their waste. The current situation of medical waste handling in these healthcare centers can cause environmental pollution and expose healthcare workers, patients, waste handlers, waste pickers, and the general public to health risks from infectious waste particularly from sharps wastes. Therefore, effective interventions are needed to solve these problems of medical waste poor management in the pri-

mary healthcare centers. The primary health care center staff must be well trained regarding waste hazards and management. Inadequate management of waste generated from Al-Baha PHC centers activities can have a negative impact on the health of community and environment. As it has been concluded a comprehensive guideline on hazardous waste management is needed, other than what is currently in existence. Further research to investigate medical waste management and related factors is required to improve the situation.

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ORIGINAL ARTICLE

## Evaluation of Cardiac Output, Stroke Volume and Ejection Fraction (EF) using Nuclear Cardiology

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### ABSTRACT

The recognition of different heart disease was frequently scored by nuclear medicine Physician by determining the location and the extend of the disease. The measurement of the heart volume in nuclear medicine is considered one of the most crucial methods of appraisal the myocardial disorders. The aim of this paper was to study the stroke volume of the heart for patient using SPECT machine. For the scanning, the patient were injected by Technetium labeled with Sestamibi and Tetrofosmin (20 mCi) then they scanned for 45 minutes using SPECT with ECG during the examination. The sample of this study were 50 patients. The quantitative analysis included the stroke volume, cardiac output and ejection fraction. The results of the study showed the upsurge in cardiac output  $6.3 \pm 1.1$  L/min ( $p > 0.05$ ) and ejection fraction  $66.8 \pm 8.4$  ( $p > 0.05$ ). The stroke volume was decreased with increasing of the both age and body mass index.

**Keywords:** Nuclear cardiology, Cardiac output, stroke volume (SV), Ejection fraction (EF).

### المخلص

التعرف على امراض القلب المختلفة كثيراً ما يسجل من قبل اختصاصي الطب النووي وذلك من خلال تحديد موقع وامتداد المرض. يعتبر قياس حجم القلب باستخدام الطب النووي واحد من أكثر الوسائل الحاسمة لتقييم اضطرابات عضلة القلب. كان الهدف الأساسي للورقة العلمية هو دراسة حجم السكتة القلبية والنتاج القلبي ومعدل قذف الدم للقلب باستخدام ماكينة تصوير الطب النووي. لغرض الفحص تم حقن المريض بالتكنيشيوم الموسم بمادة الاستامبيي والتيروفوزمين ومن بعد ذلك تم فحص المرضى بعد ٥٤ دقيقة باستخدام كلا من جهازَي التصوير بالطب النووي وجهاز تخطيط القلب. شملت الدراسة عدد ٥٥ مريض. شمل التحليل الكمي للدراسة حجم السكتة القلبية والنتاج القلبي ومعدل قذف الدم. أظهرت النتائج زيادة في النتاج القلبي بمعدل (٣٦ + ١١) ومعدل قذف الدم (٤٨ + ٨٦٦). سجل حجم السكتة القلبية انخفاض مع كلا من العمر ومعدل كتلة الجسم.

## 1. INTRODUCTION

The main function of the heart is preserving adequate flow of blood around the body. It consists of four-chamber pump [1]. Nuclear Cardiology has important role in heart problem diagnosis [2-3]. Gated SPECT Cardiac Quantification (GSCQ) is another method that is based on k-means cluster classification to separate the cardiac region from other extracardiac structures [4]. The myocardial surface boundaries are determined using hybrid count-geometric analysis for the calculation of the LV volumes and EF [5]. The method uses thresholding and the nongated data to determine a cutoff value that serves to separate the LV volume. More refinements and constraints are carried out to remove the small remaining volumes within the image and to accurately define and obtain a clean long axis LV binary image [6]. The long-axis images are resliced to obtain the most apical and basal slices in addition to the myocardial apex. The first apical slice is defined as the first short-axis slice containing the LV cavity, while the position of the last basal slice is defined as the last short-axis slice containing the basal limit of septum plus 10 mm toward the LV base [7]. In 1990s, the myocardial measurement was introduced into the cardiac nuclear applications. This technique was based on quantifying the 3D activity distributions within the heart into 2D polar map or bull's-eye [8]. The polar map is constructed through modelling the myocardium into a cylindrical and spherical coordinate system [9]. Another semiquantitative approach used to quantify

tracer uptake is implemented by dividing the myocardium into 20 segments. An ejection fraction (EF) is the portion of blood ejected from simultaneously with cardiac beat. It is valued using the stroke and diastolic volume, and is a characteristic amount of the pumping competence of the heart [10]. Hearts that move actively but don't prosper in ousting more amount of blood are called cardiac failure. Left ventricular ejection fraction (LVEF) is a degree of the competence of impelling blood into the circulatory system, whereas right ventricular ejection fraction (RVEF) is a value of the competence of impelling into the pulmonary flow [11].

## 2. Materials and Methods

This study conducted to evaluate the Heart Ejection fraction (EF) Using Nuclear Cardiology segmentation. Once the patients referred for scanning, the patients asked to stopover the cardiac treatment drugs for 24 hours previously the study because it reduced the radiotracer approval. Also asked for abstaining until the administration of the radiopharmaceutical, afterward the administration patient have to wait for minutes then eat fatty rich meal in order to excrete of the gall bladder.

This study led in the Nuclear Medicine department of Elnileen Medical Center, Khartoum, Sudan. The study included 50 patients of both genders, who referred for nuclear cardiology assessment due to symptomatic heart complains that recognized by aggressive methods. During the examination patients asked to stop

the medication for one day before the study as well as abstaining afterward night which disturb the radiopharmaceutical material consumption. Then after 20 minutes post-injection patients requested to have fatty mealtime. Then One hour waiting time, patient scanned using SPECT machine with ECG apparatus. Both right and left oblique rest and stress projections were acquired. SPSS program was used for data analysis. The outcomes with  $p > 0.05$  considered substantial ones. T-test used to test the significance of the relationships between the variables of the study.

### The results:

The sample of this study were 50 patients with age range of 41-70 year ( $56.2 \pm 8.5$ )  $p > 0.05$ . In the study, 14% were in 40-45 years, 20% were in 46-50 years, 12% were in 51-55 years, 16% were in 56-60 years, 14% were in 61-65 years and 24% were in 66-70 years. The body mass index (BMI) of the patients in this study were ranged of 14-30  $\text{kg/m}^2$  ( $56.2 \pm 8.5$ )  $p > 0.05$  (Table 1).

**Table 1. Age group of the patients**

Age group (years)	Percentage (N=50)
40-45	14 (7)
46-50	20(10)
51-55	12(6)
56-60	16(8)
61-65	14(7)
66-70	24(12)

In this study the results of EF showed that 42% of the sample were in range of 50-70 % (EF) and 58 % of the sample were above the 70% (EF) (table 2). The cardiac output were ranged from 4-8 with the mean of  $6.3 \pm 1.1$  ( $p > 0.05$ ). The stroke volume were ranged from 55-100 ml/beat with the mean of  $80.2 \pm 11.7$  ( $p > 0.05$ ) (Table 2).

**Table 2. Ejection Fraction results as disturbed in the sample:**

Ejection Fraction results	No. of patients (%) N
Above 70%	(42%) 21
% 50-70	(58%) 29
36-49%	-
35% and below	-

**Table 3: The predicted lower, upper and mean limits for body mass index (BMI), Cardiac output (L/min), SV (ml/m<sup>2</sup>) and EF (%).**

Age (years)	BMI				Cardiac Output L/min				SV (ml/m <sup>2</sup> )				EF (%)			
	Low- er	Mean	Up- per	SD	Low- er	Mean	Up- per	SD	Low- er	Mean	Up- per	SD	Low- er	Mean	Up- per	SD
40-45	15	22.6	28	5.0	5.2	6.5	7.7	1.0	66	76.1	88	8.6	55	67	77	8.7
46-50	19	24.1	29	3.7	4	6	7.5	1.3	62	83.4	100	10.7	57	66.7	78	6.7
51-55	14	20.3	30	6.7	4.5	6.5	7.7	1.5	57	75.8	94	12.6	52	62.5	78	9.8
56-60	15	22.3	30	5	4.9	6.4	8	1.2	73	86	99	9.7	64	71.9	80	5.6
61-65	17	19.9	24	2.5	4.7	5.9	7.1	1.0	60	73.7	96	13.9	53	63.0	79	10.2
66-70	16	20.8	27	3.9	4.3	6.4	7.8	1.1	55	80.8	98	11.9	50	68.8	80	8.6

**Figure 1. Relationship between cardiac output and EF****Figure 2. Relationship between the Cardiac output and Body mass Index (BMI)****Table 4. Ejection Fraction results of related studies:**

Authors	EF (mean + SD)
(Sumito et al (2016	68.5 + 9.7
(Elkader et al (2014	57.12 ± 8.6
(Yogesh et al (2016	64 ± 8
Ding et al (2016)	63.05 ± 1.84
Ogah and Bamgboye	58.9 ± 13.4

**Discussion:**

This study highlighted the importance of nuclear cardiology. The use of nuclear cardiology has grown-up progressively, and it contribute with a large number in myocardial diseases. Nuclear Cardiology is has also wider role as well as metabolic imaging, innervation imaging, among other technologies. This make it better than various imaging modalities use in cardiology. Nuclear medicine is beneficial in starting treatment plans in patients with myocardial disorders and CHF by displaying the perfection with pharmacological management. Coronary

heart disease is one of the death leading disease in both gender because of many factors such as increased blood pressure, cholesterol consumption and smoking. The nuclear cardiology has recently gained popularity as noninvasive diagnostic tool in evaluation of heart disease. In this study discovered that the percentage of the increased ejection fraction in elderly aged group were more than younger patients, it was 54% in old whereas the younger was 14%. This finding supported by Kim et al (2002), Elkader et al (2014) and Sharief (2015) who found the same results in elderly

patients. On other hand, this study revealed that BMI and cardiac output had correlated in t-test with  $p = 0.001$  ( $p > 0.05$ ) which is considered extremely statistically significant. This results supported by Cain et al, (2009) and Mathew et al (2008). In general, both SV and EF revealed an increase with age group 56-60 years (Table 3). This results support by Nikitin et al (2006), Cain et al (2009) and Gulati et al (2013). Although differences in cardiac measurements between males and females in this study were (Cardiac output:  $5.9 \pm 1.1$  vs  $6.1 \pm 1.2$  L/min,  $p = 0.002$ , SV:  $83 \pm 12$  ml vs.  $81 \pm 13$  ml,  $p < 0.002$ ; EF:  $68 \pm 11$  vs.  $65 \pm 12$ ,  $p = 0.018$ ) correspondingly. This study showed that cardiac output were in normal range which 4-8 L/min ( $6.3 \pm 1.1$ ,  $p > 0.05$ ). The SV were in normal range which 55-100 ml/beat ( $80.2 \pm 11.7$ ,  $p > 0.05$ ) (Table 2). Veldhuisen et al (2009) and Anane et al. (2012), supported the results of this study who found that a significant upsurge in the LVEF befallen after treatment. Obesity disturbs the cardiovascular scheme straight in numerous methods, furthermore its unintended effects, and it upsurges disease and death. Several practical difficulties make cardiac studies hard to make and interpret in obese patients. Tentative this obesity prevalent is an essential obstacle that affect the populace health. This results support by many scientist such as Rider et al (2009), Boer et al (2010) and Eltayeb et al (2014). Nuclear Cardiology has exceptional described sensitivity and negative predictive significance in the revealing of heart disease in patients.

## Conclusion:

This study had demonstrated a cardiac output, SV and EF of Khartoum population using the invasive nuclear cardiology techniques. Nuclear Cardiology can be used as method of choice in cardiology department as it is cheap and suitable in many centers in Sudan.

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## ORIGINAL ARTICLE

## Prevalence of Obesity and overweight among Primary School Children, in Majmaah Saudi Arabia

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## Abstract

**Background:** Obesity has become an epidemic worldwide. In 2010, the World Health Organization (WHO) estimated that 42 million children under 5 years of age were overweight or obese. In the Eastern Mediterranean Region, the disease reached an alarming level, the prevalence among schoolchildren was 12%–25%. The objective of the current study was to assess obesity and overweight among primary school Students in Majmaah, Saudi Arabia.

**Materials and Methods:** This was a cross-sectional and community -based study conducted at primary schools in Majmaah, the capital of Majmaah province in Riyadh region, Saudi Arabia. A sample frame included all primary schools in the city. The sample size was calculated as 400. Pre-tested questionnaire was employed to collect data. Height and weight of the children were measured and body mass index (BMI) was calculated

**Results:** Age of respondents ranged from 6-14

## الملخص

خلفية:

أصبحت زيادة الوزن والسمنة وباءا عالميا وقدرت منظمة الصحة العالمية معدل السمنة وزيادة الوزن وسط الاطفال دون سن الخامسة ب ٤٢ مليون طفل في العام ٢٠١٠. تعتبر مطقة الشرق الاوسط من المناطق التي وصل فيها معدل السمنة وزيادة الوزن الي معدلات عالية ودق ناقوس الخطر حيث وصلت الي ١٢٪ و ٢٥٪. الهدف من الدراسة الحالية هو تقييم معدل زيادة الوزن والسمنة في المدارس الابتدائية بمدينة المجمعة بالمملكة العربية السعودية.

منهجية الدراسة:

هذه الدراسة مقطعية مجتمعية تمت في المدارس الابتدائية بمدينة المجمعة وهي عاصمة محافظة المجمعة بمنطقة الرياض بالمملكة العربية السعودية. اشتمل اطار العينة جميع المدارس الابتدائية بمدينة المجمعة. بلغ حجم العينة ٤٠٠ طالب وطالبة. تم استخدام الاستبانة المسبقة للاختبار لجمع البيانات كما تم قياس الاطوال والاوزان للاطفال باستخدام اجهزة قياس الطول والوزن ومن ثم تم حساب معدل كتلة الجسم.

النتائج:

years (mean =  $10 \pm 2.1$  years). The prevalence of overweight and obesity among primary school students were 10.1% and 18.9% respectively. The prevalence rate of overweight and obesity among male students were 11.2% and 17.6% respectively. The prevalence rate of overweight and obesity among females was 9.2% and 19.8% respectively. There is no significant association between nutrition status with social factors (age/gender

**Conclusion:** Overweight and obesity were high among the school children. Fast food and soft drinks were highly consumed by the primary school children

**Key Words:** Obesity, Overweight, social factors

عمر الطلاب والطالبات ما بين ٦ الى ١٤ سنة (الوسط الحسابي  $10 \pm 2,1$ ). معدل انتشار زيادة الوزن والسمنة وسط الطلاب والطالبات: ١٠,١٪ و ١٨,٩٪. معدل انتشار زيادة الوزن والسمنة وسط الطلاب الذكور: ١١,٢٪ و ١٧,٦٪. معدل انتشار زيادة الوزن والسمنة وسط الطالبات الاناث كان ٩,٢٪ و ١٩,٨٪. لم تثبت الدراسة وجود علاقة بين الحالة التغذوية والعوامل الاجتماعية كالعمر والنوع.

الخلاصة:

معدل زيادة الوزن والسمنة مرتفع وسط الطلاب والطالبات بمدارس المجموعة الابتدائية كما اتضح ان استهلاك الوجبات السريعة وشرب المياه الغازية كان من اكثر الاشياء آت العلاقة بزيادة الوزن والسمنة لدى الطلاب والطالبات.

## Introduction:

Childhood overweight and obesity are on the rise and considered as a serious health problem worldwide. In 2010, the World Health Organization (WHO) estimated that 42 million children under 5 years of age were either overweight or obese [1]. Obesity in general is a major risk factor for non-communicable diseases (NCDs), and it is estimated that by the year 2020, three-quarter of all deaths in developing countries will be attributed to NCDs. Many diseases and health-related abnormali-

ties are associated with obesity such as metabolic, cardiovascular, and musculoskeletal disorders [2]. Obese children are more prone to develop such diseases and abnormalities. One study among children aged 2-19 years in USA showed that 31.7% were overweight and 16.9% were obese [1]. Increasing rates of obesity and overweight have been observed globally, For example, Brazil showed an increase from 4.1% in 1975 to 13.9% in 1997; China from 6.4% in 1991 to 7.7% in 1997; and India from 16% in 2002 to 24% in 2007

[1]. The Middle East has included its share in this global epidemic of obesity, in a national survey in the

United Arab Emirate (UAE) the prevalence of overweight and obesity were estimated to be 21.5% and 13.7% among children aged 5-17 years respectively [1]. A study on Lebanese children aged 6 and 8 years puts the prevalence of overweight and obesity at 25.5% and 6.5% respectively. In Saudi Arabia, childhood obesity is being considered as a serious public health problem. Obesity and overweight among school-age children have reached 9.3% and 23% respectively [2]. Comparatively, the rates of obesity and overweight among preschool children were reported as approximately 6% and 15% respectively [3].

A variation of this prevalence is seen in the Eastern and central regions have the highest prevalence of obesity and overweight while southern regions have the lowest prevalence of obesity and overweight. Both regional and national studies showed a trend of rising obesity over time [1].

A national household survey conducted in Saudi children found that the prevalence of obesity was 16.7% among boys and 19.4% among girls ranging from highest in the East-

ern province and lowest in the Southern. [2.]

Using the prevalence reported by El Mouzan in Riyadh based on a 2005 reference data set (21% for overweight and 9.3% for obesity), it was estimated that the average of overweight and obesity for the last 7 years was 21% and 12.3%, respectively [3]. Al- Rukban conducted a survey on adolescents males aged 12-20 years from government boy schools and found that 13.8% were overweight and 20.5% were obese respectively; the prevalence of obesity was highest in Riyadh city [4]. In the northwest region of Riyadh, Al Alam conducted a survey among females aged 8-12 years and found that obesity prevalence was 14.9%; the 12 years old children were mostly affected [5]. Alsaed conducted study in Al-Khobar city in 2006, the prevalence of overweight and obesity were 20% and 11%, respectively [6]. BMI is increasing worldwide, with 36.9 % of men and 38 % of women estimated to have a BMI  $\geq 25$  kg/m<sup>2</sup> [7]. There appears to be a changing perception of obesity; this was illustrated in a population survey in which fewer overweight and obese individuals defined themselves as overweight in 2007 when compared with 1999, despite a significant increase in the prevalence of obesity [8].

The objectives of the study were to determine the prevalence of obesity and overweight among primary school children in Majmaah, Saudi Arabia.

## Materials and Methods:

### Study design and subjects

A descriptive, cross-sectional, community-based study to assess obesity and overweight among primary school children in Majmaah city, Saudi Arabia during 2014-2015. Majmaah city is the capital of Majmaah province which is located in Riyadh region. The study population was students in the primary schools in Majmaah city of 6-14 years of age and both genders.

### Sampling

Primary Schools in Majmaah city were listed from which 20 were selected by systematic random sampling. The sample was distributed between males and females according to population size. Within the school, the students were selected from different classes. The sample size was calculated as 400.

### Data collection

A pre-tested questionnaire was used to collect data. The questionnaire contained socio-

demographic characteristics, data on dietary habits and exercise. The questionnaire was filled by the parents of the children. Measurements of weight and height were conducted to calculate the body mass index (BMI).

Height was recorded using a measuring tape, with individuals standing without shoes. Each individual was asked to stand straight next to the wall. The head was kept erect and the height was measured to the nearest 0.5 cm. Weight was recorded on a measuring scale calibrated initially by taking two successive readings to the nearest 0.1kg. Each student was instructed to wear light clothes and stand barefoot on the weighing scale [ 8].

The height and weight were used to calculate the BMI using the formula:

$BMI = \text{Weight (kg)} / \text{height (m)}^2$ . WHO growth chart which depended on data from widely different ethnic backgrounds and cultural settings was used [9]. Students with BMI below  $-2$  SD (from the mean) for age and sex were defined as underweight. Students with BMI between  $-2$  SD and  $+1$  SD,  $+1$  SD and  $+2$  SD and  $+2$  SD from the mean were defined as normal, overweight and obese respectively.

Data analysis was performed using the Statistical Package for Social Science (SPSS), version 19. Pearson's Chi Square was applied to confirm associations between qualitative variables. P value less than 0.05 was considered statistically significant.

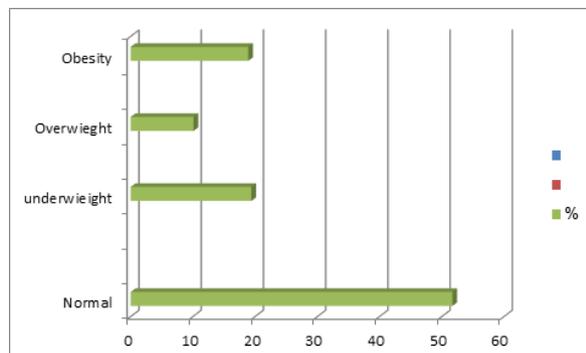
### Ethical concern

An ethical approval was obtained from the ethical committee of the Basic and Health Research Center of Majmaah University. Coordination and permission was obtained from the education administration in Majmaah province.

A total of 387 out of 400 responded to the survey giving a response rate of 96.8%. Age of the respondents ranged from 6-15 years old (mean= 10.5 ± 2.1 years, 95% CI = 10.5-10.9).

The prevalence rate of overweight and obesity among primary school students in Majmaah primary schools was 10.1% and 18.9% respectively

### Results:



**Figure (1)**  
**Nutrition status among school children in Majmaah**

**Table (1) Association of nutrition status and social factors of Majmaah primary school children**

Social Factors	Nutritional Status					P Value
	Underweight	Normal	Over weigh	Obese	Total	
Gender						
Male	(35.3%)60	(35.9%)61	(11.2%)19	(17.6%)30	(43.9%)170	0.6933
Female	(41.5%)90	(29.5%)64	(9.2%)20	(19.8%)43	(56.1%)217	
Total	(38.8%)150	(32.3%)125	(10.1%)39	(18.9%)73	(100%)387	
Age/years						0.610
6-8	(32.2%)28	(28.7%)25	(8.0%)7	(2.3%)2	(22.5%)87	
9-11	(25.1%)52	(34.8%)72	(9.7%)20	(3.4%)7	(53.5%)207	
More than 11	(8.0%)70	(9.7%)20	(13.6%)12	(19.1%)8	(22.7%)88	
Total	(38.8%)150	(53.5%)207	10.1%)39	(18.9%)73	(100%)387	

Table (1) shows the association between the prevalence of nutritional status and social factors, p value was 0.6933. The prevalence rate of overweight and obesity among male students were 11.2% and 17.6% respectively. The prevalence rate of overweight and obesity among females .was 9.2% and 19.8% respectively .P value was 0.610

**Table (2) Association of Nutritional Status of school children and life style**

Life Style	Nutritional Status					P
	Under-weight	Normal	Over weigh	Obese	Total	
Food Item						0.1895
Meat	(31.5%)23	(31.5%)23	(12.3%)9	(24.7%)18	(18.9%)73	
Vegetables	(46.1%)41	(27.0%)24	(5.6%)5	(26.0%)19	(23.0%)89	
Carbohydrates	(36.6%)86	(33.2%)78	(10.6%)25	(15.3%)36	(60.7%)235	
Total	(38.8%)150	(32.3%)125	(10.1)39	(18.9%)73	(100%)387	

Soft Drink/day						
Once	(60.0%)90	(52.8%)66	(25.6%)10	(27.4%)20	(48.1%)186	0.001
time 2-3	(28.0%)42	(16.8%)21	(30.8%)12	(35.6%)26	(26.1%)101	
and more 4	(12.0%)18	(30.4%)38	(43.6%)17	37.0%)27	(25.8%)100	
Total	(38.8%)150	(32.3%)125	(10.1%)39	(18.9%)73	(100%)387	
Eating Fast Food /Wk						
Once	(35.2%)45	(39.8%)51	(9.4%)12	(15.6%)20	(38.8%)128	0.001 <
Twice	(37.8%)34	(14.3%)10	(27.2%)28	(29.5%)31	(31.2%)103	
3times and more	(12.2%)11	(12.9%)9	(24.3%)25	(51.4%)54	(30.0%)99	
Total	(27.3%)90	(21.2%)70	(19.7%)65	(31.8%)105	(100%)330	
Performing regular exercise						
1-2	(11.5%)14	(47.9%)46	(11.5%)11	(2.1%)25	(44.9%)96	< 0.001
3-4	(36.9%)33	(26.1%)18	(2.0%)6	(17.4%)12	(32.2%)69	
and more 5	(55.1%)27	(28.5%)14	(6.1%)3	(10.2%)5	(22.9%)49	
Total	(34.6%)74	(36.4%)78	(9.4%)20	(19.6%)42	(100%)214	

Table (2) shows the association between nutritional status and respondents' socio-demographic factors. There was significant association between obesity/overweight and students eating fast food ( $p < 0.001$ ), performing regular exercise ( $p < 0.001$ ) and consuming soft drinks ( $p = 0.001$ ): However, there was no significant association between obesity/overweight and eating different food items ( $p=0.1895$ ).

## Discussion:

The results of the present study is similar to previous studies; Ali Al Shehri et al found the prevalence of overweight and obesity among

Saudi school children as 23% and 9.3% in boys and girls respectively [1]. The current study is also in line with results of a cross-sectional national epidemiological household survey conducted among Saudi children in which the prevalence of obesity was 16.7% and 19.44% in the boys and girls respectively [2]. Similarly a review article by Ali Al Shehri between 2000 -2012 revealed that the rates of overweight and obesity among school-age children have reached 23.1% and 9.3%, respectively [10].

Our findings are consistent with Al-Almaie SM who showed that the prevalence of overweight and obesity among male adolescents was 10.2% and 19.3% respectively [11]. Our findings also finds similarity with a previous study about obesity prevalence among Saudi school boys (6-12 years old) in 1988 and 2005, where the prevalence increased from 3.4% 1988 to 24.5% in 2005 [12]. There is evidence that the prevalence of childhood overweight and obesity in Saudi Arabia is growing dramatically, this may be attributed to urbanization and adopting sedentary life style; the problem seems to be worsening when the children grow older [8]. Our study findings go in line with a study done In 2008, by Amin etal who found that the prevalence of overweight and obesity among schoolboys aged 10-14 years were 14% and 9.7% respectively [12].

Our findings support Al Dossary who conducted a representative study comparable to the Al Saeed survey in time, place, and references among children aged 2-18 years, it found that 19% of the children were overweight and 23.3% were obese. Al Dossary study also indicated that adolescents aged 14-

18 years have the highest rates of overweight and obesity. [13]

The prevalence of overweight and obesity in adolescents in the eastern region has reached approximately 29%. This finding serves as evidence that the rates of overweight and obesity in adolescents have reached alarming levels. The estimated average prevalence of overweight in the eastern region was 19.1%. Based on reference data from 2005, El Mouzan showed in 2012 that the prevalence of overweight and obesity reached 20.1% and 9.1% respectively [4].

In our study there is significant association between overweight/obesity and eating fast food ( $p < 0.001$ ), with performing exercise ( $p < 0.001$ ), and with drinking soft drinks ( $p = 0.001$ ). However, there is no significant association between overweight/obesity and eating different food items ( $P = 0.1895$ ). The result does not show significant association between overweight/obesity and social factors i.e. age and gender. Global, regional and national prevalence of overweight and obesity in children and adults 1980-2013, A systematic analysis was conducted which

showed that there have been substantial increases in prevalence among children and adolescents in developed countries, with 23.8% of boys and 22.6% of girls being either overweight or obese in 2013. [14]. Musaiger .A.O etal conducted a study in the Mexico City area, on Physical activity and television viewing were related to obesity prevalence in Mexican children 9 ± 16 y old and significant association was found .[15]

Concerning factors associated with obesity in the Eastern Mediterranean Region, During the past decade, there has been increasing emphasis, especially in Saudi Arabia, Bahrain, Egypt, Kuwait, Lebanon and Tunisia, on determining the factors associated with obesity [17,18,19]. Nevertheless, in-depth studies on this aspect are few, which means there is a grave need for establishing a well-designed, community- based study in the Region. [16]

Changes in lifestyle, dietary habits, physical activity, and the socio-cultural environment play an important role in obesity.[20] combination of an excessive nutrient intake such as fast-food chains, high soft drinks and a sedentary lifestyle are the main causes in devel-

oping obesity.[21] Changes in socioeconomic status have had a significant effect on physical activity with the availability of easy transport, the increase in electrical home appliances long periods in watching television and sedentary activities.

### **Acknowledgement:**

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ORIGINAL ARTICLE

## Knowledge and attitude of Albaha University's students to perform Cardiopulmonary Resuscitation, Saudi Arabia

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### Abstract

**Background/Objective:**In 2015, the Saudi Heart Association suggested that one in four adults is at risk for cardiac arrest within the next 10 years. Cardiopulmonary resuscitation is considered one of the important determinants for out-hospital cardiac arrest survival. The aim of this study was to assess level of cardiopulmonary resuscitation knowledge and attitude among students of Albaha University.

**Methods:** Following a cross-sectional study, questionnaires were distributed to 500 students recruited via stratified random sampling technique. Only 341 (68.2%) completed the study.

**Results:** A total of 341 students were completed the questionnaire; 49% of students had a previous knowledge of cardiopulmonary resuscitation. Most of students (90%) were not confident on having sufficient CPR knowledge, 69.5% of them knew emergency phone number in Saudi Arabia, and 8.8% of the students had personally witnessed a cardiac arrest victim, of those witnessed cardiac arrest no one did full cardiopulmonary resuscitation. Although 62% of students reported willing to

### الملخص

الخلفية/الهدف: أعلنت جمعية القلب السعودية في فبراير ٢٠١٥ أن مواطن سعودي بين كل أربعة مواطنين في المملكة العربية السعودية سيكونون معرضين للسكتة القلبية المفاجئة خلال العشرة أعوام القادمة. الإنعاش القلبي الرئوي يعتبر واحد من أهم العوامل التي تحدد معدل النجاة من السكتات القلبية خارج المستشفى. هدفت الدراسة الى قياس سلوكيات ومستوى معرفة الطلبة بمهارات إنعاش القلب والرئة الأساسية في جامعة الباحة.

هذه دراسة وصفية مستعرض تهتم اجراءها على الطلاب (ذكور واناث) بجامعة الباحة. تم توزيع عدد ٥٠٠ استبانة على الطلاب / الطالبات باستخدام العينة العشوائية الطبقية. كانت الاستجابة فقط من ٣٤١ (٢, ٦٨٪) طالب/ طالبة الذين أكملوا الدراسة.

النتائج: تم توزيع الإستبانة على عدد ٣٤١ طالب وطالبة. حيث تبين ان ٤٩٪ من الطلاب لديهم معلومات مسبقة عن مهارة إنعاش القلب والرئة. أغلب الطلاب (٩٠٪) غير واثقين بما لديهم من معلومات، ٦٩,٥٪ من الطلاب لديهم المعرفة برقم الاسعاف . ٨,٨٪ من الطلاب قد تعرض والموقف يستوجب قيامهم بعملية إنعاش القلب والرئة، الا انه لم يقم أي احد منهم

perform cardiopulmonary resuscitation, when students confronted with 6 hypothetical cardiac arrest scenarios, the option of providing full cardiopulmonary resuscitation are less frequently chosen. Fear of doing mistakes when performing cardiopulmonary resuscitation due to lack of competence were reported in (42.5%) of students as a reason for being reluctant to perform rescue breathing.

**Conclusion:** The study found that overall attitude toward CPR are positive. However, the proper knowledge of CPR was not sufficient. Thus, the incorporation of cardiopulmonary resuscitation learning approaches within university curricula will provide the opportunity to develop knowledge and skills required to save people lives.

**Keywords:** Cardiopulmonary Resuscitation, Knowledge, Attitude, Students

بتنفيذ عملية انعاش القلب والرئة الصحيحة. وبالرغم من ان ٦٢٪ من الطلاب قد ابدوا استعداد هم للقيام بعملية انعاش القلب والرئة الا انه عند مواجهتهم بعدد ستة من السيناريوهات لمصابين بالسكتة القلبية، كان إختيار عمل جميع الخطوات لعملية انعاش القلب والرئة من أقل الإختيارات . ٨, ٤٠. الخوف من الخطاء لوحظ عند ٤٢, ٥٪ من الطلاب كمبرر لعدم عمل التنفس الصناعي.

الخلاصة: أوضحت الدراسة أن المستوى العام لسلوكيات الطلبة تجاه الانعاش القلبي الرئوي كانت إيجابية، على الرغم من صحة المعرفة كانت غير كافية. لذلك فإن دمج الإنعاش القلبي الرئوي ضمن مناهج الجامعة سيوفر فرصة لتطوير المعرفة والمهارات المطلوبة للحفاظ على حياة الناس.

## 1. Introduction:

Survival from out hospital cardiac arrest (OHCA) depends on a sequence of time sensitive and interconnected links termed “ the chain of survival “(1). Two of these links, early bystander cardiopulmonary resuscitation (CPR) and early defibrillation, have been prioritized as the two most important links in the chain of survival(2). Delivery of early bystander CPR can increase the chance of survival two to three folds(3). However, early

bystander CPR rate still low, the rate of cardiac arrest is high. In Saudi Arabia, Bystander CPR rate varies between 15.4% and 20.8% in OHCA (4, 5). Knowledge of CPR, performing of simple task and attitude to performing CPR are important keys to increase bystander contribution to the survival of OHCA (6, 7).

Many studies investigated knowledge of CPR among health care professional and school students in Saudi Arabia(6, 8-10).

However, the limitation of previous studies in Saudi Arabia was they were conducted among medical, dentist or nursing students who may have a CPR knowledge gained through study courses. Furthermore, it was reported in the literature that both CPR training and attitude to performing CPR were varies between different age groups and between countries (7). Thus, the aim of this study was to assess the level of CPR knowledge and attitude among students in Albaha University, Saudi Arabia.

## 2. Materials and Methods:

A cross sectional design was used to assess CPR knowledge and attitude towards CPR among students in Albaha University. The study was conducted in Albaha university campus between 15 January 2016 and 15 February 2016. Albaha University suited at South-Western area of Saudi Arabia. It is the only governmental university located in this area established in 2006. It consists of faculties and school offering several degrees ranging from diploma to master degree on several fields of art, science and medical studies.

The study population consisted of 23,863 students, and the target population for this

study included all students (males and females) registered for the second semester of the academic year 2016/2017. Students were categorized based on their field of study into 3 main sectors; health sector (consisted of students enrolled in faculty of applied medical sciences, faculty of medicine and faculty of clinical pharmacy), scientific sector (consisted of students enrolled in Faculty of Engineering, Faculty Of Sciences, and Faculty Of Computer Sciences) and literature sector (consisted of students enrolled in Faculty Of Art And Humanities, Faculty Of Art And Scientific And Faculty Of Administrative And Financial Studies). A stratified random sampling was used to select a proportionate sample size. The targeted sample size was 500 students, and only 341 (68.2%) completed the study. The sample size was calculated using the following measures:  $n = \frac{z^2 \cdot p \cdot q}{d^2}$ , where,  $n$  = factorial sample size,  $p$  = estimated proportion (0.1),  $q$  = (0.9),  $z$  = (1.96), and  $d$  = standard error. Then  $n$ ; sample size was calculated by  $n = \frac{z^2 \cdot p \cdot q}{d^2}$ .

The questionnaire was developed and adopted from the original questionnaire used by Kantsad et al (2011) (7). The original questionnaire

was consisted of 28 questions and used to assess students' knowledge and attitude to performing bystander CPR in Norway. In the current study the questionnaire was modified by researcher to include 33 questions distributed into five major sections. Section 1 consisted of questions regarding age, gender and field of the study. Section 2 assessed the students previous knowledge and training on CPR and automated external defibrillator (AED). Section 3 assessed the practical experience and attitude toward CPR and AED and section 4 assessed the theoretical knowledge of CPR and in Section 5, students were asked to respond to realistic cardiac arrest scenarios. After that the questionnaire was validated and pre-tested on 30 students as a pilot study.

voluntary with the right to withdraw at any time without any penalty. Furthermore, participants were assured that all information will be kept confidential by which the researcher only have the right to review and only the overall knowledge and attitude on CPR will be announced and published.

The data was collected using the adopted questionnaire and then the data was checked and cleaned before analysis to enhance accuracy and reliability data. Data analysis was undertaken using the Statistical Package for the Social Sciences (SPSS) version 20. Descriptive statistics was used to describe demographic data. Chi-square test was used and Fisher exact test were used for E values less than or equal to 5. Statistical significance was reported at the conventional p-value equal and less than 0.05 and/or 0.001 levels (as significant and highly significant respectively).

Ethical approval was obtained from the deanship of scientific research on January 2016. Target participants, who were willing to participate, received a cover letter explaining the purpose and outcome of the study and assuring them that that their participation is vol-

### 3.Results:

#### 3.1. Tables

**Table 1: Distribution of students according to the college enrolled in.**

Demographic characters		Male	Female
School	Scientific sector	(41.8%)77	(45.2%)71
	literaturesector	(35.3%)56	(29.3%)46
	Health sector	(22.8%)42	(25.5%)40
Total		(54%)184	(46%)157

**Table 2: Previous CPR and AED knowledge and attitude toward CPR among student at Albaha University.**

Respondent response	All N=341	Male n=184	Female n=157	P value
(Do you have a previous knowledge about CPR? (yes	(49.3%)168	(40.8%)75	(59.2%)93	*0.000
(Have you had a CPR training course? (Yes	(10.6%)36	(10.3%)19	(10.8%)17	0.509
Do you feel that you have a sufficient CPR knowledge in situa- (tion with cardiac arrest?(Yes	(9.7%)33	(11.4%)21	(7.6%)12	0.161
Have you heard about Automated external defibrillator ((AED)? (Yes	(67.7%)231	(66.3%)122	(69.4%)109	0.309
<b>?How do you evaluate your ability to use the AED</b>				
Excellent-	(9.7%)33	(12%)22	(7%)11	0.273
Good-	(20.2%)69	(20.7%)38	(19.7%)31	
I don't know how to use the AED device-	(70.1%)239	(67.4%)124	(73.2%)115	
<b>?If you have had no CPR course, what is the reason</b>				
.Little interest -	(22.4%)66	(20.6%)33	(24.4%)33	0.051
little time -	(24%)71	(23.1%)37	(25.2%)34	
Not sure where to attend course -	(48.1%)142	(47.5%)76	(48.9%)66	
Costs -	(5.4%)16	(8.8%)14	(1.5%)2	
<b>(Do you think that you need more CPR training?(Yes</b>	(90.6%)309	(86.4%)159	(95.5%)	*0.003
<b>If you think that you need more CPR training,what is the :reason</b>				
Heart disease within family-	(12.3%)42	(15.8%)29	(8.3%)13	*0.013
Avoid unnecessary death -	(69.2%)236	(62.5%)115	(77.1%)121	
Other reason or no answer -	(18.5%)63	(21.7%)40	(14.6%)23	

<b>:CPR course should be</b>				
Mandatory for all students -	(40.8%)139	(73%)68	(45.2%)71	
Mandatory for health related students -	(15%)51	(15.8%)29	(14%)22	
optional -	(41.9%)143	(42.9%)79	(40.8%)64	*0.036
Don't support implementation of training course -	(2.3%)8	(4.3%)8	(0%)0	
<b>If the AED device presents in Public area are you willing to use this device in case of cardiac arrest? (Yes</b>	(43.1%)147	(42.9%)79	(43.3%)68	0.516
<b>If you have never received AED training would you like to learn how to use AED? (Yes</b>	(74.8%)255	(69%)127	(81.5%)128	*0.023

Statistical significant different using Chi square test and p value less than 0.05

**Table 3: Theoretical Knowledge of CPR**

Respondent response	All N=341	Male n=184	Female n=157	P value
The Emergency telephone number in Saudi Arabia “red crescent” (Correct Answer (997- Not correct -	(69.5%)237 (28.7%)98	(72.3%)133 (24.5%)45	(66.2%)104 (33.8%)53	0.138
What is the survival rate in out-of-hospital cardiac arrest if CPR is performed correctly (correct answer(10%- Not correct-	(37%)126 (63%)215	(34.8)64 (39.5%)120	(65.2%)62 (60.5%)95	0.216
What is the increment in chance of survival in out-of-hospital cardiac arrest, if the patient receives sufficient CPR before arrival of emergency personnel (correct answer (it increases two fold- Not correct-	(41.3%)141 (58.7%)200	(41.8%)77 (58.2%)107	(40.8%)64 (59.2%)93	0.463
You are alone and come across an apparently lifeless adult person. What do you do correct answer (check for consciousness,secure airways and-check if the patient breathing Not correct-	(28.2%)96 (71.8%)245	(23.9%)44 (33.1%)52	(76.1%)140 (66.9%)105	*0.039
It turns out the patient is breathing but shows no response to verbal stimuli. What do you do? -correct answer (put ( the patient in recovery position and call for ambulance Not correct-	(64.5%)220 (35.5%)121	(63.6%)117 (36.4%)67	(65.6%)103 (34.4%)54	0.392

You decide to perform CPR. Which of the following combinations of chest compressions and mouth ventilation would you choose	(42.2%)144	(37.5%)69	(47.8%)75	*0.036
correct answer (First 30 chest compression, then 2 mouth ventilation, in repeating rounds	(57.8)197	(62.5%)115	(52.5%)82	
Not correct-				

Statistical significant different using Chi square test and p value less than 0.05

**Table 4: Personnel experience and attitude toward CPR :**

Respondent response	All N=341	Male	Female	P value
Have you ever personally witnessed an assumed cardiac arrest (and experienced that someone needed CPR)? (yes	(8.8%)30	(11.4%)21	(5.7%)9	*0.048
If you answered yes in question 8, did you intervene in any of the following ways	(0%)0	(0%)0	(0%)0	0.407
No CPR at all-	(0%)0	(0%)0	(0%)0	
Full CPR-	(86.7%)26	(90%)18	(80.2%)8	
Called Only-	(13.3%)4	(20.2%)2	(20%)2	
Did chest compression Only-				
Are you willing to perform CPR if you personally witness a (cardiac arrest)? (yes	(62.2%)212	(60.3%)111	(64.3%)101	0.259
?If you answered no in question 1, what it the reason	(26.4%)90	(27.7%)51	(24.8%)39	0.273
	(17.6%)60	(19.6%)36	(15.3%)24	
I have to little knowledge in CPR -	(1.1%)2	(1.1%) 2	(0%)0	
Fearing of harming the victim -	(55.4%)189	(51.6%)95	(59.9%)94	
Fearing of disease transmission -				
others or no answer-				
Q31:reason for reluctant to perform rescue breathing for :scenarios from 1-6	(30.5%)104	(38.6%)71	(21%)33	*0.003
	(21.1%)72	(17.9%)33	(24.8%)39	
Fear of disease transmission-	(42.5%)145	(37%)68	(49%)77	
feel of repulsive to perform-	(5.9%)20	(6.5%)12	(“5.1%)8	
Fear of performing it wrong because lack of competence-				
other reason or no answer-				
Q32” if the rescue breathing is removed fromCPR Guideline, would it be easier for you to initiate CPR? yes	(44.3%)151	(46.2%)85	(42%)66	0.254

Statistical significant different using Chi square test and p value less than 0.05

**Table 5 : Gender differences according to response to six cardiac arrest scenarios.**

Respondent response	All N=341	Male	Female	P value
Scenario 1 :arrested Member of your family				
Call ambulance only -	(52.2%)178	(48.9%)90	(56.1%)88	
Chest compression only-	(16.1%)55	(19%)35	(12.7%)20	
Incomplete CPR-	(24.9%)85	(22.3%)41	(28%)44	*0.023
Full CPR-	(6.7%)23	(9.8%)18	(3.2%) 5	
Scenario 2 :arrested intravenous drug user				
Call ambulance only -	(81.5%)278	(75.5%)139	(88.5%)139	
Chest compression only-	(11.4%)39	(16.3%)30	(5.7%)9	
Incomplete CPR-	(6.5%)22	(7.1%)13	(5.7%)9	*0.007
Full CPR-	(0.6%)2	(1.1%)2	(0%)0	
Scenario 3 :Arrested child				
Call ambulance only -	(50.7%)173	(50%)92	(51.6%)81	
Chest compression only-	(20.8%)71	(20.7%)38	(21%)33	
Incomplete CPR-	(23.2%)79	(22.8%)42	23.6%)37	0.744
Full CPR-	(5.3%)18	(6.5%)12	(3.8%)6	
Scenario 4 :arrested elderly lady with vomitus on her mouth				
Call ambulance only -	(69.2%)236	(66.8%)123	(72%)113	
Chest compression only-	(14.7%)50	(12%)22	(17.8%)28	
Incomplete CPR-	(14.7%)50	(18.5%)34	(10.2%)16	0.014
Full CPR-	(1.5%)5	(2.7%)5	(0%)0	
Scenario 5 :arrested adolescent with blood on his face				
Call ambulance only -	(74.2%)253	(69.6%)128	(79.6%)125	
Chest compression only-	(10%)34	(11.4%)21	(8.3%)13	
Incomplete CPR-	(12.9%)44	(16.3%)30	(8.9%)14	0.131
Full CPR-	(2.9%)10	(2.7%)5	(3.2%)5	
Scenario 6 :arrested stranger collapsed during exercise				
Call ambulance only -	(60.4%)206	(59.8%)110	(61.1%)96	
Chest compression only-	(17.3%)59	(15.2%)28	(19.7%)31	
Incomplete CPR-	(17%)58	(20.1%)37	(13.4%)21	334.
Full CPR-	(5.3%)18	(4.9%)9	(5.7%)9	

Statistical significant different using Chi square test and p value less than 0.05

### 3.2 The participants

The mean age for participants was 21.5 years (SD=2.6), and the sex of participants were male 184 (54%), and female 157(46%). Of the 341 students who completed the questionnaire, 148(43%) were enrolled in a scientific sector, 111(33%) in literature sector and 82(24%) in health sector (Table 1).

### 3.3 Previous knowledge and attitude toward CPR and AED:

Forty-nine percents of participants have knowledge about CPR, and female (59.2%) were significantly more knowledgeable than male on CPR ( $p=0.00$ ). The majority of students 308 (90%) were not confident on having sufficient CPR knowledge.

Only 10.6% of the students have attended a CPR training and most of them, 309 (90.6%), said they would like to receive more CPR training. The reason behind requesting more CPR training was to avoid unnecessary death (69.2%) and again the female students reported a significantly higher score ( $p=0.013$ ). Of the participated students, 40.8% of the students supported the mandatory CPR training in university with and male students, 68(73%) showed significantly higher commitment than

female students, ( $p=0.036$ ).

However, majority of the students (67.7%) have heard about the Automated External Defibrillator (AED), only 9.7% of them were competent in using the AED and majority (70%) was not able to use the AED device. The majority of female students 128(81.5%) would like to learn how to use the AED machine, they reported a significant higher commitment than male students ( $p=0.023$ ). Table 2 shows the previous CPR and AED knowledge and attitude toward CPR among students at Albaha University.

### 3.4 Theoretical knowledge of CPR:

The majority of students (69.5%) knew the emergency phone number in Saudi Arabia (997), the male students were not more knowledgeable than female ( $p=0.138$ ). About one third (39.6%) of students believed that CPR has a little influence on survival if emergency personnel arrive early (39.6%). The answers indicate lack of knowledge on the exact survival rate and the increment in chance of survival rate in out of hospital cardiac arrest (OHCA). Only 37% of students knew the correct answer for survival rate in OHCA and 41.3% believed that the increment in chance

of survival, if the patient received sufficient CPR in out of hospital settings, would be increased by twofold. In contrast to male, 76.1% of female respondents demonstrated significantly basic knowledge in handling an apparently lifeless adult person ( $p=0.039$ ). The correct number for chest compressions and ventilation was known by 42.2% of the students, with a female students scored significantly higher than male students ( $p=0.036$ ). Table 3 demonstrates the difference between male and female in theoretical knowledge of CPR.

### 3.5 Personal experience and attitude toward CPR:

Despite the young age of the students, 30 (8.8%) had personally witnessed an assumed victim of cardiac arrest, with a significantly more personnel experience among male students (11.4% vs. 5.7,  $p=0.048$ ). Of those who had personally witnessed cardiac arrest, No one did a full CPR, 86.7% called the emergency number only and 13.3% only did chest compression. When asking about student's willing's to perform CPR, 47.8 % answered that they would not perform CPR due to lack of knowledge (26.4%), fear of harming other (17.6%) and fear of disease transmis-

sion (1.1) and (5.9%) had either no answer or other not specified reason. There was no statistical significant difference between male and female regarding this point ( $p=0.273$ ). However, when exposing students to cardiac arrest scenarios (Table 4), both a afraid disease transmission (30.5%) and lack of competence (42.5%) became more prevalent answer. In addition, 44.3% of respondents would initiate CPR if the rescue breathing is removed from CPR guideline.

### 3.6 Response to cardiac arrest scenarios

The relationship between the bystander performing CPR and the victim may influence the CPR performance. In order to see if the students willing to perform CPR would be changed when more specific details and the identity of victim was given, we provided students with six cardiac arrest scenarios. All of these scenarios proposed to be happened in out of hospital settings and the relationship between victim and bystander varies. Student's response are categorized into the following categories: Full CPR (call ambulance, chest compression and rescue breathing), incomplete CPR (any combination of 2 choices e.g. call ambulance and rescue breathing),

chest compression only or rescue breathing only.

Students were more willing to perform full CPR on family members (6.7%) and not willing if the victim was suspected to be drug abuser (0.6%) ( $p=0.000$ ). There was a significant gender difference in scenario 1, 2 and 4. Male students (9.8%) reported a significantly higher commitment than female student (3.2%) in providing full CPR to arrested member of their family ( $p=0.023$ ). It was further reported that when the students confronted with a scenario of arrested child, (81.5%) would call ambulance only and only 0.6% would perform full CPR ( $p=0.007$ ). The majority of participant (69.2%) would call ambulance only in case of arrested elderly lady and only (1.5%) would perform CPR ( $p=0.014$ ). Table 5 shows the gender difference according to response to provided cardiac arrest scenarios.

#### 4. Discussion:

The current study sought to examine the level of cardiopulmonary resuscitation knowledge and attitude among students in Albaha University, Saudi Arabia. In this study, more than half (51%) of the students did not have

previous information about CPR due to lack of CPR information among students. The results are higher and contradict the previous studies results. For example, in Saudi Arabian study only 31% of students at King Saud University did not have a previous knowledge about CPR (10), and in another study the lack of information about CPR was less than 50% of students (11).

Most of the students reported willing to receive more CPR training. However they reported the similar barriers to taking CPR courses described in other studies such as lack of interest and time (7, 12). Cost is not considered a barrier by students, but about 40% don't know where to find a CPR course.

The finding of poor CPR knowledge in this study is similar to previous studies finding, a study conducted among school students in Saudi Arabia revealed a poor CPR information when compared to previous CPR awareness studies, researcher explained this results by the academic background of the previously surveyed students (for example, medical and health professional students) (8). Similar

finding was found in another study conducted in China, of the surveyed respondents, only 0.4% answered all questions related to CPR knowledge(13). Our findings supported the evidence suggested that public knowledge of CPR, the use of AED and survival rate after cardiac arrest is poor(14). This underlines the need for CPR courses in the university and general public places, 40.8% supported the mandatory CPR courses in university and would even like more CPR training, this reflect their awareness of the important role of CPR training in saving victim life.

Despite the young age of participants, we explored that 8.8% of students had personally witnessed an assumed cardiac arrest and experienced that someone needs basic life support. This result is similar to the finding of a study conducted in Norway, in which 8% of secondary school students experienced a cardiac arrest scenario(7). In another study conducted in Saudi Arabia a higher rate (12.7% ) of the students experienced a situation required CPR and 14% are actually performed CPR(10). The rate is higher also in another country (2).This finding supported the no-

tion that students is a cost effective target to CPR training course. Training courses should be implemented to all students starting from school age with a refresher course in frequent interval to help retain knowledge.

Willing to perform CPR seems to be influenced by victims to bystander relationship. Our finding was consistent with the finding of other studies regarding the self-reported willing to perform CPR(10, 15). However, students willing to perform CPR were changed when more specific details and victim identity were provided. Students expressed more willing to perform full CPR when confronted of scenario of family member and arrested child, however it is still low when compared to other studies(7, 8, 12). The possible explanation for the low percentage of students willing to perform CPR, when confronted to cardiac arrest scenario, could be related to insufficient CPR knowledge and skills, and It could be also influenced by the setting in which the scenarios were presented.

The results of this study revealed that 30.5% of participant is reluctant to perform mouth to

mouth breathing due to fear of disease transmission. The finding was higher than reported in Japan (16) and Australia (17). This finding underlines the importance of the fact that the chance of getting a communicable disease from doing mouth to mouth breathing is very low (18).

The strengths of this study include the assessment of knowledge and attitude of university's students using a stratified random sampling technique. The sample of the study was extrapolated from medical and non medical fields of study. The study limitations were stemmed from the fact that it was conducted in only one university; such studies will yield more useful results if conducted on more sample size with complete randomization all over the Saudi Arabia.

### 5. Conclusion:

In conclusion, the results of this study presented that overall students' attitude toward CPR is positive. However, the proper knowledge of CPR was not sufficient especially when confronting students with hypothetical cardiac arrest scenarios. These results confirm that students at this age group are important target

for future CPR courses aimed at increasing the contribution of bystander to the survival of out of hospital cardiac arrest. Courses, refresher courses and strategies should be implemented by university to increase survival of out of hospital cardiac arrest.

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ORIGINAL ARTICLE

## Stress, Burn Out, Anxiety and Depression among Health Professionals of Majmaah University.

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### Abstract

**Background and Aims:** Stress, Burnout, Depression and Anxiety are the most common work related mental and behavioral disorders. Recent studies have shown that professions such as medical and health care fields are most predisposed to such disorders. Very few have been conducted on health professionals working in universities. This study was designed to identify the presence of these disorders among the health professionals in Majmaah University

**Methods:** The study was conducted among the health specialties colleges of Majmaah University, Kingdom of Saudi Arabia. An observational cross-sectional study design was adopted for this research. A convenience sample of 90 subjects with 30 subjects each from medicine, dentistry and applied sciences were randomly selected. The Depression, Anxiety and Stress Scale - DASS 21 and the Maslach Burnout Inventory (MBI) was used to measure Depression, Anxiety and Stress and Burnout. All the results were tabulated and analyzed for statistical difference using SPSS version 23.

**Results:** A moderate amount of total burnout

### الملخص

أهداف الدراسة: يعتبر الإجهاد والإرهاق والاكتئاب والقلق من العوامل الأكثر شيوعاً المتعلقة بالاضطرابات العقلية والسلوكية. وقد أظهرت الدراسات الحديثة أن العاملين في المهن الطبية والرعاية الصحية هم أكثر عرضة إلى مثل هذه الاضطرابات. وقد أجريت القليل من الدراسات على المهنيين الصحيين العاملين في الجامعات. وقد تم تصميم هذه الدراسة للتعرف على وجود هذه الاضطرابات بين العاملين في المجالات الصحية في جامعة المجمعة.

طرق البحث: أجريت الدراسة في الكليات ذات التخصصات الصحية في جامعة المجمعة، المملكة العربية السعودية.

تم اعتماد تصميم الدراسة العينية لهذا البحث. وقد تم اختيار عينة عشوائية من ٩٠ شخصاً في هذه الدراسة ٣٠ شخصاً من كلية الطب و٣٠ من كلية طب الأسنان و٣٠ من كلية العلوم الطبية التطبيقية. وقد استخدم مقياس DASS 21 لقياس الاكتئاب والقلق والإجهاد ومقياس Maslach MBI لقياس الإرهاق وقد تم جدولته جميع النتائج وتحليلها احصائياً باستخدام SPSS النسخة ٢٣. النتائج: وجدت كمية معتدلة من الإرهاق الكلي بين العاملين في جميع الكليات الثلاث بينما كان القلق والاكتئاب

was seen in all the three faculties, Anxiety and depression was significantly more in the applied sciences group whereas stress was significantly more in the medical group.

**Conclusions:** Mild to moderate levels of stress, anxiety, depression and burnout was seen in this study. It is a significant finding and both the individuals and the University should create awareness regarding identification and management of signs and symptoms of these disorders.

**Key words:** Anxiety, Burnout, Depression, Health professionals, Stress,

أكثر في مجموعة كلية العلوم الطبية التطبيقية في حين الضغط النفسي كان أكبر بكثير في مجموعة كلية الطب. الاستنتاجات: وجدت مستويات خفيفة الى معتدلة من الإجهاد، والقلق، والاكتئاب والإرهاق في هذه الدراسة. وهو اكتشاف مهم على الجميع من أفراد الجامعة العمل على خلق الوعي بشأن التعرف على أعراض هذه الاضطرابات والعمل على معالجتها.

### Introduction:

Health professionals such as doctors (Medical/ Dental), physiotherapists, Nurses, auxiliary personnel are more prone to mental & behavioral disorders (MBD), because Health services involve taking care of other people, making decisions which affect their life, in which mistakes or errors could be costly, and sometimes irreversible.<sup>1,2</sup>

Stress, Burnout, Depression and Anxiety are the most common work related mental and behavioral disorders. Recent studies have shown that professions that have direct interaction with humans such as medical and health care fields are most predisposed to stress, burnout

and related disorders.<sup>3,4</sup> Stress can be defined as the biological reaction to any adverse internal or external stimulus, acute stress is a natural and useful reaction to threat or encountered problems which are inevitable. On the other hand, humans are unfortunately more affected by chronic stress, because humans are no longer allowed to choose between “fight or flight” so, as a consequence, we become continuously exposed to stress factors which we react to by anticipating, repressing, rationalizing and becoming worried or choose compromise in order to overcome different situations.<sup>5</sup>

The burnout syndrome is considered a public health problem due to its increasing frequency and the negative consequences it has on the healthcare system. This hampers the medical system, either directly, by affecting the health of the professionally exhausted medical employees or indirectly, through the consequences it has on the quality of medical care. According to expert studies, the burnout syndrome has been identified as a risk factor for future heart disease incidence. According to Maslach, the burnout syndrome has the following three dimensions:

Emotional exhaustion – it highlights lack of energy, perception of the inadequacy between one's own emotions and the context and the fact that significant resources have been consumed at work. It is the basic dimension, manifested by a decreased emotional tone, emotional indifference or oversaturation.

Depersonalization – it refers to the disruption of interpersonal relationships as the affected person becomes dependent on others, or negativistic, indifferent, cynical.

Personal accomplishment– it can manifest either through the tendency of negative self-as-

essment of one's capabilities, achievements, professional success, or by limiting one's opportunities and obligations to others. Consequently, the affected person is perceived as incompetent and incapable to achieve goals.<sup>6</sup>

Although burnout and depression have many similar manifestations and are closely related, studies on health professionals have concluded that they are different. Burnout differs from depression in that burnout only involves a person's relationship to his or her work, whereas depression globally affects a person's life. Anxiety disorders are severe medical illness seen frequently in health professionals due to the nature of the job; they are often seen in association with other behavioral disorders.<sup>7</sup>

Many studies have documented the presence of behavioral disorders like burnout and stress among health professionals.<sup>3,4,8,9,10</sup> Health professionals employed in the university play a dual role of clinician as well as an academician, but very few studies have been conducted on health professionals working in universities. This study which is first of its kind in this region was designed to identify the presence of stress, anxiety, depression

and burnout among the health professionals in Majmaah University and to also explore if any differences exist between different medical professions in terms of these disorders.

### **Material and Methods:**

The study was conducted among the health specialties colleges of Majmaah University, Kingdom of Saudi Arabia. An observational cross-sectional study design was adopted for this study. The inclusion criteria for the study was all faculty members of the university working in a health specialty college (Medical, Dental or Applied Medical sciences) who agreed to participate in the study, were involved in active teaching and qualified to work in the clinical section. Faculty members involved only in clerical work or who did not agree were excluded from the study. This study was conducted only in the male sections of the college as some of the specialties had a disproportionate male female ratio which could confound the results. University ethical clearance was obtained and a convenience sample of 90 subjects with 30 subjects each from medicine, dentistry and applied sciences were randomly selected. Each questionnaire

was personally given to the participants after ensuring that they satisfied the inclusion criteria and collected back by researcher after checking for its completion. Thus invalid or incomplete questionnaires were avoided and a final sample size of 90 was obtained.

The Depression, Anxiety and Stress Scale - DASS 21 is a 21 item self-report questionnaire designed to measure the severity of a range of symptoms. The essential function of the DASS is to assess the severity of the core symptoms of Depression, Anxiety and Stress.<sup>5</sup>The Maslach Burnout Inventory (MBI) is by far the most widely used, accepted, valid, and reliable measurement tool of burnout.<sup>11</sup> The 22 total items are broken up into the three themes with nine items relating to emotional exhaustion, five to depersonalization, and eight to accomplishment.

All the results were tabulated and analyzed for statistical difference among different health professionals using software SPSS version 23.

### **Results:**

Table 1 shows the mean age and experience of the subjects in all the specialties, the mean

**Tables:****Table 1: Age distribution**

Specialty	Age	Experience in years
Dental	<b>39.5</b>	<b>11.18</b>
Medical	<b>41.21</b>	<b>10.46</b>
Applied sciences	<b>42.24</b>	<b>14.0</b>

**Table 2: DASS 21 Score**

Specialty	Depression	Anxiety	Stress
Dental	<b>4.94±1.03</b>	<b>9.12±2.76</b>	<b>7.51±1.11</b>
Medical	<b>6.43±3.87</b>	<b>10.14±4.21</b>	<b>10±4.87</b>
Applied sciences	<b>9.38±2.88</b>	<b>13.79±1.87</b>	<b>8.76±3.64</b>
	<b>P= 0.0376</b>	<b>P=&lt;0.001</b>	<b>P=&lt;0.001</b>

**Table 3: Maslach burnout inventory [MBI] score**

Specialty	Emotional exhaustion	Depersonalization	Personal Accomplishment
Dental	<b>19.13±2.43</b>	<b>6.11±3.19</b>	<b>39.93±3.65</b>
Medical	<b>23.21±5.98</b>	<b>6.78±5.43</b>	<b>40.12±2.77</b>
Applied sciences	<b>25.67±6.21</b>	<b>5.96±8.76</b>	<b>32.13±1.61</b>
	<b>P=&lt;0.001</b>	<b>P= 0.594</b>	<b>P=&lt;0.001</b>

overall age of the sample was 40.98 and the mean age of applied sciences group was the highest at 42.24.

The results of DASS 21 showed that the scores for depression for Dental ( $4.94 \pm 1.03$ ) and Medical ( $6.43 \pm 3.87$ ) faculties were well within the normal range of 0-9, applied sciences had a score of  $9.38 \pm 2.88$  which was just above the normal range. All three groups showed slightly higher anxiety scores, score for dental group was  $9.12 \pm 2.76$  which was just above mild range of 8-9, medical group had an anxiety score of  $10.14 \pm 4.21$  and applied sciences had a score of  $13.79 \pm 1.87$  which was in the moderate range of 10-14. Stress scores were more in the medical group at  $10 \pm 4.87$  when compared to dental ( $7.51 \pm 1.11$ ) and Applied sciences ( $8.76 \pm 3.64$ ), all three groups were in the normal range of 0-14 for stress.

The mean values for depression and anxiety was more in the faculty of applied sciences with a score of  $9.38 \pm 2.88$  and  $13.79 \pm 1.87$  respectively, the difference was statistically significant with P value for depression was  $P= 0.0376$  and for anxiety was  $P= <0.001$ . Stress was seen to be more in the medical

section with a score of  $10 \pm 4.87$  as compared to applied sciences  $8.76 \pm 3.64$  and dental  $7.51 \pm 1.11$ . The difference was statistically significant  $P= <0.001$ .(Table 2)

Maslach burnout inventory scores are seen in table 3; the three components of burnout were scored separately. The Scores for emotional exhaustion for all three groups were in the moderate range of 17-26 with Dental at  $19.13 \pm 2.43$ , medical at  $23.21 \pm 5.98$  and applied sciences at  $25.67 \pm 6.21$ . Emotional exhaustion was significantly more in the applied sciences group with  $P= <0.001$ . The scores for depersonalization were at  $6.11 \pm 3.19$ ,  $6.78 \pm 5.43$  and  $5.96 \pm 8.76$  for dental, medical and applied sciences respectively, these scores were just above the low range of 0-6. No significant difference was seen among the three groups in depersonalization scores with  $P=0.594$ . Personal accomplishment scores were in the low range of 39+ for dental and medical group at  $39.93 \pm 3.65$  and  $40.12 \pm 2.77$ , however the score for applied sciences ( $32.13 \pm 1.61$ ) was in the moderate range and this difference was statistically significant ( $P= <0.001$ ). Overall all three groups reported presence of moderate amount of burnout, with

higher scores seen in applied sciences group and least among the dental group.

## Discussion

Health care professionals are exposed to high stressful situations and are involved in dealing with illness and suffering, hence have been found to be predisposed to stress, burnout, depression and other such disorders in many previous studies.<sup>11,12,13</sup> Health professionals working in the university are a unique set of individuals who perform the duties of a clinician and in addition they also have to manage the demanding duties of an academician like preparing and conducting lectures, practicals, assessment etc. Moreover such people are highly qualified and have certain desirable personality traits like high emotional intelligence, desire for high achievement and perfectionism.<sup>14</sup> Such traits are beneficial in their work place but on the other hand will not allow them to perceive themselves as incompetent or incapable to achieve goals, which in turn leads to more stress, anxiety, depression and burnout.

This study investigated the presence

of burnout and other mental behavioral disorders in the health professionals working in Majmaah University, and to compare different medical professionals in the same university. Such studies are very rare<sup>15</sup> and to our knowledge this is the first such report in any university of Saudi Arabia. Our results showed that anxiety scores in all our groups were in moderate range, which was consistent with many recent studies which have reported that anxiety disorders are seen frequently in health professionals.<sup>16</sup> Depression and stress among the health professionals in our study were in normal range which is in contrast with many other studies which have reported high scores of stress,<sup>5</sup> however the applied science group had relatively high scores of depression which is consistent with other studies conducted on nurses,<sup>17</sup> who are part of the applied sciences group. Stress was highest among the medical group as compared to others. The faculty of the medical college has to attend night duties and also perform all the academic duties in the university which is not the case in case of other two groups of dental and applied sciences.

Burnout has been identified to be a serious

problem among health care workers; it is not only a problem for the individual health care provider but also for the patients, the institution and is associated with higher medical errors.<sup>12,14,18</sup> Burnout can be a result of monotony of the working area, high fatigue or due to dealing with illness and human suffering.

Maslach burnout inventory has three components to measure burnout, emotional exhaustion refers to the depletion or draining of emotional resources. Depersonalization refers to an impersonal and dehumanized perception of ones recipients and lack of personal accomplishment is the tendency to evaluate ones work negatively. High scores for emotional exhaustion and depersonalization indicate burnout whereas low scores of personal accomplishment indicate burnout. Prevalence of burnout in our study was in the moderate range which is consistent with many similar studies conducted on various health professionals.<sup>1,6,8,11</sup> In this study we have compared three different groups of health professionals in which we found that the applied science group had high rate of emotional exhaustion and low rate of personal accomplishment which are both an indication of burnout. In

our study the medical group had higher depersonalization scores as compared to other groups which was consistent with other studies which state that doctors have a higher depersonalization as compared to the applied sciences.

Burnout and various other mental behavior disorders like stress, anxiety and depression in work place are a serious concern to the individual, the institution and incase of health professionals working in a university it also affects their patients and students.<sup>19,20</sup> Hence it is imperative that such disorders are recognized at the earliest and both the individual as well as the institution work together towards reducing the factors which may cause such disorders. Our study was the first to be done on health professionals working in a university and it could provide a basis for further in depth studies with large sample size and help in preventing mental disorders in this unique group of professionals who are working with both patients and students.

**Conclusion:** Our study investigated the presence of stress, burnout, anxiety and depression among the health professionals in Majmaah

University. Although the levels of the mental behavior disorders are mild to moderate in our sample, it is still a significant finding and both the individuals and the University should create awareness regarding identification and management of signs and symptoms of these disorders.

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REVIEW ARTICLE

## Risk Factors, Pathophysiology, and Management of ICU Delirium: A Literature Review

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### Abstract

**Background:** Delirium is an acute change in mental status with an unpredictable course of diminished attention and incoherent thinking, which is common among ICU patients. Various evidence implies a correlation between delirium and many fatal outcomes in intensive care unit (ICU) patients, such as higher 6-month mortality rate, longer hospital stays, longer post-ICU hospital stays, a higher occurrence of cognitive impairment, and long-term cognitive impairment after a critical illness.

**Aim:** To identify the risk factors, pathophysiology, and management of ICU delirium among critically ill patients

**Method:** Using literature review, this study thoroughly examined the results of studies from different journals investigating ICU delirium.

**Findings:** The identified risk factors were age, cigarette smoking, alcohol abuse, steroids, sedatives, total number of medications, sodium level, hypoalbuminemia, hypertension, sepsis, chronic renal failure, trauma, immobility, and pain. Moreover, underlying mechanisms in the development of ICU delirium were cholinergic deficiency, neuropathologic lesion, direct brain insults, aberrant stress re-

### الملخص

الخلفية: الهذيان هو التغير الحاد في الحالة العقلية مع وجود حالة لا يمكن التنبؤ بها من تضائل في الاهتمام والتفكير السليم، وهو أمر شائع بين المرضى في العناية المركزة. هنالك أدلة متعددة لوجود علاقة بين الهذيان والعديد من النتائج القاتلة لمرضى وحدة العناية المركزة مثل ارتفاع معدل الوفيات خلال 6 أشهر، والبقاء في المستشفى لفترات طويلة، والبقاء في المستشفى لفترة طويلة بعد فترة وحدة العناية المركزة، وحوادث ضعف متزايد للإدراك المعرفي وضعف طويل المدى للإدراك المعرفي.

الهدف: تحديد عوامل الخطر، والفيزيولوجيا المرضية، والعناية بالمرضى الذين يصابون بالهذيان في وحدة العناية المركزة. الطريقة: مراجعة أدبية لنتائج الدراسات العلمية المحكمة من مجلات مختلفة تناقش موضوع الهذيان في العناية المركزة.

النتائج: تمثلت عوامل الخطر للإصابة بالهذيان في: السن والتدخين، وتعاطي الكحول، والمنشطات والمهدئات، استعمال بعض الأدوية، ومستوى الصوديوم في الدم، ونقص ألبومين الدم، وارتفاع ضغط الدم، وتعفن الدم، والفشل الكلوي المزمن، والصدمات النفسية، وعدم القدرة على الحركة، والألم. وعلاوة على ذلك كانت الآليات الكامنة في تطوير الهذيان في وحدة العناية المركزة متمثلة في نقص الكولينيرجيا الباثولوجيا العصبية، والضغط النفسي. وهنالك العديد من الطرق الفعالة لعلاج الهذيان سوا

sponse and inflammatory process, and alteration of plasma melatonin. Numerous effective non-pharmacologic and pharmacologic treatments are available to manage delirium.

**Conclusion:** Delirium is a form of acute brain dysfunction that is not well-recognized in ICU. The identification of the risk factors and the possible underlying mechanisms for the development of delirium continues to be the first step in its management; then, the next step is often pharmacologic and non-pharmacologic treatments. The choice of these treatments should be understood as part of a greater multicomponent approach in management of critically ill patients.

**Keywords:** ICU delirium, Risk factors, Pathophysiology, Pharmacologic treatments, Non-pharmacologic treatments

دوائية او غير دوائية.

الخلاصة: الهذيان في وحدة العناية المركزة يعتبر شكلاً من أشكال الخلل الوظيفي في الدماغ والذي لم يتم التعرف عليه بشكل جيد في وحدة العناية المركزة. يعتبر التعرف على عوامل الخطر والأسباب المحتملة الخطوة الأولى في العلاج. والخطوة التالية هي في العلاجات الدوائية وغير الدوائية. وينبغي أن يكون مفهوماً أن اختيار هذه العلاجات يعتبر جزءاً من طريقة مرضى العناية المركزة.

## 1. INTRODUCTION

Delirium is a critical change in mental status with an unpredictable course of diminished attention and incoherent thinking [1], which is common in patients such as the elderly, those who abuse alcohol, and patients in intensive care unit (ICU) [2]. It is remarkable that the incidence of delirium in the ICU varies vastly throughout study populations and institutions, ranging from 20% to 40% [3-6]. One reason for the disparity in incidence rates in different settings is that delirium is often disregarded, since it is anticipated to occur in patients with severe illness, and medical resources are favorably devoted to managing the life-threatening problems [7]. In addition, an identified limitation of studies which evaluated the incidence rates of delirium in ICU is that the

screening instruments [3,8], and only quite a few studies that the diagnosis was confirmed by a psychiatrist [9].

In comparison to other end-organ injuries, delirium is considered an organ failure of the brain [10]. Evidence implies delirium is substantially related to different harmful outcomes in ICU patients. Some of these adverse effects include: higher 6-month mortality rate, longer hospital stays, longer post-ICU hospital stays, a higher occurrence of cognitive impairment [11], and long-term cognitive impairment after a critical illness [12].

Despite of its significant impact on patients, the mechanisms that explain the occurrence of delirium in critically ill patients are not completely understood [13]. Some hypothesized

mechanisms comprise neurotransmitters, inflammation, physiological stressors, metabolic imbalances, and electrolyte disorders [14]. On the other hand, even though many studies have examined the risk factors for delirium, results are diverging for several commonly studied factors include intake of alcohol, smoking, age, hypertension, and mechanical ventilation [13]. Knowledge of the risk factors, pathophysiology, and management of delirium would permit early detection of ICU patients with a high possibility of developing delirium and would be beneficial for effective prevention and development of intervention strategies. Therefore, the aim of this study was to identify the risk factors, pathophysiology, and management of ICU delirium among critically ill patients by thoroughly examining the results of studies from different journals.

## 2. METHOD

There were many electronic sources available utilized by the author such as ProQuest and Science Direct between 2001 and 2015 to ascertain potentially pertinent articles. The search was carried out using the following keywords: ICU delirium, risk factors, pathophysiology, pharmacologic management, and nursing management. The reference lists of all related articles were manually inspected to identify additional studies significant to the review. The citations were delimited to those published in English language. Studies were included if they met the following inclusion criteria: (1) minimum of one risk factor associated with ICU delirium, (2) used a validated delirium assessment tool, (3) minimum

of one pathophysiology associated with ICU delirium, (4) pharmacologic management of ICU delirium, and (5) nursing management of ICU delirium. Studies were eliminated if they were conducted in a non-ICU setting and the full text is not available.

The following data were extracted from each study: first author's last name, publication year, purpose, study design, sample size, method, key findings, and study limitations. This article provides significant information regarding risk factors, pathophysiology, and management of ICU delirium among critically ill patients.

## 3. FINDINGS

### 3.1 SEARCH RESULTS AND STUDY CHARACTERISTICS

The initial literature search retrieved 4010 citations, and 3893 were excluded on the basis of the title and/or abstract because they were duplicates and other irrelevant articles. Full text of the remaining 117 articles were considered for detailed evaluation. Forty-two articles were subsequently excluded from this review: 57 were not conducted in ICU setting, 29 reported another irrelevant risk factor(s), 15 studies have no full-text available, 11 did not specify the study setting, and 5 did not involve pharmacologic management. Thus, 28 articles were included in the final analysis.

The characteristics of the 28 studies are summarized in table 1-3. All the researches were conducted in an ICU setting. The number of

studies for each design were as follows: Seven studies for prospective cohort design [2, 6, 15-19]; five studies for prospective observational design [7, 8, 20-22], two descriptive correlational [23, 24]; two randomized controlled trial [25, 26]; one retrospective cohort [27], one focused review [10], one literature review [28]; one exploratory and case series[29]; one exploratory[30]; one prospective pre- or post-intervention cohort study [31]; one case study [32]; one prospective, pre-post protocol implementation evaluation [33];one prospective before and after quality improvement project [34]; one quasi-experimental [35];one comparative study [36]; and one prospective, double-blind, randomized trial [37]. The sample size of each study ranged from 5 to 4,450 patients. All the studies included for risk factors and management used a validated delirium assessment tool.

### **3.2 DEFINITION**

Over the past years, the researchers and clinicians used 30 or more synonyms for labeling intensive care unit (ICU) delirium, and these are 'ICU psychosis', 'acute confusion' and 'ICU syndrome' [38, 39]. The introduction of the Diagnostic and Statistical Manual of Mental Disorders, third edition (DSM-III) in 1980 and consequently the fourth revised edition (DSM-IV-R) conveyed consistency to the terms defining delirium. Delirium is defined as a disruption of consciousness and an alteration in cognition that progresses over a short period of time and tends to fluctuate

during the day [38-40]. Attention is the most affected under the cognitive domain [40, 41]. Presently, delirium is considered as a disease with a variety of severity rather than a binary phenomenon. Subsyndromal delirium has been described as patients with one or more symptoms that never advance to meet full DSM-IV-R delirium diagnosis [9].

### **3.3 RISK FACTORS**

Table 1 summarizes the identified risk factors of ICU delirium. Several risk factors suggested that contribute to the development of ICU delirium include age, lifestyle, medications, laboratory chemistry abnormalities, medical history, immobility and pain.

#### **Age**

Age is one of the greatest risk factors for the incidence of delirium in ICU patients [42]. This association was confirmed by some studies [6, 7, 10, 15, 16]. It is noteworthy that Sharma and colleagues [6] found the mean age of their whole sample was 45 years old, which was similar to the findings of Agarwal and co-researchers [43]. However, a substantially greater percentage of elderly patients (>65 years old) experienced delirium if compared to younger patients [6], which corroborates that prevalence and incidence of delirium are higher in the elderly, and old age is one of the main predisposing risk factors for delirium [15, 42, 44].

## Lifestyle

Cigarettes contain toxic agents that induce atherosclerotic and microvascular transformations, which form gradually with time and persist even years after quitting [45]. These significant changes are associated with cognitive deterioration and dementia, most especially among older smokers [46] which intensifies the risk of developing delirium [46]. These findings were confirmed by several studies [2, 6, 10, 15, 16, 18,47]. It is noteworthy that smokers have a three-fold higher risk of delirium than nonsmokers [45].

Additionally, alcohol abuse is believed to be another common factor correlated with delirium [2], supported by different studies [2, 10, 15, 18].

## Medications

Steroid medications [12] sedative medications [12, 9, 10], insulin, and multiple prescribed medications [12] are identified risk factors for delirium related to drug use.

Studies claim the use of steroids can lead to various psychiatric symptoms like psychosis, depression, mania and cognitive disturbances. Consequently, the development of cognitive disorders and psychosis and the development of delirium may have a similar mechanism [12].

Another identified serious risk factor for the development of delirium among ICU patients is the use of sedatives [12] — also responsible for the longer ICU stays [12]. Specifically, Si-

mons and his co-researchers [9] claim the use of midazolam and propofol were individually correlated with a heightened risk of delirium, which was enhanced when a combination of midazolam and propofol was prescribed. On the other hand, benzodiazepines also were seen to be linked with delirium within diverse ICU populations, and have shown a dose-dependent correlation [18].

Moreover, the intake of multiple medications was also an essential factor for the development of delirium. This finding implies that clinicians should administer medications carefully in ICU patients [12].

## Laboratory chemistry abnormalities

It is remarkable that certain laboratory chemistry results were identified as significantly associated with the development of delirium. Some of these laboratory results were hyperuricemia, hypoalbuminemia, deranged ALT, acidosis [6] elevated sodium levels, and elevated bilirubin levels[2].

An abnormal level of sodium has been associated with encephalopathy which may initiate the development of delirium. Certain drugs and heart failure are the common causes of unprecedented levels of sodium. On the other hand, the irregularity in bilirubin has a recognized relationship with hepatic dysfunction and delirium [2].

Hypoalbuminemia causes a decline in the osmotic force which fails to sustain a sufficient amount of intravascular volume. In turn, this

could diminish brain perfusion which makes the patient vulnerable to delirium [1].

### Medical history

One review article identifies studies that discuss the neuropsychological effects of chronic hypertension where hypertensive patients show poor performance on memory, attention and abstract reasoning when compared to normotensives [2]. Further, when hypertensive patients are subjected to significant physical or psychological stresses in the ICU, they may be more susceptible to developing delirium [2]. Specifically, vascular problems brought about by hypertension places patients at a greater risk for cerebral hypoperfusion and possibly for cerebral hypoxia, which is significantly related to the development of delirium [48].

Notably, sepsis increased the risk of developing delirium which is consistent with the findings of previous studies [49]. Sepsis causes acute brain dysfunction and delirium by the stimulation of inflammatory cytokine and endothelial damage, which aggregates the permeability of the blood-brain barrier initiating damage to the capillary blood flow [50].

Encephalopathy is common among patients with renal failure possibly caused by uremia, thiamine deficiency, dialysis, hypertension, fluid and electrolyte imbalances or drug toxicity [51]. Encephalopathy exhibits complex symptoms which advance from mild sensorial clouding to delirium and coma [51]. This is supported by a study conducted by Pipan-

mekaporn and colleagues [16] wherein they found that chronic renal failure increased the risk of delirium.

Also, delirium has been acknowledged as a severe and frequent clinical problem in trauma victims [52, 53], evident in some studies [9, 54, 55]. Moreover, Naidech and colleagues [56] found that after focal neurologic injury among the patients in their study, delirium symptoms were present and considered to be a cause of successive poorer functional outcomes.

### Immobility and pain

ICU delirium and neuromuscular function have been hypothesized to be strongly interconnected [57]. Observational and clinical trial data indicate that one of the risk factors for delirium among ICU patients is immobility [57-59].

On the other hand, several studies reported that untreated pain is a risk factor for the development of delirium [33, 60]. Specifically, Pisani and co-researchers [61] claim that pain within 24 hours of ICU discharge among their patients had a significant relationship with persistent delirium.

### 3.4 PATHOPHYSIOLOGY

Numerous hypotheses have been posited to explain the underlying pathophysiology of ICU delirium. Table 2 summarizes the underlying mechanisms of pathophysiology of ICU delirium which include:

## Cholinergic deficiency

The origin of the cholinergic deficiency hypothesis came from observations that delirium occurred with the intake of drugs that injure cholinergic function [28]. Specifically, there was a strong correlation between the proliferation of serum anticholinergic activity (SAA) levels and the development of delirium, while the reduction in the level of SAA was related to the resolution of delirium. Moreover, a possible mechanism for cholinergic insufficiency includes the damage of presynaptic, synaptic or postsynaptic functions of acetylcholine [28] which could lead to hallucinations and cognitive inadequacies [62].

Monoamine activity stabilizes the cholinergic system where the dysfunction has also been connected with delirium. Particularly, dopamine, norepinephrine, and serotonin have functions in arousal and the sleep-wake cycle which facilitates physiological responses to stimuli. Extreme levels of dopamine may cause hyperactive delirium which has been related to a concurrent decline in acetylcholine. Thus, acetylcholine and dopamine may have an inverse relationship in the pathogenesis of delirium [28].

Serotonin has a direct and indirect relationship to the cholinergic deficiency hypothesis. Specifically, excess levels of serotonin have been observed in concurrence with reduced levels of acetylcholine [28]; thus, it may be associated with cholinergic deficiency [63]. On the other hand, norepinephrine has a vital role in regulating attention, anxiety, and

mood; like dopamine, an overload in the noradrenergic activity has been linked with hyperactive delirium [64].

## Neuropathologic lesion

A study by Janz and colleagues [29] claim diminished cerebral blood flow, cerebral hypoxia, and cerebrovascular disease may contribute to the development of delirium in ICU patients. They conducted brain autopsies and found that 86% exhibited hypoperfusion and gross and microscopic cerebrovascular disease. Specifically, in most of the autopsied brains, hippocampal lesions were the only specific neuroanatomical structures that were impaired [29]. This damage of the hippocampus postulates a neuroanatomical explanation for long-term cognitive impairment because its normal function is to transfer information into long-term memory [4].

## Direct brain insults

Direct brain insults include acute processes that impair brain function by initiating energy deficiency, metabolic abnormalities, trauma, hemorrhage, or direct alterations in neurotransmitter levels by drugs. In patients with delirium, severe brain dysfunction was distinct in multiple regions which were triggered by hypoxemia and systemic hypoglycemia. This could lead to deficiencies in attention and cognition which meet the criteria for delirium [30].

Brain injury markers identified include serum brain-derived neurotrophic factor (BDNF) and

neuron-specific enolase (NSE) [65], which were substantially increased in ICU patients with delirium [24]. It is remarkable that every 2-fold increase in plasma NSE concentration was accompanied by a 5.2% increased risk of delirium [66]. This finding corroborates that neuronal damage arises in the pre-ICU setting or soon after admission, which is a secondary factor in patients who experienced delirium later during an ICU stay. It is more likely that serum BDNF and NSE levels may indicate predisposition to early development of delirium among critically ill patients [24].

### **Aberrant stress response and inflammatory process**

Acute stress is well-known to affect attention, cognition, motivation, mood, perception, and other facets of mental function [67]. Similarly, systemic inflammation brings fatigue, diminished activity, anhedonia, and diminished appetite [30], adaptive mechanisms of the body. However, dysfunction of the stress response and intensified inflammatory states are common with aging and neurodegeneration [68]. It is evident that prior pathology and systemic problems such as stress, infection, injury, and surgery repeatedly act together to induce delirium [30].

Prolactin is a stress hormone comparable to cortisol that can disturb behavioral or cognitive function and also participates in the regulation of the immune system further than sexual reproductive and lactogenesis properties [69]. It is notable that hyperprolactinemia has repeatedly been reported in neuropsychi-

atric disorders, including schizophrenia, bipolar disorder, and altered mood [70]. A study conducted by Nguyen and colleagues [20] claimed patients with delirium had elevated prolactin levels. Prolactin affects behavior or cognitive function by acting on the brain limbic system and the prefrontal cortex [69]. An elevated prolactin level stimulates brain dopamine hyperactivity which could bring cognitive dysfunction or delirium [71]. Further, prolactin augments sleep deprivation, which is one of the contributing factors for ICU delirium [72].

In critical illness, systemic inflammation and disrupted coagulation are vital factors in the development and persistence of delirium [73]. Girard and co-investigators [12] found three plasma markers of inflammation and coagulation such as metalloproteinase-9 (MMP-9), soluble tumor necrosis factor receptor-1 (sTNFR1), and protein C are correlated with delirium in the ICU. These results validate the hypothesis that inflammation and disrupted coagulation are essential mechanisms of delirium during critical illness.

On the other hand, tryptophan and tyrosine, amino acid precursors for neurotransmitters, are linked to the development of delirium in patients [74]. A potential mechanism for tryptophan-related delirium is through the release of neurotoxic metabolites which form after activation of the immune and inflammatory response systems seen in critical illness [74]. A high tryptophan concentration may lead to high production of melatonin, thereby

initiating the somnolent symptoms of hypoactive delirium; while a low tryptophan ratio could be responsible for a decline in melatonin, sleep dysregulation, and the development of hyperactive delirium [75]. On the other hand, patients with elevated levels of tyrosine are more likely to have a dopamine overload or its downstream neurotransmitter, norepinephrine, both of which have been connected to the pathogenesis of delirium [76].

### **Alteration of plasma melatonin**

Melatonin is a hormone originated from the pineal gland whose concentration reportedly diminishes during the postoperative period [77]. A declining level of melatonin may be a sign of the severity of illness [21] which can be a precipitating risk factor for postoperative delirium [78]. Further, less amount of melatonin concentration might also be a sign of the aging process [21], which is most repeatedly cited as one of the predisposing factors for postoperative delirium [78]. Also, diminished melatonin secretion in the postoperative period may initiate sleep disturbances and subsequent interruption of the sleep-wake cycle, which in turn can promote the development of delirium [79].

### **3.5 MANAGEMENT**

Similar to the multiple hypotheses and risk factors suggested to explain the pathophysiology and contributing factors of ICU delirium, several nonpharmacologic and pharmacologic treatments have been examined in critically ill patients with delirium. Haloperi-

dol is the identified drug of choice useful in the majority of patients; however, due to its recognized adverse effects, there are continuous clinical trials to seek more drug options to treat delirium. However, in addition to the pharmacologic regimen, there are nonpharmacologic treatments to help reduce the adverse effects of delirium. Available treatments published in articles between 2009 and 2017 are discussed in Table 3.

#### **3.5.1 Nonpharmacologic treatments**

Prevention and management of delirium are fundamental to the reduction of its adverse effects [25]. Various nonpharmacologic strategies have been recommended in the ICU, including: standard nonpharmacologic prevention, plus early and intensive occupational therapy (OT) [25]; sleep enhancement and relaxation protocols [31]; electroconvulsive therapy (ECT) ([32]; pain assessment on day 2 of ICU stay [19]; Music, Opening/closing of blinds, Reorientation/cognitive stimulation, and Eye/ear care (M.O.R.E.) [33]; multidisciplinary team focused on the reduction of heavy sedation and the increase of staffing in the ICU [34]; and sleep care guidelines for noise and light reduction [35].

#### **Occupational therapy**

Alvarez and co-researchers [25] initiated a standard nPP plus early and intensive OT beginning in the first 24 hours of admission of patients to the ICU. This intervention was delivered twice a day, 40 minutes each session, one in the morning and one in the evening for

five consecutive days. OT intervention had a positive impact evidenced when patients had notably fewer hours of delirium when matched with the control group that used proven interventions in hospitalized elderly patients.

Further, patients who received the intervention had a significantly lower risk of developing delirium, significantly lower incidence of delirium, and higher independence level. Upon discharge, the enhanced functionality of patients influences the recovery process as well as reduces the use of resources in the long term and prevents rehospitalization [80].

### **Sleep enhancement and relaxation**

Sleep enhancement and relaxation protocols were proposed to promote sleep and eradicate factors that restrict the normal sleep-wake cycle. At night, nursing assistants were prohibited from regular bathing of patients. Lights and televisions were turned off, and monitors and machinery were put to night mode. Light therapy lamps were turned on during daytime hours. Twice a day, afternoons and evenings, patients were programmed to have 90-minute periods of quiet time where compact disc players were made accessible with soothing music [31]. Patients who experienced this intervention had a significant decrease in the duration of delirium, less time being delirious, and less time being mechanically ventilated [31].

### **Electroconvulsive therapy**

Electroconvulsive therapy (ECT) is a well-established and successful standard management of protracted refractory psychiatric conditions which includes delirium [81] as well as delirious mania [82]. Nielsen and co-investigators [32] conducted ECT in six ICU patients in collaboration with psychiatrists experienced in treating delirium. ECT yielded a notably positive effect in these five cases. Specifically, long-standing agitation and discomfort were controlled in all patients after the unsuccessful use of the usual pharmacologic therapy. ECT was successful for four patients in managing delirium in 6 to 19 days. The last patient became relaxed and free from stress but continued in a state of posttraumatic amnesia following a head injury [32]. It is remarkable that ECT appears to be the most effective and rapidly active treatment modality in certain mental disorders despite ever-increasing psychopharmacologic alternatives [83].

### **Pain assessment**

Certain studies indicate that pain may be a risk factor for the development of delirium [42,84]. Pain itself triggers deleterious cognitive effects as well as agitation in the ICU, which if not recognized can lead to unsuitable sedative administration [10]. Payen and co-researchers [19] conducted a prospective cohort study of mechanically ventilated patients receiving analgesia on day 2 of their stay in the ICU. They found that patients evaluated for pain on day 2 were more likely

to obtain sedation level assessment, non-opioids, and analgesia during painful procedures than patients whose pain was not measured. Patients also acquired fewer hypnotics, had a shorter duration of mechanical ventilation, and a reduced length of stay in the ICU [19].

### **M.O.R.E. nonpharmacologic strategies**

Most literature that supports the effectiveness of nonpharmacologic interventions has taken a multifaceted approach, and many of these protocols included the implementation of a sedation and mobilization protocol [65]. A study by Rivosecchi and co-researchers [33] supports the use of M.O.R.E. (Music, Opening/closing of blinds, Reorientation/cognitive stimulation, and Eye/ear care) nonpharmacologic strategies to the ICU patients with delirium, to lessen their time of being delirious if a mobilization procedure and a sedation algorithm already exist in the institution. It is noteworthy that this intervention diminished the amount of time Medical Intensive Care Unit (MICU) patients experienced delirium as well as lessened the risk of developing delirium while regulating the predisposing risk factors for delirium [33].

### **Multidisciplinary team**

Immobility is responsible for neuromuscular weakness [85] which is related to a reduction in ICU survivors' physical function, quality of life, and return to work [86]. Researchers led by Needham [34] developed a multidisciplinary team concentrated on decreasing heavy sedation and increasing MICU staffing

which includes full-time physical and occupational therapists. This quality improvement project resulted in reduced use of benzodiazepines with lower median sedative doses; patients had improved sedation and delirium status, and a higher level of functional mobility. Thus, ICU and hospital lengths of stay were decreased [34].

### **Sleep care**

Sleep disruptions can have unfavorable effects on cognition and emotions as well as in the standard functions of cardiovascular, respiratory and immune systems [87]. These adverse consequences put ICU patients at a higher risk of infection, complications, longer hospital stays and mortality [88]. Li and co-researchers [35] conducted a quasi-experimental study among surgical patients from the ICU who were cared for by nurses utilizing the sleep care guidelines for noise and light reduction. Perceived noise and sleep interruptions from care-related activities and noises were significantly lower in patients who experienced the sleep care guidelines. Patients reported having better sleep quality and efficiency [35].

### **3.5.2 Pharmacologic treatments**

Several factors contribute to the development of delirium, and one of these is excessive dopaminergic activity [89]. Antipsychotics have been examined comprehensively as a treatment practice; guidelines support the use of high potency non-sedating antipsychotics for the treatment of severe agitation

when other methods became unsuccessful [90]. Identified effective pharmacologic treatments for delirium in the literature include atypical antipsychotics such as haloperidol, risperidone, olanzapine and aripiprazole [36]; quetiapine [26]; and dexmedetomidine and midazolam [37].

### **Antipsychotics**

Haloperidol, a typical antipsychotic, is the first choice among the pharmacological treatments in various populations [91], noting it has not been approved by the US Food and Drug Administration for delirium [92].

Boettger and co-researchers [36] compared the effectiveness and side-effect profile of the typical antipsychotic haloperidol with the atypical antipsychotics risperidone, olanzapine, and aripiprazole in the treatment of delirium. It is remarkable that the atypical antipsychotics risperidone, aripiprazole, and olanzapine and the typical antipsychotic haloperidol were equally effective in the treatment of delirium symptoms. However, these drugs have distinct side effects. Specifically, haloperidol triggers increased rates of extrapyramidal symptoms, and olanzapine significant sedation [36].

### **Quetiapine**

Quetiapine is an atypical antipsychotic which has numerous benefits that may be especially valuable when managing delirium in the ICU, including a predominate antihistaminic mechanism of action, a short half-life that enables

dose titration, and few reports of extrapyramidal symptom effects [93]. Devlin and co-investigators [26] conducted a randomized, placebo-controlled trial to assess the efficacy and safety of quetiapine to intravenous haloperidol in critically ill patients with delirium. It is remarkable that when quetiapine was dose increased, it achieved a faster resolution of delirium, a diminished time of delirium and agitation, and a better disposition upon discharge than patients who received as-necessary intravenous haloperidol therapy alone. Therefore, an increasing dose of quetiapine may assist to avoid adverse effects of haloperidol [26].

### **Dexmedetomidine**

Dexmedetomidine is an alpha-2 adrenoreceptor agonist which has a unique mechanism of action, providing sedation and anxiolysis through the receptors within the locus coeruleus, analgesia through the receptors in the spinal cord, and reduction of the stress response with no substantial respiratory depression [94]. Riker and co-investigators [37] conducted a prospective, double-blind, randomized trial among ICU patients, administering either dexmedetomidine or the usual sedation of midazolam infusions for up to 30 days of mechanical ventilation. A notable finding was: patients managed with dexmedetomidine experienced delirium 20% less often than patients managed with midazolam and were removed from mechanical ventilation almost 2 days earlier. This finding suggests alpha-2 agonists advance many vital aspects of critical care such as less delirium and

shorter periods hooked to mechanical ventilator [37].

#### 4. DISCUSSION

Delirium is highly prevalent in the ICU setting across the developing and developed countries. The studies included in this review identified numerous risk factors that could be present to patients who are at risk to develop ICU delirium. Therefore, it is vital to screen and obtain a thorough medical history to all the patients admitted in the ICU for delirium so that the clinician may be aware to cut down on the possible avoidable risk factor and overall incidence of delirium. Moreover, if these cannot be prevented then the health care team should be cautious for the emergence of delirium and manage it properly. It is also important to note that the identification of the risk factors is the initial step of an approach that could lead to earlier diagnosis and intervention which could contribute to a better and more cost-effective management.

There are quite a number of hypotheses established by the studies in this review regarding the pathophysiologic mechanisms of ICU delirium. It is important that the clinicians must be aware of this to provide an effective and appropriate intervention for the patients. There are important directions for future research which include identification of delirium biomarkers and determining genetic contributions. These would allow critical advances in both basic and clinical investigation of delirium.

It was established by the studies in this review that non-pharmacologic strategies of ICU delirium are effective to control, to decrease the amount of time, as well as to reduce the risk of the development of delirium. It is remarkable that the participation of the nursing unit director and nursing unit clinicians in the educational process will result in better acceptance and involvement to the protocol implementation. Thus, it is encouraged that the nursing unit director and nursing unit clinicians must be involved in training the nurses to the new non-pharmacologic strategies that will be implemented in the hospital. On the other hand, the choice of medication used to provide sedation for ICU patients is essential to deliver safe and effective care. Since Quetiapine added to as-needed Haloperidol resulted in faster delirium resolution and less agitation, future studies should assess its effect on mortality, resource utilization, post-intensive care unit cognition, and dependence after discharge in a larger group of patients. Moreover, Dexmedetomidine appears to provide several advantages compared with Midazolam, thus, future studies must look beyond the quality or quantity of sedation to focus on additional important clinical outcomes including prevalence of delirium and time of mechanical ventilation.

Overall, future studies should be performed prospectively with larger sample sizes, use a control group of patients with similar illness but with the absence of delirium, and randomized controlled trial to further establish the findings mentioned in this review.

## 5. CONCLUSION

Delirium, an essential form of acute brain dysfunction, is not well-recognized in the ICU. The identification of risk factors and the possible underlying mechanism for the development of delirium continue to be the first step in its management. The next step is often pharmacologic and non-pharmacologic treatments. Identified risk factors were age, cigarette smoking, alcohol abuse, steroids, sedatives, intake of multiple medications, elevated sodium levels, hypoalbuminemia, hypertension, sepsis, chronic renal failure, trauma, immobility, and pain. Underlying mechanisms in the development of ICU delirium are a cholinergic deficiency, neuropathologic lesion, direct brain insults, aberrant stress response and inflammatory process, and alteration of plasma melatonin.

The prevention and management of delirium are vital to decrease its adverse effects. Non-pharmacologic strategies that have been recommended in the ICU include standard non-pharmacologic prevention plus early and intensive OT, sleep enhancement and relaxation protocols, ECT, pain assessment on day 2 of ICU stay, M.O.R.E., a multidisciplinary team focused on the reduction of heavy sedation and an increase of staffing in the ICU, and sleep care guidelines for noise and light reduction.

Antipsychotics have been assessed meticulously as a practice of treatment and guidelines backing the use of high potency non-sedating antipsychotics for the treatment of severe agitation when other methods are ineffective. Effective pharmacologic treatments for delirium in the literature include antipsychotics such as haloperidol, risperidone, olanzapine, aripiprazole, quetiapine, dexmedetomidine, and midazolam. The choice of drugs and other non-pharmacologic treatments should be understood as part of a greater multicomponent approach to the treatment of a critically ill patient. Future evidence-based strategies to minimize the duration and adverse effects of delirium while assuring patient comfort and safety should be based on the greater benefits that it may provide to the patient.

### KEYPOINT BOX:

- Several risk factors that contribute to the development of ICU delirium include age, lifestyle, medications, laboratory chemistry abnormalities, medical history, immobility and pain.
- Some of the pathophysiologic basis for the development of delirium are cholinergic deficiency, neuropathologic lesion, aberrant stress response and inflammatory process, direct brain insult, and alteration of plasma melatonin.

- Haloperidol is the drug of choice for the treatment of delirium, however, there are various available non-pharmacologic treatment which could help in decreasing the duration as well as the incidence of delirium.

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BRIEF COMMUNICATION

## Outcomes of Phototherapeutic Keratectomy To Treat Recurrent Corneal Erosion

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### Abstract:

**Aim:** To present the outcomes of phototherapeutic keratectomy (PTK) to treat recurrent corneal erosion.

**Methods:** This case series evaluated eyes that had undergone PTK for recurrent corneal erosion at an eye center in Riyadh, Saudi Arabia. Data were collected on preoperative and postoperative vision, cause of corneal erosion, treatment zone of the laser, recurrence of the erosion and pain postoperatively and the number of successful cases postoperatively. Treatment success was defined as epithelial healing for at least 6 months postoperatively. The factors associated to success were analysed.

**Results:** The study sample was comprised of 11 eyes of 11 (6 males; median age 33 years) patients with recurrent erosion. Trauma (5 eyes), pterygium excision (1 eye), Salzmann nodule (1 eye) and leucoma (1 eye) were the main causes of recurrent erosion. Postoperatively, 10 (91%) eyes achieved success. The median duration of follow up was 23 months (25% quartile, 17 months). After management, one eye had mild pain. One case had induced astigmatism greater than 1D.

**Conclusion:** PTK was an effective modality for treating recurrent corneal erosion due to varying underlying aetiology. The outcomes in the Arab population were similar to published studies of other populations.

**Key words:** Recurrent corneal erosion; phototherapeutic keratectomy; cornea.

### الملخص

**الهدف :** لتقديم نتائج علاج القرنية الضوئي (بي تي كي) لعلاج تقشع القرنية المتكرر.

**الطريقة:** قيمت سلسلة الحالات هذه العيون التي خضعت لتقشع القرنية المتكرر في أحد مراكز العيون في الرياض بالمملكة العربية السعودية. تم جمع البيانات عن قوة الرؤية قبل العملية وبعدها، سبب تقشع القرنية، حجم منطقة العلاج بالليزر، ومدى تكرار التقشع وآلام بعد العمل الجراحي وعدد الحالات الناجحة بعد العمل الجراحي. تم تعريف نجاح العلاج شفاء النسيج الطلائي للقرنية لمدة لا تقل عن 6 أشهر بعد العمل الجراحي. تم تحليل العوامل المرتبطة بالنجاح.

**النتائج:** تألفت عينة الدراسة من أحد عشر عينا لأحد عشر مريضا (6 ذكور، متوسط العمر 33 سنة) يعانون من التقشع المتكرر. الضربات (5 عيون)، استئصال لحمية القرنية (عين واحدة)، نتوءات سالزمان (عين واحدة) وبيضاض القرنية (عين واحدة) كانت الأسباب الرئيسية للتقشع المتكرر. بعد العمل الجراحي، حققت عشر (91%) عيون النجاح. وكان متوسط مدة المتابعة 23 شهرا (25% الربعي، 17 شهرا). بعد العلاج، عين واحدة كانت تعاني من ألم خفيف. وقد أصيبت إحدى الحالات بزيادة انحراف القرنية لأكثر من 1 دايوبتر.

**الاستنتاج:** كان العلاج الضوئي للقرنية طريقة فعالة لعلاج تقشع القرنية المتكررة لأسباب مختلفة. وكانت النتائج للسعوديين مماثلة للدراسات المنشورة في الدول الأخرى.

## **Introduction:**

Recurrent corneal erosion syndrome is a disabling condition that affects vision related quality of life of working adults<sup>1</sup>. Different treatment modalities have been attempted for centuries. The underlying principle of most procedures is removal of the pathological epithelium to ensure a good base for improved adhesion and viability<sup>2</sup>. The excimer laser has been successfully used as a therapeutic modality for corneal pathologies.<sup>3</sup> Phototherapeutic keratectomy (PTK) has provided promising outcomes for managing recurrent corneal erosions. A randomized controlled trial of PTK for corneal erosions in a mainly Caucasian population, concluded that this procedure was safe and effective<sup>4</sup>. A large series evaluating PTK on an Asian population has also been published<sup>5</sup>. To the best of our knowledge, there is no published literature on PTK for corneal erosion in an Arab population. The population of Saudi Arabia is exposed to bright sunlight and dry dusty environment resulting in a high prevalence of corneal degenerative diseases<sup>6</sup>. Hence, the study of PTK for the management of recurrent corneal erosion in this vulnerable population would be beneficial.

This study presents the outcomes of all the cases of recurrent corneal erosion that were treated with PTK at an eye institute in central Saudi Arabia.

## **Methods:**

This retrospective case series evaluated the outcomes of PTK for the management of recurrent corneal erosions at a private ophthalmic centre in central Saudi Arabia between 2014 and 2016. Data were collected via chart review. The ethics and research committee of the institution approved this study. Written informed consent was waived because this was a retrospective chart review.

One ophthalmologist performed history taking including use of medications, eye surgery, cornea surgery and systemic and ocular comorbidities. The best-corrected distance visual acuity (BCVA) was measured with an ETDRS chart placed at 6 meters distance from the patient. If patient could not read the top line of the chart, he/she was re-tested at 3 meters distance. The vision of the affected eye was noted in decimal notation. The anterior segment assessment was performed with slit lamp biomicroscopy (Topcon Corp., Tokyo,

Japan). The cornea was assessed for signs of epithelial instability, corneal dystrophy and degeneration.

Manual debridement of the corneal epithelium was performed with a 57 Beaver blade. PTK was performed with the EC-5000 excimer laser (NIDEK Co. Ltd., Gamagori, Japan). This laser has a repetition rate of 30 to 40 Hz. The ablation diameter ranged between 5.5 and 7.5 mm. The total pulse energy ranged from 23 to 106 mJ. The ablation depth ranged between 15 to 70 $\mu$ m.

Postoperative follow up was performed at day1, 1 week, 6 weeks, 6 months and 12 months. The history of recurrence and treatment performed was reviewed at each follow up visit. Postoperative examinations included BCVA, refraction, anterior segment and cornealexamination using slit lamp biomicroscopy. The patient was asked about symptoms such as pain, photophobia, redness, tearing and glare.

The cornea was stained with a sterile fluorescein strip to determine the presence/absence of epithelial defects. The epithelial adhesion at the site of recurrence was evaluated before

and after repeated blinking.

Data were collected on a pretested data collection form. The information was transferred to a Microsoft Excel spreadsheet (Microsoft Corp., Redmond, WA, USA). For univariate analysis, we used the Statistical Package for Social Studies (IBM Corp., Armonk, NY, USA). Quantitative variables were plotted to determine if they were normally distributed. As this was a small sample size with wide variation, the median, 25% quartile, minimum and maximum values of the variables were calculated. For qualitative variables, frequency and percentage proportions were calculated.

## Results:

The study sample was comprised of 11 cases of recurrent corneal erosion treated with PTK. The patient demographics and ophthalmic features are presented in Table: 1. The majority of patients were in the working age-group. Trauma was the leading corneal comorbidity that was the likely the underlying cause of recurrent erosion.

The median duration of follow up was 23

months (25% quartile, 17 months; minimum, 4 months and maximum, 105 months).

Of the 11 cases, recurrent erosion had healed at the last follow up visit in 10 eyes (89.9%; 95% confidence interval:73.9 – 100). One person had mild pain and one person had recurrent erosion for which repeat PTK was recommended.

Preoperative vision and vision at last follow up visit for each case is presented in figure1. Vision improved in 3 eyes and remained unchanged in 5 eyes. Vision decreased in 2 eyes.

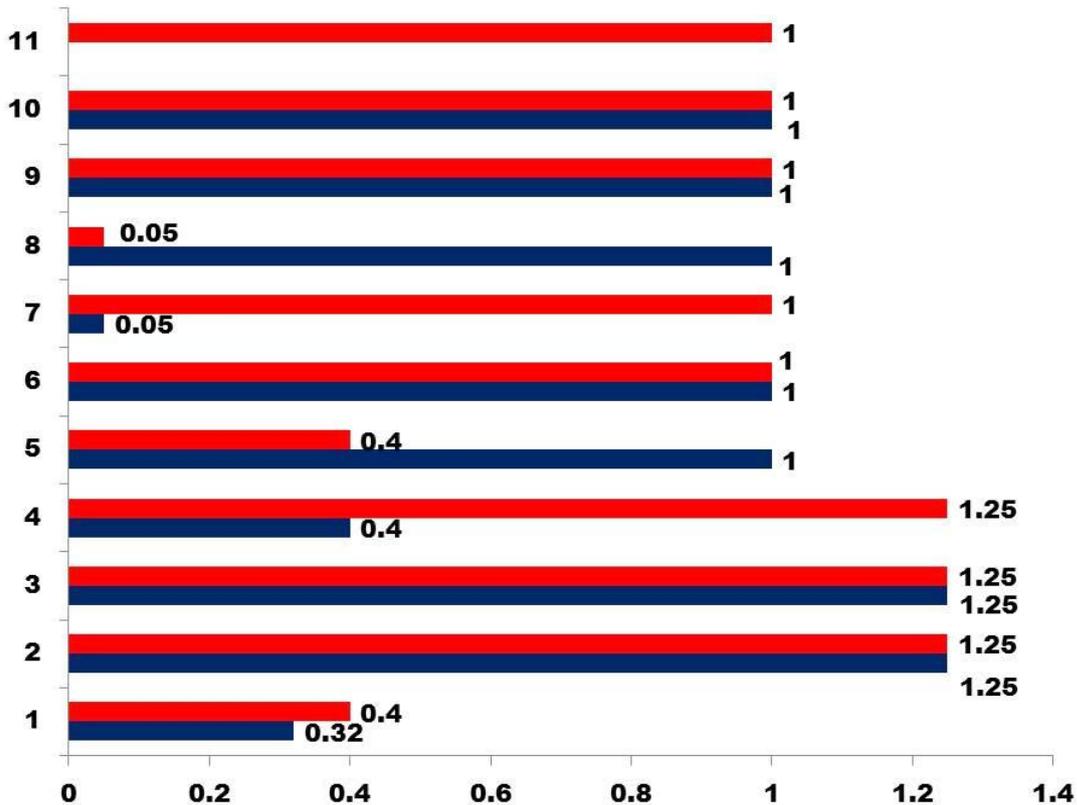
In one eye, preoperative vision could not be noted.

One female patient whose cornea did not respond to PTK had trauma as an underlying cause of recurrent corneal erosion and was followed out to 22 months postoperatively. Prior to intervention, this case had undergone antibiotic therapy, patching, bandage contact lens and lubricants.

Table 2 presents the outcomes of the current study and those from articles published in the previous five years.

**Table:1 Demographics and ocular characteristics of patients with recurrent corneal erosion.**

Qualitative variables		Number	Percentage
Gender	Male	6	54.5
	Female	5	45.5
Refractive status	Emmetropia	3	27.2
	Myopia	0	0
	Hyperopia	5	45.5
	Astigmatism >1D	1	9.1
	Missing	2	18.1
Corneal pathology	Trauma	5	45.5
	Salzmann nodule	1	9.1
	Post-surgical	1	9.1
	Leucoma	1	9.1
	Unknown	3	27.2
Quantitative variables			
Age	Median	33	
	quartile 25%	28	
	Minimum	18	
	Maximum	62	
Vision	Median	1.0	
	quartile 25%	0.4	
	Minimum	0.05	
	Maximum	1.25	



### Discussion:

In this case series of PTK for recurrent corneal erosion, we noted excellent outcomes. We found good visual acuity outcomes postoperatively. However, some astigmatic changes may occur after corneal healing. Additionally, active infection seems to hinder the success of this intervention.

The success rate of corneal healing in the current study was similar to previous studies enrolling different populations<sup>3,4,5</sup>. The similar

outcomes across diverse population samples could be due the stimulation of deeper layers of the epithelium induced by the laser energy that improves adhesion to Bowman's membrane and the removal of pathogens with the laser energy.

In nearly half of the study sample, ocular trauma was the underlying cause of recurrent erosion. Reidy et al<sup>6</sup> also reported a similar proportion of cases with trauma as an underlying cause.

Prevention of ocular trauma either by foreign body on cornea or surgical trauma can help mitigate the incidence of recurrent corneal erosion.

Hyperopic shift in eye with recurrent erosion following PTK is a known complication but generally transient in nature<sup>7</sup>. There were no cases of marked hyperopic shift but there were changes in the axis of astigmatism in some cases. This could be due to an inherent pathology rather the superficial corneal ablations in our study, which are less likely to cause deeper tissue changes.

There were some limitations to this study. This case series enrolled a small sample size and a prospective study with large sample size is required prior to adopting PTK for recurrent corneal erosion into clinical practice.

Conventional approaches to treat recurrent corneal erosion by a general ophthalmologist could be effective but not as successful as PTK. However, the high cost of the laser needs to be considered before altering the clinical practice to manage this relatively rare condition. An option may be to refer cases to refractive surgeons who could assist in man-

aging recurrent corneal erosion.

### **Acknowledgments:**

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Figure:1 The best corrected visual acuity before and after phototherapeutic keratectomy for the treatment of recurrent corneal erosion.

X-axis is the best-corrected visual acuity (BCVA) in decimal notation

Y-axis indicates the case number.

Blue coloured bar denotes BCVA preoperatively and

Red coloured bar denotes BCVA at last follow up after phototherapeutic keratectomy.

CASE STUDY

## Aesthetic and Functional Rehabilitation of Multiple Grossly Decayed Anterior Teeth- A case report

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### Abstract

The loss of tooth structure due to caries in the anterior region is a major issue, as it affects both the function and the aesthetics. Only root canal treatment may not be the solution for such cases and the advancement of the material sciences and the cutting edge technology has brought forth many options to treat such cases. Fibre reinforced post is one such contribution to the material advancement. The present case report will demonstrate the use of the fibre reinforced post and prefabricated metal NiTi post for the successful treatment of the unaesthetic, functionally damaged maxillary anterior teeth.

**Key words:** anterior teeth, aesthetics, dental caries, fibre reinforced post, metal post, rehabilitation.

### الملخص

فقدان بنية الأسنان بسبب التسوس في المنطقة الأمامية لها تبعات كثيرة، حيث أنها تؤثر على الناحية الوظيفية والجمالية. معالجة قناة الجذر فقط قد لا يكون الحل الأمثل لمثل هذه الحالات. مع التقدم العلمي والطبي والتطور التكنولوجي أصبح هنالك العديد من الخيارات لعلاج مثل هذه الحالات. من هذه التطورات صناعة أوتاد سنية من الألياف والأوتاد السنية المصنوعة من مادة النيكل تيتانيوم. وفي هذه الحالة العلاجية تم استخدام هذه الأوتاد بنجاح لإعادة بناء الشكل الجمالي والوظيفي للأسنان الأمامية العلوية والتي كانت تعاني من تسوس وكسور شديدة.

## Introduction

Dental caries remains one of the oldest non-communicable disease (NCD) to effect the human Race. According to the survey on the global burden of diseases, dental caries remains the most prevalent among 291 NCD's [1]. The consequence of the untreated dental caries range from mild to severe pain, odontogenic infections, tooth loss and subsequently compromise in the functional abilities of the oral cavity [2]. Apart from this, if caries affects tooth is in the anterior region of the oral cavity it might have the complications like unaesthetic appearance and the psychological problems related to the negative appearance [3].

A variety of treatment options have been proposed to deal with caries affected tooth and usually, the condition of the affected tooth determines the treatment choice. In cases where significant loss of tooth structure has occurred due to caries, most common treatment of choice is root canal treatment followed by post and core [4,5]. The factors that determine the choice of the post are; the aesthetic requirement, position of the affected tooth and

the extension of caries in the oral cavity and the remaining tooth structure [6,7,8].

The purpose of the current article is to present a case report on the successful treatment of severely decayed maxillary anterior teeth using the fibre reinforced composite resin and Prefabricated metal posts. Both posts have the advantage of increased strength and are more durable. According to the recent literature fibre reinforced composite are expected to become still more popular as they are minimally invasive and they offer low-cost alternative to conventional restorative procedures [9]. This, in fact, is the truth of the moment as the literature is explicit with case reports on the fibre reinforced posts [5, 10, 11, 12].

## Case report

A 19-year-old male patient came to the department of restorative dentistry with the chief complaint of the decayed tooth in the upper front teeth. On examination, it was found that the maxillary right lateral incisor and the left lateral incisor and the canine were grossly decayed (Figure 1).



**Figure 1. Pre-operative intra oral view**

Maxillary right central incisor had a porcelain fused ceramic crown. There was severe loss of tooth structure in the maxillary right lateral incisor. The left maxillary central incisor had an unaesthetic filling. On closer examination, it was found that the maxillary left lateral incisor was decayed as well as fractured. Upon the performance of vitality test, it was evident that the maxillary right lateral and maxillary left lateral and canine were non-vital. However, the upper left central incisor showed the partial response, suggesting the underlying degenerative changes.

### **Treatment plan**

After the thorough investigation, it was decided to go ahead with the root canal treatment of maxillary right lateral incisor and maxillary left central incisor, lateral incisor and canine. Following root canal treatment maxillary left central incisor, lateral incisor and canine were restored using the metal post. As the maxillary right lateral incisor had significant loss of tooth structure due to extensive caries and subsequent fracture, it was decided to go ahead with glass fibre reinforced post as it is more durable and it is the material of choice for the tooth with the minimal crown. Three-unit porcelain fused to metal ceramic bridge in relation to maxillary left central incisor, lateral incisor and canine and single unit ceramic crown in relation to maxillary right lateral incisor was planned.

### **Treatment**

Access opening was done in relation to maxillary right lateral incisor using cavity access Z set (Dentsply). This was followed by the cleaning and shaping using the protaper NiTi rotary instruments (Dentsply), up to the apical size of F2. Continuous copious irrigation us-

ing 5ml of 2.5 % sodium hypochlorite solution was carried out. Using Apex plus sealer (Ivoclar Vivadent) and F2 (Dentsply) gutta-percha cones the obturation was performed. The gutta-percha was partly removed leaving the apical 5 mm of the filling to maintain a good seal after the completion of a root canal. Corresponding FRC Posted reamer was used to prepare the post space. An adhesive (Ivoclar Vivadent AG), dual-curing luting composite system (Multilink II, Ivoclar Vivadent AG) and a glass-fibre reinforced composite root canal post (FRC Postec, Ivoclar Vivadent AG) were placed according to the manufacturer's instructions in relation to maxillary right lateral incisor (Figure 2).



## Figure 2. Post-operative intra oral view

Prefabricated unimetric NiTi posts were placed using the corresponding reamer according to manufacturer's instructions in relation to maxillary left lateral incisor and canine. This was followed by core build-up using composite in an incremental manner (Tetric N Ceram, Ivoclar Vivadent AG). Cementation of all ceramic crowns was done using glass ionomer luting cement (Medium) (Figure 3).



### Figure 3. Post-operative IOPA

#### Discussion:

The traditional cast metal post and prefabricated metal post core is widely popular treatment modality in cases where the tooth structure has been lost significantly due to caries or trauma. Nevertheless, the major disadvantage of these type of post was the lack of modulus elasticity, which resulted in the root fracture [9].

The coronal dentin is adhesive friendly and can bond to the adhesive in better manner than the radicular dentin. Nevertheless, the fibre reinforced composites mimic the dentin, solving the problem of bonding to the radicular dentin [13].

The advancement in material research has brought forward the fibre reinforced restorative material and this new generation restorative material has proven its worth in the mutilated cases as well. The fibre reinforced materials have the unique properties of unidirectional fibres in the resin matrix which enhance the impact strength, flexural strength and the modulus of elasticity. Apart from this, they are capable of creating monoblock unit

for supporting the coronal restoration [5, 14, 15].

The present case report illustrates the capability of fibre reinforced tooth material in restoring the grossly mutilated tooth. The procedure is simple and can be performed in the single sitting. Moreover, the material is biocompatible, can maintain the hue and translucency of the natural tooth and it is corrosion resistant as well [16]. However, these fibre-reinforced materials are very costly and hence are not economically viable.

The concurrent literature is in support of the usage of fibre reinforced post in endodontically treated incisors as they increase the resistance to fracture and can improve the prognosis [13]. Although the fibre reinforced materials are here to stay, it requires a meticulous protocol. The clinician showed by wise enough to choose the best possible material and the best possible technique for each case as the field of endodontics continuously evolving in terms of material advancement and technique enhancement.

The possible causes of fibre reinforced material include the presence of the secondary

smear layer. During the removal of the root filling material to create a post space the secondary smear layer will be formed which is rich in remnants of the sealer and gutta-percha which become plastic under the influence of the friction produced during the drilling. This may compromise the adhesive ability of the material. Thus, one has to be meticulous enough to achieve clean dental surface for the successful retention of the post.

### Conclusion

The fibre reinforced tooth material provides ideal strength and durability as an anterior restorative material and the prefabricated metal posts are more economical. The present case report illustrates the same.

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CASE STUDY

## Acute abdomen due to vinyl gloves ingestion in a mentally retarded patient: a case report

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### Abstract:

Foreign body ingestion is a common problem, particularly in pediatric age group. Most of these bodies pass unnoticed and without complications. Only 10 – 20% of cases require endoscopic removal. Surgery is indicated in 1% of patients.

Vinyl glove ingestion is a rare differential diagnosis of acute abdomen. A detailed history is helpful to reach the diagnosis in case of foreign body ingestion. We report herein a case of vinyl glove ingestion in a mentally retarded patient, who presented with acute abdomen and mandated a surgical intervention.

### Key Words:

Vinyl glove, ingestion, mentally retarded

### الملخص

يعد ابتلاع الأجسام الغريبة مشكله طبية شائعة ، لاسيما لدى الأطفال. معظم هذه الأجسام المبتلعة تخرج من الجسم دون حدوث أي مضاعفات . حوالي ١٠-٢٠٪ من هذه الحالات تحتاج الي منظار هضمي لاستخراجها ، ويحدث التدخل الجراحي في ١٪ من الحالات .

إن ابتلاع قفازات الفينيل هو تشخيص تفرقي نادر كسبب من أسباب حالات البطن الجراحية الحادة . يعتبر التاريخ المرضي التفصيلي وسيلة مهمة للوصول إلى التشخيص في مثل هذه الحالات .

تستعرض دراسة الحالة ابتلاع قفازات الفينيل بواسطة مريض متخلف عقليا والتي سببت له حالة بطن جراحي حاد استدعى تدخلا جراحيا .

## Introduction:

Foreign body ingestion is a common problem especially in pediatric age group and frequently happen accidentally. This problem can also occur in adults, particularly elderly, prisoners, psychiatric and mentally retarded patients. Fish bones, bones, and dentures are the most common foreign bodies swallowed by adults. In prisoners and psychiatric patients, the most common foreign bodies ingestion observed are razor blades, batteries, and other sharp metallic objects<sup>1-4</sup>

## Case presentation:

A 26 –year- old male, a known case of severe mental retardation and hyperactivity presented from Rehabilitation Center to the Emergency Department with acute abdomen. Due to the mental status of the patient we were unable to obtain a proper history from either the patient or his attendant. The patient was noted to have five loose motions for two days. He had vomited twice and was reluctant to take food. Clinically, he was conscious and vitally stable. Abdominal examination revealed marked tenderness and guarding on the right side. The hematological and biochemical parameters were normal. The chest and abdominal X-rays were normal

Written Consent was obtained from his guardian and based on the clinical assumption of an acute surgical abdomen, exploratory laparotomy was performed. The exploration revealed a hard mass in the stomach almost obstructing the pylorus. Other intra-abdominal organs were normal. Gastrotomy was performed, and clumps of eighteen swallowed gloves were retrieved (Figure 1&2). The patient had an uneventful recovery. He was followed up in the surgical outpatient clinic and had no post-operative complications

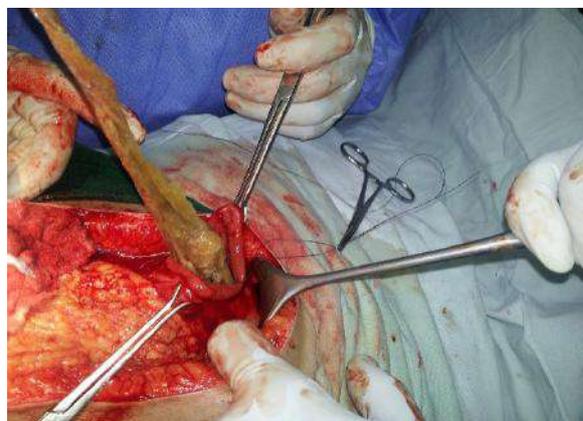


Figure - 1



Figure - 2

## Discussion:

The majority of ingested foreign bodies pass uneventfully. About 10 – 20% may need endoscopic removal, and surgical intervention is indicated only in 1% of patients<sup>1-4</sup>. A detailed history and proper physical examinations are helpful to reach the diagnosis in a case of foreign body ingestion. Sometimes, no proper history can be obtained especially in children and mentally retarded patients, and such patients are more likely to have a delayed presentation<sup>3, 5</sup>. Few cases of vinyl gloves ingestion are reported in the medical literature. Kamal I et al reported five cases of vinyl gloves ingestion in mentally retarded patients, of whom one patient died due to massive gastrointestinal bleeding from a large gastric ulcer caused by a vinyl glove. The other four patients had exploratory laparotomy and removal of the ingested vinyl gloves through gastrotomy. Upper gastrointestinal endoscopy was helpful in confirming the diagnosis. They concluded that attempting endoscopic removal of vinyl gloves in the stomach is not recommended unless they are still soft and pliable because they become hard and stiff and can cause esophageal injury and bleeding. Fur-

thermore, they concluded that the surgical intervention is the best choice<sup>6</sup>

A study by Stringel et al reported four cases of vinyl gloves ingestion in pediatric age group, three of them were mentally retarded and one of them was a victim of child abuse. The management of these cases was as follows: three underwent laparoscopic-assisted removal of vinyl gloves and one had a laparotomy. All of them recovered uneventfully. They concluded that, whenever vinyl glove ingestion is suspected, wait and see is not a good option and a prompt surgical intervention is recommended<sup>7</sup>

Leeds et al. reported a cerebral palsy adult patient with glove ingestion, in which the endoscopic retrieval was unsuccessful. He had laparoscopic removal of the foreign body accompanied with endoscopy uneventfully. They believed that changes seen in the glove are secondary to exposure of latex rubber to the stomach secretions<sup>8</sup>. As mentioned in our case, a decision may have to be made on clinical grounds only, especially in mentally retarded patients. The ingested vinyl gloves can harden, become stiff on exposure to gas-

tric acid and therefore the best approach to remove such a vinyl bezoar is through gastrotomy whether via a laparoscopic approach (preferred) or open approach. The wait and observe policy adopted for metal objects is not advisable as passage of such hardened, irregular surfaced gloves can cause perforations.

### Conclusion:

Attendants in mentally retarded centers are recommended to be aware of the possibility of vinyl glove ingestion. Early surgical intervention is a preferable line of management.

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## GUIDELINES FOR MANUSCRIPT PREPARATION

### **A. TYPES OF MANUSCRIPTS**

#### **I. ORIGINAL MANUSCRIPTS**

Manuscripts submitted in this category are expected to be concise, well organized, and clearly written. The maximum length is 5000 words, including the abstract, references, tables, and figure legends. The maximum length is 5000 words, including the abstract, references, tables, and figure legends.

- The structured abstract must not exceed 250 words.
- The title must not exceed 130 characters.
- A maximum of 4 tables and 4 figures is allowed.
- References should not exceed a maximum of 100.
- The abstract must be organized as follows:
- Background & Aims
- Methods
- Results
- Conclusions
- Do not use abbreviations, footnotes or references in the abstract.
- An electronic word count of the abstract must be included.
- Three to ten key words at the end of the abstract must be provided.

The manuscript must be arranged as follows:

- Title page
- Abstract
- Introduction
- Materials and methods (or Patients and methods)
- Results
- Discussion
- Acknowledgements
- References
- Tables
- Figure legends
- Figures

Acceptance of original manuscripts will be based upon originality and importance of the investigation. These manuscripts are reviewed by the Editors and, in the majority of cases, by two experts in the field. Manuscripts requiring extensive revision will be at a disadvantage for publication and will be rejected. Authors shall be responsible for the quality of language and style and are strongly advised against submitting a manuscript which is not written in grammatically correct English. The Editors reserve the right to reject poorly written manuscripts even if their scientific content is qualitatively suitable for publication. Manuscripts are submitted with the understanding that they are original contributions and do not contain data that have been published elsewhere or are under consideration by another journal.

#### **II. REVIEW ARTICLES**

Review articles on selected clinical and basic topics of interest for the readers of the Majmaah Journal of Health Science will be solicited by the Editors. Review articles are expected to be clear, concise and updated.

- The maximum length is 5000 words, excluding the summary, references, tables, and figures.
- References should not exceed a maximum of 150.
- The inclusion of a maximum of 4 high-quality tables and 4 colored figures to summarize critical points is highly desirable.
- Review articles must be accompanied by a title page and a summary.

- Reviews should include at least one Key Point Box, with a maximum of 5 bullet points, that briefly summarizes the content of the review.

Review articles are reviewed by the Editors and may be sent to outside expert reviewers before a final decision for publication is made. Revisions may be required.

### **III. EDITORIALS**

This section consists of invited brief editorial comments on articles published in the Majmaah Journal of Health Science

The length of an editorial should not exceed 1500 words, excluding references.

- A maximum of 1 table or 1 figure is allowed.
- References should not exceed a maximum of 20.
- A title page must be provided.

### **IV. CASE REPORTS**

Case reports would be only accepted if they represent an outstanding contribution to the Etiology, pathogenesis or treatment of a specific condition.

- The maximum length is 3000 words, including the summary and references.
- A maximum of 2 tables and 2 figures is allowed.
- References should not exceed a maximum of 15.
- A title page must be provided.

### **V. LETTERS TO THE EDITOR**

Letters to the Editor will be considered for publication if they are related to articles published in recent issues of Majmaah Journal of Health Science. Occasionally, Letters to the Editor that refer to articles not published in Majmaah Journal of Health Science will be considered.

The length of a Letter to the Editor should not exceed 800 words.

- A maximum of 1 table or 1 figure is allowed.
- References should not exceed a maximum of 10.
- No more than 4 Authors may appear in the author list.

### **VI. COMMENTARIES**

International commentaries will be solicited by the Editors only.

- Commentary articles should not exceed a maximum of 800 words, excluding tables or figures.
- A maximum of 1 table or 1 figure is allowed.
- References should not exceed a maximum of 10.
- A title page must be provided.

## **B. MANUSCRIPT SUBMISSION**

### **ORGANIZATION OF THE MANUSCRIPT**

- The submitted manuscript must be typed double-spaced throughout and numbered (including references, tables and figure legends). Preferably using a "standard" font (we prefer Times/Arial 12).
- For mathematical symbols, Greek letters, and other special characters, use normal text. The references must be in accordance with the Vancouver reference style (see References).
- Approved nomenclature for gene and protein names and symbols should be used, including appropriate use of italics (all gene symbols and loci, should be in italics) and capitalization as it applies for each organism's standard nomenclature format, in text, tables, and figures.
- Full gene names are generally not in italics and Greek symbols are not used. Proteins should not be italicized.
- Improperly prepared manuscripts will not be entered into the peer review process and will be sent back to the author for correction.

### **TITLE PAGE MUST CONTAIN:**

- A title of no more than 130 characters.

- Running title (not to exceed 60 characters)
- Names of the Authors as it should be published (first name, middle initial, last name)
- Affiliations of all authors and their institutions, departments, or organizations (use the following symbols in this order to designate authors' affiliations: \*, †, ‡, §, ¶, ||, #, \*\*, ††, ‡‡, §§, ¶¶, || ||, ##).
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**Animal trials:** Manuscripts reporting experiments using animals must include a statement giving assurance that all animals received human care and that study protocols comply with the institution's guidelines. Statistical methods used should be outlined.

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1. Informed consent was obtained from each patient included in the study and
2. The study protocol conforms to the ethical guidelines of the 1975 declaration of helsinki as reflected in a priori approval by the institution's human research committee.

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**Drugs and chemicals:** Drugs and chemicals should be used by generic name. If trademarks are mentioned, the manufacturer's name and city should be given. All funding sources supporting the work, either public or private, especially those from pharmaceutical companies, must be provided.

**Genetic Sequence data:** In papers reporting a novel DNA or amino sequence, verification that the data have been or will be submitted either to Gen-Bank or EMBL is required. Please provide this verification and the accession number in the covering letter.

## REFERENCES

References must be in accordance with the Journal of Hepatology reference style. References are ordered as they appear in the text and citation numbers for references are placed between "brackets" ("[]") in the text as well as in the reference list.

Authors should be listed surname first, followed by the initials of given names (e.g. Bolognesi M). If there are more than six authors, the names of the first six authors followed by et al. should appear.

Titles of all cited articles are required. Titles of articles cited in reference list should be in upright, not italic text; the first word of the title is capitalized, the title written exactly as it appears in the work cited, ending with a full stop. Journal titles are abbreviated according to common usage, followed by Journal years, semicolon (;) before volume and colon (:) before full page range (see examples below).

All articles in the list of references should be cited in the text and, conversely, all references cited in the text must be included in the list.

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*An example of how references should look within the text:*

"HVPG was measured by hepatic vein catheterization using a balloon catheter according to a procedure described elsewhere [14, 15] and used as an index of portal hypertension [16]."

*An example of how the reference list should look:*

[14] Merkel C, Bolognesi M, Bellon S, Zuin R, Noventa F, Finucci G, et al. Prognostic usefulness of hepatic vein catheterization in patients with cirrhosis and esophageal varices. *Gastroenterology* 1992;102:973-979.

[15] Groszmann RJ, Wongcharatrawee S. The hepatic venous pressure gradient: anything worth doing should be done right. *Hepatology* 2004;39:280-282.

## FIGURES

A maximum of 4 figures is allowed

(This can be modified if needed by Editorial board).

- Figures will be often, but not always, re-designed by graphic designers. By signing and transferring the Copyright Agreement to MJHS, the author gives permission to the graphic designers to alter the visual aspect of any figures, tables, or graphs. The scientific content of figures will not be altered. Please provide this information with your covering letter.
- All graphics submitted to Majmaah Journal of Health Science should be sent at their actual size, which is 100% of their print dimension and in portrait orientation.
- Two standard widths are used and figures should fit in one (8.5 x 23.5 cm) or two (17.5 x 23.5 cm) columns
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- Illustrator compatible EPS files with RGB color management (\*.eps),
- Photoshop (\*.psd) or PDF (\*.pdf) files (greyscale or RGB) at the appropriate resolution, which is:
  1. 300 dpi for color figures
  2. 600 dpi for black and white figures
  3. 1200 dpi for line-art figures
- For all photomicrographs, where possible, a scale should appear on the photograph. Photographs of identifiable patients should be accompanied by written permission to publish from patient(s).
- • Furthermore, panel lettering should be in Arial bold 14 pt, capitalized and no full stop (A, B) while lettering in figures (axes, conditions), should be in Arial 8 pt, lower case type with the first letter capitalized and no full stop. No type should be smaller than 6 pt.

## TABLES

A maximum of 4 tables is allowed

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- When submitting tables in Microsoft Word table function, no tab, space or colors should be used. Tables should contain a maximum of 10 columns.
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- Include tables in the submitted manuscript as a separate section.

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- Figure legends should be listed one after the other, as part of the text document, separate from the figure files.
- Please do not write a legend below each figure. Each figure legend should have a brief title that describes the entire figure without citing specific panels, followed by a description of each panel, and the symbols used.
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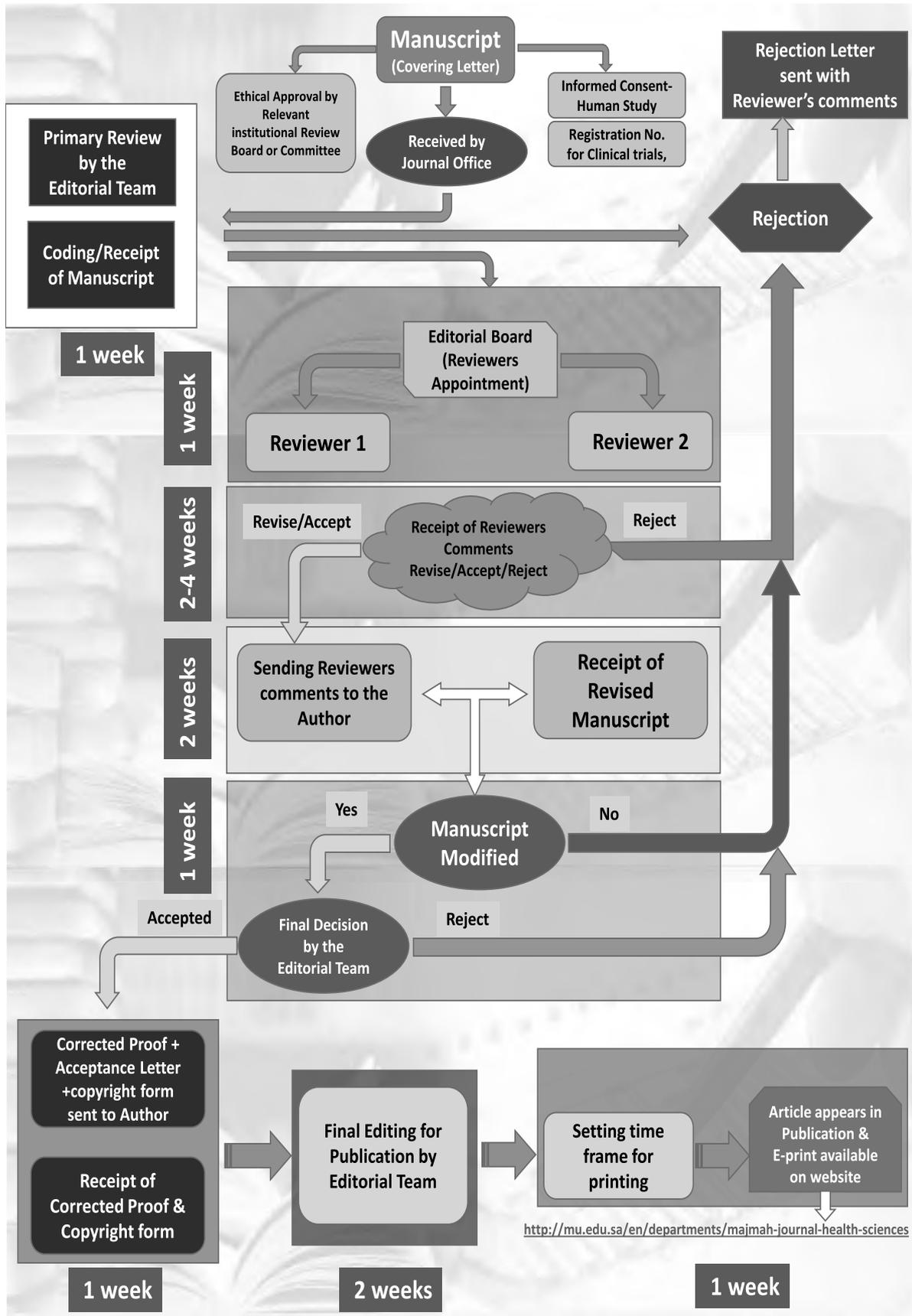
The manuscripts should include a complete and detailed description of what was done. This includes a description of the design, measurement and collection of data, the study objective and major hypotheses, type and source of subjects, inclusion and exclusion criteria and measures of outcome, number of subjects studied and why this number was chosen. Any deviation from the study protocol should be stated. The baseline characteristics of any compared groups should be described in detail and -if necessary -adjusted for in the analysis of the outcome.

For randomized clinical trials the following should also be clearly documented: treatments, sample size estimation, method of random allocation and measures taken for maintaining its concealment including blinding, numbers treated, followed-up, being withdrawn, dropping out, and having side effects (numbers and type). The statistical methods used should be relevant and clearly stated. Special or complex statistical methods should be explained and referenced.

Complex analyses should be performed with the assistance of a qualified statistician. Unqualified use of such analyses is strongly discouraged. The underlying assumptions of the statistical methods used should be tested to ensure that the assumptions are fulfilled.

For small data sets and if variable distributions are non-normal, distribution free (non-parametric) statistical methods should be used. The actual p values - whether significant or not - should always be presented (not NS). Confidence intervals convey more information than p values and should be presented whenever possible. Continuous variables can always be summarized using the median and range which are therefore preferred. Only in the infrequent case of a Normal distribution are the mean and standard deviation (SD) useful. Complex analyses (including Cox and logistic regression analysis) should be presented in sufficient detail: i.e. variable scoring, regression coefficients, standard errors and any constants. Odds-ratios or relative risks are not sufficient documentation of such analyses. The handling of any missing values in the data should be clearly specified. The number of statistical tests performed should be kept at a minimum to reduce spurious positive results. Explorative (hypothesis generating) analyses without confirmation using independent data are discouraged. Figures showing individual observations e.g. scatter plots are encouraged. Histograms may also be useful. Tables should indicate the number of observations on which each result is being based





## **Forthcoming Conferences & Workshops**

Title: 7th International Conference on “Medical, Medicine and Health Sciences”

Place: New Delhi, India

Date: August 2-3, 2017

URL: <http://academicfora.com/mmhs-august-2-3-2017-new-delhi-india>

About the Conference: The conference will cover vital issues in medical, medicine and health sciences under multiple sub-themes. The aim of our conference is to support, encourage and provide a platform for networking, sharing, publishing and nurturing the potential growth of individual scholars across the globe.

Title: International Conference on Musculoskeletal Ultrasound

Place: New Delhi, India

Date: August 25-27, 2017

URL: <http://www.musk2017.com>

About the Conference: Organised by Musculoskeletal Ultrasound Society. Highlights: Basic course in MSK USG (All joints sonoanatomy and clinico pathological correlation), Advanced MSK USG course. Thirty Hands on workshops (4 hours) each day with 1:6 faculty-delegate ratio, Interactive teaching program with faculty

Title: Mayo Clinic Neuroscience and Oncology Innovation Summit 2017

Place: Orlando, USA

Date: September 07-09, 2017

URL: <http://go.evvnt.com/107995-0>

About the Conference: This course will provide attendees with an update in major areas of neuroscience and oncology research from basic science, translational laboratories and clinical trials research. Lectures will cover neuroscientific arenas including brain tumor biology and growth, vascular neogenesis, nanotechnology for tumor suppression, viral vectors for tumor

destruction, and other new agents to target and destroy brain tumors. The conference will discuss basic tumors of the brain and other sites including breast in addition to metastatic brain tumor therapies. Also, the course will cover the latest diagnostic and therapeutic approaches to tumors. Lectures will be supplemented with high yield industry and CEO-level Q&A sessions, precision medicine, and patient and celebrity stories. Other high yield sessions will include governmental policy makers that are guiding brain tumor patient care for future health care systems.

Title: 11th Asia Pacific Symposium on Cochlear Implants and Related Sciences 2017

Place: Famagusta, Cyprus

Date: September 19-22, 2017

URL: <http://apsci2017.com/>

About the Conference: The symposium will gather prominent global experts in the field and will serve as a dynamic forum, promoting productive clinical debates between basic scientists, clinical specialists and researchers on the critical issues within the various aspects of hearing, speech and balance disorders. Innovation in different aspects of technology will be presented in an extensive industrial exhibition. The symposium prides itself on having the most up-to-date clinical, scientific and academic program, concentrating not only on future therapies and interventions, but also on disease prevention and treatment goals.

Title: 6th Global Bacteriology and Parasitology Annual Meeting

Place: Singapore

Date: September 13-14, 2017

URL: <http://bacteriology.conferenceseries.com/asiapacific/registration.php>

About the Conference: The conference aims to provide an opportunity to share knowledge, expertise along with unparalleled networking opportunities between a large number of medical and industrial professionals in this sphere. Bacteriology Asia Pacific 2017 conference

gathers renowned scientists, physicians, young researchers, industrial delegates and talented student communities in the field of bacteriology and parasitology under a single roof where networking and global partnering happens for the acceleration of future research.

Title: Emirates Society of Emergency Medicine Conference 2017

Place: Dubai

Date: December 6-9, 2017

URL: <http://www.esemconference.ae>

About the Conference: ESEM becoming the largest and best Emergency Medicine Conference in the Middle East. The conference has been comprehensively organized to capture the excellent innovations in Emergency Medicine, primarily in the areas of pre-hospital care, Trauma, Toxicology, Disaster Medicine, Paediatric EM, Emergency Nursing, Simulations, Public Health, Research Updates and other sub branches related to the field of emergency medicine.

Title: ISERD - 243rd International Conference on Medical and Health Sciences (ICMHS)

Place: Dammam, kingdom of Saudi Arabia

Date: August 25-26, 2017

URL: <http://iserd.co/Conference2017/SaudiArabia/6/ICMHS/>

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# MJHS

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