

**DEVELOPMENT, VALIDATION, AND
EVALUATION OF THE SYSTEMATIC
ASSESSMENT FOR RESILIENCE FRAMEWORK**

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EVALUATION OF THE SYSTEMATIC
ASSESSMENT FOR RESILIENCE FRAMEWORK**

by

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LIST OF SYMBOLS

Cronbach's α	Cronbach's alpha
n	Sample size
p	p-value

LIST OF ABBREVIATIONS

AFL	Assessment for Learning
AIT	Attention and Interpretation Therapy
AOL	Assessment of Learning
APA	American Psychology Association
ARS	Academic Related Stressors
CBI	Copenhagen Burnout Inventory
CBT	Cognitive Behavioral Therapy
COVID	Coronavirus Disease
CVI	Content Validity Index
DASS-21	Depression, Anxiety and Stress Scale 21
DOCEE	Direct Observation of the Clinical Examination Encounter
FGD	Focus Group Discussion
FVI	Face Validity Index
HPE	Health Professions Education
ICD	International Classification of Diseases
IDI	In-Depth Interview
IQR	Inter Quartile Range
IRM	Integrated Resilience Model
MBI	Maslach Burnout Inventory
MCQs	Multiple Choice Questions
MeRS	Medical Professionals Resilience Scale
MSSQ	Medical Students Stressor Questionnaire
OSCE	Objective Structured Clinical Examination
PRISMA	Preferred Reporting of Items for Systematic Reviews and Meta-Analyses
PS	Power Sample
PTSD	Posttraumatic Stress Disorder
RCT	Randomized Control Trials
S-REF	Self-Referential Executive
SAR	Systematic Assessment for Resilience
SARS	Systematic Assessment for Resilience Scale
SPSS	Statistical Package for Social Sciences

TA	Test Anxiety
UA	Universal Agreement
UoS	University of Sharjah
USM	Universiti Sains Malaysia

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**PEMBANGUNAN, PENGESAHAN DAN PENILAIAN KERANGKA
PENTAKSIRAN SISTEMATIK UNTUK RESILIENSI**

ABSTRAK

Masalah kesihatan mental, seperti tekanan, kegelisahan, keletihan, dan kemurungan, terus meningkat dalam kalangan pelajar perubatan, mengakibatkan kesan negatif yang akhirnya membawa kesan negatif terhadap perawatan pesakit yang optimum. Bukti menunjukkan bahawa pentaksiran adalah penyebab utama masalah mental tersebut. Walaupun sejumlah intervensi telah dimulakan untuk meningkatkan tahap kesihatan mental pelajar perubatan, mereka menumpukan pada aspek individu dan mengabaikan pendekatan komprehensif di pelbagai peringkat dan pentaksiran itu sendiri. Kemunculan intervensi kebingkasan mempunyai kelebihan berbanding intervensi-intervensi kesihatan mental yang lain, maka para penyelidik mula untuk melaksanakannya. Tujuan kajian ini adalah untuk membangunkan, mengesahkan, dan menilai kerangka SAR. Pada fasa pertama, empat tinjauan naratif, tinjauan skop, dan perbincangan kumpulan fokus dilakukan untuk meletakkan asas yang kuat untuk pembangunan kerangka tersebut. Fasa kedua melibatkan pengesahan kandungan dan proses tindak balas (pengesahan permukaan). Kerangka baru dinilai pada fasa ketiga dan terakhir melalui dua trek: pertama, dengan melatih sekumpulan pensyarah perubatan dan mengukur penggunaan garis panduan kerangka baru ini sebelum dan selepas latihan. Kedua, dengan melaksanakan kerangka ini di satu institusi perubatan dan mengukur parameter kesihatan mental tertentu di kalangan pelajar perubatan sebelum dan selepas latihan pensyarah perubatan untuk menerapkan kerangka tersebut. Selanjutnya, maklum balas kualitatif dikumpulkan untuk kedua-dua kaedah penilaian. Setelah sintesis dan triangulasi hasil dapatan fasa satu, kerangka SAR dibangunkan. Kerangka SAR secara teorinya mengengahkan empat konstruk

kebingkasan iaitu kawalan diri, pengurusan, penglibatan, dan pertumbuhan, melalui lima fasa penilaian merangkumi pengalaman penilaian, arahan penilaian, persiapan penilaian, fokus pemeriksa, dan refleksi pelajar. Di samping itu, setiap fasa penilaian mengandungi beberapa panduan praktikal untuk meningkatkan tahap kebingkasan. SAR menunjukkan tahap kesahan kandungan dan permukaan yang tinggi. Semasa penilaian trek pertama, kebanyakan panduan SAR dipatuhi, dan para guru memberikan maklum balas yang sangat baik. Pada penilaian SAR kedua, pelaksanaan SAR mengurangkan parameter kesihatan mental pelajar dengan ketara. Selain itu, pensyarah perubatan berkongsi pengalaman positif mereka dan melaporkan perubahan pelajar yang ketara. Kajian semasa menunjukkan kerangka SAR adalah baharu dan holistik untuk memupuk kebingkasan pelajar secara sistematik melalui amalan pentaksiran. Inovasi SAR berasal dari keunikannya sebagai intervensi kebingkasan yang menasaskan penyebab utama masalah kesihatan mental pelajar perubatan secara sistematik, yang seterusnya memberikan ufuk baharu untuk proses pentaksiran dalam pendidikan perubatan. Walau bagaimanapun, penyelidikan lanjut diperlukan untuk menyediakan lebih banyak bukti tentang keberkesanan garis panduan SAR menangani isu kesejahteraan doktor pada masa hadapan melalui pentaksiran.

DEVELOPMENT, VALIDATION, AND EVALUATION OF THE SYSTEMATIC ASSESSMENT FOR RESILIENCE FRAMEWORK

ABSTRACT

Mental health issues, such as stress, anxiety, burnout, and depression, continue to rise among medical students, resulting in negative side effects that ultimately jeopardize optimal medical care and patient health. Evidence indicates that assessment is the primary cause of these mental issues. Although several interventions have been initiated to improve the mental health of medical students, these have focused on individual aspects, ignoring a comprehensive approach across multiple levels and the assessment itself as the root cause. The emerging resilience intervention has an advantage over other mental health interventions, which has led researchers begin to implement it. The purpose of this study was to develop, validate, and evaluate a systematic framework for promoting resilience through the assessment system. In the first phase, four narrative reviews, a scoping review, and a focus group discussion were conducted to lay a solid foundation for the framework's development. The second phase involved content validation and the response process (face validation). The new framework was evaluated in the third and final phase using two tracks: first, by training a group of international medical teachers and measuring their utilization of the framework's guidelines before and after training and, second, by implementing the framework in a single medical institution and measuring certain mental health parameters among medical students before and after the training of their medical teachers to apply the framework. Furthermore, qualitative feedback was gathered for both evaluation tracks. After synthesis and triangulation of the results gathered during phase one, the systematic assessment for resilience (SAR) was developed. The SAR

theoretically promotes four resilience constructs—self-control, management, engagement, and growth—and does so through five phases of assessment—assessment experience, assessment direction, assessment preparation, examiner focus, and student reflection. In addition, each assessment phase contains several practical guidelines to promote resilience. The SAR showed a high level of content and face validity. During the first track’s evaluation, most of the SAR guidelines were adhered to, and the teachers provided promising feedback. In the second track of evaluating the SAR, the implementation of the SAR in a medical school significantly improved students’ mental health parameters. Additionally, the medical teachers at the study site shared their positive experiences and reported significant student changes after implementing SAR. The current study presents a novel and holistic framework for fostering student resilience through assessment practice. The novelty of the SAR comes from its uniqueness as a resilience intervention that targets the leading cause of medical students’ mental health problems, approaching this in a systematic way, in turn providing a new horizon for the assessment process in medical education. Nevertheless, additional research is required to provide more evidence on the effectiveness of SAR guidelines addressing the wellbeing issues of tomorrow’s doctors through assessment.

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter sheds light on the research's background, problem statements, and significance. It also includes the objectives of the research, the research questions, the research hypotheses, and the operational definitions.

1.2 Research background

Medicine is a demanding and intense field of study that places strain on medical students' psychological and physical well-being (Veal, 2021). Medical students have long viewed medical education as stressful (Yusoff, 2018; Chisholm-Burns *et al.*, 2021). This fact has been mirrored by the high level of stress in medical students. Multiple international studies have found a significant prevalence of stress among medical students, ranging from 21% to 56 % (Dyrbye *et al.*, 2006; Yusoff *et al.*, 2013; Abdalla and Shorbagi, 2018; Moir *et al.*, 2018; Erschens *et al.*, 2019; Frajerman *et al.*, 2019; Jordan *et al.*, 2020; Ragab *et al.*, 2021).

Stress exacerbates other mental health disorders such as anxiety, burnout, and depression (Yusoff *et al.*, 2013). Chronic exposure to stressful situations contributes to poor academic achievement, poor clinical competence, hindered decision making, negative relationships with peers, professional misconduct, and sleeplessness (Dyrbye *et al.*, 2005; Lyndon *et al.*, 2014; Yusoff, 2018; Jordan *et al.*, 2020; Chisholm-Burns *et al.*, 2021; Ragab *et al.*, 2021; Upsher *et al.*, 2022). Additionally, stress is associated with substance abuse, excessive alcohol consumption, and suicide (Dyrbye *et al.*, 2005; Berkowitz, 2019; Jordan *et al.*, 2020; Veal, 2021). It has been stated that doctors who were distressed throughout their undergraduate study may develop dissatisfaction

with their profession, which potentially jeopardize patient care (Shapiro *et al.*, 2000; Mihailescu and Neiterman, 2019).

Stress is a necessary precursor to other mental health issues such as anxiety, burnout, and depression (Folkman and Lazarus, 1986). In the medical field, there is an alarming fact of mental health issues among medical students. For instance, a meta-analytical study found that 34% of medical students suffer from anxiety (Tian-Ci Quek *et al.*, 2019). Here, depression and burnout have increased to 44% (Frajerman *et al.*, 2019). In their systematic review, Cuttilan *et al.* (2016) discovered that depression and anxiety disorders were the most commonly reported mental problems among Asian medical students. Although recognizing these worrisome statistics and their associated consequences is necessary to support the global consensus advocating for improved mental health among medical students (Tomlinson, 2017), the most important step is identifying and mitigating the main stressors.

Numerous studies have been identified assessments—including exams and tests—as the primary source of stress for medical students (Dyrbye *et al.*, 2005; Yusoff *et al.*, 2013; Lyndon *et al.*, 2014; Weber *et al.*, 2019). This stress stems from various factors within the assessment system. One important factor is the current assessment model used in medical education known as the assessment of learning (AOL) model. This model emphasizes objectivity in assessment data (ten Cate and Regehr, 2019), optimizing psychometric properties of assessment tools (Hodges, 2013), assigning grades, and categorizing students as either competent or not, typically as pass or fail (Pugh and Regehr, 2016). Consequently, students perceive assessments as distressing events associated with social judgment and stigmatization, especially when their status is determined by a pass or fail outcome (Pugh and Regehr, 2016; Wadi *et al.*, 2020c). Another contributing factors are the nature and structure of test items also play a role.

Ambiguous or unclear questions and unpredictable assessment tools create confusion, uncertainty, and difficulties in providing accurate responses (Zeidner, 1998). Insufficient briefing about the exam format adds to the unpredictability and uncertainty, intensifying anxiety levels and affecting students' preparation and time management (Jones *et al.*, 2020). Furthermore, specific assessment formats involving direct interaction with examiners, such as Objective Structured Clinical Examinations (OSCEs), oral exams, and short cases, have been reported as stress-provoking assessment modalities (Guraya *et al.*, 2018). The pressure to perform flawlessly while being observed amplifies anxiety and self-doubt, as students fear making mistakes or receiving negative evaluations (Zeidner, 1998). Moreover, examiners' behaviour, often characterized as excessively strict, a phenomenon known as the "hawk" effect, contributes to the stress experienced by students during exam (McManus *et al.*, 2006). Given the complexity of the assessment system and its various components, it is important to explore interventions that can mitigate the negative effects of assessment on student well-being (Wadi *et al.*, 2020c).

Medical educational institutions should prioritize the well-being of their students by implementing supportive measures that help alleviate the assessment-related negative effects and foster a more supportive learning environment (Huey and Palaganas, 2020). To achieve this, it is crucial to assess the mental health of medical students right from the admission and selection process for entry into medical schools. While medical schools have implemented rigorous admission criteria to identify the most promising future medical professionals, these criteria often lack clear guidelines for evaluating mental health issues among applicants (Appel, 2023). Although some studies have identified selection criteria that include factors related to compassion in students (Abraham *et al.*, 2022), the demanding workload, time constraints, and high-

pressure environment of medical school frequently contribute to elevated stress levels. For these reasons, there are various interventions that can help students improve their well-being (Yusoff, 2014). Some of these interventions focus on personal development skills such as self-development, time management, and study skills. Others are geared toward promoting mindfulness and meditation activities, such as yoga and self-hypnosis (Yusoff, 2014). Although these stress management programs may contribute to the promotion of student well-being in some ways, none of them have integrated the intervention into a comprehensive approach across multiple levels and time periods (Sanderson and Brewer, 2017; Chmitorz *et al.*, 2018; Ferreira *et al.*, 2021). As a result, a strong argument is being made for establishing a holistic interventional approach toward enhancing medical student well-being throughout their education, which can then help in assisting them in developing the necessary capacities to maintain their well-being throughout their demanding medical education and professional careers (Howe *et al.*, 2012; Huey and Palaganas, 2020). Here, the use of resilience as a mental health intervention is becoming increasingly popular (Chmitorz *et al.*, 2018; Kunzler *et al.*, 2020). Resilience is recognized as a valuable attribute that not only helps individuals bounce back from adversity but also enhances other related qualities important for medical students, confidence (self-efficacy), coordination (planning), control, composure (low anxiety), and commitment (persistence) (Martin and Marsh, 2006). Resilience enables individuals to regulate their emotions, thoughts, and behaviours, leading to improved self-control and the ability to make informed decisions, prioritize tasks, and manage time effectively (Huey and Palaganas, 2020).

The concept of resilience has evolved from a static personality trait to a dynamic process of adversity adaptation (Luthar *et al.*, 2000b; Richardson, 2002; Sanderson and Brewer, 2017). Sanderson and Brewer (2017, pg. 69), defined resilience

as “the dynamic capacity to overcome adversity by utilizing personal, social, and organizational resources to achieve personal growth and transformation”. Hence, resilience becomes an evolutionary intervention (Sanderson and Brewer, 2017; Kunzler *et al.*, 2020). Some researchers have argued that resilience can be nurtured and trained so that individuals can anticipate situations, change their outcomes, and become active participants in the resilience process (Ferreira *et al.*, 2021). From this perspective, resilience has become essential for medical students not only in overcoming adversity, but also in developing sufficient self-efficacy to help them solve problems, think creatively, and build trustworthy relationships in their healthcare team or with patients (Howe *et al.*, 2012).

1.3 Problem statement

In order to develop competent and healthy physicians, medical schools should prioritize not only competence but also the well-being of their students (Veal, 2021). Therefore, a crucial step for decision makers in medical schools is to identify and mitigate the sources of stress in medical curricula, creating a more supportive learning environment (Seritan *et al.*, 2012).

The assessment system has been recognized as the primary stressor among medical students, potentially leading to various mental health issues, and chronic consequences of stress can potentially compromise patient care (Shapiro *et al.*, 2000; Mihailescu and Neiterman, 2019). Consequently, immediate action is imperative to evaluate the assessment system factors that contribute to stress and its effects. This evaluation will lay the foundation for evidence-based interventions aimed at mitigating the negative effects of assessment and fostering a supportive assessment system within medical curricula (Lineberry, 2019).

Simultaneously, resilience has emerged as a crucial psychological concept in medical education (Howe et al., 2012; Chmitorz et al., 2018). It equips individuals with the necessary skills to navigate life's adversities, including threat analysis, action planning, and resource allocation (Howe et al., 2012; Chmitorz et al., 2018; Huey and Palaganas, 2020; Ferreira et al., 2021). These capacities are essential for medical students to function effectively and provide optimal care (Howe *et al.*, 2012). However, existing resilience interventions in medical curricula primarily focus on individual training programs, lacking a comprehensive approach that promotes resilience across different levels and time (Ferreira *et al.*, 2021)

Considering the significance of the assessment system as a stressor and the importance of resilience, a crucial question arises: Can resilience be nurtured through the assessment system? Addressing this knowledge gap, this study aims to provide an evidence-based answer, contributing to the development of a comprehensive resilience intervention integrated within the assessment system. By doing so, this research endeavours to enhance medical education and support the well-being of medical students.

1.4 Significance of the study

- i. The purpose of this study is to develop a unique intervention that fosters resilience while directly addressing the primary cause of mental health issues among medical students, which is the assessment system. This will be achieved by creating a comprehensive framework that simultaneously promotes resilience in the process of student assessment.

- ii. The proposed framework will be based on a deep understanding the invisible link between three key factors—resilience, test anxiety, and assessment—as well as developing data-driven resilience-promoting guidelines.
- iii. Unlike existing interventions that focus solely on resilience at individual bases, the proposed framework offers a holistic and integrated approach to cultivating resilience within the assessment process. It serves as a system-built intervention that considers the overall assessment context.
- iv. The framework will undergo rigorous validation to assess its content validity and evaluate its effectiveness after implementation. This validation process will ensure that the framework is reliable and aligns with its intended goals.

By utilizing the proposed framework to foster resilience among medical students, there is potential to enhance their mental well-being, indirectly improving their healthcare delivery, and ultimately enhancing patient safety.

1.5 Study objectives

1.5.1 General objective

To develop, validate, and evaluate a systematic assessment framework that promotes resilience among medical students.

1.5.2 Specific and sub-specific objectives

1.5.2(a) To design and develop a systematic assessment for resilience (SAR) framework.

- i. To explore the theoretical foundations of psychological resilience, academic resilience, test anxiety, and student assessment and then correlate findings to find the basis for promoting resilience during an assessment.
- ii. To determine the factors that either increase or decrease test anxiety.

- iii. To explore medical students' perspectives on test anxiety and their thoughts on reducing its burden.
- iv. To construct a systematic assessment for the resilience (SAR) framework.

1.5.2(b) To validate the systematic assessment for resilience (SAR) framework

- i. To determine the content validity of the SAR framework.
- ii. To determine the response process validity of the SAR framework.

1.5.2(c) To evaluate the usability and applicability of SAR among medical teachers, along with its influence on students

- i. To explore the perspectives of medical teachers on the usability and applicability of the SAR framework.
- ii. To investigate the consequences of using the SAR on students' resilience, academic stress, anxiety, burnout, and depression.

1.6 Research questions

1.6.1 How should the SAR framework be designed?

1.6.2 What are the validity evidences to support for SAR framework?

1.6.3 How feasible and practical is the SAR framework?

1.6.4 What effect does teachers' use of the SAR framework have on students?

1.7 Research hypotheses

1.7.1 Hypothesis I

There is a significant difference between the percentage of SAR guidelines used pre- and post-training.

1.7.2 Hypothesis II

There is a significant difference between students' resilience scores before and after their teachers implemented the SAR guidelines.

1.7.3 Hypothesis III

There is a significant difference between students' academic stress scores before and after their teachers implemented the SAR guidelines.

1.7.4 Hypothesis IV

There is a significant difference between students' anxiety scores before and after their teachers implemented the SAR guidelines.

1.7.5 Hypothesis V

There is a significant difference between students' depression scores before and after their teachers implemented the SAR guidelines.

1.7.6 Hypothesis VI

There is a significant difference between students' burnout scores before and after their teachers implemented the SAR guidelines.

1.8 Operational definitions

1.8.1 Resilience

Sanderson and Brewer (2017, pg. 69) defined *resilience* holistically and combined previous perspectives of this concept. They defined resilience as “the dynamic capacity to overcome adversity by utilizing personal, social, and organizational resources to achieve personal growth and transformation”.

1.8.2 Academic resilience

Academic resilience has been defined as the process of adapting well in the face of adversity, trauma, tragedy, threats, or significant sources of stress during study and exam period (Martin and Marsh, 2008). This definition highlights resilience as a state rather than a trait.

1.8.3 Stress

Stress is defined as the body's nonspecific response to the demands made upon it or to disturbing events in the environment (Selye, 1974; Rosenhan and Seligman, 1995). It is not just a stimulus or response, but rather, it is a process by which we perceive and cope with environmental threats and challenges (Myers, 2004). Therefore, the environmental factors that cause stress are referred to as stressors (Lazarus, 1990). Linn and Zeppa (1984) suggested that some stress in medical school training is needed for learning. Stress that facilitates learning is called "favourable stress," while stress that suppresses learning is called "unfavourable stress." The later has been designated as "distress." When stress occurs, the stressor is either intense, prolonged, or both. To eliminate confusion, the term "stress" in the current study refers to distress (National Research Council (US), 2008).

1.8.4 Anxiety

Anxiety, which is a fundamental human emotion signalling uncertainty or threat in the environment, has occupied an important place in the literature as one of the most pervasive and consequential stress responses encountered by man (Sarason *et al.*, 1990). In contrast to stress, anxiety is characterized by persistent, excessive worries that persist even in the absence of a stressor (American Psychological Association, 2022).

1.8.5 Test anxiety

Test anxiety is a special type of anxiety. It refers to the complex of phenomenological, physiological, and behavioural responses that accompany the fear of potential negative consequences or failure on an exam or similar evaluative circumstance (Zeidner, 1998). It may impair concentration (Hjeltnes *et al.*, 2015) and working memory, both of which affect the academic performance of students (Moran, 2016).

1.8.6 Burnout

Burnout can be defined as “a state of physical, emotional and mental exhaustion that results from long-term involvement in work situations that are emotionally demanding” (Schaufeli and Greenglass, 2001). The World Health Organization (2020) considered burnout as a syndrome resulting from unmanaged chronic workplace stress and characterized by extreme fatigue, negativity, or cynicism toward one’s job, along with diminished personal effectiveness.

1.8.7 Depression

Depression is a clinical psychiatric illness characterized by fluctuating mood, cognition, neurovegetative functions, and inter-episode remissions. The American Psychiatric Association (2013) established clinical diagnosis criteria that include five or more of the following symptoms: a sad mood, weight changes, sleep disturbances, psychomotor agitation or retardation, exhaustion, difficulty of attention, and repeated suicidal ideation. These symptoms should not be caused by any substance or medical condition. Furthermore, these symptoms should manifest as distinct episodes lasting for at least two weeks (American Psychiatric Association, 2013). The current study investigates depressive symptoms using the Depression, Anxiety, and Stress Scale (DASS-21), a valid and effective screening tool. A positive screening does not imply

a diagnosis of depression; rather, it shows the presence and intensity of symptoms.
(Lovibond and Lovibond, 1995).

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter begins by shedding light on the alarming statistics and facts of mental health problems among medical students. Subsequently, the role of assessment in medical schools will be examined, with a focus on its underlying aspects that contribute to mental health problems among students. The chapter will then explore the most common mental health problems experienced by medical students, examining their underlying concepts and theoretical models. Additionally, the concept of resilience, particularly in the academic context, will be investigated, emphasizing its theoretical foundations. Finally, the chapter will delve into potential points for interventions that promote resilience, with a specific focus on the assessment system.

2.2 Mental health problems among medical students

Although the optimal goal of medical schools is to develop safe and competent doctors, the mental health of doctors is rarely focused on, which is a concern considering that mental health is a major attribute of ‘the safe doctor’ (Tomlinson, 2017). The World Health Organization defines mental health as a condition of complete well-being in which every person fulfils their own potential, can deal with life's adversities, can work creatively and fruitfully, and can make a positive contribution to their community (World Health Organization, 2004). However, the literature has indicated a downfall in mental health of medical students. Stress, for example, is prevalent among medical students and ranges from 21% to 56% (Yusoff *et al.*, 2013; Abdalla and Shorbagi, 2018; Moir *et al.*, 2018; Erschens *et al.*, 2019; Frajerma *et al.*, 2019; Jordan *et al.*, 2020; Ragab *et al.*, 2021) Burnout and depression among medical

students have continued to increase, reaching 44% (Frajerman *et al.*, 2019). A global meta-synthesis reported that 34% of medical students have anxiety (Tian-Ci Quek *et al.*, 2019). The American Medical Association's Council on Medical Education reported that American medical students committed suicide threefold more than other students in other disciplines (Berkowitz, 2019). In their systematic review, Cuttilan *et al.* (2016) found that the top reported mental problems among Asian medical students were depression and anxiety disorders. In the same vein, Zeng *et al.* (2019) reported similar findings, with more prevalent suicidal ideation found among Chinese medical students. These figures paint a distressing picture, highlighting the urgent need for addressing the mental well-being of medical students and compelling decision-makers to identify the primary causes of these mental health issues and work towards mitigating their burden.

Assessment, tests, and exams have emerged as the primary culprits behind the rising tide of mental health issues among medical students (Dyrbye *et al.*, 2005; Yusoff *et al.*, 2013; Lyndon *et al.*, 2014; Weber *et al.*, 2019). The relentless pressure to excel in rigorous evaluations, coupled with the immense volume of knowledge to absorb, takes a toll on medical students' psychological well-being (Veal, 2021). The weight of expectations, combined with the constant need to perform well in exams, creates a highly stressful environment, often leading to feelings of overwhelm, anxiety, and even burnout and depression among students (Pugh and Regehr, 2016). These challenges jeopardize the overall well-being and future success of these promising healthcare professionals (Shapiro *et al.*, 2000; Mihailescu and Neiterman, 2019). Therefore, it is imperative that educational institutions and medical programs recognize the detrimental impact of this assessment-heavy culture and take proactive measures to support and prioritize the mental health of their students (Huey and Palaganas, 2020).

2.3 The role of assessment in medical schools and its contribution to mental health problems

Since prehistoric times, students have been assessed. In Rome in the fifth century BC, the testing phenomenon was documented, and Socrates used questionnaires to encourage his students to think critically. The assessment was then formalized in Europe in 1219 at the University of Bologna, where students were evaluated using oral questions. The first written exams were held at the University of Cambridge in England in 1792 (Trifoni and Shahini, 2011). Consequently, assessment has been used in all education sectors. Teachers use exams to measure students' learning and do so through a variety of methods and tools; in the end, schools award certificates or licenses to students based on their achievement of learning outcomes (Schuwirth and van der Vleuten, 2020).

Assessment has become an inseparable part of our daily lives. Academic success, work applications, and university enrolment are only a few of the significant decisions made based on test results. As a result, test anxiety has become widespread issue in contemporary society. Earlier in the field of test anxiety, well-known researchers Sarason and Mandler (1952) stated: *"We live in a test-conscious, test-giving culture in which people's lives are partially determined by their test performance."*

In medical education, knowledge and clinical skill assessments are frequently used to determine competence of medical students (Schuwirth and van der Vleuten, 2020). This assessment practice is commonly referred to as the assessment of learning (AOL) model (Pugh and Regehr, 2016). This AOL model emphasizes objectivity in assessment data (ten Cate and Regehr, 2019), striving to optimize the psychometric properties of assessment tools (Hodges, 2013), assigning grades, and categorizing students as either competent or not, typically as pass or fail (Pugh and Regehr, 2016).

Consequently, students perceive assessments as distressing events associated with social judgment and stigmatization, especially when their status is determined by a pass or fail outcome (Pugh and Regehr, 2016; Wadi *et al.*, 2020c).

In addition to the AOL model, when considering the sociotechnical perspective of the assessment system (Lineberry, 2019), it becomes evident that the system is a complex and multifaceted framework that involves various participants, such as assessee (learners), assessors (educators), and test administrators. Within this system, there are social structures at play, including power dynamics and interpersonal relationships among learners and educators. Additionally, the system encompasses a range of tasks, from the development and preparation of assessments to their administration, including communication and logistics. It also involves the completion of assessments and subsequent reflection and action. Moreover, the assessment system incorporates both physical and conceptual technologies, such as assessment methods, data collection equipment, scoring processes, and report formats (Lineberry, 2019). These components interact and shape the overall negative effect of the assessment system.

To better understand the negative effects of the assessment system, the researcher has conceptualized them into three phases: pre-test, intra-test, and post-test. These phases represent combining the arguments presented by Zeidner (1998) in the transactional model of test anxiety and Pugh and Regehr (2016) deliberation on the “stings of assessment.” By examining these phases, we can gain insights into the cumulative negative effects experienced by individuals within the assessment process.

2.3.1 Pre-test effects

The pre-test effects were triggered by the perception of test stakes (high or low), prior experience with similar tests (passing or failing), and the amount of material to be

studied. Hence, the psychological evaluation may have either motivating or debilitating effects. At first glance, the anticipation of being tested can provide extrinsic motivation (Cilliers *et al.*, 2012a). In other words, the impending test pressure may motivate students to study and attempt to consolidate their understanding of the test material (Jones *et al.*, 2020). On the other hand, it may be perceived as challenging, ego-threatening, or harmful, resulting in test anxiety, especially if the individual perceives inadequate coping resources or limited coping ability (Zeidner, 2007). This results in students acting in the opposite way (procrastination and other study avoidance behaviours) (Pugh and Regehr, 2016). Students have learned to approach test situations with trepidation, anxiety, and a fear of failing because the interpretation of a test situation is largely determined by one's past experiences, particularly failure (Zeidner, 1998). In addition, anxiety levels increase when the nature of the anticipated exam is unclear, and the study material is unstructured or undetermined (Cilliers *et al.*, 2012a). Insufficient briefing about the exam format adds to the unpredictability and uncertainty, intensifying anxiety levels and affecting students' preparation and time management (Jones *et al.*, 2020).

2.3.2 Intra-test effect

In addition to the effects of anticipating an upcoming test, the testing process itself can lead to the testing effect. The testing effect may be favourable for consolidating what has been learned if the retrieval process goes smoothly. Retrieving information results in greater learning than repeated study alone. Nonetheless, the retrieval process could be hindered by several exam-related factors. One contributing factor is the nature and structure of test items. Ambiguous or unclear questions and unpredictable assessment tools can create confusion, uncertainty, and difficulties in providing accurate responses (Zeidner, 1998; Wadi *et al.*, 2022c).

Additionally, specific assessment formats involving direct interaction with examiners, such as Objective Structured Clinical Examinations (OSCEs), oral exams, and short cases, have been reported as stress-provoking assessment modalities (Guraya *et al.*, 2018). The pressure to perform flawlessly while being observed amplifies anxiety and self-doubt, as students fear making mistakes or receiving negative evaluations (Zeidner, 1998). Moreover, examiners' behaviour, often characterized as excessively strict, a phenomenon known as the "hawk" effect, contributes to the stress experienced by students during exam (McManus *et al.*, 2006).

2.3.3 Post-test effects

The final phase in which assessment can have a significant impact on mental well-being occurs after the test has taken place. This post-assessment phase is crucial as it involves the feedback provided to students, the fairness and justification of scores, and the decision on pass or fail based on their performance (Cook and Lineberry, 2016). If students do not receive adequate or meaningful feedback, it can create a sense of uncertainty and confusion, contributing to heightened anxiety (Pugh and Regehr, 2016).

Moreover, if the assessment scores are perceived as unjustified or unfair, it can further exacerbate anxiety and distress among students (Zeidner, 1998). Students may question the accuracy or validity of the assessment process, leading to a sense of frustration and disappointment (Cook and Lineberry, 2016). Unjustified scores can also erode students' confidence in their abilities and undermine their self-esteem, negatively impacting their overall mental well-being (Pugh and Regehr, 2016).

Furthermore, the decision on pass or fail based on student performance carries significant weight and consequences (Spring *et al.*, 2011). If the decision is perceived as unjust or arbitrary, it can result in what is commonly referred to as "test stigmata" (Pugh and Regehr, 2016). This stigmatization can have severe psychological effects,

such as feelings of shame, inadequacy, and a diminished sense of self-worth (Zeidner, 1998; Spring *et al.*, 2011; Pugh and Regehr, 2016).

In conclusion, the assessment process has a profound influence on mental well-being throughout its three distinct phases. From the pre-test anticipation to the intra-test experience and post-test feedback and outcomes, understanding these effects is crucial for fostering positive mental well-being and mitigating any negative consequences that assessments may have on individuals. By recognizing and addressing the potential challenges and stressors associated with assessments, educational systems can strive to create a supportive and conducive environment that promotes the overall mental health and well-being of students (Wadi *et al.*, 2020c).

2.4 The most common mental health problems among medical students

In the following subsections, the most common mental health problems among medical students will be explored, providing insights into their underlying concepts and theoretical models. Specifically, the focus will be on stress, anxiety, including its subtype test anxiety, burnout, and depression.

2.4.1 Stress

Stress is a biological reaction to circumstances that put a person under physical or psychological strain (Selye, 1975; Lazarus, 1990). A stressor is an internal or external source that causes stress. Over the past 70 years, research into human stress has gained popularity in the behavioural and health sciences (Shapiro *et al.*, 2000).

2.4.1(a) Theoretical foundation of stress

The most commonly cited stress paradigm is the transactional model of stress and emotion (Lazarus and Folkman, 1984). According to this framework, stress results from a dynamic interaction between a person's environment and themselves. Lazarus

and Folkman (1984) describe stress as "a relationship between the individual and the environment that the person perceives as exhausting or exceeding his or her resources and harming his or her wellbeing" (pg. 19). According to this definition, a person often responds to stress by making an effort to regain equilibrium, utilize resources for stress reduction, and employ effective coping mechanisms. The primary, secondary, and reappraisal stages of stress evaluation are presupposed by the stress paradigm. Each of these phases takes place during the process of emotional experience and the impact it has on later coping mechanisms.

The process of determining whether an occurrence is favourable, negative (threatening), or irrelevant is known as primary appraisal. A favourable or irrelevant occurrence does not cause any rise in physiological arousal. If an individual experiences a negative occurrence, a secondary assessment will subsequently be performed, which involves a person assessing the resources at their disposal to handle the issue. This assessment will result in a harm appraisal if a loss manifest. A threat appraisal will emerge when a person expects danger, while a challenge appraisal happens when a person feels confident in their capacity to fulfil the demands associated with dealing with the event. Reappraisal is a continuous re-evaluation of the event that takes place as fresh information or resources for dealing with an incident arise (Smith *et al.*, 1990).

2.4.1(b) The implication of the transactional model of stress on assessment

In addition to the primary, secondary, and reappraisal stages of stress described by Lazarus and Folkman (1984), Zeidner (1998) provides a comprehensive analysis and practical implications of the transactional model of stress. According to Zeidner, this model consists of three essential elements: stress antecedents, stress mediators, and stress outcomes (Zeidner, 1998).

Stress antecedents encompass a range of personal and environmental factors that influence an individual's experience of stress. 1) Personal factors include personality traits such as self-efficacy, optimism, and social evaluative trait anxiety, which shape how individuals perceive and react to stressful events. For instance, individuals with high self-efficacy may approach stressful situations with greater confidence and resilience, while those with low self-efficacy may experience more difficulty in coping with stress (Zeidner, 1998). Recognizing the influence of these personal factors is crucial in developing effective stress reduction interventions that aim to nurture and strengthen individuals' positive traits and abilities (Jones *et al.*, 2020). 2) Environmental factors also serve as significant antecedents, encompassing elements such as the test environment and the presence of examiners (Zeidner, 1998). The test environment can have a profound impact on individuals' stress levels and overall experience. A supportive and conducive test environment can help alleviate stress and foster a sense of calm and focus, enabling individuals to perform at their best (Zeidner, 1998). Conversely, a stressful or unsupportive test environment can heighten anxiety and negatively affect performance (Zeidner, 1998). Similarly, the presence of examiners during assessments can influence stress levels, as individuals may experience added pressure or self-consciousness. Ensuring a positive and supportive test environment and examiner can contribute to a more optimal and stress-reduced assessment experience (Wadi *et al.*, 2022a).

Stress mediators act as intermediate factors that influence the relationship between antecedents and stress outcomes (Zeidner, 1998). These mediators play a significant role in shaping an individual's stress response and coping strategies. Common mediating variables include stress assessments, threat perceptions, and coping mechanisms. Stress assessments involve the individual's subjective evaluation of the

stressor's significance and their perceived ability to cope with it. Threat perceptions refer to the individual's appraisal of the potential harm or challenge posed by the stressor (Zeidner, 1998). Coping mechanisms, on the other hand, are the strategies employed by individuals to manage and cope with stress. Developing and enhancing effective coping mechanisms is a key target for stress reduction interventions. By providing individuals with the necessary tools and skills to cope with stress, these interventions can empower individuals to better manage and navigate challenging situations, ultimately promoting well-being and resilience (Wadi *et al.*, 2022a).

Ultimately, stress outcomes encompass the physiological, psychological, and behavioural responses that occur as a result of the stress evaluation process. These outcomes can vary widely depending on the individual's characteristics and the coping mechanisms they employ (Zeidner, 1998). Physiological reactions may include changes in heart rate, blood pressure, or hormonal responses, while psychological reactions can involve emotional responses such as anxiety or frustration. Behavioural responses can manifest as changes in behaviour, such as avoidance or increased effort to address the stressor (Zeidner, 1998).

By understanding the interplay between these elements within the transactional model of stress, researchers and practitioners can gain valuable insights into how individuals appraise and respond to stressors (Zeidner, 1998). This knowledge can inform the development of effective interventions and support systems aimed at helping individuals manage and mitigate the negative effects of stress on their well-being (Wadi *et al.*, 2020c).

2.4.2 Anxiety

Anxiety, a basic human feeling that indicates environmental uncertainty or risks, has taken up a significant amount of space in the research as one of the most common

and significant stress responses humans experience (Sarason *et al.*, 1990). Anxiety has attracted significant attention in extant research. The existing research in this field has focussed on how anxiety affects adaptive outcomes like cognitive and social performance, subjective wellbeing, and somatic health or sickness. Consequently, it is virtually always associated with mental stress (Lazarus, 1993). However, this perspective has been debated heavily in the existing literature (Zeidner, 1998).

Various definitions of anxiety have been presented in the literature. It has been presented as a stimuli condition, a reaction to a stressful experience, or the threat of a catastrophic future event (Shechter and Zeidner, 1990). Scholars' inability to achieve a consensus on a formal definition of anxiety has been exacerbated by some degree of uncertainty. First, there is a conceptual misunderstanding concerning the effects of anxiety since there is no differentiation between anxiety as a personality trait and anxiety as a transitory emotional experience (Spielberger, 1975). There is debate about whether the label 'anxiety' refers to a physical state (such as elevated heart and respiration rates or self-reports) or a perceived, hypothetical state (Sarason, 1978). Last but not least, some of the confusion results from the frequent, almost concurrent use of both definitions of anxiety.

2.4.2(a) Theoretical foundation of anxiety

The primary metatheoretical premise underpinning transactional cognitive-motivational analysis is that both stress and emotions are essentially related to person-environment interactions (Lazarus, 1991; Lazarus, 1993). Subsequently, the strength or intensity of the emotion an individual experiences is determined by real or projected adaptational contacts with the environment that an individual assesses as having an impact on their wellbeing, either positively or negatively. According to the cognitive-motivational viewpoint, every emotion is underpinned by specific relational

fundamental concepts. The various personal interpretations given to events, such as injury or loss, threat, and reward, are referred to as primary relational motifs. Any emotion that is triggered represents a high-level synthesis of several assessments of the person's level of environmental adaptation. When someone is faced with an unclear existential threat, the individual will experience a risk or warning to ego or self-esteem. As a result, anxiety can develop when a situation is perceived as a threat following a cognitive and symbolic process. Anxiety is one emotion that can reveal a person's belief system, event appraisals, and goal hierarchy. As the manifestation of anxiety in an evaluation encounter is a sign that an existential threat has not been sufficiently addressed, its sheer existence can be informative to some extent.

2.4.2(b) The difference between anxiety and stress

According to Sarason (1978) theory anxiety is a response to a perceived threat and the inability to effectively handle the situational challenge, whereas stress is inherent to how a particular condition is interpreted. An anxious individual thinks they can't handle the tasks they have been presented with (Sarason, 1978). According to Sarason *et al.* (1990), the following are significant conditions for anxiety:

- The person characterizes the circumstance as difficult, risky, or difficult.
- The person believes they lack the coping mechanisms needed to respond to a call to action, a situational limitation, or an opportunity, rendering them ineffectual or incapable of dealing with the task at hand.
- The person is preoccupied with self-deprecating thoughts that impair their ability to execute cognitive tasks. They predict failure and the loss of respect or self-esteem from others. They are fixated on the negative effects of their own shortcomings or with unfavourable outcomes.