



The Crucial Role of Pneumococcal Vaccination in Hajj Pilgrimage: Advocating for Compulsory Policy Changes

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## Editorial

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This issue of the journal has a good number of paper discussing various issues of importance to health.

Hadi et al., did an extensive review on Physical and psychological impacts of cancer on children and adolescents and strategies to improve it. The authors stressed that childhood cancer is a major cause of morbidity and mortality. Globally, cancer is one of the most sever health illness among children and adolescents. every year approximately 151,435 cases with cancer are diagnosed that lead to physical and psychological impacts on children and adolescent (Cancer Statistics Center, 2020 & Schüz, J.; Roman, E, 2021). Furthermore, previous data from the World Health Organization showed approximately 400,000 children and adolescents aged 0–19 are diagnosed with cancer annually (WHO, 2021). A young population with longer life expectancies and a recognized rising cancer burden both locally and globally pose challenges to providing the finest healthcare. The authors concluded that their literature review highlighted precise evaluation of physical and psychological impacts of cancer among children and their parents that necessary to guarantee excellent care and efficient therapy and to find best ways to decrease these impacts.

Alenazi, et al., reviewed the use of artificial intelligence in nursing education. This study uses a quantitative research design and regression analysis to examine the impact of artificial intelligence (AI) integration on nursing students' attitudes and academic performance. A sample of 300 nursing students was surveyed to identify key factors influencing their acceptance and use of AI technology in their education. Results revealed that technological proficiency and positive attitudes toward AI significant-

ly predicted improved academic performance. These findings have significant practical implications for curriculum development in nursing education, emphasizing the importance of integrating AI and enhancing students' technological skills.

Asim, et al ., presented a case of cardiac amyloidosis. They pointed that Amyloidosis is a multisystem disorder. Cardiac involvement causes restrictive cardiomyopathy. A 65yrs old gentleman presented with worsening shortness of breath. Investigations including echo and cardiac MRI showed cardiomyopathy consistent with amyloidosis. Cardiac involvement is related with poor prognosis and increased mortality.

Iqbal et al., discussed the benefits of fasting. They stressed that there has been increased popularity of fasting as a lifestyle choice and a way of losing weight. Overall, fasting results in significant health benefits. Fasting during Ramadan (i.e. religious fasting) leads to additional benefits. In their second paper they discussed Reaction to aluminium in vaccines. They stressed that Some children can develop nodules at the site of their immunisations. These are granulomas due to a reaction with aluminium which is present in some vaccines. The nodules are benign and further investigations are not needed. The nodules can cause intense itching and treatment is aimed at treating this until the nodules resolve on their own.

Ayoub et al., discussed the Crucial Role of Pneumococcal Vaccination in Hajj Pilgrimage: Advocating for Compulsory Policy Changes. The annual Hajj pilgrimage to Mecca brings together millions of individuals from diverse geographic regions, presenting significant public health challenges, particularly concerning the transmission of infectious diseases. This article

highlights the critical importance of pneumococcal vaccination as a preventive measure during Hajj. Given the heightened risk of respiratory infections in such a densely populated and international gathering, the authors advocate for making pneumococcal vaccination compulsory for all pilgrims. The article discusses the public health benefits of widespread vaccination, including the reduction in cases of pneumonia, meningitis, and sepsis caused by *Streptococcus pneumoniae*. It also examines potential barriers to implementing compulsory vaccination policies, such as logistical challenges, vaccine hesitancy, and the need for culturally sensitive approaches. The authors emphasize the necessity of collaboration among health authorities, religious leaders, and pilgrims to ensure successful policy implementation and enhance health outcomes during the pilgrimage.

Hussain, et al., report a case report on Early Diagnosis and Management of Acute Pericarditis in a patient with G6PD deficiency. They pointed that Pericarditis, caused by infections, autoimmunity, or trauma, often causes sudden chest pain and may result in complications like pericardial effusion and cardiac tamponade, affecting patient outcomes. A 30-year-old male with G6PD deficiency and asthma presented with acute pleuritic chest pain post-upper respiratory tract infection. The evaluation revealed muffled heart sounds, global ST elevation on ECG, elevated CRP (119mg/L) and troponin T (445ng/L). An echocardiogram showed preserved left ventricular systolic function and an MRI confirmed acute myopericarditis. Colchicine therapy was initiated but discontinued after six weeks due to liver function test abnormalities, following which the patient made a full recovery. This case emphasizes viral-triggered pericarditis's presentation, stressing early diagnosis and manage-

ment. Despite colchicine's temporary liver impact, prompt treatment resulted in full recovery, highlighting early intervention's effectiveness in avoiding complications. The authors concluded that this case illustrates the critical role of prompt diagnosis and careful management in achieving favorable patient outcomes.

# The Crucial Role of Pneumococcal Vaccination in Hajj Pilgrimage: Advocating for Compulsory Policy Changes

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## Abstract

The annual Hajj pilgrimage to Mecca brings together millions of individuals from diverse geographic regions, presenting significant public health challenges, particularly concerning the transmission of infectious diseases. This article highlights the critical importance of pneumococcal vaccination as a preventive measure during Hajj. Given the heightened risk of respiratory infections in such a densely populated and international gathering, the authors advocate for making pneumococcal vaccination compulsory for all pilgrims. The article discusses the public health benefits of widespread vaccination, including the reduction in cases of pneumonia, meningitis, and sepsis caused by *Streptococcus pneumoniae*. It also examines potential barriers to

implementing compulsory vaccination policies, such as logistical challenges, vaccine hesitancy, and the need for culturally sensitive approaches. The authors emphasize the necessity of collaboration among health authorities, religious leaders, and pilgrims to ensure successful policy implementation and enhance health outcomes during the pilgrimage.

**Keywords:** Hajj pilgrimage, Pneumococcal Vaccination, policy changes



## Background

The annual Hajj pilgrimage, drawing millions to Mecca, poses a public health challenge. In the context of potential infectious disease spread, pneumococcal vaccination is crucial. This article stresses its importance, advocating for compulsory vaccination during Hajj. It explores public health benefits, potential barriers, and the necessity of collaboration among health authorities, religious leaders, and pilgrims(1).

The pneumococcal vaccine is a vaccine that provides protection against infections caused by the bacterium *Streptococcus pneumoniae*, commonly known as pneumococcus. This bacterium can cause a range of illnesses, including pneumonia, meningitis, and septicaemia (bloodstream infection)(1,2). Pneumococcal infections can be severe, especially in young children, older adults, and individuals with weakened immune systems.

There are two main types of pneumococcal vaccines:

### **Pneumococcal Conjugate Vaccine (PCV): (Infants and young children)**

It protects against the most common types of *Streptococcus pneumoniae* that cause severe diseases in children, such as pneumonia and meningitis.

Different formulations of PCV cover different sets of pneumococcal serotypes(3).

### **Pneumococcal Polysaccharide Vaccine (PPSV): (Adults and older individuals)**

It provides protection against a broader range of pneumococcal serotypes compared to PCV.

PPSV is often recommended for adults over the age of 65 and individuals with certain medical conditions that increase their risk of pneumococcal disease(3).

## Discussion

46 journal articles have been reviewed using Pub Med and Google scholar search exploring review on the importance and intake of pneumococcal vaccine before Hajj. Some of the studies aimed to discuss the effectiveness of the vaccine for preventing pneumococcal disease during Hajj season, and the cost effectiveness of taking the vaccine, while other studies focused on the awareness and percentage of people taking the vaccine before Hajj(4,6,7).

Those studies were conducted in Europe, USA, Canada, Malaysia, Australia and Saudi Arabia.

The majority of the studies indicated that a large percentage of pilgrimages were in fact not immunized against pneumococcal disease and the intake of the vaccine is sub-optimal in the majority of cases(8,9). In addition, a

large percentage of pilgrimages experienced symptoms or had to be hospitalized due to upper and lower respiratory tract infections during the Hajj season(10).

Compulsory pneumococcal vaccination not only protects individual pilgrims but also contributes to the concept of herd immunity. By increasing the proportion of immune individuals within the Hajj population, the overall transmission of pneumococcal bacteria is reduced, providing indirect protection to unvaccinated individuals, including local communities hosting returning pilgrims(11).

### **Factors contributing to the increased risk of pneumonia transmission:**

**Crowded Conditions:** Pilgrims from diverse geographical regions converge in Mecca, leading to overcrowded conditions in accommodation, transportation, and religious sites. The close proximity of individuals creates an environment conducive to the spread of respiratory pathogens, including those causing pneumonia. Pilgrims often share living quarters, such as tents or accommodation in close proximity, increasing the risk of exposure to respiratory droplets containing infectious agents(6,7,8).

**Viral and Bacterial Respiratory Infections:** Pneumonia can be caused by various pathogens, including viruses (such as influenza) and bacteria (including *Streptococcus pneumoniae*). The congregation of individuals facilitates the person-to-person transmission of these pathogens(3,5).

**Strenuous Activities and Fatigue:** Pilgrims may engage in physically demanding activities during the Hajj, leading to fatigue and potential compromise of the immune system. Fatigue can increase susceptibility to respiratory infections, including pneumonia(2,9).

**International Travel:** Pilgrims travel from different parts of the world, bringing with them various strains of respiratory pathogens. The mixing of diverse populations contributes to the potential for the introduction and spread of infectious diseases(1,2,3).

Preventive measures are implemented to minimize the spread of pneumonia and other respiratory infections during the Hajj season:

**Vaccination:** Health authorities often recommend vaccinations, including influenza and pneumococcal vaccines, to pilgrims before they embark on the Hajj journey. These vaccinations aim to reduce the risk of respiratory infections(7).

**Health Education:** Pilgrims receive health education on respiratory hygiene, the importance of handwashing, and other preventive measures. Awareness campaigns emphasize the early recognition of symptoms and prompt seeking of medical attention(2).

**Surveillance and Healthcare Facilities:** Surveillance systems are in place to monitor and respond to infectious disease outbreaks. Healthcare facilities are equipped to handle respiratory infections, and rapid response teams are deployed if needed(5).

**Crowd Management:** Efforts are made to manage crowds efficiently, with designated routes and measures in place to reduce congestion in key areas.

Despite these measures, the sheer scale of the Hajj pilgrimage poses ongoing challenges for public health officials. Continuous monitoring, preparedness, and international collaboration are essential to mitigate the risk of infectious disease transmission, including pneumonia, during the Hajj season(4).

### **Barriers to Implementing compulsory vaccination and Possible Solutions:**

Despite the evident benefits, implementing compulsory pneumococcal vaccination for Hajj pilgrims faces several challenges. These include logistical issues, vaccine hesitancy, and potential resistance from certain religious groups. Overcoming these barriers requires a multifaceted approach involving collaboration between public health authorities, religious leaders, and the Hajj organizing committee. Raising awareness about the public health benefits of pneumococcal vaccination and addressing misconceptions are crucial steps in fostering acceptance among pilgrims.

#### **1. Logistical Challenges:**

Implementing a compulsory pneumococcal vaccination policy requires a well-organized infrastructure for vaccine procurement, distribution, and administration. Logistical challenges, such as ensuring an adequate vaccine supply, establishing vaccination centers, and coordinating with healthcare providers, can impede the smooth execution of policy changes(6).

#### **2. Vaccine Hesitancy:**

Vaccine hesitancy, fueled by concerns about vaccine safety, efficacy, or religious beliefs, poses a significant barrier to policy change. Building trust in the safety and efficacy of pneumococcal vaccines is essential to overcome vaccine hesitancy and achieve high vaccination coverage(4,5).

#### **3. Cultural and Religious Sensitivities:**

The Hajj pilgrimage is deeply rooted in cultural and religious traditions. Introducing compulsory vaccination policies may face resistance from religious leaders or communities with concerns about the compatibility of vaccination with religious beliefs. Engaging in open and respectful dialogue with religious leaders, incorporating religious perspectives into educational materials, and involving religious institutions in the vaccination campaign are crucial steps in navigating these sensitivities(3).

#### **4. Lack of Awareness:**

Limited awareness about the importance of pneumococcal vaccination and its potential public health benefits may contribute to low acceptance rates among pilgrims. A comprehensive communication strategy that emphasizes the health advantages of vaccination, addresses misconceptions, and disseminates information

through multiple channels is essential to overcome this barrier(5,7).

#### **5. Ethical Considerations:**

There are ethical considerations related to the autonomy of individuals and their right to make informed decisions about their health. Mandating vaccines involves balancing public health objectives with individual rights(2).

#### **6. Evolving Public Health Strategies:**

Public health strategies and recommendations can evolve based on the changing epidemiological landscape, the availability of vaccines, and scientific advancements. Decision-makers continually assess the need for compulsory vaccination based on these factors(8,11).

#### **7. Communication Gaps:**

Inadequate communication strategies by health authorities and Hajj organizers may contribute to a lack of awareness or understanding of vaccination recommendations. Effective communication tailored to the cultural and linguistic diversity of pilgrims is essential(11).

#### **8. Vaccine Availability:**

Limited availability of vaccines or challenges in procuring an adequate supply could affect the feasibility of widespread pneumococcal vaccination. Therefore, global collaboration is needed(6).

#### **9. Global Health Collaboration:**

Decisions about vaccination policies for international events like Hajj often involve collaboration between health authorities of different countries, international health organizations, and religious leaders. Harmonizing recommendations ensures a unified approach to health measures(1,4).

#### **10. Cost-Effectiveness Analysis and economic factors**

Pneumococcal vaccination before Hajj offers individual protection against pneumonia, meningitis, and septicemia caused by *S. pneumoniae*. By preventing these illnesses, pilgrims are spared the financial burden of medical consultations, hospitalizations, and potential long-term complications. The cost of vaccinating an individual must be weighed against the substantial economic impact of treating pneumococcal infections, making pre-Hajj vaccination a prudent investment in personal health(7,8,10).

The societal savings accrued from preventing the spread of infectious diseases during and after Hajj underscore the cost-effectiveness of implementing a comprehensive vaccination strategy.

In addition to healthcare savings, pneumococcal vaccination positively influences productivity. A vaccinated population is less susceptible to illness-related absenteeism, enhancing workforce productivity. The economic impact extends to sectors beyond healthcare, reinforcing the cost-effectiveness of a proactive vaccination approach.

While the cost-effectiveness of pneumococcal vaccination is evident, challenges such as vaccine procurement, distribution logistics, and potential vaccine hesitancy must be addressed. Collaborative efforts between health authorities, vaccine manufacturers, and religious leaders are essential to overcome these barriers and ensure optimal cost-effectiveness(4,6,9).



## Conclusion

The annual Hajj pilgrimage presents a unique and challenging public health scenario, with the potential for the rapid spread of infectious diseases. Pneumococcal vaccination emerges as a key preventive measure to mitigate the impact of respiratory infections during and after the pilgrimage. We are advocating for compulsory policy changes to make pneumococcal vaccination a prerequisite for all pilgrims which is essential in ensuring optimal public health outcomes. More studies are needed to evaluate the importance of pneumococcal vaccine and policies need to be reviewed for possible compulsory vaccinations for Hajj in the future.

The collaboration between health authorities, religious leaders, and the pilgrim community is pivotal in addressing potential barriers to implementation. By prioritizing the health and well-being of pilgrims, as well as the broader communities they interact with, compulsory pneumococcal vaccination stands as a critical step towards enhancing the overall health security of the Hajj pilgrimage.

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Data sharing is not applicable as no new data were generated or analysed during this study

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All Authors wrote the manuscript equally

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# What are the benefits of fasting and of Ramadan?

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## Abstract

There has been increased popularity of fasting as a lifestyle choice and a way of losing weight. Overall, fasting results in significant health benefits. Fasting during Ramadan (i.e. religious fasting) leads to additional benefits.

**Keywords:** Fasting, Ramadan

## Introduction

Obesity is on the rise. In the UK 38% of people are overweight and 26% are obese(i). Obesity is defined as a Body Mass Index (BMI) of 30 or above. Overweight is a BMI between 25 and 30. In South-Asians the criteria is stricter with values as low as 23.9 for being obese and 19.2 for being overweight. This means this group are also more likely to get diabetes as there is a direct correlation between an abnormal BMI and the risk of developing metabolic derangements such as type 2 diabetes(ii).

Fasting usually pertains to the restriction of the intake of solid foods, and has been undertaken in various forms throughout the world over time.

## Ramadan

The month of Ramadan is the ninth month of the Islamic calendar and is observed by millions of Muslims around the globe. Although the predominant act of worship in the month is that of fasting, Muslims undertake various other acts of worship throughout this month, including extra prayers and increase in charity.

In Islam, Muslims have been ordained to fast in the month of Ramadan. This is abstaining from food and drink in the daylight hours. Fasting is from the pre-dawn until sundown and in northern hemispheres can be around 18 hours in the summer. The purpose of fasting is to become more conscious of God. This is known as taqwa. In the Quran, Allah says “O you who believe, the fasts have been enjoined upon you as they were enjoined upon those before you, so that you may have taqwa”(iii). There is no equivalent English word for taqwa but it means a state of consciousness where the presence of the Creator is constantly felt.

There are other aspects of Ramadan to consider and how they may impact health. The first one is that in Ramadan the Muslim community tends to be more sociable. There is a common practice to invite friends and family to open the fast and eat together (the opening of the fast is called iftar). Some Muslim communities will open their doors to all faith groups and have community iftars which are often free to enable community cohesion and build upon interfaith dialogues.

The benefits of a good social network have been well documented. There is evidence to show that social support can improve physical health including improved outcomes in cancer sufferers(iv). Conversely, many studies have suggested that loneliness can have a negative impact on health and well-being (v,vi).

Having someone to call on you in ill health can mean a great deal when you're not feeling well. Interestingly, this is something that is actively encouraged in the Muslim faith. There is a saying of the Prophet (hadith) on this: “When a Muslim visits a sick Muslim at dawn, seventy thousand

angels keep on praying for him till dusk. If he visits him in the evening, seventy thousand angels keep on praying for him till the morning; and he will have (his share of) reaped fruits in Jannah”(vii).

Helping others whether that be financially or providing support to others, are strongly emphasized acts of worship in Islam and Muslims believe that all good actions are rewarded more in the month of Ramadan.

A recent study has shown that volunteering can improve one's immunity.

Volunteering and being charitable is known to have an impact on the community but has also been found to have positive mental and physical effects on the person(viii).

Not only has volunteering been linked to reduced functional decline, it has also been shown to reduce the risk of hypertension, cardiovascular disease and mortality(ix).

Several mechanisms have been hypothesized as to the reason behind this, including the impact of having a purpose for life, and increased life satisfaction.

### Intermittent fasting

Intermittent fasting (IF) is a way of losing weight with additional benefits that has become increasingly popular. We will look at the evidence to see if it actually works or if it is just the latest craze.

There are different types of IF. The main underlying concept is fasting or time-restricted feeding. This can be done with a fasting and eating window. The times can vary and are flexible. For example, 18:6 involves fasting for 18 hours a day and having an eating window of 6 hours. Most of the fasting window is during the night time. During the fasting window only water, black tea or coffee can be consumed. This is wet fasting and different from the fasting in Ramadan when nothing can enter the mouth, not even water.

Some people will gradually progress from 18:6 to one meal a day (OMAD) which means only consuming one meal in 24 hours.

Extended fasting (EF) is more intense with 36, 48, 60 or 72 hours of fasting.

With this type of fasting there is no calorie counting.

5:2 is another way of fasting whereby during two days out of 7, calories are restricted to 500 in 24 hours. These are spread out throughout the day so there is no eating or fasting window.

Fasting in the religion of Islam is not restricted to Ramadan and it was a practice of the Prophet to fast every Monday and Thursdays, which many Muslims now adopt. This has some similarities to the 5:2 diet.

## Fasting

There are many perceived benefits of fasting. It allows your gut to rest, improves concentration, reduces inflammation and can lead to better sleep(x, xi).

It can also promote autophagy whereby the body removes damaged cells. There have been claims that this can reduce the chances of getting cancer although more research is needed on this(xii).

The principle behind how IF can lead to weight loss is that overall less calories are consumed. In addition, during the fasting period, fat reserves are used. This effect is obviously exaggerated the longer the fasts. Also, if healthy foods are consumed in the eating window this will have more benefits and lead to increased weight loss. Similarly, the higher the BMI the more initial weight loss there will be although studies have found that IF has this benefit and others even in those who have a normal BMI(xiii).

Studies have shown that diets such as IF which involve restricting calories to a very low number don't lead to long term weight loss as they are not sustainable(xiv).

Also, fasting prevents insulin spikes so can reverse pre diabetes and reduce the risk of developing type two diabetes(xv).

Fasting has been shown to improve low-density lipoprotein cholesterol. The depletion of glycogen in hepatocytes means that lipids are utilized for energy production, hence fasting reduces blood lipid levels(xii).

Some studies have found that fasting can have a negative impact on mood, cause irritability and increase anger symptoms(xvi). However, there have been a few studies which suggest that fasting could also improve mood. The proposed difference could be in fact related to the reason for fasting, as religious fasting has been found to have a positive impact on mood(xvii). Furthermore, fasting has been suggested as a form of mood enhancer for those with chronic pain(xviii).

## Conclusion

Dietary fasting has increased in popularity for weight loss over the years. Many types of fasting have been advocated including alternate day fasting, and IF in which there is a time restricted calorie intake.

The act of fasting has been studied extensively with many medical benefits including weight loss and improved glycemic control. Fasting carried out for religious reasons results in additional benefits.

## Abbreviations

BMI: Body Mass Index  
IF: Intermittent Fasting  
OMAD: One Meal A Day  
EF: Extended Fasting

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# Artificial Intelligence in Nursing Education

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## Abstract

This study uses a quantitative research design and regression analysis to examine the impact of artificial intelligence (AI) integration on nursing students' attitudes and academic performance. A sample of 300 nursing students was surveyed to identify key factors influencing their acceptance and use of AI technology in their education. Results revealed that technological proficiency and positive attitudes toward AI significantly predicted improved academic performance using AI. These findings have significant practical implications for curriculum development in nursing education, emphasizing the importance of integrating AI and enhancing students' technological skills.

**Keywords:** Artificial Intelligence, Nursing Education, Technological Proficiency, Academic Performance, Regression Analysis



## Introduction

### Background and Rationale

Artificial intelligence (AI) is increasingly being recognized as a transformative force in healthcare education, particularly in the training of future nurses. AI tools can provide personalized learning experiences, support decision-making through advanced simulations, and enhance clinical training by offering real-time feedback (Smith et al., 2023). As AI becomes more prevalent in nursing education, there is a pressing need to understand how nursing students perceive and interact with these technologies, making our study particularly relevant (Chen et al., 2022).

However, the adoption of AI in nursing education is challenging. Students' attitudes toward technology, their technological proficiency, and their experiences with AI can all influence the effectiveness of AI integration in the curriculum (Gaur et al., 2021). While some studies have explored the potential of AI in nursing education, few have investigated the technological proficiency and attitudes toward AI to improve academic performance using AI, particularly concerning their academic performance (Johnson et al., 2020).

Despite the growing interest in AI's role in nursing education, more empirical research is needed on the factors influencing nursing students' acceptance of AI and the impact of these factors on their academic performance. This study aims to fill this gap by exploring the relationships between nursing students' technological proficiency, attitudes toward AI, and academic performance.

### Research Question

1. How does AI integration affect nursing students' academic performance?

## Methods

### Study Design

This study employed a cross-sectional, quantitative design to investigate the relationships between technological proficiency, attitudes toward AI, and academic performance among nursing students. Data were collected using a structured survey, and multiple regression analysis was conducted to examine the predictive relationships among the variables.

### Sample and Sampling Procedure

The sample comprised 300 nursing students enrolled in undergraduate nursing programs at three universities. A random sampling technique was used to ensure that the sample was representative of the broader nursing student population. Inclusion criteria included current enrollment in a nursing program, willingness to participate, and consent to complete the survey.

### Instruments

**1. Demographic Questionnaire:** This included age, gender, year of study, prior experience with technology, and prior exposure to AI.

**2. AI Attitudes Scale (AIA):** A 20-item scale was used to measure nursing students' attitudes toward AI in education. The scale covered dimensions included perceived usefulness, ease of use, and overall acceptance of AI (Cronbach's alpha = .85).

**3. Technological Proficiency Scale (TPS):** A 15-item self-report measure assessed students' skills and comfort levels with various forms of technology, including computers, mobile devices, and educational software (Cronbach's alpha = .88).

**4. Academic Performance Scale (APS):** This scale measured students' academic performance, focusing on GPA, engagement in coursework, and participation in clinical simulations (Cronbach's alpha = .82).

### Data Collection

Data collection was conducted over two months. Surveys were distributed electronically via the university's email system, with reminders sent to non-respondents after two weeks. Participation was voluntary, and students were informed of the study's purpose and assured of their anonymity and confidentiality.

### Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics were calculated to summarize the demographic characteristics of the sample. Multiple regression analysis was then used to explore the relationships between technological proficiency, attitudes toward AI, and academic performance. The level of statistical significance was set at  $p < .05$ .

## Results

### Demographic Characteristics

The study sample consisted of 300 nursing students, of whom 225 (75%) were female and 75 (25%) were male. The mean age of participants was 22.5 years (SD = 3.4), with the majority of students (45%) in their third year of study. Forty percent of the students reported prior experience with AI technology.

**Table 1. Demographic Characteristics of the Sample**

Variable	N	%
<b>Gender</b>		
Male	75	25%
Female	225	75%
<b>Age</b>		
18-21	140	46.7%
22-25	120	40.0%
+26	40	13.3%
<b>Year of Study</b>		
1st	50	16.7%
2nd	115	38.3%
3rd	135	45.0%
<b>Prior Experience with AI</b>		
yes	120	40%
No	180	60%

### Regression Analysis

The regression analysis showed that both technological proficiency ( $\beta = 0.35$ ,  $p < .001$ ) and positive attitudes toward AI ( $\beta = 0.42$ ,  $p < .001$ ) were significant predictors of academic performance using AI. The overall model was statistically significant,  $F(2, 297) = 98.76$ ,  $p < .001$ , and explained 50% of the variance in academic performance ( $R^2 = .50$ ).

**Table 2. Regression Analysis Summary**

Predictor	B	SE B	$\beta$	p
Technological Proficiency	0.25	0.05	0.35	< .001
Attitudes toward AI	0.30	0.04	0.42	< .001

### Subgroup Analysis

An additional subgroup analysis was conducted to examine whether the relationships between technological proficiency, attitudes toward AI, and academic performance differed by year of study. The analysis revealed that third-year students showed a stronger relationship between attitudes toward AI and academic performance using AI ( $\beta = 0.47$ ,  $p < .001$ ) compared to first- and second-year students.

**Table 3. Regression Analysis by Year of Study**

Year of Study	Technological Proficiency ( $\beta$ )	Attitudes toward AI ( $\beta$ )	$R^2$	p
1st Year	0.31	0.29	0.45	< .001
2nd Year	0.34	0.35	0.48	< .001
3rd Year	0.35	0.47	0.55	< .001
4thYear	0.31	0.29	0.45	< .001

## Discussion

### Interpretation of Findings

The findings from this study support the hypotheses that technological proficiency and positive attitudes toward AI are significant predictors of academic performance using AI among nursing students. These results are consistent with previous research suggesting that students who are more technologically proficient and hold favorable views of AI are more likely to engage effectively with AI-driven educational tools, leading to better academic outcomes (Smith et al., 2023; Gaur et al., 2021).

The stronger relationship between attitudes toward AI and academic performance among third-year students may reflect their greater exposure to clinical environments where AI applications are more prevalent. This exposure may enhance their understanding of AI's relevance and usefulness, positively influencing their academic performance (Johnson et al., 2020).

### Implications for Nursing Education

These findings have important implications for nursing education. Educators should consider incorporating AI-focused training into the curriculum to enhance students' technological proficiency and to foster positive attitudes toward AI. Such initiatives could include workshops, simulations, and hands-on experiences with AI tools used in clinical practice (Chen et al., 2022).

Furthermore, the curriculum should be designed to gradually introduce AI concepts in the early years of study, with more advanced applications being integrated as students progress. This approach could help build confidence and competence in using AI technologies, ultimately leading to better academic and professional outcomes (Smith et al., 2023).

### Limitations

This study has several limitations. First, the cross-sectional design limits the ability to draw causal inferences. Longitudinal studies are needed to explore how attitudes toward AI and technological proficiency evolve and how these changes impact academic performance. Second, self-reported measures may introduce response bias, as students might overestimate their proficiency or attitude levels. Future studies should consider using objective assessments of technological skills and AI engagement.

### Future Research

Future research should explore the long-term effects of AI integration in nursing education on students' academic and professional development. Additionally, qualitative research could provide deeper insights into students' experiences with AI, including the challenges they face and the strategies they use to overcome them. Understanding these aspects could inform the development of more effective AI training programs in nursing education.

## Conclusion

This study contributes to the growing literature on AI in nursing education by identifying key factors influencing students' acceptance and use of AI. The findings underscore the importance of technological proficiency and positive attitudes toward AI in enhancing academic performance using AI. As AI continues to evolve, nursing educators must proactively integrate these technologies into the curriculum to prepare students for the future of healthcare.

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# Review of Physical and Psychological Impacts of Cancer on Children and Strategies to Improve it

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## Abstract

**Purpose:** Children with cancer experience physical and emotional health consequences which influence their body image and self-confidence, and decrease their physical, mental and social functions. The current study will highlight precise evaluation of physical and psychological impacts of cancer among children that necessary to guarantee excellent care and efficient therapy and to find best ways to decrease these impacts.

**Methods:** The literature search revealed 1200 topics for initial investigating. After reviewing the topics for their overall topics related to physical and psychological impacts of cancer on children and Adolescents and Strategies to decrease these effects, due to exclusion criteria remained 20 studies for literature review.

**Results:** The results showed that childhood cancer leads to physical and psychological negative impacts on children such as pain, fatigue, social isolation, deterioration of self-concept, body image disturbance, nausea, discomfort, anxiety and stress and to reduce these effects some strategies suggested and tested such as hospital clowns, play, encourage kids' participation in healthcare, social therapy, massage therapy, animal-assisted intervention, mandala drawing, the home-based multimodal symptom-management program cognitive-behavioral therapy and problem-solving skills training.

**Conclusion:** Healthcare professionals and their families must provide psychological therapies and physical support to children diagnosed with cancer in order to improve their quality of life and lessen the negative consequences of the disease and treatment. Therefore, need to further studies to establish these strategies in line with progress and development in health care services.

**Key words:** physical and psychological effects, cancer, children



## Introduction

Childhood cancer is a major cause of morbidity and mortality. Globally, cancer is one of the most severe health illnesses among children and adolescents. Every year approximately 151,435 cases with cancer are diagnosed that lead to physical and psychological impacts on children and adolescents (Cancer Statistics Center, 2020 & Schüz, J.; Roman, E, 2021). Furthermore, previous data from the World Health Organization showed approximately 400,000 children and adolescents aged 0–19 are diagnosed with cancer annually (WHO, 2021). A young population with longer life expectancies and a recognized rising cancer burden both locally and globally, pose challenges to providing the finest healthcare.

Locally, the Kingdom of Saudi Arabia has seen an increase in the incidence of cancer over time (Chaudhri, E., Fathi, W., Hussain, F., & Hashmi, S. K., 2020). This may be due to improvements in diagnostic techniques, medical technology, and an effective system for referring patients to reputable tertiary hospitals and oncology-specific treatment facilities located in the country's major cities for further testing and treatment (Chaudhri, E., Fathi, W., Hussain, F., & Hashmi, S. K., 2020). Within this demographic, globally, acute lymphoblastic leukemia is the most common type of childhood cancer. It accounts for approximately 19 percent of all pediatric cancers (WHO, 2021), constituting 34.6 percent of all cases in Saudi Arabia (Ministry of Health, 2020). Children with cancer face many challenges regarding diagnosis and treatment that can affect their lives. Children experience physical and emotional health consequences which influence body image and self-confidence, and decrease their physical, mental and social functions. Moreover, the parents and siblings are profoundly affected psychologically, physiologically, socially, and financially (Lewandowska, A at et al., 2021).

Some studies have been conducted to assess physical and psychological impacts of cancer on children and their parents. A study was done by Lewandowska, A at et al., (2021) to evaluate issues that faced children and parents during treatment and hospitalization and recognized the requirements from their experience. As a result of this study, the authors showed that 82% of children report having unpleasant feelings with the illness overall; the most common ones are anger (33%), depression (58%) and fear (61%). Furthermore, patients most frequently cited isolation as a factor that negatively impacted their wellbeing (76%).

Additionally, the shock of the child and families from identifying the medical diagnosis, the process of diagnostic tests, the course of therapy, recurrence of admission to the hospital, and the health care organization environment are factors that interfere with mental and physical functions, low self-esteem and negatively impact on body image (H.J. Hsiao et al., 2019 & M. Oud et al., 2019). According to Miller et al. (2011), physical side effects such as

nausea, discomfort, and fatigue are frequently linked to chemotherapy and can affect patient compliance with treatment and recovery. However, children with cancer may experience less pain, anxiety, and depression with cognitive-behavioral therapy. It has the potential to lessen behavioral discomfort as well. More research is required on these components of functioning, as there has been insufficient study on them despite the large effects on stress, anger, and self-efficacy. Because the results are based on a variety of participants and interventions, it is important to carry out carefully planned intervention studies that involve cancer survivors (Melesse, T. G., Chau, J. P. C., & Nan, M. A., 2022). In addition, Arriaga, P., Melo, A.S. & Caires, S. (2020) conducted a study to investigate the impact of Hospital Clowns (HCs) on the physical and emotional responses of pediatric patients during ambulatory chemotherapy. HCs are professional artists who work to foster positive relationships through play and humor with patients, caregivers, and medical staff in order to promote a happy environment at the hospital (Spitzer 2006). HCs are one of the numerous complementary non-pharmacological approaches such as play, that appear to encourage kids' participation in healthcare (Stenman et al. 2019). Diversion, visualization, and music therapy are also suggested to be helpful coping mechanisms for kids facing more invasive and painful cancer treatments (Landier and Tse 2010; Thrane 2013). Hospital Clowns (HCs) employ a number of these strategies in concert with one another with the primary objective of improving the wellbeing of everyone they come into contact with while visiting patients. The results of this study demonstrated the value of HCs as supportive care agents for children, as their short-term effects during ambulatory chemotherapy appear to improve the health of young patients (Arriaga, P., Melo, A.S. & Caires, S., 2020). An evidence-based clinical practice guideline (CPG) done by Christen et al. 2020 showed increase in the proportion of children, adolescents and young adult cancer survivors, suffering from cancer related fatigue, even years after the end of treatment.

A local study by Al Thibani & Moud, (2024), aimed to assess the anxiety levels of children with cancer and their parents following admission to the Military Hospital in Riyadh City. According to this study, parents of cancer patients as well as their children are suffering from moderate to severe anxiety. It is crucial to give careful thought to the psychological health of cancer patients and their families; it is not a subject to be disregarded (Al Thibani & Moud, 2024).

One study showed children and adolescents with cancer may experience pain, anxiety, or depression, which presents a significant problem for health care providers (Rodriguez, 2020). In recent years, a number of studies have been published that highlight the benefits of technology for the management of symptoms (Rodriguez, 2020). It is crucial to take this research into account in order to lessen the detrimental effects on this population's quality of life (Rodriguez, 2020). In order to better understand the advantages of emerging technologies

for treating pain, anxiety, and depression in children and adolescents with cancer, this study examined the evidence that was currently available (Rodriguez, 2020). Six electronic databases were used in a systematic search to find studies that focused on pain, anxiety, and depression and included technological interventions (Rodriguez, 2020). The studies were published between 2008 and 2018 and included cancer patients aged 0 to 18. Only five of the 1261 identified studies satisfied the inclusion requirements for this systematic review (Rodriguez, 2020). Furthermore, only two studies that used robots to provide entertainment and social therapy saw notable gains. In three studies, the usage of virtual reality, a smartphone application, and a videogame produced positive effects on pain and anxiety (Rodriguez, 2020).

However, all previous studies had limited attempts made to evaluate the issues in the biopsychosocial domain of stresses and needs among children and adolescents receiving cancer treatment. Furthermore, a small amount of research discussed the methods and strategies to decrease the consequences of childhood cancer. (Lewandowska, et al., 2021).

Therefore, this literature review will highlight precise evaluation of physical and psychological impacts of cancer among children and their parents that are necessary to guarantee excellent care and efficient therapy and to find the best ways to decrease the negative impacts.

## Method

The literature review method was conducted in this research. Numerous articles were defined through searches of four electronic databases: CINAHL, Google Scholar, PubMed, and Web of Science. Key words during the search process included physical impact of cancer, psychological effects of cancer, cancer-related fatigue, childhood cancer, quality of life with cancer, cancer-related psychosocial challenges.

The most used key words in the health care literature was childhood cancer, therefore, these terms were used during the search in databases as the key terms.

Due to the presence of inclusion and exclusion criteria such as eligible research, the majority of earlier studies were included. These studies: 1) were original, 2) were published in English, 3) included children diagnosed with cancer between birth and age 21, 5) described individuals who had survived cancer at any age who were at least three years post-diagnosis and/or one year post-therapy completion, and 6) included a sample size greater than twenty to improve generability. Research with a broad range of ages and/or times between diagnosis and treatment were only kept if the mean age and/or time interval satisfied the previously described requirements, organizations, or included some specific diseases.

The literature search revealed 1200 topics for initial investigating. After reviewing the topics related to our research and discarding unrelated topics and repeated titles, 60 topics remained for literature review. Furthermore, 40 studies were excluded from research because they did not align with inclusion criteria in our research. Also due to exclusion criteria, two more studies were excluded during full-text reading, yielding 20 studies for integrative review.

The strength of each study was assessed based on the validity and reliability of a tool that was used to assess patient safety culture (Cummings et al., 2010; Lee & Scott, 2016).

## Results

Results were synthesized into four domains: (1) the prevalence of childhood cancer (2) physical effects of cancer on children; (3) psychological impact of cancer on children and their families; (4) protective factors against these impacts. Overall, cancer globally is one of the most severe health illnesses among children and adolescents. Every year approximately 151,435 cases with cancer are diagnosed (Cancer Statistics Center, 2020 & Schüz, J.; Roman, E, 2021). Additionally, most of the studies showed that childhood cancer leads to negative impacts physically and psychologically on children and their families, such as pain, fatigue, social isolation, deterioration of self-concept, body image disturbance, nausea, discomfort, anxiety and stress. Regarding reduction of these negative impacts, some strategies were suggested and tested to fight the impacts of childhood cancer such as hospital clowns, play, encouraging kids' participation in healthcare, social therapy, massage therapy, animal-assisted intervention, mandala drawing, the home-based multimodal symptom-management program cognitive-behavioral therapy and problem-solving skills training. Additionally, in three studies, the usage of virtual reality, a smartphone application, and a videogame produced positive effects on pain and anxiety.

## Discussion

The aim of this literature review was to highlight precise evaluation of physical and psychological impacts of cancer among children, adolescents and their parents that are necessary to guarantee excellent care and efficient therapy and to find best ways to decrease these impacts. These effects negatively impacted their activities of daily living, and impaired participants' schooling. The majority of the research showed childhood cancer primary effects on children and adolescents such as pain, sadness, or anxiety in addition to other secondary factors such as nausea, fear, stress, rage, self-efficacy, body image concerns and quality of life. However, patients who received virtual reality or video game therapies reported much less pain (Fazelniya, Najafi, Moafi & Talakoub, 2017 & Atzori et al., 2018). Additionally, the study's findings demonstrated the beneficial effects of computer games both during and four weeks following the intervention. In order to help patients adopt better health-related habits, it is imperative that this effective method of teaching self-care practices be used

in conjunction with patient interaction (Fazelniya, Najafi, Moafi & Talakoub, 2017). The structure and content of this interactive computer game, *The City of Dreams*, was notable for its consideration of the causes of anxiety and worry regarding the side effects of chemotherapy, the application of cognitive and behavioral theories of game design, the use of entertaining games and music in addition to role-playing, and the employment of graphic artists and professional engineers in programming (Fazelniya, Najafi, Moafi & Talakoub, 2017). The game's aforementioned features all helped to achieve the desired outcomes (Fazelniya, Najafi, Moafi & Talakoub, 2017). The researchers might educate and instruct children receiving chemotherapy in a bright and appealing virtual setting by using the computer game *The City of Dreams*. It improved their quality of life and decreased their worry and anxiety related to the negative effects of chemotherapy (Fazelniya, Najafi, Moafi & Talakoub, 2017). Furthermore, the technologies included the creation of smartphone software, computer and tablet gaming, virtual reality gear, and robots built especially to carry out pediatric oncology treatments (Atzori et al., 2018). The reduction of pain during invasive procedures was enabled by employing robots as a helpful diversion. Moreover, both the pain and quality of life improved with the use of a mobile application (Jibb, L. A et al., 2017). Therefore, professionals could be qualified to create this kind of technology for use in the treatment of young cancer patients. These apps should include music and visual components, combining symptom evaluation with practical treatments that encourage self-care and lower stress levels and symptom assessment with direct interventions that promote self-care and reduce stress levels (Do et al, 2018).

The physical and psychological side effects of chemotherapy, which can induce anxiety about beginning chemotherapy and even resistance or rejection of an anti-cancer treatment program, are factors that significantly impact the quality of life for children diagnosed with cancer (Baker, P. D., & Ellett, M. L. (2007). In order to improve patients' quality of life, it is crucial to enrol them in self-care programs and raise their level of awareness and function regarding current treatment regimens, such as chemotherapy (Fazelniya, Najafi, Moafi & Talakoub, 2017).

This study has some limitations which include the dearth of high-quality methodological studies and the lack of a meta-analysis. Most of the studies that have focused on childhood within the context of oncological disease are pilot studies of combined methodology, qualitative, or excessively reduced samples that did not yield relevant results. Some of the more recent studies that have introduced innovative technological interventions include the design of humanoid robots, mobile applications with child interfaces, and studies that are very recent. Despite their original nature, these publications were disqualified since the majority of them sought to reveal the technological development processes of their instruments rather than employing them as an intervention in a patient group to get

outcomes about our relevant variables. Therefore, there is urgent need to develop new studies to cover all factors that effect on children and adolescents with cancer physically and psychologically with enough sample size to enable generalizability of data. Furthermore, we need to do new meta-analysis to accurately measures for variables.

## Conclusion

Healthcare professionals and their families must provide psychological therapies and physical support to children and adolescents diagnosed with cancer in order to improve their quality of life and lessen the negative consequences of the disease and treatment. Therefore, there is need for further studies to establish these strategies in line with progress and development in health care services.

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# Reaction to aluminium in vaccines

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## Abstract

Some children can develop nodules at the site of their immunisations. These are granulomas due to a reaction with aluminium which is present in some vaccines. The nodules are benign and further investigations are not needed. The nodules can cause intense itching and treatment is aimed at treating this until the nodules resolve on their own.

**Keywords:** aluminium, vaccines, reactions



## Case Study

An 18-month-old female of Asian ethnicity born and living in the UK developed multiple palpable lumps under her skin at the site of her immunisations (outer aspects of both upper thigh). Her mother was unsure how long they had been there for. She came across them as she had noticed her scratching at those areas frequently. The skin there had become inflamed and excoriated. At times, for example when in the bath the skin would bleed due to scratching. On examination there were no other lumps elsewhere and on systems review the child had no other symptoms and no history of note. There was no family history of atopy.

The mother was concerned that the lumps were due to cancer. The doctor (a newly qualified General Practitioner (GP)) had never come across this presentation before and did not make any connection with her immunisations. The GP referred the child in to paediatrics and also did some research.

It transpired that the child had granulomas associated with aluminium which is used as an adjuvant in certain vaccines.

## Pathophysiology

The nodules occur as the body is reacting to the aluminium. This is an autoimmune reaction and a type of contact allergy. The body is trying to remove the aluminium.

It is a very rare reaction (incidence unknown) (i).

The nodules can appear quite late after the vaccinations (months or even years). Histology demonstrates aluminium crystals within the granulomas (ii).

## Diagnosis

This is often a clinical diagnosis. However, in the past in some cases the nodules were mistaken for tumours which led to unnecessary anxiety for parents, investigations and even surgery. When investigations have been done contact allergy has been verified by epicutaneous testing with aluminium chloride hexahydrate 2% and metallic aluminium.

## Immunisation schedule

In the UK, the immunisation schedule is detailed in Table 1 (iii).

Menitorix and MMRVaxPro do not contain aluminium. The vast majority of other immunisations in the primary schedule do (iv).

4 in 1 or 6 in 1 vaccinations do contain aluminium so include Infanrix Hexa, Infanrix/IPV + hib, Boostrix IPV and Revaxis.

If the symptoms have completely resolved well before the vaccination is due then it should be safe to give the

vaccine but administering aluminium based vaccines when the pruritis and irritation reaction is ongoing may worsen things (v).

## Risk factors for developing granulomas

These granulomas have been described since 1960 (vi) but their incidence has increased. In the 1990's, 745 out of 76,000 children in Sweden had this reaction (vii).

The risk for granulomas increases with the number of aluminium containing vaccine doses. Other factors which may increase the risk are prematurity and having siblings with granulomas(viii).

Overall little is known about why certain children develop this reaction and other don't and this is an area where more research is needed.

## Symptoms

Intense pruritis is the main symptom. This is often worse when the child is unwell with a cold or other infection or if warm/hot (for example in the bath) (ix). The itching causes small firm nodules which can be felt under the skin and when they appear cause more itching and a vicious cycle ensues. The itching also causes the nodules to become swollen so they are more prominent.

Skin changes such as eczema, hypertrichosis and hyperpigmentation are common(viii) and often alert parents to check the area and find the nodules.

In addition, most children then become sensitized against aluminium although fortunately this does seem to improve over time (x). Products that have also been reported to cause a reaction are aluminium containing deodorants, ear drops, antiseptics, sun protectors, tattooing pigments and the metal aluminium itself.

## Treatment Options

Fortunately, this condition is self-limiting. Treatment is aimed at alleviating the intense itching

Duoderm patches are very effective at protecting the skin and are waterproof and discreet too. Reasonably potent topical steroids such as mometasone can also help as well as liberal emollient use(xi). In particular, anti-itching preparations such as balneum plus can help soothe the itching. Anti-histamine use especially sedative varieties aren't recommended or practical as the itching is a constant long-term symptom.

Steroid injections can help but are often not carried out as it would need to be done under ultrasound guidance and under general anaesthetic in a child who is unable to stay still. For the same reason and also because of the benign nature and the risk of significant scarring, excision of the granulomas is not recommended.

Table 1

	<b>AGAINST</b>		
8 weeks old	Diphtheria, tetanus, pertussis, polio, Haemophilus influenzae type b (Hib) and hepatitis B	DTaP/IPV/Hib/HepB	Infanrix hexa or Vaxelis
	Meningococcal group B (MenB)	MenB	Bexsero
	Rotavirus gastroenteritis	Rotavirus	Rotarix
12 weeks old	Diphtheria, tetanus, pertussis, polio, Hib and hepatitis B	DTaP/IPV/Hib/HepB	Infanrix hexa or Vaxelis
	Pneumococcal	Pneumococcal conjugate vaccine (PCV)	Prevenar 13
	Rotavirus gastroenteritis	Rotavirus	Rotarix
16 weeks old	Diphtheria, tetanus, pertussis, polio, Hib and hepatitis B	DTaP/IPV/Hib/HepB	Infanrix hexa or Vaxelis
	MenB	MenB	Bexsero
1 year old	Hib and Meningococcal group C (MenC)	Hib/MenC	Menitorix
	Pneumococcal	PCV booster	Prevenar 13
	Measles, mumps and rubella (MMR)	MMR	MMRvaxPro or Priorix
	MenB	MenB booster	Bexsero
3 years 4 months old	Diphtheria, tetanus, pertussis and polio	DTaP/IPV	Boostrix IPV
	MMR	MMR	MMRvaxPro or Priorix
12 to 13 years old	Cancers and genital warts caused by specific human papillomavirus (HPV) types	HPV	Gardasil 9
14 years old	Tetanus, diphtheria and polio	Td/IPV	Revaxis
	Meningococcal groups A, C, W and Y	MenACWY	Nimenrix

## Prognosis

Aluminium granulomas are benign and self-limiting.

Most of these granulomas do resolve and once they disappear the itching also stops. However, the time this takes is extremely variable (0.5 to 12 years, median 3-4 years)(v).

It is important to avoid further aluminium containing vaccines especially if existing granulomas are still present as those will exacerbate them and can lead to formation of new granulomas. This may mean that certain vaccines in the schedule are missed. This doesn't often pose a huge risk to the child especially if booster doses are omitted due to the effects of herd immunity. Subsequent doses can also be postponed up to 6-12 months(v). It can be helpful to get individual advice from a paediatric immunologist as each child is different. Also, more studies are needed in this area.

## Conclusion

Most health care professional are unaware about aluminium associated granulomas. It is therefore important to educate those who see children, on this topic as it is easy to recognise once you know about them. As they are a benign and self-limiting condition it can significantly reduce anxiety in parents and avoid unnecessary investigations and interventions for the child. Symptomatic relief of the intense pruritis is the mainstay of treatment.

## Abbreviations

**GP:** General Practitioner  
**Hib:** Haemophilus influenzae type B  
**MenB:** Meningococcal group B  
**PCV:** Pneumococcal conjugate vaccine  
**MenC:** Meningococcal group C  
**MMR:** Measles, mumps and rubella  
**HPV:** Human papillomavirus

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# Gout- from a primary care perspective

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## Abstract

Gout is a type of inflammatory arthritis which can cause recurrent episodes of acute pain and joint inflammation.

Epidemiological studies show it is 2-6 folds more common in men than in women. It is caused by raised serum uric acid levels which, when gets deposited in joints and tissues can cause significant pain and morbidity. Untreated gout can cause permanent joint damage. Hyperuricemia can also cause urate nephropathy and renal stones. It is associated with other cardiovascular diseases.

Risk factors include male sex, obesity, genetics, purine rich food, alcohol, certain medications, chronic kidney disease, hypertension and diabetes mellitus.

Gout can present as rapid onset pain and swelling of any joint, predominantly of the first metatarsophalangeal joint. Tophi can present as painless, nodules on extensor surfaces of joints or other body parts.

Diagnosis is by identification of uric acid crystals in joint fluid aspirates.

Management involves modifying risk factors, treatment of acute attacks using non-steroidal anti-inflammatory drugs, colchicine, steroids and long-term prophylaxis medications. Prophylaxis is based on treat to target approach and involves urate lowering drugs like allopurinol, febuxostat. There are other newer drugs available in secondary care.

Despite the availability of effective prophylactic medications to lower uric acid levels, the prevalence of gout is increasing. It stresses the importance of patient education as well as initiating urate lowering drugs in patients presenting with recurrent attacks and those with other co-morbid risk factors.

The aim of this article is to provide an overview of gout and its management in primary care. We, as authors also highlight the importance of patient education and empowerment in better understanding of their disease and adherence to long term management. We also strongly advocate starting urate lowering therapy for at risk patients by primary care physicians. This will not only prevent future gout attacks, but also reduces long term complications like joint damage, tophi, renal stones, renal impairment and reduce the risks of cardiovascular disease.

**Key words:** Gout, inflammatory arthritis, hyperuricemia, urate lowering therapy, prophylaxis



## Introduction

Gout has been referred to as “disease of kings” in the past, because of their high consumption of purine rich food and high consumption of alcohol (1).

Gout is a type of inflammatory arthritis caused by deposition of monosodium urate crystals. It is a chronic condition usually caused by elevated serum uric acid levels (2). Although hyperuricemia causes gout, not everyone with raised serum uric acid levels develop gout. The diagnosis is mainly by identifying uric acid crystals in the joint fluid aspirate. It usually presents as a rapid, onset severe pain and swelling of a joint, mainly the first metatarsophalangeal joint. Presence of tophi indicate longstanding untreated gout. It can also cause urate nephropathy and renal stones. Lifestyle modification along with urate lowering therapy to reduce serum urate levels below the target, is the mainstay of gout management (3).

Primary care physicians are very good at managing acute gout attacks. However, only one third of UK patients with gout, are started on urate lowering therapy, despite the availability of good prophylactic medications. This could be multifactorial. Patient education and understanding of the disease is key in effective management (4).

The aim of this article is to raise awareness among primary care physicians, on managing gout, focussing on prompt use of urate lowering therapies, thereby reducing future risks of gout flares and reducing cardiovascular morbidity and mortality.

## Epidemiology

Gout prevalence in the general population is 1-4%. It is 2-6 times more common in males than females. Premenopausal women are protected because of the uricosuric action of oestrogen. A UK general practice survey in 2012 showed the prevalence of Gout to be 2.49%, with a male to female ratio of 4.3:1. The incidence has since been increasing worldwide due to poor unhealthy dietary habits, sedentary lifestyle and Obesity etc. (3,5).

## Pathophysiology

Purines from dietary sources and endogenous synthesis (by liver and small intestine) are broken down to produce uric acid as its end product. Uric acid is primarily excreted through the kidneys (60-75%) and the rest through the GI tract (6). Xanthine oxidase is an enzyme that helps conversion of Purines to its end product uric acid. Xanthine oxidase inhibitors like Allopurinol and Febuxostat help prevent this conversion into uric acid. Figure 1 illustrates pathophysiology of gout. Although hyperuricemia causes urate crystal formation, there are other local factors that come into play like temperature, PH, synovial and cartilage factors. This explains why, not everyone with hyperuricemia develop gout (6). Gout is caused by either under excretion or over production of uric acid. Under

excretion contributes to 90% of cases of Gout, while only 10% of cases are due to over production. When uric acid levels reach above the threshold, it causes extracellular urate saturation and crystal formation in joints and tissues. These crystals activate inflammatory processes causing acute gouty arthritis. Over the years, chronic inflammation leads to destruction of the joints causing chronic gouty arthritis and tophi formation. Chronic hyperuricemia also leads to urate nephropathy and nephrolithiasis (3)

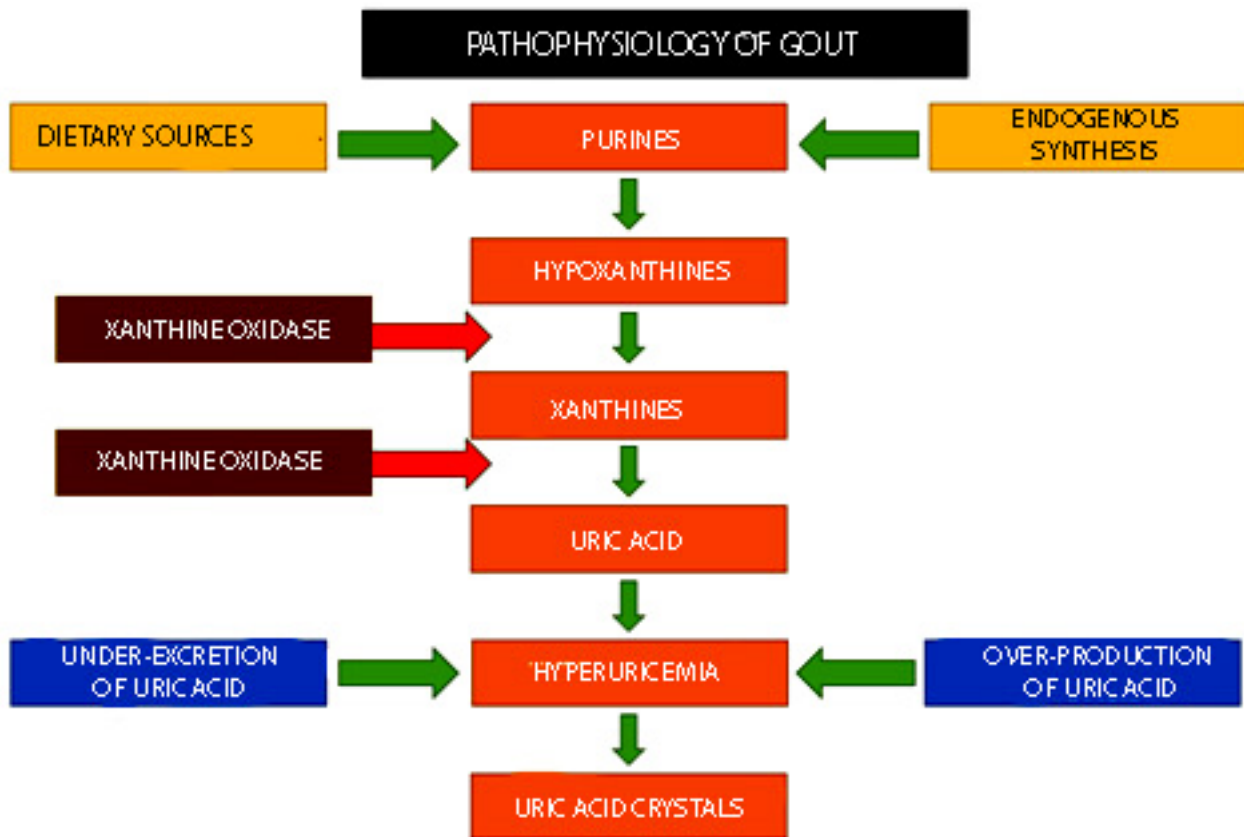
## Aetiology

Gout occurs due to a combination of factors including genetics, dietary and other lifestyle choices, other comorbidities, some of them are listed in table below (3,5).

Risk Factors include
HTN
CKD
Hyperlipidemia
Psoriasis
Obesity
Diabetes mellitus
Metabolic syndrome
Chemotherapy
Drugs: Diuretics ; low dose aspirin and cyclosporin



Figure 1



## Diagnosis

### Clinical features

Gout can present as an acute painful, swollen joint with redness that comes abruptly, usually overnight. The most affected joint is the first metatarsophalangeal joint, also called as Podagra. It accounts for 70% of first attacks. Other joints that can be affected are knee, midtarsal joints, wrists, ankles and joints of hands. On examination, the affected joint shows warmth, redness, swelling and tenderness. Tophi present as hard nodules on skin in and around joints (7).

American College of Rheumatology (ACR) Criteria for diagnosis of Gout (10) are:

- Finding of monosodium urate crystals in joint fluid or identified from tophi is diagnostic.
- Or 6 or more clinical features from the following:

- 1) More than 1 attack of acute arthritis
- 2) Maximum inflammation within 1 day
- 3) Monoarthritic attack, with redness observed over joint
- 4) First MTP joint swollen or painful
- 5) Unilateral first MTP joint attack
- 6) Unilateral tarsal joint attack
- 7) Tophus
- 8) Hyperuricemia
- 9) Asymmetrical swelling within a joint on Xray film
- 10) Subcortical cyst without erosions on Xray film
- 11) Joint culture negative for organisms during attack.

## Investigations

Serum urate levels are usually low during an acute attack. Hence, it is advisable to check serum urate levels 2-4 weeks after an acute attack.

Other blood tests like renal function, lipids, Hba1c, LFT may be ordered to screen other co-morbidities including metabolic syndrome.

The gold standard diagnosis of gout is by identification of uric acid crystals in joint fluid aspirate.

Plain Xray is still used mainly for imaging in gout. More recently there are more advanced imaging modalities like ultrasound, MRI, CT and dual energy CT. These can show early changes of joint damage and tophi. In future we may be able to rely on these advanced imaging methods rather than examining joint aspirates.

Another use of these advanced imaging might help us in objectively monitoring gout treatment response (8).



Erosive arthropathy in Gout of proximal phalanx Eggebeen, A.T., 2007. Gout: an update. American family physician, 76(6), pp.801-808 (9).

### Differential Diagnoses:

The acute gout attacks can mimic other conditions like septic arthritis, pseudogout and cellulitis.

Chronic tophaceous gout should be differentiated from rheumatoid arthritis, nodal osteoarthritis (3,5).

## Management of Gout

Management of gout involves nonpharmacological and pharmacological management.

### Nonpharmacological management:

This includes advice to patients on smoking cessation, alcohol reduction, adapting healthy dietary habits, exercise.

As dietary factors are well known cause of gout, diet and lifestyle modification forms an important aspect of managing gout.

### Dietary advice for patients: (10,11,12)

- Avoid high purine diet like red meat and seafoods like shellfish and organ meats like liver.
- Avoid high sugar or fructose containing drinks.
- Vegetables rich in purines like spinach, soybeans and mushrooms can be consumed.
- Patients should be encouraged to drink more than 2 Litres of water per day.-
- Increased dairy products intake is found to be protective against gout.
- Exercise, weight loss and reducing alcohol are all part of effective management, promoting healthy lifestyle and thereby preventing gout attacks in patients, as well as reduce the cardiovascular risks in patients.

### Pharmacological management:

This mainly involves two components

- a) Managing acute flares
- b) Reducing serum uric acid to levels below the target threshold to prevent future flare ups (13)

Acute gout flares typically present as sudden severe acute inflammatory joint pain, it also lasts for a short period. Starting anti inflammatory medications early on like non-steroidal inflammatory drugs will stop the inflammatory processes, alleviate pain and preserve joint function. Commonly used medications are Naproxen, Diclofenac and Indomethacin are prescribed at the maximum dose for the shortest possible duration (5,7).

Colchicine, due to its anti-inflammatory properties is also used to treat acute gout flares as well as given as prophylaxis while initiating Urate lowering therapies. It is prescribed at a dose of 500mcg given 2 to 4 times a day, with a maximum of 6mg per course. The common side effects include gastro-intestinal effects like nausea, vomiting and diarrhoea, which occurs in 5-10% of cases (5,14).

In cases where above medications are intolerant or contra-indicated, steroids- either systemic or intra-articular provide symptomatic relief during acute attacks (7). Prednisolone at a dose of 30-35mg per day for 3-5 days is recommended.

Hypertensive patients on loop or thiazide diuretics, who develop gout, should be switched to losartan or a calcium channel blocker (15).

### Prophylactic Medications in primary care:

Lack of patient knowledge about their disease, creates a barrier when initiating Urate lowering therapy. Patients see Gout as an acute disease with intermittent flares, rather than a chronic, progressive disease. Educating patients at diagnosis, discussing their risk factors, explaining that it is a lifelong condition and the role of medications in lowering their serum urate levels and thus preventing long term complications, will help patients in adherence to their treatment (7,16).

### When to offer Urate lowering therapy (ULT):

NICE recommends offering ULT using a treat to target approach, in those with multiple gout attacks, chronic kidney disease stages 3-5, those with tophi, on diuretics and those with chronic gouty arthritis (7).

2020 American College of Rheumatology guideline for the management of gout strongly recommends initiating ULT for those with more than 1 subcutaneous tophi, evidence of radiographic damage attributable to gout or more than or equal to 2 gout flares per year (17).

ULT should be initiated with a treat to target strategy, aiming for serum uric acid levels below 360 micromol/L or 6 mg/dL, but consider a lower target serum urate level of 300 micromol/L for those with gout, who have tophi or chronic gouty arthritis (7).

Initiating Urate lowering therapy can precipitate acute gout attacks. Hence it is recommended to use prophylaxis against these by using either NSAID's (along with PPI cover) or Colchicine cover for 3-6 months until serum urate target levels are reached. This will help patients' compliance in lifelong treatment (7,18,19).

NICE recommends Allopurinol and Febuxostat as first line prophylactic agents. These drugs should not be stopped during an acute attack (7).

### Allopurinol:

Allopurinol is a xanthine oxidase inhibitor-an enzyme involved in the production of uric acid. It is one of the first line prophylactic medications used in gout. It should be initiated at a dose of 100mg/day, with a gradual 50-100mg increments every 4 weeks, till target serum urate levels are reached. The usual dose is 100- 600mg, with a maximum dose of 900mg. It should be used with caution in those with renal impairment. In certain ethnic populations like Han Chinese, Thai and Korean, it is common to have HLA-B\*5801 allele. Such patients develop allopurinol hypersensitivity syndrome, steven johnson syndrome/toxic epidermal necrolysis, which can be fatal. Allopurinol should be avoided in such people (7,20).

**Febuxostat:**

Febuxostat is a non-purine xanthine oxidase inhibitor. It is recommended at a dose of 80mg once daily, slowly titrated up by 2-4 weeks to 120mg daily, until target serum urate levels are reached. It is not recommended in those with ischaemic heart disease and congestive cardiac failure. If hypersensitivity reactions occur, it should be stopped straight away (7,11).

Other medications like probenecid, sulfinpyrazone, pegloticase, lesinurad are available to use in secondary care.

**When to refer to secondary care:**

Most cases of gout are managed in primary care. However certain patients mentioned below, need secondary care referral: (7)

- a) When the diagnosis is uncertain
- b) When the patient is intolerant to the usual medications or does not respond to them.
- c) When treatment is contraindicated.
- d) In cases of CKD stages 3b to 5.
- e) When a patient has an organ transplant.

**Conclusion**

Gout is a common and well-studied type of inflammatory arthritis. We, as primary care physicians are best placed to manage gout, help patients better understand their disease. Accepting a chronic disease diagnosis and taking lifelong medications, can be daunting for patients. By educating and empowering patients on the relationship between their gout attacks and cardiovascular risks, we can help them adopt a healthy lifestyle and prevent further complications.

We advocate the importance of patient education by giving patients all the information they need to know about their disease at the time of diagnosis. We also recommend early initiation of urate lowering therapy among at risk patients by primary care physicians and maintaining a treat to target approach until target serum urate levels are reached. To help better compliance, it is advisable to start prophylaxis against acute gout flares while initiating ULT. It is imperative to utilise this opportunity to screen for all other cardiovascular diseases, to treat patients in a timely manner and prevent longer term complications. It is also advisable to check serum urate levels annually, to make sure targets are being met.

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# Cardiac Amyloidosis

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## Abstract

Amyloidosis is a multisystem disorder. Cardiac involvement causes restrictive cardiomyopathy. A 65-year-old gentleman presented with worsening shortness of breath. Investigations including echo and cardiac MRI showed cardiomyopathy consistent with amyloidosis. Cardiac involvement is related to poor prognosis and increased mortality.

**Keywords:** Cardiac Amyloidosis

## Case Report

A 65-year-old gentleman was admitted with worsening SOB and ongoing chest discomfort for the last 1 year. He presented with a 2-week history of worsening chest tightness on minimal exertion and had a recent episode of SOB at rest. There were associated pressure-like symptoms for weeks in the chest, which radiated to the right arm. Exercise tolerance was reduced to around 50 yards.

A coronary angiogram performed 2 years ago for similar symptoms showed 50% stenosis RCA and was managed medically.

Past medical history included hypercholesterolemia and ischaemic heart disease. He was an ex-smoker with a 10 pack year smoking history. He drank alcohol occasionally. The examination was unremarkable. Trop I was mildly raised 232 and 257. Electrocardiography showed normal sinus rhythm and left bundle branch block, low voltage QRS complexes, and old posterior Q waves. Echocardiography was performed which showed mild left ventricular hypertrophy, significant diastolic dysfunction and trivial regurgitation of all valves.

A repeat coronary angiogram showed moderate ostial disease in small vessels, and mild mid-vessel disease with muscle bridging in mid to distal segment.

He subsequently had a cardiac MRI, which showed significant left and right ventricular wall thickening (up to 17 and 19mm respectively) with moderate to severe systolic dysfunction on both sides. The delayed images following the administration of gadolinium were consistent with cardiomyopathy.

For protein electrophoresis, Lambda-free light chain bands were present in the serum and the urine. Urinary protein concentration was high with a value of 0.12(0.01g/l). Lambda was high to 1020(5.70-26.30 mg/l). Skeletal survey was negative and ultrasound abdomen showed no visceromegaly.

## Discussion

Amyloidosis refers to a collection of conditions in which abnormal protein folding results in insoluble fibril deposition in tissues. The different types of amyloidosis include light-chain, senile systemic (wild-type transthyretin), hereditary (mutant transthyretin), and secondary (AA) diseases.

Cardiac involvement is most common and most severe in AL amyloidosis but can occur in all types of systemic amyloidosis (5). Cardiac amyloidosis presents as a restrictive cardiomyopathy characterized by progressive diastolic and subsequently systolic biventricular dysfunction and arrhythmia (6). Myocardial ischemia can result from amyloid deposits within the microvasculature (7-8).

Syncope is common and a poor prognostic sign (9). It is typically exertional or postprandial as part of restrictive cardiomyopathy, sensitivity to intravascular fluid depletion from loop diuretics combined with autonomic neuropathy, or conduction tissue involvement (atrioventricular or Sinoatrial nodes) or ventricular arrhythmia (10-12). Other symptoms are fatigue, dizziness, dyspnoea, angina, pulmonary oedema, cardiac tamponade, pulmonary hypertension and death.

Laboratory investigations include NT-proBNP, serum and urine protein electrophoresis, serum and urine immunofixation, urine for proteinuria, Transthyretin protein (TTR) and genetic studies.

Echocardiogram shows increased muscle wall thickness, biventricular dysfunction and granular or sparkling appearance of the myocardium. A low voltage on the electrocardiography and increased septal and posterior left ventricle wall thickness on the echocardiogram are highly specific for cardiac amyloidosis in the setting of biopsy-proven systemic amyloidosis. Other electrocardiography features include conduction defects and arrhythmias. Atrial fibrillation and flutter are most common arrhythmias. Late gadolinium-enhanced (LGE) cardiovascular magnetic resonance imaging (CMRI) is useful in the evaluation of cardiac amyloidosis. Amyloid infiltration leads to the expansion of extracellular space that retains gadolinium, resulting in a signal enhancement in comparison with normal myocardium, which can be detected in the late washout phase during delayed enhanced imaging. Global subendocardial enhancement is the most common pattern (13-17).

Endomyocardial biopsy has been considered to be the gold standard for demonstrating cardiac amyloid deposition(18). Amyloid deposits show characteristic apple-green birefringence under polarized light when stained with Congo red. It also differentiates with other infiltrative causes (19-21).

Treatment is generally supportive with diuretics, beta-blockers and ACE inhibitors. Calcium channel blockers and digoxin are avoided due to risk of toxicity (22-24).

Pacemakers or implantable cardioverter defibrillators may not prevent sudden cardiac death due to electromechanical dissociation (25). Biventricular pacing may be beneficial as a pacing option to avoid decompensation of the stiffened ventricle as a result of induced dyssynchrony from right ventricular pacing (26).

Chemotherapy has been used in AL amyloidosis with a response rate of 60 per cent. Cardiac transplantation is not a good choice in patients with cardiac involvement because of increased mortality (27-33).

A 2016 Mayo Clinic study showed a median overall survival of 3.5 years in 23 patients (median age, 53 years) with AL who received orthotopic heart transplantation (34).

Seven patients who achieved a complete hematologic response to either chemotherapy or autologous stem cell transplantation had a median survival of 10.8 years (34).

## Conclusion

In summary, AL amyloidosis is a multisystem heterogeneous disorder with multiorgan involvement. Cardiac involvement is related to poor outcomes. Early intervention with symptomatic treatment and chemotherapy can be beneficial. A cardiac transplant is not a good choice due to increased mortality.

## Disclosure:

The authors report no conflicts of interest in this work

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# Relationship between Coping Strategies and Psychological Distress in Middle Eastern University and College Students: Structural Equation Modeling Analysis

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## Abstract

**Aim:** The purpose of this study was to describe the relationship between coping strategies and psychological distress (anxiety and depression) in Middle Eastern university and college students.

**Background:** The adjustment process of university and college students is characterized by new experiences associated with maturation as well as challenges imposed by academic responsibilities. Difficulty or inability to cope with various demands of the transition into emerging adulthood places them in a perilous position that increases the risk of psychological distress.

**Design:** This study was a cross-sectional study.

**Methods:** Data were obtained via a questionnaire completed by 251 health care students enrolled in an English-speaking college and a university. Psychological distress was measured with Hospital Anxiety and Depression Scale and coping strategies were measured with Brief COPE Inventory. Five subscales selected for this study were problem solving, social support, religious, self-blame, and denial coping strategies. The data were analyzed using structural equation models with anxiety and depression as outcome variables.

**Results:** The results revealed difference in the types of coping strategies linked to anxiety and depression. The five coping strategies explained 46% variance in anxiety, whereas only the use of self-blame and religious coping strategies explained 26% variance in depression.

**Conclusion:** The finding of the study highlight that interventions may need to focus on different types of coping strategies depending on the nature of students' psychological distress.

**Keywords:** Anxiety; Coping; Coping strategy; Depression; Psychological distress



## Introduction

The adjustment process of university and college students is characterized by experiences of heightened demands for academic success and the need for achieving psychological autonomy as well as facing responsibilities for their actions and needs. Difficulty or an inability to cope with such demands and obligations places them in a perilous position that increases the risk of psychological distress. Psychological distress is frequently used as an indicator for mental health and is defined as an emotional distress characterized by symptoms of anxiety and depression (Barlow & Durand, 2005).

## Background

Evidence suggests that the prevalence rate of psychological distress ranges from 10% to as high as 84% among Western university and college students (Garlow et al., 2008; Steptoe, Tsuda, Tanaka, & Wardle, 2007), and 22% to 52% among the students in the Middle East (Al-Busaidi et al., 2011; Amr et al., 2013; Bayati, Beigi, & Salehi, 2009; Bayram & Bilgel, 2008), which are both higher than the rate of 14% to 17% in the general population (Steptoe et al., 2007). Students with increased levels of psychological distress are at a greater risk of developing long-term mental illness, for which the onset manifests shortly before or during the typical university and college age (Kessler et al., 2005). A serious concern is that students who are experiencing increased levels of psychological distress are unlikely to seek assistance or intervention.

Psychological distress is influenced by the various coping strategies that individuals adopt to deal with the stressor. Coping is defined as cognitive and behavioral efforts people use to manage internal and external demands of circumstances that they consider stressful and which exceeds one's resources (Tamres, Janicki, & Helgeson, 2002). Based on the Transactional Model of stress and coping by Folkman and Lazarus, coping strategies are typically categorized into problem-focused and emotion-focused coping (Lazarus, 1993). Problem-focused coping refers to strategies used to alter the cause of the stressor (Julal, 2013). Emotion-focused coping refers to strategies used to alleviate negative feelings by reinterpreting the stressful situation (i.e., positive reframing), or by avoiding the stress-inducing circumstances (Gardner, Krageloh, & Henning, 2014). However, some authors have challenged the notion stating that classifying coping strategies predominantly into problem-focused and emotion-focused coping is too simple given the complexity involved in the ways people respond to stressors. The Brief COPE scale by Carver et al. (1989) allows an additional categorization of dysfunctional coping. Dysfunctional coping refers to negative emotion-focused strategies used to deal with internal distress, i.e., behavioral disengagement, avoidance, and substance use (Carver, 1997). Cooper, Katona and Livingston (2008) used the Brief COPE

to validate the categorization of three types of coping responses: 1) problem-focused, 2) emotion-focused, and 3) dysfunctional. Although university and college students typically use both problem-focused and emotion-focused coping strategies, a greater proportion of students who experience an increased level of anxiety or depression use dysfunctional coping strategies (Carnicer & Calderon, 2014; Lee, Dickson, Conley, & Holmbeck, 2014; Siu & Chang, 2011). In contrast, students who use more problem-focused coping strategies and target their efforts to change the source of stressor by using more problem solving (i.e., making plans) and less dysfunctional coping strategies experience a decreased negative affect and a greater sense of well-being (Park & Adler, 2003; Sasaki & Yamasaki, 2007).

Most of the research on coping reflects Western and European perspectives. Although few studies have examined types of coping strategies used by young adults in the Middle East, no studies to date have explored the impact of coping behaviors on psychological distress of Middle Eastern university and college students. Given the detrimental effects associated with psychological distress and its potential for symptoms persisting into adulthood, it is imperative the overlooked coping strategies used by the students in the Middle East be examined.

Therefore, the purpose of this research was to describe the relationships between coping strategies (problem-focused, emotion-focused, and dysfunction) and psychological distress (anxiety and depression) in university and college students living in Qatar. The examination of coping responses of participants in this study was guided by the theoretical perspective proposed by Carver (1997) and focused on the influence of three categories of coping strategies validated from previous research (Cooper, Katona, & Livingston, 2008; Petrinc, Mazanec, Burant, Hoeffler, & Daly, 2015).

## Methods

### 1. Study design

A quantitative survey was conducted following a cross-sectional design.

### 2. Study setting & sample

The study participants were 251 students enrolled in an English-speaking college and a university in Qatar. A cover letter describing the study was distributed to the Dean and all faculty members of each institution to introduce the research and to ask for their support with data collection. With permission to enter classrooms, students were visited in-person in their classrooms where the description of the study was provided. Students who agreed to participate in the research were requested to complete self-report questionnaires on paper. The inclusion criteria were: 18 years or older and attending university or college in Qatar; able to read and understand written English; and consent to participate in the study.

### 3. Measures

**Coping:** Coping strategies of study participants were assessed using the Brief COPE, which is an abbreviated version of the COPE Inventory. The Brief COPE consists of 28 items that encompasses 14 dimensions (subscales): self-distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self-blame. The response to each item is rated on a four-point Likert-type scale that ranges from 'I haven't been doing this at all' (1) to 'I have been doing this a lot' (4). Higher scores reflect a greater tendency to use the particular coping strategy. Cronbach's alpha reported in previous studies for each of the subscales ranges from below 0.60 to 0.87 (Tang et al., 2016). Test-retest reliability and construct validity have been established with studies of people with dementia and women with breast cancer. Five subscales, representing problem focused, emotion-focused, and dysfunctional coping strategies, were selected from the questionnaire for the purpose of this study: problem-solving, social support, religious coping, self-blame, and denial. The choice of subscales was informed by both theoretical perspectives and the findings of previous studies that have shown the association between the selected subscales of coping strategies and psychological distress. The function of problem focused coping is reflected in the subscale of problem-solving; emotion focused coping is reflected in social support and religious coping; and dysfunctional coping is reflected in self-blame and denial.

**Psychological distress:** Anxiety and depression aspects of psychological distress were measured with the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983). The HADS consists of 14 items in which seven items measure anxiety and the other seven items measure depression. The response to each item is rated on a four-point Likert-type scale that ranges from 0-3 and a sum of total score is calculated separately for anxiety and depression. Higher scores for each dimension indicate higher levels of anxiety or depression. The number of factors most commonly reported is a two-factor structure consisting of anxiety and depression. Cronbach's alpha varies from 0.68 to 0.93 for anxiety, and 0.67 to 0.90 for depression (Bjelland et al., 2022). The concurrent validity has been demonstrated with the General Health Questionnaire (GHQ-28), Beck Depression Inventory (BDI), and Spielberger State-Trait Anxiety Inventory (STAI) (Bjelland et al., 2022).

**Source of stress and demographic data:** The participants were asked to choose as many relevant sources of stressor as applicable from the following options: academic, role transition, family, personal, social relationships and others. Data of demographic characteristics, including information on extraneous variables such as gender and age, were also collected.

### 4. Analysis

The survey responses were entered into a data file using the Statistical Package for the Social Sciences (SPSS) software. Demographic characteristics and levels of psychological distress of the sample were described using means and standard deviations (for continuous variables) and percentages (for ordinal and nominal variables). Bivariate relationships between the study variables were examined using Pearson correlations. Chi-square and t-test tests were conducted to examine group differences. Structural equation modeling was applied, using the Mplus software to determine the extent to which coping strategies explain variation in psychological distress. The recommended two-step approach was followed by first conducting psychometric analyses to establish the measurement models and subsequently fitting a structural model to examine the associations between the latent variables (Byrne, 2012). Two separate models were specified to examine the associations with anxiety and depression as two separate outcomes reflecting psychological distress. Weighted least squares estimation, with mean and variance adjustment (WLSMV), was used to accommodate the ordinal scaling of the variables. In addition, the relatively small amount of missing data (< 5%) was accommodated via pairwise deletion (Enders, 2013). Global fit indices were used to examine the goodness fit of the models, including the root mean square error of approximation (RMSEA) and the comparative fit index (CFI), with CFI values >0.95 and RMSEA values <0.08 being indicative of acceptable model fit (Kline, 2016). Furthermore, we examined residual correlations to identify potential areas of misfit. We followed the convention to regard a p value of <0.05 (2-sided) as being indicative of a statistically significant result.

#### 4.1 Ethics Approval

The study was approved by the University of Calgary Conjoint Health Research Ethics Board (UCCHREB), the College of North Atlantic-Qatar (CNAQ) Institutional Review Board (exempted for the ethical review CAN-Q IRB file #: IRB-2017-004 based on Ministry of Public Health Guidelines, Regulations and Policies for Research Involving Human Subjects, Category 2), and Primary Health Care Corporation Independent Ethics Committee.

## Results

### 1. Sample Description

The study participants were enrolled mostly in healthcare-related programs and in various years of their studies (see Table 1). The sample consisted of 81.3% females (n=204) and 18.3% (n=46) males, and their mean ages were 25.8 years (SD 8.1) and 21.9 years (SD 3.5), respectively. The largest racial group was Arabic (44.2%), followed by Asian (29.5%). Most of the students lived at home (98%). The most common religions were Islam (79.3%) and Christianity (16.7%). The most common sources of stress for students were related to academic responsibilities and personal issues. Nearly half of the study participants reported experiencing either normal or mild levels of anxiety, with the highest proportion of students (36%) reporting a moderate level of anxiety (Table 2). The pattern was slightly different for depression where more than 75% of students reported experiencing normal to mild levels while the remaining students reported moderate (17.6%) to severe (4%) levels of depression (Table 2). The distribution of coping strategies for each of the five subscales is summarized in Table 3.

### 2. Psychometric Analyses

The first phase of the analysis involved establishing the measurement structure of two instruments, HAD and Brief COPE (see Figures 1 & 2). The frequently reported factor structure of the HAD consisted of a two-factor model that discriminates dimensions of anxiety and depression (Bjelland et al., 2002; Helvik et al., 2011; Mykletun & Dahl, 2001). The test of the model showed that a two-factor model has a satisfactory fit with the data, WLSMV  $\chi^2(76) = 202.46$ , RMSEA = 0.08, CFI = 0.910). The measurement structure for Brief Cope was determined based on confirmatory factor analyses of several factor structures reported in the literature. The model of three composite subscales of the Brief COPE used in Cooper et al.'s study did not have a good fit with the data. Based on the assumption that college students would share similar characteristics and contexts, an 11-factor model described in Tang et al.'s (2016) study involving a Hong Kong college sample was selected to test for the goodness of fit. Five of the 11 factors that aligned with this study's hypothesized model were selected for the purpose of this study including: problem-solving, social support, self-blame, denial, and religious coping strategies. Additionally, two items in the questionnaire, #4 (took alcohol or drugs to feel better) and #11 (been using alcohol and other drugs to help me get through it), were removed because the coping strategies involve culturally and legally forbidden behaviors for people of Islamic faith and were therefore considered to be irrelevant for Muslim students (Ali, 2014). The goodness-of-fit of the resulting five-factor model was satisfactory: WLSMV  $\chi^2(67) = 123.24$ , RMSEA 0.058 CFI 0.97.

### 3. Structural Equation Models

Separate structural equation modeling analyses were conducted for the outcome variables of anxiety and depression. The model for anxiety resulted in a good fit (WLSMV  $\chi^2(174) = 268.173$ , RMSEA 0.046 CFI 0.957), with 46% of the variance in anxiety being explained by the five coping strategies. The model for depression also resulted in a good fit (WLSMV  $\chi^2(174) = 282.654$ , RMSEA 0.050 CFI 0.949), with an explained variance of 29%. Anxiety was explained by all five coping strategies: problem solving ( $p = 0.004$ ), social support ( $p = 0.019$ ), self-blame ( $p < 0.0001$ ), denial ( $p = 0.024$ ), and religious coping strategies ( $p = 0.003$ ) (Figure 3). However, the pattern was different for depression, which was explained by only two of the subscales: self-blame ( $p < 0.0001$ ) and religious coping strategies ( $p = 0.004$ ) (Figure 4).

Table 1. Characteristics of study participants

Variable	n (%) / Mean (SD)	Significance in group difference
<b>Sex (n= 251)</b>		
Male	n= 46 (18.3)	
Female	n= 204 (81.3)	
<b>Age (n= 240)</b>	Mean ( $\pm$ SD)	$p < 0.001$
Male	21.9 ( $\pm$ 3.6)	
Female	25.8 ( $\pm$ 8.1)	
<b>Academic programs (n= 251)</b>		
Nursing	154 (61.4)	
Paramedic	21 (8.4)	
Radiography	12 (4.8)	
Respiratory	11 (4.4)	
Pharmacy Tech	7 (2.8)	
Environmental & Occupational Health	8 (3.2)	
IT	16 (6.4)	
Chemistry	22 (8.8)	
<b>Race (n= 248)</b>		
Arabic	111 (44.8)	
Asian	74 (29.8)	
Black	34 (13.7)	
South Asian	17 (6.9)	
Caucasian	6 (2.4)	
Other	6 (2.4)	
<b>Religion (n= 251)</b>		
Muslim	199 (79.3)	
Christian	42 (16.7)	
Hindu	7 (2.8)	
Other	3 (1.2)	
<b>Marital status (n= 251)</b>		
Married	73 (29.1)	
Divorced	2 (0.8)	
Single	170 (67.7)	
Living with a partner	6 (2.4)	
<b>History of anxiety (n= 249)</b>	45 (18.1)	
<b>History of depression (n= 251)</b>	57 (22.7)	

Missing data: Anxiety n=1; Depression n=1



Table 2. Severity levels of anxiety and depression in study participants

Severity		Anxiety * n (%)	Depression ^ n (%)
Normal	(0-7) ¥	61 (24.4 )	129 (51.6)
Mild	(8-10)	59 (23.6)	67 (26.8)
Moderate	(11-14)	90 (36)	44 (17.6)
Severe	(15-21)	40 (16)	10 (4)

\* Anxiety n= 250    ^ Depression n=250    ¥= value of total score



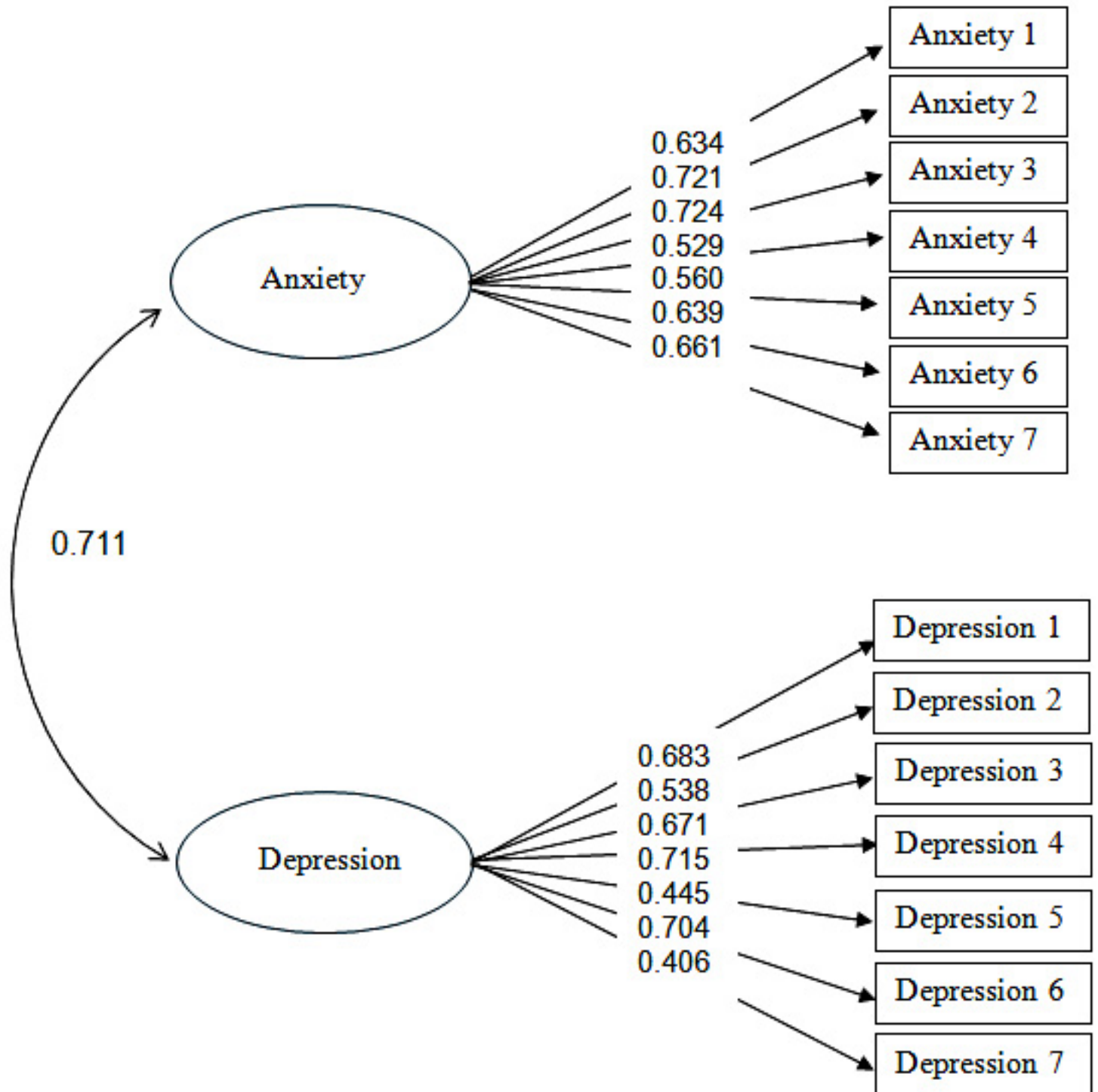
Table 3. Frequency of coping strategies used by Middle Eastern university and college students

Dimensions and items	haven't been doing this at all	been doing it a little bit	been doing this a medium amount	been doing this a lot
<b>Problem Solving</b>				
been doing something about the situation (coping 2) (missing value= 2)	7.2%	25.3%	43.4%	24.1%
been taking actions to make situation better (coping 7) (missing value= 0)	2.8%	17.5%	42.6%	37.1%
been trying to come up with strategy about what to do (coping 14) (missing value= 1)	5.2%	22.0%	48.4%	24.4%
been thinking hard about what steps to take (coping 25) (missing value= 0)	5.6%	22.7%	38.6%	33.1%
<b>Social Support</b>				
been getting emotional support (coping 5) (missing value= 1)	13.2%	34.4%	32.4%	20.0%
been getting help and advice from other people (coping 10) (missing value= 1)	10.8%	32.4%	33.2%	23.6%
been getting comfort and understanding (coping 15) (missing value= 1)	13.2%	26.0%	40.0%	20.8%
been trying to get advice or help from others about what to do (coping 23) (missing value= 3)	13.3%	27.0%	34.3%	25.4%
<b>Self-blame</b>				
been criticizing myself (coping 13) (missing value= 3)	20.2%	39.1%	25.0%	15.7%
been blaming myself for things that happened (coping 26) (missing value= 0)	23.1%	36.3%	16.7%	23.9%

**Table 3. Frequency of coping strategies used by Middle Eastern university and college students**  
(continued)

<b>Denial</b>				
been saying to myself "this isn't real" (coping 3) (missing value= 5)	40.7%	29.7%	17.9%	11.8%
been refusing to believe it happened (coping 8) (missing value= 0)	41.4%	31.5%	18.7%	8.4%
<b>Religious</b>				
been trying to find comfort in my religion or spiritual beliefs (coping 22) (missing value= 4)	12.1%	10.5%	27.1%	50.2%
been praying or meditating (coping 27) (missing value= 2)	9.6%	13.7%	24.1%	52.6%
n= 251				

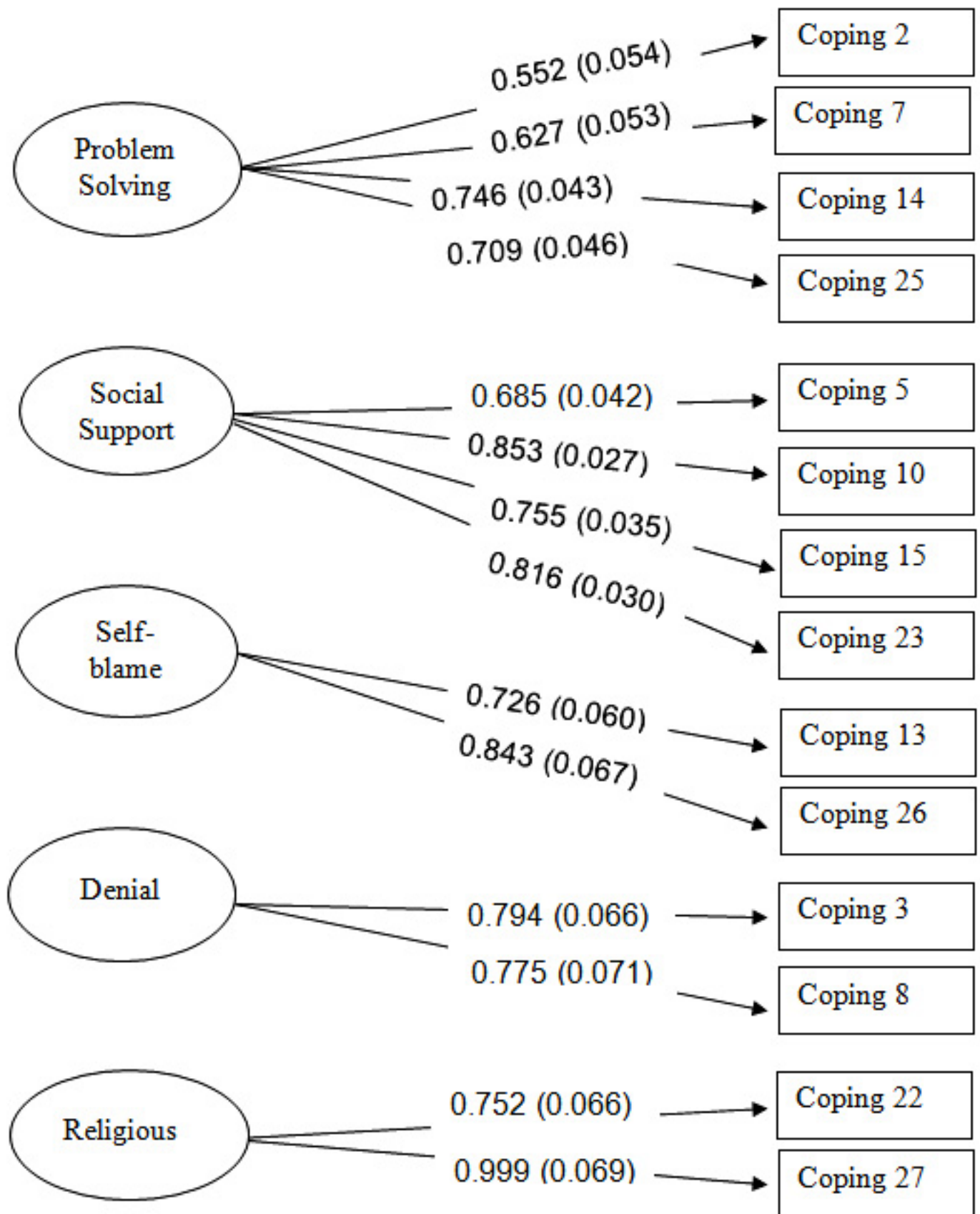
Figure 1: Measurement Model of Hospital Anxiety and Depression Scale



$$\chi^2 (76) = 202.46 \quad \text{RMSEA} = 0.08 \quad \text{CFI} = 0.91 \quad (p < 0.0001)$$

Note: Values are standardized estimates

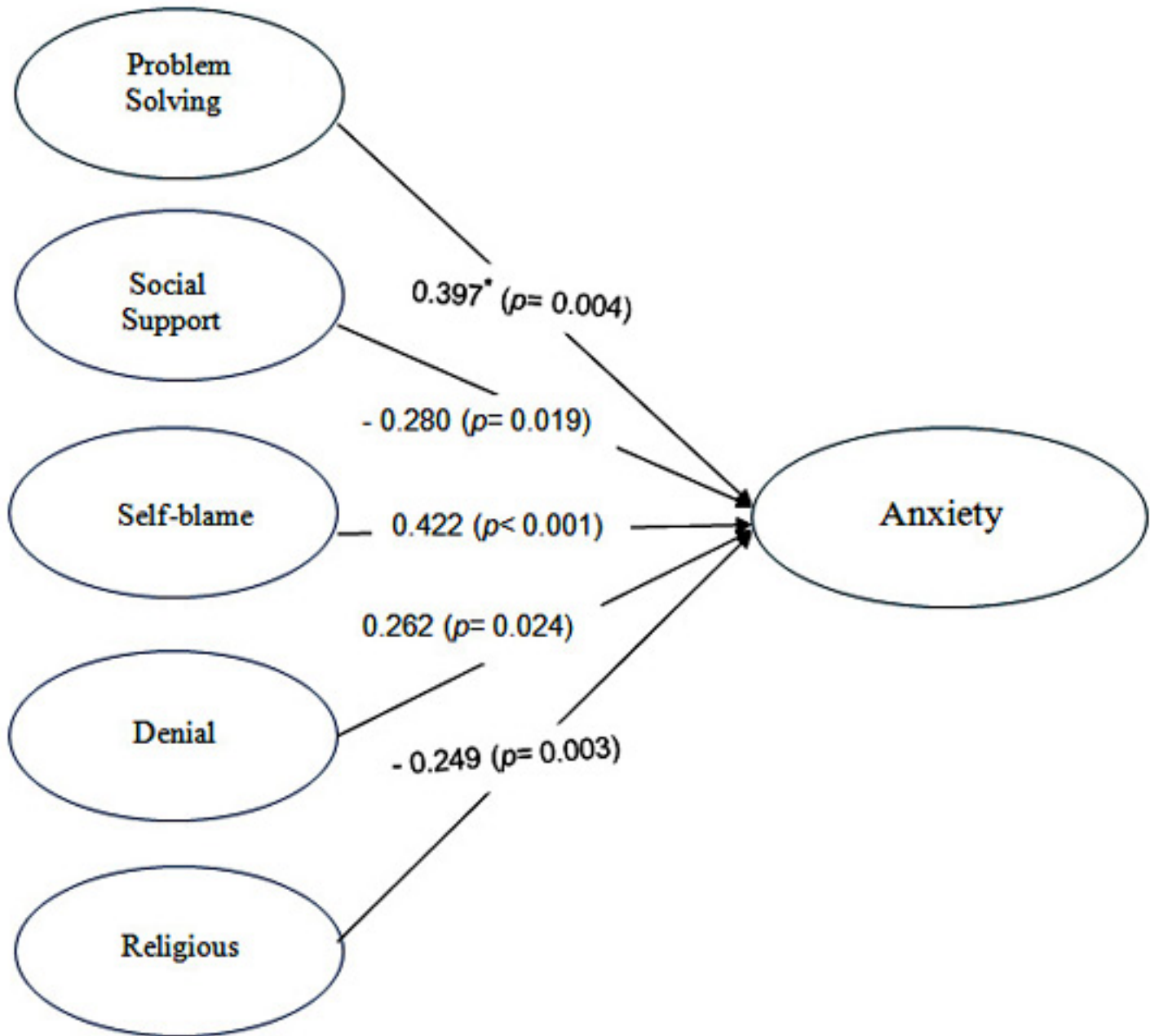
Figure 2. Measurement model of Brief Cope Questionnaire



$\chi^2 (67) = 123.24$  RMSEA = 0.058 CFI = 0.97 ( $p < 0.0001$ )

Note: Values are standardized estimates with standard errors in brackets. Correlations among the latent variables were estimated but are not shown.

Figure 3: Structural Equation Model: Predictors of Anxiety

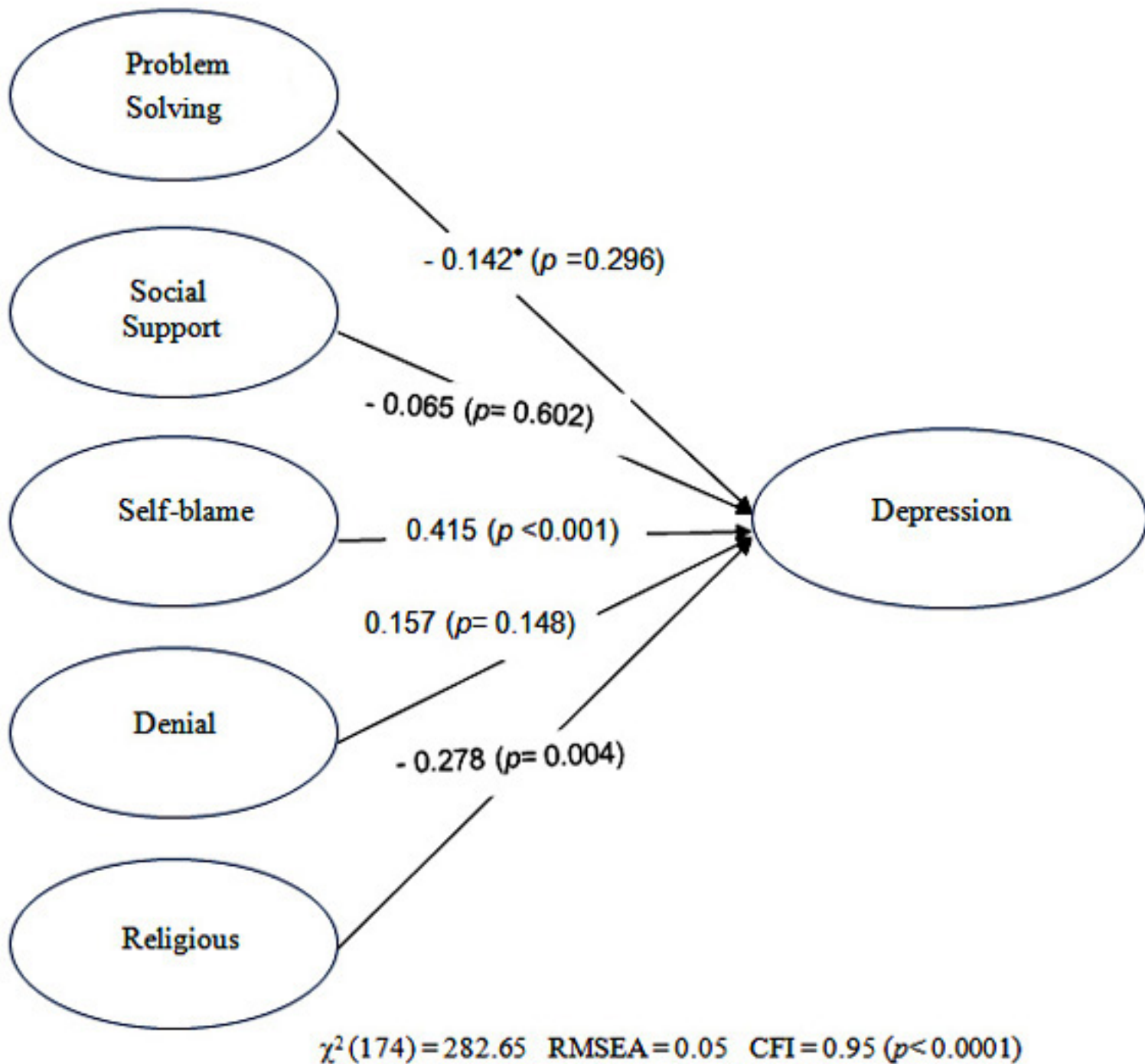


$$\chi^2(174) = 268.17 \quad \text{RMSEA} = 0.046 \quad \text{CFI} = 0.96 \quad (p < 0.0001)$$

\* Values are standardized estimates. Correlations are not shown. See figures 1 and 2 for measurement structures of the latent variables. Correlations among the exogenous latent variables were estimated but are not shown.



Figure 4: Structural Equation Model: Predictors of Depression



\* Values are standardized estimates. Correlations are not shown. See figures 1 and 2 for measurement structures of the latent variables. Correlations among the exogenous latent variables were estimated but are not shown.

## Discussion

The purpose of this study was to examine the relationship between coping strategies and psychological distress in college and university students in the Middle East. The results showed that a substantial proportion of students were experiencing at least mild to moderate levels of anxiety and depression, and the scores of some students were much higher at moderate to severe levels. Although students were experiencing both anxiety and depression, a greater proportion of students were affected by anxiety, and at a higher level, in comparison to the proportion of students affected by depression.

When comparing the results of this study to those of other studies of students in western countries, the findings reveal that there are both similarities and differences in coping strategies used by students in the Middle East and in western countries. Students from countries in both regions are similar in using a combination of problem- and emotion-focused coping strategies which influenced their levels of anxiety and depression. In particular, dysfunctional coping strategy such as self-blame was significantly associated with their psychological distress. There are differences between students from countries in the two regions related to the specific type and frequency of coping strategies that were utilized for dealing with stressors. For example, religious coping is much more frequently used among students of the Middle East in comparison to students in western countries (Abdel-Khalek & Lester, 2007; Gardner et al., 2014).

Anxiety was significantly associated with the use of all five coping strategies: problem-solving, social support, religious coping, self-blame, and denial. This pattern is consistent with results of previous studies and affirms that students in both Middle East and in western countries use a variety of coping strategies that function as problem focused and emotion focused coping. More specifically, our hypothesized model of problem focused, emotion focused, and dysfunctional coping strategies was supported (Buizza, 2021; Eisenbarth, 2019). However, the frequency of particular coping strategies that students used differed between Middle East and in western countries. For instance, students in the Middle East frequently and consistently used religious coping strategy to deal with stressors whereas the western students' reliance on religious coping strategy was either inconsistent or non-significant. The difference was also noted in the nature of the relationship between problem solving coping strategy and anxiety. The order of the reported relationship among students of western countries is typically in a negative direction, meaning, higher the use of a problem coping strategy, the lower the level of anxiety. However, the pattern of relationship observed among students in the current study was in an opposite direction. That is, the frequent use of problem-solving coping strategy was associated with a higher level of anxiety. One of the possible explanations for the contrasting relationships between two groups may be

linked to people's appraisal of the stressor. When an individual appraises the stressor as uncontrollable, the use of problem-solving coping strategy is associated with a higher level of psychological distress (Forsythe & Compass, 1987). Thus, it is plausible that for students in the Middle East who are experiencing significant levels of psychological distress, the stressor may be perceived as an event beyond their control. Another explanation may be related to the design of the study. Because the current study is of a cross-sectional design, it is possible that the observed relationship may operate in an opposite direction. For example, students who are anxious may engage in more frequent use of problem-solving coping strategy in an attempt to alleviate the stressor. Another difference between students from the two regions is in the type of emotion-focused coping strategies used, such as playing sports or engaging in exercises. While students in western countries were observed to frequently participate in sports or exercises to relieve stress and deal with stressors, Middle Eastern students' engagement in sports or exercises were infrequent. Part of the explanation may be related to the history of past campaigns in Western countries to increase the public's awareness on the importance of participating in sports and exercises for managing stress. Finally, although the use of dysfunctional coping strategy such as taking drugs or alcohol among students in the Middle East is unknown, for students in western countries, this is one of the most frequently reported coping strategies used to deal with stressors.

The observed pattern of the relationship between coping strategies and depression was different to that of anxiety. Of the five coping strategies included in the hypothesized model, only two coping strategies were statistically significantly related to depression: self-blame and religious coping. The results support the findings of previous studies about the negative effects of self-blame (Mahmoud, Staten, Hall, & Lennie, 2012). Depressed individuals are more likely to blame themselves for the stressor they are facing. A study by Buizza et al. (2021) examining coping strategies of students who reach out to a university counselling service reported that self-blame coping strategy is a major predictor of mental health issues (i.e., depression). According to Janoff-Bulman (as cited in Graham & Juvonen, 1998), self-blame can be categorized into the two types: behavioral self-blame and characterological self-blame. With behavioral self-blame, the cause of a negative event is perceived as controllable, whereas with characterological self-blame, the cause of a negative event is perceived as uncontrollable. People who exhibit characterological self-blame for negative outcomes cope more poorly and are more depressed than people with behavioral self-blame. Consistent with this theoretical perspective, the use of self-blame coping strategy in the current study was significantly associated with increased levels of both anxiety and depression. In comparison to the self-blame coping strategy, the link between religious coping strategy and depression has been mixed and inconsistent. Religious coping is largely divided into positive religious

into positive religious coping and negative religious coping. Positive religious coping reflects features such as a secure relationship with God, in spiritual communication with others, and holding a novel worldview. Negative religious coping represents holding a tense and conflictual relationship with God and interpreting challenges as punishment from God. The type of religious coping has been reported to influence differential outcomes. Sarizadeh et al. (2020) found that negative religious coping is positively related to depression ( $p=0.001$ ), whereas positive religious coping is negatively related to depression among high school students ( $\beta= -0.25$ ,  $p=0.001$ ). Similarly, Areba et al. (2018) have also reported that positive religious coping is related to decrease in symptoms of depression among Somali college students ( $\beta = -0.04$ ,  $p=0.05$ ). Additionally, Gardner et al. (2014) reported a negative correlation between positive religious coping and perceived stress among international Muslim university students in New Zealand ( $\rho = -0.48$ ,  $p < 0.01$ ). However, in contrast to the findings of the above studies, Sapranaviciute et al. (2013) did not find a significant relationship between religious coping and depression (OR 1.08, CI 0.90-1.30) among international students.

Several limitations need to be mentioned. First, due to the use of questionnaires for data collection, potential biases due to self-selection, self-reporting, inaccurate recall cannot be ruled out. Second, the cross-sectional design of the study reduces the ability to confirm causality. Third, because of convenience sampling, the results of the study have limited generalizability. For example, the study sample included proportionally more females.

## Implication and Conclusion

Given the reported moderate to high levels of psychological distress and their effect on both academic progress and long term well being of individuals, it is important to identify those students who are, or at risk of, developing an increased level of psychological distress so that early intervention can be initiated. The focus of intervention should be on improving adaptive coping strategies and to discourage the use of maladaptive coping strategies such as self-blame. For international students, Muslim students in particular, the focus should be on fostering their reliance on faith to deal with the stressor.

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# Early Diagnosis and Management of Acute Pericarditis in a patient with G6PD deficiency: A Case Report

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## Abstract

Chest pain is a common presentation in clinical practice and needs immediate intervention. It can have several differentials, and it is vital to recognise the signs and symptoms early, differentiate it from other important causes and initiate appropriate management in a timely manner.

Here we present a case of acute chest pain in a young male, following a viral upper respiratory tract infection, which was later diagnosed as acute myopericarditis. Prompt investigations, early referral and treatment allowed the patient to make a full uneventful recovery and prevent adverse complications.

**Keywords:** Acute pericarditis, myopericarditis, pleuritic chest pain, G6PD deficiency, colchicine therapy.



## Case presentation

A 30-year-old male patient with a pre-existing history of G6PD deficiency and asthma presented to a general practitioner with a two-day history of acute, central, pleuritic chest pain. The patient had recently completed a four-day course of antibiotics for an upper respiratory tract infection. He denied experiencing haemoptysis or fever. The chest pain was exacerbated by supine positioning and alleviated by leaning forward. Vital signs were stable, including temperature. Physical examination revealed muffled heart sounds. Chest X-ray was unremarkable excluding consolidation or other abnormalities (Figure 1). ECG demonstrated global ST elevation, suggesting acute pericarditis (Figure 2). Given the clinical presentation and ECG findings, the patient was promptly referred to the emergency department for further evaluation. Laboratory investigations revealed elevated C-reactive protein at 119mg/L and troponin T at 445 ng/L. The echocardiogram demonstrated preserved left ventricular systolic function (Figure 3). Subsequent cardiac magnetic resonance imaging (MRI) confirmed findings consistent with acute myopericarditis (Figure 4). The patient was initiated on non-steroidal anti-inflammatory drugs and colchicine therapy and discharged from the hospital. However, colchicine treatment was discontinued after six weeks due to adverse effects on liver function tests. Following up in the cardiology clinic, the patient made a full recovery.

## Background

Acute pericarditis is the predominant inflammatory heart condition over acute myocarditis and infective endocarditis (1). Acute pericarditis occurs in about 27.7 cases per 100,000 people annually in the general population, while hospital admissions for pericarditis are estimated at 3.32 cases per 100,000 person-years. It is more common in young males (1). Pericardium is a double layered fibro-elastic sac providing a cover around the heart. It consists of 2 layers: a visceral layer around the epicardium and a richly innervated parietal layer. These are separated by a potential space containing around 15-50ml of serous fluid. Pericarditis is the inflammation of the pericardial sac. It is the most common diseases involving the pericardium. It is classified as acute, subacute, chronic or recurrent. Recurrent cases can occur in up to 30% of the cases (2). Inflammation in the pericardium can lead to accumulation of fluid leading to pericardial effusion. The fluid can be serous, haemorrhagic or purulent depending on the cause. If this pericardial effusion becomes large, it can cause pressure on the heart affecting diastolic filling, leading to cardiac tamponade, which is a life-threatening emergency. Pericardial thickening later can present as constrictive pericarditis (2).

Acute pericarditis has a multifactorial aetiology. It can be classified as infectious (attributed to around 80-85% cases) and non-infectious (attributed to around 15-20% of cases). Infectious causes include viruses like- Cocksackie virus, echovirus, herpes, influenza, adeno, HIV, HCV,

parvo viruses, SARS-Co-V2 etc. Bacterial causes among infectious aetiology can include tuberculosis and rarely fungal or parasitic. Non-infectious causes can include neoplastic, metabolic, drug related- including vaccines (covid-19) (1,2).

Acute pericarditis often presents with sharp, pleuritic chest pain that worsens when lying down and improves with sitting forward, as supine position increases the pressure on the heart while sitting up relieves the pressure. Other nonspecific symptoms like fever, cough, shortness of breath maybe present indicating underlying cause, like in our case. On auscultation there is a pericardial friction rub, which can be explained by friction of the 2 inflamed layers of pericardium. This can be heard as a high-pitched scratchy or squeaky sound at the left sternal border. Basic investigations include ECG-which may show diffuse ST elevation, PR depression, bloods including inflammatory markers and cardiac troponins, a chest x-ray, echocardiogram and other cardiac imaging modalities like CT or cardiac MRI to assess myocardial inflammation in some cases. Other tests to investigate underlying diseases to find the secondary cause like QuantiFERON test for tuberculosis, viral serology for HIV, and autoimmune screening etc should be done (1,3).

According to ESC guidelines 2015, the diagnosis of acute pericarditis is made when 2 of the 4 criteria are met:

- 1) typical pleuritic chest pain
- 2) pericardial friction rub
- 3) widespread ST elevation or PR depression on ECG
- 4) pericardial effusion (4).

Most cases of pericarditis usually resolve within 4 weeks, but in cases where the symptoms persist longer than 4-6 weeks, it is called incessant pericarditis, whereas if the symptoms last more than 3 months, it is called chronic pericarditis. If there is a period of remission lasting more than 4-6 weeks in between episodes, it is called recurrent pericarditis (5).

Exercise avoidance is advised for patients, especially in athletes for a period of 3 months. Treatment involves using first line drugs like non-steroidal anti-inflammatory drugs and colchicine. Aspirin is given in doses of 750- 1000mg every 8 hours, while ibuprofen is given as 600mg every 8 hours for a period of 1-2 weeks. Colchicine is given as 0.5mg twice a day for 3 months. Colchicine use not only helps in remission but also reduces the risks of recurrence by more than half. Corticosteroids should be avoided, due to risk of viral replication and should be reserved for cases of idiopathic pericarditis, where there might be underlying autoimmune disorder. If patients do not respond to above medications, azathioprine, intravenous immunoglobulin and anakinra (an interleukin-1 $\beta$  antagonist) can be used. Surgical pericardiectomy is used when all above treatments fail, as a last resort, in those with history of cardiac surgery or with features of constriction (4,5).

Figure 1: Unremarkable chest X-ray findings



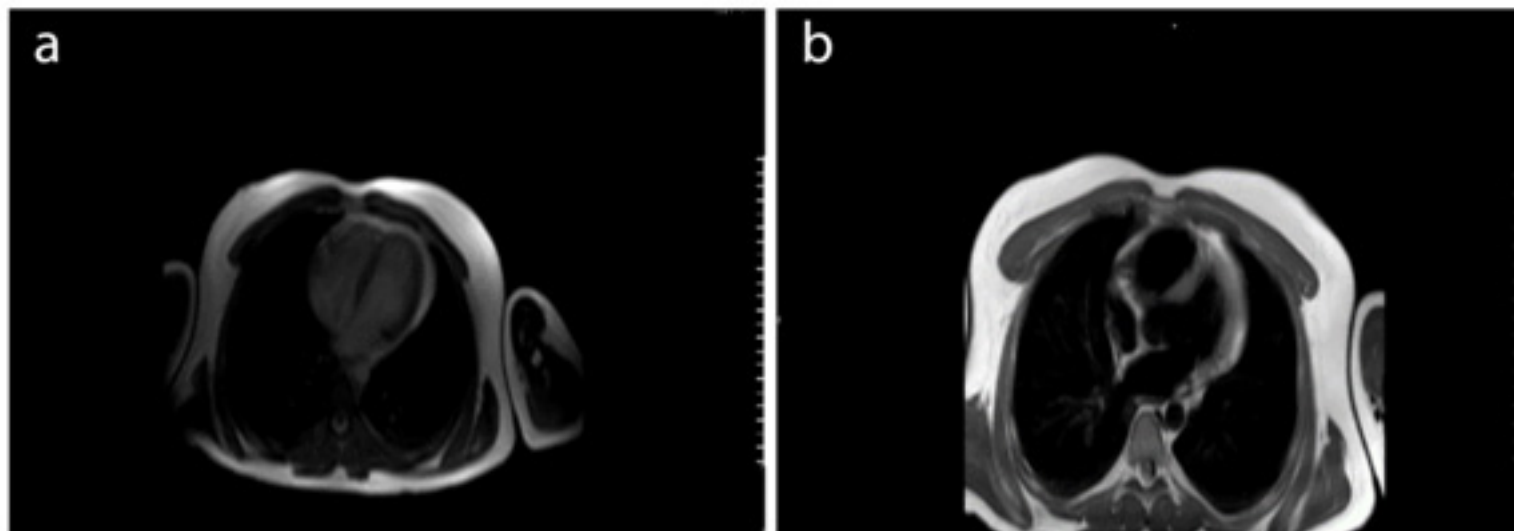
Figure 2: Global ST-segment elevation



Figure 3: Unremarkable findings on ECHO



Figure 4 (a and b): CMR findings on MRI consistent with myopericarditis



## Discussion

This case presents a classic scenario of acute pericarditis following an upper respiratory tract infection in a young male with underlying comorbidities of G6PD deficiency and asthma. While the exact aetiology remains elusive, the temporal relationship to the infection suggests a viral trigger, a common antecedent in acute pericarditis. The patient's presentation with pleuritic chest pain, ECG changes and elevated inflammatory markers is consistent with the typical clinical picture.

The exact pathophysiology of acute pericarditis is complex and often multifactorial. Aligning with the presented case it typically involves an initial insult, which triggers an inflammatory response. This insult can be viral, bacterial, autoimmune or even traumatic (6). The inflammatory process leads to the release of inflammatory mediators such as cytokines and chemokines, which recruit immune cells to the pericardium (7). The accumulation of these cells and the release of inflammatory substances results in pericardium thickening, pericardial effusion and potentially fibrin deposition (6). The increased pressure within the pericardial sac due to fluid accumulation can impair ventricular filling, leading to hemodynamic compromise in severe cases (8). Diagnosis of myopericarditis is made when there is myocardial involvement in cases of acute pericarditis, as evidenced by raised cardiac enzymes. It has presentation ranging from mild self-limiting disease to symptoms of heart failure, arrhythmias, syncope and even cardiac arrest. Chest x-ray and echocardiogram will point to any underlying heart failure or ventricular dysfunction. Cardiac MRI is used to assess degree of myocardial or pericardial involvement (4,9).

The patient in our case study, had minor myocardial involvement, with raised cardiac troponins. His chest x-ray was unremarkable, and echocardiogram showed preserved left ventricular systolic function. Cardiac MRI showed LV apical subepicardial oedema, hyperaemia and late enhancement, consistent with myocarditis thus pointing to a diagnosis of myopericarditis.

Excluding acute coronary syndrome can be a bit challenging yet vital, if a similar case presents in an older patient with multiple cardiac risk factors. In such instances, coronary angiography is usually essential (1,9).

The presence of elevated troponin T in this case is noteworthy. While typically associated with myocardial injury, it can also be elevated in acute pericarditis, particularly in cases of myopericarditis. This finding aligns with the study conducted by Imazio et al., (10) which investigated the role of cardiac troponin I (cTnI) in acute pericarditis. Their study found that cTnI elevation is common in this condition, often associated with younger age, male sex, ST-segment elevation and pericardial effusion. This finding emphasizes the importance of considering a broader differential diagnosis when evaluating patients with chest pain and elevated cardiac biomarkers (10). An RCT study by M Imazio et al., investigated the effectiveness

of colchicine, when given along with conventional anti-inflammatory medications, after a first episode of acute pericarditis. The results suggested reduced rate of incessant or recurrent pericarditis as compared to placebo (11).

The development of liver dysfunction necessitated the discontinuation of the medication in our case. This highlights the importance of close monitoring for adverse effects. While most acute pericarditis cases resolve spontaneously, complications such as pericardial effusion, cardiac tamponade and constrictive pericarditis can occur (1). Fortunately, our patient did not develop any complications and made a full recovery.

Considering, the due order for occurrence in the presented case, early diagnosis and timely management serve as a cornerstone for a complication-free completed recovery in patients with acute pericarditis.

## Conclusion

This case highlights the importance of considering acute pericarditis or myocarditis in a young patient presenting with chest pain following a recent viral infection. Taking a focused history, recognizing clinical signs early on and ordering and interpreting appropriate investigations in timely manner helped initiate treatment early and prevent complications. Newer modalities like cardiac MRI are very sensitive in diagnosing myocardial involvement in myopericarditis and help in narrowing down differentials in an acute care setting.

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