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## What is known about Ventricular Septal Defect in University Female Students of Saudi Arabia?

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### Abstract

This study was performed to estimate the knowledge and awareness of the university students about the presence of ventricular septal defects (VSDs) in Saudi Arabia. A cross-sectional study was performed in Princess Nourah bint Abdulrahman University (PNU) campus where a total of 350 female students in the age group of 17-25 years were surveyed using a clinically appropriate structurally designed questionnaire. Only a third of the population were familiar with the definition and anatomical location of VSDs. Although, majority of the population believed that VSDs are subject to cure, a negligible population of the students were aware that VSDs are associated with pulmonary hypertension in adults, although, about half of the population were associated with people who were suffering from VSDs. Even though promising, only half of the population were aware of rapid breathing in infants and association of endocarditis with VSDs. Regarding life-style factors, only 18% of the population knew that VSD patients are restrained from different physical activities. This population study is the first of its kind to determine the knowledge of the university students regarding the characteristics, symptoms, risk-factors, management and life-style factors associated with VSD. It identified the imperative need to organize campaigns to raise awareness about the disease process and management among female population who will be future mothers since Awareness about VSDs can help manage the physical, social, cognitive and emotional well-being of the patients with better outcomes to reduce the mortality rate.

**Keywords:** ventricular septal defects; Princess Nourah bint Abdulrahman University (PNU) ; Population based educational campaigns to raise awareness; Restricted life-style factors, Awareness.

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## **1. Introduction**

VSD, is a common congenital heart disease (CHD) with a hole in the septum, which separates the right and the left ventricles. Lack of development of a region of the septum at birth (or more exceptionally due to myocardial infarction or trauma at adulthood) may result in VSD. Recent studies show that almost 50% of the population of children suffering from CHDs suffer from VSD [1]. In fact, with successful screening of kids and substantial advancement in imaging system, incidence of VSDs have increased ranging from 1.56 – 53.2 per 1000 live births. On eliminating bicuspid aortic valve disorder, VSDs are considered as one of the most customary congenital defects in the adults [2].

VSDs vary substantially with regards to their location, size and negative impact on haemodynamic parameters [3]. Indeed, due to the presence of the hole in the septum and rather than travelling to the body, the oxygenated blood is flowing to the lungs thereby exerting high pressure on heart or causing high pulmonary resistance [4]. VSD can be classified based on their location in the ventricular septum. The portion of the ventricular septum that isolates the aortic vestibule from the lower region of the right atrium and upper portion of the left ventricle is known as the membranous ventricular septum. The larger, thicker and non-planar component of the septum surrounded by the muscles is referred to as the muscular ventricular septum which closes naturally during childhood due to muscular blockage [5]. Often, a malfunctioning membranous septum also affects the muscular septum and are known as perimembranous defects [6]. Perimembranous deformity is widely present among the majority and is further divided into inlet, trabecular and infundibular defects. Septal deformity adjacent to the arterial valves are termed as supracristal defect which accounts for 5-7% of the diverse kinds of defects in the western countries [7]. VSDs can be classified based on their size too. Usually, a smaller VSD appears normal on electrocardiogram (ECG) and chest X-Ray. However, larger VSDs are presented with enlarged ventricles where R waves are tall, S waves are deep in the leads V1-V6 on the ECG with characteristic cardiomegaly and jutting pulmonary network showing on the X-Ray [8]. Haemodynamic consequences of VSDs usually depend on the magnitude of the defect, pulmonary tension and developing pressure between the right and the left ventricles [9]. VSDs are associated with chromosomal aberrations typically characterized by an addition or deletion of a chromosome. Fetal karyotyping is recommended to validate chromosomal abnormality on confirming VSD using antenatal diagnosis. Prior research elucidates the significance of the transcription activation genes, such as Gata4, Gata6 and Tbx5 in the development of neonatal abnormalities and cardiovascular defects [10]. Haploinsufficiency of Gata4 and Tbx5 leads to atrioventricular septal defects.

Management of VSDs depend on its size. Although, smaller defects do not require any medical intervention, medium and larger defects need to be treated with therapeutics such as diuretics, digoxin, afterload reduction therapy and surgery [11]. Diuretics such as Furosemide and Aldactone are commonly used to reduce salt and water reabsorption, thereby, enhancing their excretion. Vasodilators such as angiotensin converting enzyme inhibitors and hydralazine enhance the function of the cardiac pump by either reducing vascular resistance or increasing the venous capacitance. Inotropic agents such as digoxin and isoproterenol function to increase the myocardial contractility. Usually corrective surgery is the mode of treatment in patients who responds to pulmonary vasodilators in order to increase vascular resistance. In this surgery, the VSD is closed with a perforated patch to allow unobstructed flow of blood from the right to the left side of the heart during increased

pulmonary vascular resistance to maintain the cardiac output [12]. Untreated VSDs pose several complications such as heart failure, restricted growth in infants, arrhythmias and pulmonary hypertension. However, the cardinal complication related to VSDs is infective endocarditis, a hideous and a fatal infection of the inner lining of the heart and the valves. Due to endocarditis, there may be vegetation occurring at the tricuspid valve region surrounding VSD or on the aortic valve [13].

It is essential as parents of children with CHDs, especially mothers, to be aware of the cardiac complications and yield to the therapeutic process for a healthy life. Also, as adult patients, one must have better understanding of possible risk factors in cardiac deterioration and endocarditis, impact of life-style factors and genetic basis of VSDs.

The present study was done to raise awareness of the female university students about VSDs with an aim to educate the future mothers about possible association of their babies with the cardiac defect. Therefore, in this study, we gauged the knowledge of the female university students in three important domains: 1. Rendition of anatomical VSD with captured figures; 2. Symptoms, complications and management of VSD; and 3. Impact of life-style and physical activities on VSD patients.

## **2. Methodology**

### The questionnaire and the Sample Population

The questionnaire used for screening the university students were referred to as “*Leuven Knowledge Questionnaire of Congenital Heart Disease*” which was designed for the adults and parents of kids suffering from VSDs to learn the fundamental basics of the disease [14]. This questionnaire was documented with the help of a Saudi student suffering from VSD and the proficiency of her cardiologist to evaluate the rationality and relevance of the questions listed. The questionnaire consisted of 3 domains: 1. Definition of VSD: This segment was designed to assess the knowledge of the anatomy and consensus definition of VSDs. 2. Symptoms, management and risk factors of VSD: This segment was designed to determine the knowledge of the clinical signs and risk factors relevant to the inception of VSDs and its different treatment modalities. 3. Life style and physical activities of VSD patients. This segment explored the knowledge of the students about the effects of the life-style factors such as physical activities and consumption of fatty food on VSD patients. A total of 350 female students studying in PNU University in different discipline such as medicine, dental, pharmacy, nursing, physiotherapy, science, humanities, law, and art and design did participate in the cross-sectional study. An individual questionnaire was handed over to each of the students.

### Pilot study:

A pilot study was conducted with 20 students in order to assure that the questions were easily apprehensible.

### Sample Size Determination:

Epi Info 3.5, a statistical software was used to determine the sample size. The sample size used was 350 students

using single population proportion formula with an error estimate of 5% and 95% confidence interval.

Data management and Analysis

A coded questionnaire was provided to the students where the answers were analyzed with SPSS version 22.0 (SPSS, Chicago, IL, USA). To explore the probable association of the risk factors used as categorical variables in the questionnaire and VSD, Pearson’s  $\chi^2$  test was used. The p values were calculated using two-tailed test where  $p < 0.05$  was considered statistically significant.



**Figure 1:** Definition of VSD

**3. Results**

Domain 1: Definition of VSD:

There were 165 university students in the age group of 21-25 years (47.14%) followed by 132 students who were above 25 years (37.71%) and 3 students in the age group of 19-20 years who participated in the study.

Regarding the definition of CHDs, 246 students (70.28%) correctly answered CHD as a malfunctioning heart

present at birth (Fig 1A). These students also confirmed that they were aware of VSDs (Fig 1B). Although, a significant population of the students were familiar with VSDs, a little more than half of the population (n = 184; 52.57%) were actually accustomed with the definition of VSDs, considering the defect as a hole in the heart (Fig 1C). Interestingly, the population of students (n = 156; 44.57%) who were knowledgeable about the septal defect, also knew VSD patients in their associated network of people (Fig 1D). Regarding their relationship with the patients, 84 of the students (24%) declared the patients as their relatives, 42 students (12%) mentioned them as colleagues and 19 students (5.42%) referred to the individuals as their neighbors. From this study, it is likely possible that an understanding of the definition of the disease for the majority of the students may have emerged owing to acquaintance with the individual patients (Fig 1E). This study also showed that 68.85% of the population (n = 241) were aware of the existing differences between VSD and atrial septal defects (ASD) (Fig 1F). Despite the fact that the students were accustomed with the origin and prevalence of the disease, unfortunately, only 30.85% of the population (n = 108) knew about the anatomy of the disease (Fig 1G). Yet, interestingly, 56% (n = 196) of the students knew that the term congenital refers to “at birth” associating the manifestations of the disorder at infancy (Fig 1H). This survey among the university students demonstrate that only one third of the population were actually aware of the prevalence, definition and anatomy of VSDs in spite of knowing patients who were close to them.



**Figure 2:** Symptoms, management and risk factors of VSD

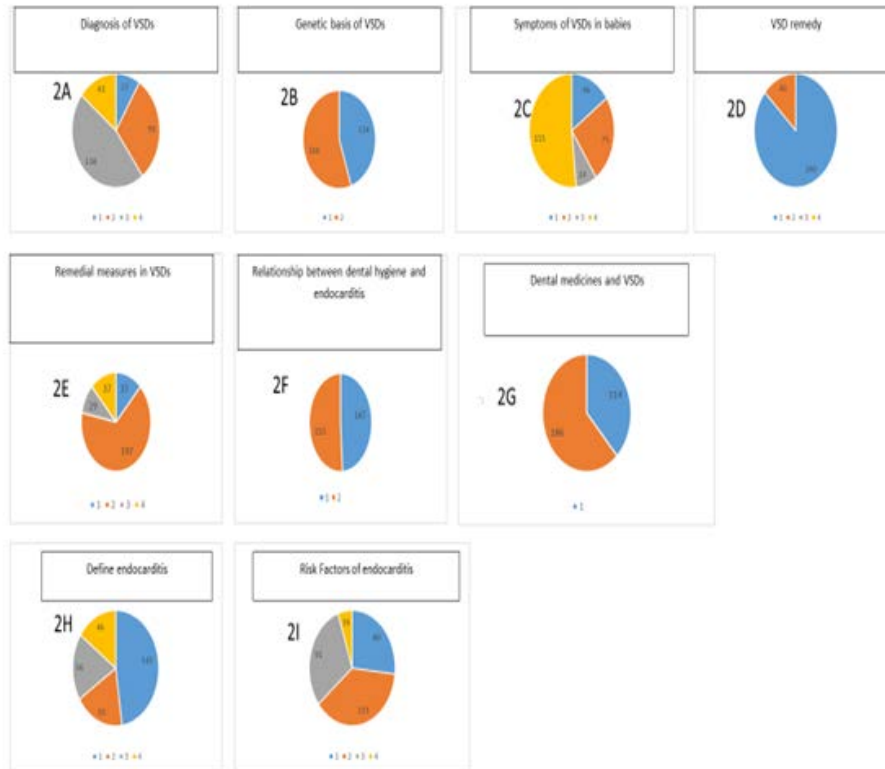


Figure 3: Life style and physical activities of VSD patients

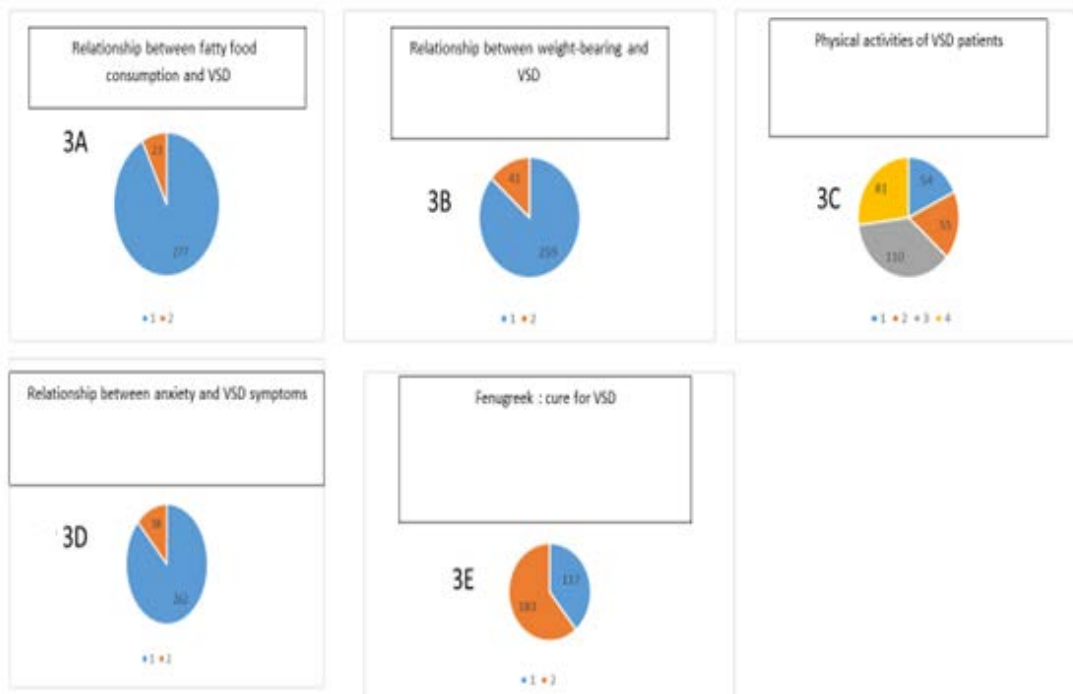


Figure 4

### Domain 2: Symptoms, management and risk factors of VSD:

Since a significant population of the students were aware of the existence of the disease, 78% of the students demonstrated well versed knowledge regarding modes of VSD diagnosis. The students were aware that, chest X-Ray, echocardiography and electrocardiography are possible diagnostic investigation that needs to be performed to validate VSDs (Fig 2A). However, less than half of the student population (n = 134; 38.28%) were aware that VSDs are genetically inherited (Fig 2B) and disappointingly, only 10% of the population (n = 35) knew about severe pulmonary hypertension as the underlying symptom attributable to VSD pathology in adult patients (Fig 2C). This study warrants the need to establish campaigns to educate the future mothers about the critical symptoms associated with VSD pathology (Fig 2C). Nevertheless, 74.28% (n = 260) of the student population believed that VSDs are curable (Fig 2D) but only 56.28% (n = 197) of the student population knew that surgical intervention is the appropriate mode of treatment for VSD (Fig 2E). This indicates that most of the students might not be aware of the different therapies that the patients undergo to correct VSDs (Fig 2E). However, about half of the student population understood the clinical significance of endocarditis (Fig 2F) and the importance of dental hygiene behind endocarditis (Fig 2G), with only 32.57% (n = 114) of the student cohort appreciating the intake of dental antibiotics before any surgical correction (Fig 2H). Surprisingly, the student population were well informed about body piercing and tattooing, use of contaminated needles, presence of dental abscess and poor nail and skin care as apparent risk factors of endocarditis (Fig 2H). This segment of the questionnaire shows that although most of the students considered VSDs totally curable and were aware of the different modes of the diagnosis, only a trivial population of the students could relate to pulmonary hypertension as a critical symptom related to onset of VSDs in the adults. Although promising, yet a little less than half of our female population did know about rapid breathing and onset of endocarditis as one of the critical symptoms and risk factors associated with VSDs in babies respectively.

### Domain 3: Life style and physical activities of VSD patients

While answering the last segment of the questionnaire, almost the entire population of the students (n = 277; 79.14%) were of the perception that consumption of food with high fat content may exacerbate VSD symptoms (Fig 3A). Regarding weight bearing activities, 86.33% of the student population accepted that there is a positive correlation between cardiac pain and weight training (Fig 3B). Due to poor understanding of the disease, only 18% of the students were aware that any form of physical activity is restrained for VSD patients (Fig 3C). The majority of the student population (n = 262; 74.85%) believed that psychological factors such as anxiety and depression could worsen the heart pain (Fig 3D). Due to lack of knowledge pertaining to prophylaxis of VSDs, 117 students (33.42%) had a misconception that traditional medicine such as fenugreek may aid in alleviating the symptoms related to VSD. This segment of the questionnaire shows that the majority of the students, who are also potential mothers are aware of the probable influence of life-style factors playing an important role in the worsening of VSD symptoms.

## **4. Discussion**

The predominance of VSDs was found to be 10.7 per 1000 in KSA. VSDs have been reported as one of the most

common CHD in Al-Bahah, a city in the southwest of Saudi Arabia. Interestingly, predominance of the disease was also found to be higher among the female populations with small asymptomatic type of VSDs. Demographic analysis based on various cities such as, Al-bahah, Asir, Riyadh, Madina, Buraida and Al-Hassa of Saudia Arabia demonstrate a prevalence of 29.6%, 32.5%, 33.1%, 34.5%, 38.4% and 39.5% of VSDs [15]. At present a very limited information is found regarding the magnitude of VSDs in Saudi Arabia [15]. It is important that the university female students who will be future mothers to have an adequate knowledge of VSD so that, if required, they can diagnose and manage the disease present in their future babies and can also educate their neighbors about the same. The present research was done in a cohort of female university students who are potential future mothers to understand their level of awareness of VSDs. Our studies showed that only 30.85% of the student population had a proper understanding of the consensus definition and anatomy of VSDs. Awareness of the physiological aspect of VSDs could be due to the fact that almost half of the surveyed population were closely associated with patients suffering from VSDs. Despite the fact that more than 74.28% of the students felt that VSDs are curable, only a negligible population of 10% were aware that VSDs are associated with pulmonary hypertension in adults. This could be primarily because the students did not know the concept and significance of pulmonary hypertension and were unable to correlate the same with VSDs. Interestingly, approximately 57.42% of the population knew that fast breathing and feeding difficulties are the critical symptoms associated with infant VSDs. This could be due to the close acquaintance of the students with the patients who shared their influence of VSDs on daily life. This study was conducted among university female students whose understanding of the magnitude of VSD related features is necessary since they are prospective future mothers who could diagnose early clinical manifestations of their babies accurately. Although the students were aware of the early clinical symptoms, only half of the population had an understanding of the possible risk factor such as endocarditis. Probably, most of the student population surveyed did not understand the meaning of such clinical terms. They probably were not aware of the antibacterial remedy to prevent this fatal disease. As a result, this study revealed a need to educate the university students who are potential mothers regarding prophylaxis against infective endocarditis to save their future babies. This study was designed so that the students will be abreast with the preliminary clinical manifestations and possible life-threatening complications associated with the onset of VSDs. This would help the parent of the patient or the patient himself at risk to begin the primary health care procedure immediately [16]. It is essential that the students be enlightened about the outcomes of endocarditis which is proven to be fatal if not treated in timely. Surprisingly, an increasing population of more than 85% of the students believed that life-style factors such as eating fatty food and weight-training could worsen the VSD symptoms. Probably, the students were aware that patients suffering from VSDs have naturally poor appetite, difficulty in eating due to rapid breathing along with frequent respiratory infections. Moreover, due to increased workload of the cardiac muscles because of the inefficiency of the heart to circulate blood to the metabolizing tissues, it is even difficult to perform light exercises [15]. The questionnaire used in our study was structured to preclude misconceptions related with certain heart defects that do not impose any restriction on the child (i.e., VSD after surgery, atrial septal defect, and pulmonary stenosis after catheter intervention). Imparting basic knowledge in the mode of population-based surveys would help the students gather information about the general life-style of the VSD patients and therefore create awareness among their neighbors. Our study showed that the student population interviewed is not completely aware of the defect. There were students who had knowledge of the prevalence, definition and anatomical aspects of the



disease, but were mostly unaware of the underlying symptoms of VSDs in the adults. There were lesser number of students who could actually correlate the clinical importance of endocarditis and its remedial measure to prevent fatality. Nevertheless, the answers for the third segment were bright with almost the entire population having some probable understanding of the relationship between fatty food consumption, weight-training and anxiety with VSD. However, excepting a small group, the entire population were unaware that VSD patients have a restricted life-style devoid of different forms of physical exercises such as swimming and running. This type of educational campaigns need to be organized more in future to have a broader understanding of the disease to help the community better. It is indispensable that the students should not only know about the anatomical definition of the defect but should also be familiar with the possible symptoms and risk factors to diagnose and manage the disease quickly to obtain a primary health care. Awareness about VSDs can help manage the physical, social, cognitive and emotional well-being of the patients with better outcomes to reduce the mortality rate. Diagnosing the disease early followed with regular health check-ups and clinical examinations such as echocardiography and electrocardiography are prerequisites to reduce the rate of morbidity and mortality significantly. For the first time, this study was done to estimate the total knowledge score based on the correct rate. For the purpose of calculation, the total number of correct answers were divided by the number of questions, the participant is supposed to answer. The total knowledge score obtained was found to be useful for clinical studies. The study was done on a small scale considering only 350 students from the university. In fact, more longitudinal and cross-sectional studies need to be conducted in the future along with control studies, to have an exact and clear perception of the disease knowledge among the people. To conclude, future population based educational campaigns is an essential approach in such interdisciplinary care programs in medical science to educate the students who are future parents and the patients themselves about the disease.

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