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Sociodemographics and clinical profiling of students seeking mental health services: a cluster analysis in a public university in Oman

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Abstract

Purpose – Mental health heterogeneity among university students significantly influences academic performance. Depression and social anxiety may produce similar academic results through distinct mechanisms, requiring different responses. Recognising mental health as a core determinant of learning enables educators to implement differentiated, inclusive support strategies that address diverse psychological needs. Therefore, exploring whether this is also the case in other countries with different cultures is important. This study aims to address the identified



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gaps by using cluster analysis to examine the sociodemographic and clinical heterogeneity among students seeking mental health services in Oman, offering culturally specific insights.

Design/methodology/approach – A retrospective chart review study was conducted to collect clinical and sociodemographic data from university students ($n = 229$) who attended the student mental health clinic at one public university in Oman from 2019 to 2023. A two-step cluster analysis was used to detect naturally occurring groupings in this study.

Findings – Two groups emerged: Cluster 1 ($n = 105$) included mostly off-campus male students (80%) in Natural/Applied Sciences (42.7%), with cognitive-behavioral (14.3%) and physiological/developmental disorders (11.4%), and with fewer diagnosis changes (39.0%). Cluster 2 ($n = 124$) comprised on-campus (87.9%, $p < 0.001$) female students (100%, $p < 0.001$) in Health/Life Sciences (35.7%) or Social/Humanities (38.4%, $p = 0.017$), primarily with emotional dysregulation disorders (87.9%, $p = 0.029$), showing significant improvement post-intervention (82.3%, $p = 0.007$) than students in Cluster 1.

Originality/value – This study highlights diverse needs, underscoring the need for tailored interventions. For off-campus males, improve accessibility and address academic stressors. For on-campus females, focus on resilience-building. Universities should adopt holistic, cluster-specific approaches, like integrated academic-mental health services, to ensure equitable, personalized care for diverse student needs. Although two clusters were identified in this study, the proposed interventions are preliminary implications requiring further validation. Efforts should be made to improve the identification of students with mental health needs before they reach a crisis point. This could involve educational campaigns, stigma reduction, and targeted outreach to at-risk populations.

Keywords Students, Residential education, Mental health, Oman

Paper type Research article

Introduction

Mental health is often described as more than the mere absence of illness; it reflects a dynamic state of well-being in which individuals can recognize their own capacities, navigate everyday pressures, remain productive, and contribute meaningfully to society (Galderisis *et al.*, 2015). Expanding on this view, the Society for Health Education and Promotion specialists emphasize that sound mental health also entails a positive sense of self and others (Dinesh Bhugra, Till, & Sartorius, 2013). An individual's susceptibility to mental illnesses is influenced by both internal and external factors, such as low self-esteem, social standing, feelings of entrapment or helplessness, cultural conflicts, discrimination, or experiences of abuse (Galderisis *et al.*, 2015). For more than a decade, research has highlighted that approximately half of university students have a psychiatric disorder, with depression, anxiety, sleeping disorders, and suicidal ideation being prevalent, and only a fraction of them seek mental health services (Raghaven, 2014). More recent findings suggest that the situation may be intensifying. For instance, Duffy, Twenge, and Joiner (2019) reported that mental health symptoms among college students have risen dramatically, nearly fourfold, over ten years. Consistently, students tend to exhibit higher levels of psychological distress compared with the general population, despite relatively low utilization of mental health services (Mazharul Islam, Wesonga, Al Hasani, & Al Manei, 2022). Against this backdrop, important gaps remain. In particular, the heterogeneity of student mental health has been underexplored in Middle Eastern settings, where sociocultural expectations, stigma, and academic pressures diverge in meaningful ways from those typically observed in Western contexts (Musa, 2024).

Study aim and objectives

Accumulating evidence emphasizes the substantial heterogeneity of mental health problems among university students (Liu, Morrison, & Zeng, 2024). University students often navigate a convergence of academic, social, and psychological stressors throughout their studies (Mboya *et al.*, 2020; Brett, Mathieson, & Rowley, 2023). For those residing on campus, the residential peer environment may function as both a risk and a resource, with considerable capacity to foster positive learning and psychosocial experiences when appropriately supported. In this regard, collaboration among educators, healthcare professionals, and residential staff or tutors is particularly salient (Ong, 2024; Porru *et al.*, 2022; Worsley, Harison, & Corcoran, 2021).

Structured peer-support mechanisms or facilitated learning groups can create repeated opportunities for students to practice social interaction, mutual support, and adaptive coping in the face of academic challenges and psychological concerns, including mental health difficulties (Cheng & Chan, 2021; Bennett, Kidger, Haworth, Linton, & Gunnell, 2024; Hurtado, Gonyea, Graham, & Fosnacht, 2020). Whether such variability manifests similarly across sociocultural contexts, however, remains insufficiently explored. Responding to this gap, the present study employs an exploratory approach to examine sociodemographic and clinical heterogeneity among students seeking university-based mental health services in Oman, thereby generating contextually grounded insights that reflect local cultural and institutional realities. Such evidence has the potential to assist university educators and healthcare providers in distinguishing discrete student profiles and in designing more precisely targeted, needs-responsive teaching and learning interventions. The objectives of this study are to identify the heterogeneity profiles of university students seeking mental health services and to examine differences among these profiles with respect to sociodemographic and mental health outcomes. Accordingly, this study had two corresponding research questions aligned with the study objectives.

- RQ1. What distinct heterogeneity profiles can be identified among university students seeking mental health services?
- RQ2. How do these identified profiles differ in terms of sociodemographic characteristics and mental health outcomes?

Literature review

Mental health and well-being heterogeneity in university students

There is growing concern over the mental health and well-being of university students, which has become a global issue. A New Zealand study reported that university students' demographic and mental health well-being showed heterogeneous distributions and responded differently across study periods (Liu *et al.*, 2024). They reported that male students were more likely to report feeling calm, active, and rested than female students. Younger students (under 20) were more likely to report feeling cheerful and rested than older students (20 and above). A study in Canada underscores the importance of addressing mental health challenges among first-year university students, particularly during times of crisis, and policy efforts to support their mental health issues (Howard, Carnrite, & Barker, 2022). In Oman, a study in a public university highlights that female students had higher examination scores, better attendance, and more time spent studying than male students (Mazharul Islam, 2014). Another local cross-sectional study in one public university found that a total of 133 (27.7%) out of 481 students had depressive symptoms (Al-Busaidi *et al.*, 2011). Furthermore, during the COVID-19 pandemic, mental illnesses increased among university students, showing a high prevalence of stress (71%), anxiety (69.2%), mild to severe levels of depression (66.3%), and frequent mental distress symptoms (30%) (Mazharul Islam *et al.*, 2022).

A systematic review highlights the urgent need for more comprehensive and inclusive research on the mental health of undergraduate engineering students (Asghar, Minichiello, & Ahmed, 2024). The study found that heavy academic workloads, sleep deprivation, competitive environments, and the culture of engineering education are identified as significant contributors to poor mental health and well-being. While stress and other mental health issues are prevalent, targeted interventions and a shift toward positive psychology offer promising avenues for improvement. The findings call for a cultural change in engineering education to support students academically, mentally, and emotionally. Previous research found that academic discipline is another factor that induces students to have different levels of mental health issues. A cross-national comparison study revealed that the highest recorded rate was 71.9% among medical students in Saudi Arabia, closely mirroring the 70% reported for

non-medical students in Tanzania (Mboya *et al.*, 2020). Additionally, some university students face challenges balancing the demands of establishing independence from their families and managing academic stress, while others may juggle significant work and family responsibilities (Pedrelli, Nyer, Yeung, Zulauf, & Wilens, 2015).

Residential living impacts university students' mental health and well-being

A qualitative study conducted in the UK explored the impact of student accommodation environments on the mental health and well-being of first-year university students (Worsley *et al.*, 2021). The transition to university is a significant period of change, often accompanied by challenges such as loneliness, social isolation, and the need to form new friendships. A qualitative study in Hong Kong interviewed 20 university students, highlighting the significant impact of the COVID-19 pandemic on the mental health and well-being of those living in residential halls and underscoring the need for targeted interventions and preventive strategies to support students' mental health during and after the pandemic (Ong, 2024). Another qualitative study evaluates the implementation and impact of new mental health well-being services at a UK university, focusing on low-intensity, non-clinical mental health support (Bennett *et al.*, 2024). This study examines the effectiveness of mental health advisors in academic departments and student accommodation, as well as the challenges they face in delivering these services. The study highlights that mental health well-being services alone cannot address broader structural issues affecting student mental health (Bennett *et al.*, 2024). This study recommended that university management develop targeted interventions to support student mental health and well-being throughout their university journey. Future studies should explore additional psychosocial factors, such as personality, social support, and optimism, to develop a more comprehensive model of student mental health and well-being (Brett *et al.*, 2023). Mental health heterogeneity among university students constitutes a multifaceted challenge with far-reaching implications for academic performance and the wider learning environment, particularly in relation to class attendance and engagement. Conditions such as depression and social anxiety, for instance, may generate superficially similar academic outcomes through fundamentally different psychological mechanisms. One student may disengage from classes due to depressive withdrawal and fatigue, while another avoids attendance altogether to escape the anticipatory distress of social evaluation. In both cases, absence is observed, yet the appropriate responses should differ.

Emerging evidence emphasizes the need to acknowledge this heterogeneity in higher education settings (Liu *et al.*, 2024). When mental health is conceptualized as a core determinant of learning rather than a peripheral concern, educators are better positioned to implement differentiated support strategies that respond to diverse psychological needs. Such an approach moves beyond assisting only those who conform to conventional profiles of distress, enabling more inclusive and responsive educational practices that accommodate the full spectrum of student mental health experiences. A study in the USA examined the impact of living on a residential campus versus off-campus on student engagement and perceived gains in learning and development (Graham, Hurtado, & Gonyea, 2018). The study shows that students living on residential campuses had small but statistically significant positive effects on collaborative learning, discussions with diverse others, and student-faculty interaction, especially when compared to students living farther than walking distance. A large survey of 76 universities in the USA examines the relationship between residential learning communities and student engagement, focusing on how these communities influence students' access to academic and social resources, their levels of engagement, and their perceived gains in learning and development (Hurtado *et al.*, 2020). The study shows that students living on residential campuses were more engaged in collaborative, reflective, and integrative learning, as well as in student-faculty interactions, than non-residential students. In contrast, a study of 574 university students in the UK showed that residential students reported higher loneliness and more stressors than students living off campus. However, no significant differences in overall well-

being or psychosocial resources were found (Brett *et al.*, 2023). A longitudinal study among 568 university students in Italy reported that students exposed to high-life challenges, such as faculty shortcomings, unsupportive environments (e.g. inconvenience and poor living conditions), high workload, and financial concerns, were associated with poorer mental health (Porru *et al.*, 2022). All these findings highlight the importance of accommodation environments in supporting students' mental health during their university studies.

Research methodology

Study design

A retrospective chart review study collected clinical and sociodemographic data on university students who attended the student mental health clinic at one public university in Oman from 2019 to 2023.

Participants

The study included all Sultan Qaboos University (SQU) students who used the student mental health clinic. In total, 303 students sought services, but only 229 (75.6%) were recorded due to the availability of their health status and a follow-up mental health assessment. Therefore, we included 229 students for further analysis in this report, with an average age of 23.1 (SD = 2.8) years, ranging from 18.0 to 39.0 years old, and more than 98% ($n = 226$) were Omani. The estimated required samples were based on hierarchical density-based spatial clustering of applications, using a noise method to detect at least 2 clusters of student groups with a separation distance of 4 and a silhouette coefficient of 0.5. This study's minimum required sample size was determined using the guidelines of Dalmaijer, Nord, and Astle (2022), which indicated that a minimum of 160 students was required to achieve 87% power at a 5% significance level.

Data collection

Data for this study were collected from the electronic health records using the TrakCare system, the primary healthcare information system utilized at the service clinic. Two main data sets were collected: Sociodemographic (e.g. age at the time of treatment, gender, academic discipline and year of study, nationality, marital status, residential status) and clinical data (e.g. diagnosis or presenting issues, treatment history and duration, types and frequency of therapeutic interventions, medications prescribed, progress and outcomes of treatment). Ethical approval for the study was granted by the university's Medical Research Ethics Committee (MREC #3126).

Data analysis

Descriptive statistics (e.g. mean, standard deviation (SD), median, range, frequency, and percentage) were used to explore the demographic and clinical outcomes of students seeking mental health services. To address objective 1, an unsupervised clustering approach was adopted. This data-driven technique is designed to uncover latent patterns at the individual level and to construct empirically grounded profiles based on shared characteristics. In the present analysis, all available sociodemographic and clinical outcomes were used simultaneously. Given that the response outcomes comprised both continuous (e.g. age) and categorical outcomes (e.g. gender, residential status, history of childhood abuse, diagnostic categories, and overall improvement status), a two-step cluster analysis was selected. This analysis is particularly well-suited for handling mixed data structures and for detecting naturally occurring groupings without the need to predefine the number of clusters a priori (Dalmaijer *et al.*, 2022). The two-step clustering also serves as an exploratory analytic strategy and a basis for hypothesis generation when the primary interest lies in grouping students according to multivariate similarity across multiple domains (Goh, Lee,

Chan, & Chan, 2014). To determine the optimal number of clusters within the cohort, the average silhouette score was used (Kaufman & Rousseeuw, 1990; Buijs, Hoogstra-Klein, de Boer, Dressel, & Langers, 2025). Higher silhouette values indicate stronger within-cluster cohesion and clearer separation between clusters, suggesting that individual cases are appropriately aligned with their respective subgroup profiles. To address objective 2, differences between cluster groups were assessed using independent *t*-tests for continuous outcomes and chi-square/Fisher's exact tests for categorical outcomes. All missing data were replaced using multiple imputation (automatic) methods because the variables included both categorical and numerical data. All analyses were performed using IBM SPSS v23.0, and all tests were set at a 5% significance level.

Results

Sociodemographic and clinical data

A total of 229 students were included in the analysis (see Tables 1 and 2). Females comprised nearly two-thirds of the cohort (63.5%, $n = 145$), while an overwhelming majority were single (96.5%, $n = 221$). The distribution of students was fairly balanced between those residing on campus (51.2%) and those living off campus (48.8%), with a similarly even spread across academic disciplines. Most students had either continued or completed their studies (95.6%, $n = 157$), and a substantial proportion belonged to cohorts from 2021 onwards (82.1%). From a clinical perspective, emotional dysregulation disorders accounted for the vast majority of initial diagnoses (81.7%). Nearly half of the students (46%) experienced changes in diagnosis during ongoing care within the department, with three-quarters (75.1%) demonstrating overall improvement. Reports of family history of mental illness (25%) and childhood abuse (20%) were relatively limited. Therapeutic intervention was almost universal (98.0%), most commonly in the form of psychoeducation (65%) and, to a lesser extent, psychotherapy (25%). Pharmacological treatment was also widely required (98.7%), with 47% receiving monotherapy, 33% receiving dual agents, and the remainder receiving multiple medications.

Comparison of sociodemographic characteristics and clinical outcomes by clusters

The 2-step cluster analysis divided the study sample into two clusters (silhouette coefficient = 0.32), with Cluster 1 comprising 105 students (45.8%) and Cluster 2 consisting of 124 students (54.2%) (see Tables 1 and 2). Clusters were formed based on similar patterns in demographic and clinical outcomes. In sociodemographic outcomes from Table 1, Cluster 1 was characterized by students who were males (80%), 86.5% were living outside the campus, 7% of them were married, and 11% of their studying areas were non-university, which means they were undergoing internship/practicum/placement, and more were studying in the Natural and Applied Sciences (42.7%) discipline. In contrast, a significant difference was found ($p < 0.001$). At the same time, students in Cluster 2 are all females (100%, $p < 0.001$) and single (100.0%, $p = 0.002$), their studying areas were in the university ($p < 0.001$), and mostly living on the campus (87.9%, $p < 0.001$), and most of them were studying in the Health and Life Sciences or Social, Humanities, and Professional Studies (38.4%, $p = 0.017$) than students in Cluster 1. All the above outcomes show a significant difference between the two clusters.

As shown in Table 2, distinct clinical patterns emerged between the two clusters. Students in Cluster 2 were more frequently diagnosed initially with emotional dysregulation disorders (87.9%), whereas cognitive and behavioral dysfunction (6.5%) and physiological or developmental disorders (5.6%) were comparatively less common. In contrast, Cluster 1 showed a broader diagnostic spread, with lower rates of emotional dysregulation (74.2%) but higher proportions of cognitive/behavioral (14.3%) and physiological/developmental conditions (11.4%), resulting in a significant overall difference ($p = 0.029$). Beyond initial diagnoses,

Table 1. Sample sociodemographic data and comparison by clusters

	Total (n = 229) n (%)	Cluster		Test~	
Characteristics		1 (n = 105) n (%)	2 (n = 124) n (%)	Statistics	p-value
<i>Gender</i>					
Male	84 (36.7)	84 (80.0)	0 (0.0)	156.668	<0.001**
Female	145 (63.5)	21 (20.0)	124 (100.0)		
Age (years): Mean ± SD	23.1 ± 2.8	23.4 ± 3.2	22.9 ± 2.4	1.123#	0.263
Median [Range]	23.0 [18.0–39.0]	23.0 [19.0–39.0]	23.0 [18.0–33.0]		
<i>Marital status</i>					
Married	8 (3.5)	8 (7.6)	0 (0.0)	9.790^	0.002**
Unmarried	221 (96.5)	97 (92.4)	124 (100.0)		
<i>Nationality</i>					
Omani	226 (98.7)	103 (98.1)	123 (99.2)	0.530^	0.595
Non-Omani	3 (1.3)	2 (1.9)	1 (0.8)		
<i>Address[#]</i>					
Muscat	56 (32.7)	32 (36.8)	24 (28.6)	6.678^	0.572
Dhofar	2 (1.2)	1 (1.1)	1 (1.2)		
Al Buraimi	3 (1.8)	1 (1.1)	2 (2.4)		
Ad Dakhiliyah	38 (22.2)	20 (23.0)	18 (21.4)		
North Al Batinah	24 (14.0)	9 (10.3)	15 (17.9)		
South Al Batinah	21 (12.3)	11 (12.6)	10 (11.9)		
North Ash Sharqiyah	8 (4.7)	6 (6.9)	2 (2.4)		
South Ash Sharqiyah	4 (2.3)	1 (1.1)	3 (3.6)		
Al Dhahirah	15 (8.8)	6 (6.9)	9 (10.7)		
<i>Residential status^{##}</i>					
At campus	108 (51.2)	14 (13.5)	94 (87.9)	116.803	<0.001**
Outside campus	103 (48.8)	90 (86.5)	13 (12.1)		
<i>Studying status[^]</i>					
Continue/complete studying	157 (95.6)	71 (94.7)	86 (96.6)	0.384^	0.703
Terminate studying	7 (4.3)	4 (5.3)	3 (3.4)		
<i>Area of study</i>					
University	217 (94.8)	93 (88.6)	124 (100.0)	14.95	<0.001**
Non-University	12 (5.2)	12 (11.4)	0 (0.0)		
<i>Academic discipline[@]</i>					
Natural and Applied Sciences	64 (33.0)	35 (42.7)	29 (25.9)	8.117	0.017*
Health and Life Sciences	69 (35.6)	29 (35.4)	40 (35.7)		
Social, Humanities, and Professional Studies	61 (31.4)	18 (21.9)	43 (38.4)		
<i>Year of first diagnosis</i>					
2019	17 (7.4)	9 (8.6)	8 (6.5)	3.258	0.516
2020	24 (10.5)	14 (13.3)	10 (8.1)		
2021	53 (23.1)	20 (19.0)	33 (26.6)		
2022	76 (33.2)	35 (33.3)	41 (33.1)		
2023	59 (25.8)	27 (25.7)	32 (25.8)		
Note(s): ^, Fisher exact test; #, independent <i>t</i> -test; ~, χ^2 test; #, missing 58; ##, missing 18; ^, missing 65; @, missing 35; Natural and Applied; Sciences (Agricultural and Marine Sciences, Engineering, Science); Health and Life Sciences (Medicine and Health Science, Nursing); Social, Humanities, and Professional Studies (Art and Social Sciences, Economics and Political Science, Education, Law); Non-university: including internship/practicum/placement; *, significant at $p < 0.05$; **, significant at $p < 0.01$					

Table 2. Sample clinical data and comparison by clusters

Clinical data	Total (n = 229) n (%)	Cluster 1 (n = 105) n (%)	2 (n = 124) n (%)	Test~	
				Statistics	p-value
<i>First diagnosis</i>					
Emotional dysregulation disorders	187 (81.7)	78 (74.3)	109 (87.9)	7.057	0.029*
Cognitive and behavioral dysfunction disorders	23 (10.0)	15 (14.3)	8 (6.5)		
Physiological and developmental disorders	19 (8.3)	12 (11.4)	7 (5.6)		
<i>Diagnosis changes</i>					
Yes	107 (46.7)	41 (39.0)	66 (53.2)	4.591	0.032*
No	122 (53.3)	64 (61.0)	58 (46.8)		
<i>Family history of mental illness⁺</i>					
Yes	55 (25.8)	23 (23.5)	32 (27.8)	0.524	0.469
No	158 (74.2)	75 (76.5)	83 (72.2)		
<i>Childhood trauma/abuse[@]</i>					
No	155 (79.1)	74 (86.0)	81 (73.6)	4.494	0.034*
Yes	41 (20.9)	12 (14.0)	29 (26.4)		
<i>Type of abuse</i>					
Physical abuse	21 (51.2)	7 (58.3)	14 (48.3)	0.344	0.558
Psychological abuse	20 (49.8)	5 (41.7)	15 (51.7)		
<i>Family relationship (parent) classification[!]</i>					
Supportive and Alive	32 (14.4)	14 (13.7)	18 (15.0)	1.009 [^]	0.829
Unknown Information	179 (80.6)	84 (82.4)	95 (79.2)		
Deceased Parent (one/both)	4 (1.8)	2 (2.0)	2 (1.7)		
Complex Family Dynamics	7 (3.2)	2 (2.0)	5 (4.2)		
<i>Substance abuse^{!!}</i>					
No	196 (97.5)	89 (97.8)	107 (97.3)	0.058 [^]	0.998
Yes	5 (2.5)	2 (2.2)	3 (2.7)		
<i>Received therapeutic intervention^{!!}</i>					
No	4 (2.0)	3 (3.3)	1 (0.9)	1.405 [^]	0.334
Yes	197 (98.0)	89 (96.7)	108 (99.1)		
<i>Classification of therapeutic intervention</i>					
Psychoeducation	129 (65.5)	61 (68.5)	68 (63.0)	3.692 [^]	0.792
Psychotherapy	50 (25.4)	19 (21.3)	31 (28.7)		
Psychoeducation & Psychotherapy	5 (2.5)	3 (3.4)	2 (1.9)		
Referral	6 (3.0)	2 (2.2)	4 (3.7)		
Behavioral techniques	4 (2.0)	2 (2.2)	2 (1.9)		
Assessment tools	1 (0.5)	1 (1.1)	0 (0.0)		
Other intervention	2 (1.0)	1 (1.1)	1 (0.9)		
<i>Received prescribed medications^{!!!}</i>					
Yes	225 (98.7)	102 (97.1)	123 (100.0)	3.561 [^]	0.096
No	3 (1.3)	3 (2.9)	0 (0.0)		
<i>Number of prescribed medications⁺⁺</i>					
Monotherapy	106 (47.1)	46 (45.1)	60 (48.8)	0.761	0.684
Dual agents	76 (33.8)	34 (33.3)	42 (34.1)		
Multiple agents	43 (19.1)	22 (21.6)	21 (17.1)		

(continued)

Table 2. Continued

Clinical data	Total (n = 229) n (%)	Cluster 1 (n = 105) n (%)	2 (n = 124) n (%)	Test~	
				Statistics	p-value
Overall improvement					
Yes	172 (75.1)	70 (66.7)	102 (82.3)	7.393	0.007**
No	57 (24.9)	35 (33.3)	22 (17.7)		
Note(s): ^, Fisher exact test; ~, χ^2 test; +, missing 16; @, missing 33; !, missing 7; !!, missing 28; !!!, missing 1; ++, missing 4; Physiological and development disorders (others, sleep disorders); Cognitive and behavioral dysfunction disorders (psychotic disorders, Obsessive-Compulsive and Related Disorder, personality disorders); Emotional dysregulation disorders (Anxiety disorders, depressive disorders, bipolar and related disorders, stress-related disorders); *, significant at $p < 0.05$; **, significant at $p < 0.01$					

Cluster 2 students appeared to follow a more dynamic clinical trajectory. Over half (53.2%) experienced a change in diagnosis during care, compared with 39.0% in Cluster 1 ($p = 0.032$). Improvements were also more frequently observed in Cluster 2 (82.3% vs. 66.7%, $p = 0.007$). A higher proportion of students in Cluster 2 reported a history of childhood abuse (26.4%), exceeding that observed in Cluster 1 (14.0%, $p = 0.034$). For the remaining clinical indicators, however, no statistically meaningful differences were detected between the two groups.

Discussion

A previous study highlights the importance of recognizing the heterogeneity of mental health among university students (Liu *et al.*, 2024). This suggests that a “one-size-fits-all” approach to improving student mental health and well-being is unlikely to be effective. Previous studies (Graham *et al.*, 2018; Worsley *et al.*, 2021) emphasize the importance of accommodating environments in supporting student mental health and well-being during the transition to university. Our study identified at least two sub-groups of students seeking mental health services, indicating heterogeneity in sociodemographic and clinical outcomes.

Our findings reveal that Cluster 2 exclusively consists of female students, with the majority residing on campus. These students demonstrated greater improvement in mental health outcomes compared with those living off-campus. Our results align with those of a UK study, which found that on-campus living fosters a supportive environment conducive to better mental health outcomes (Worsley *et al.*, 2021). Therefore, interventions should consider the differences in mental health and well-being between male and female students. Liu *et al.* (2024) recommended that female students may benefit more from programs aimed at improving calmness and rest. At the study university, the housing section provided on-campus accommodation for female students, except for those with special needs, such as disabilities. Others, including male or international students, have provided accommodation for them outside the campus, around 100 km surrounding the university (Oman Observer, 2017). The target university did not offer formal residential education, which is different from some universities worldwide, like in the USA or Singapore, where they had heads/deans, associate heads/deans, residential staff, or resident assistants to operate the daily logistics work and develop residential education for students living in the residential house (Residential Colleges, 2024; YaleNUS College, 2024). However, previous studies have shown that residential education for on-campus residents reduces loneliness by creating inclusive social environments that can improve mental health and well-being (Brett *et al.*, 2023). Our findings show that there may be a connection between consistent follow-up and staying on campus and its impact on the improvement of their mental health issues. We suggest that the higher rate of diagnosis changes in Cluster 2 may reflect diagnostic refinement rather than instability. Students living on campus

may have had easy, convenient access to follow-up and more continuous care because the clinic is located closer to the residential area, allowing students to attend appointments with more accurate reassessment and better treatment matching over time. This issue may partly explain the better outcomes observed in Cluster 2, which live on campus, although causality cannot be inferred from this retrospective study. Instead, universities should adopt targeted interventions that address the specific components of well-being and consider the varying impacts of physical health, financial capacity, and demographic factors. By doing so, universities can better support their students' mental health issues (Bennett *et al.*, 2024; Liu *et al.*, 2024). On the other hand, another reason for such improvement in mental status for those living on campus is time management and seeking help, which is more manageable and accessible. Students should spend more time studying, as increased study hours are linked to better academic outcomes (Mazharul Islam *et al.*, 2022). Also, students living on the campus can actively seek help from their respective mentors when needed, as this can improve understanding and performance (Mazharul Islam, 2014). Female students may have had higher attendance and spent more time studying, which are positively associated with better academic performance than in male students, because females do not need to spend much time traveling from their accommodation to their studies. In line with previous studies, this will increase access to academic and social resources, such as attending classes, meeting faculty, and using academic support services within their residence (Hurtado *et al.*, 2020), compared with those who are living off campus (Graham *et al.*, 2018). Although students on campus, especially females, showed better outcomes, it is unclear whether this is related to residence, gender, academic discipline, or other overlapping factors, and further research is needed to examine this complex relationship. On the other hand, mental health services providers could collaborate with accommodation management staff to create spaces that promote healthy well-being. These spaces should include comfortable social areas that encourage student interaction, thereby creating environments that better meet their needs. In conclusion, this finding suggested that university management could develop two specific healthcare plans for the students, one for a campus- and off-campus-wide culture (e.g. gender) that supports mental health awareness and reduces stigma, encouraging students to seek help without fear of judgment.

An additional pattern emerging from the present analysis concerns academic discipline, whereby students enrolled in the Natural and Applied Sciences, most notably engineering, were disproportionately represented in Cluster 1 relative to Cluster 2. This observation aligns with evidence from a recent systematic review (Asghar *et al.*, 2024) indicating that engineering students experience a broad spectrum of mental health challenges, including a higher burden of physiological and developmental conditions such as sleep-related disorders. Consistent with this literature, Cluster 1 comprised a larger proportion of male students presenting with non-emotional dysregulation diagnoses, particularly physiological and developmental disorders, compared with their counterparts in Cluster 2. These differences may, at least in part, reflect entrenched gender distributions within engineering and related disciplines, where male predominance remains common. Such structural patterns likely contribute to the observed divergence between clusters across multiple dimensions, including gender composition, field of study, and symptom profiles. In contrast, Cluster 2 consisted exclusively of female students, the majority of whom exhibited emotional dysregulation conditions, such as stress and anxiety. Students in this Cluster were less likely to be enrolled in the Natural and Applied Sciences. They were more commonly concentrated in health and life sciences (e.g. nursing) and in social sciences, humanities, and professional programs (e.g. education) than in Cluster 1. Taken together, these findings suggest that mental health vulnerabilities among university students may not be uniformly distributed but instead intersect meaningfully with academic discipline and gendered educational pathways. From a practical standpoint, the results could support the development of discipline-sensitive mental health strategies at the institutional level. In collaboration with academic advisors, university management may tailor healthcare and psychosocial support initiatives to reflect the distinctive academic demands and workload pressures, thereby strengthening early awareness and targeted support for student mental well-being.

Limitations and recommendations

This study has a few limitations. First, a cross-sectional design limits the ability to establish causal relationships between variables. Second, a substantial proportion of responses regarding family relationships (80.6%) were recorded as “unknown”, which limits the strength of any conclusions in this domain. As such, interpretations suggesting the presence of supportive environments should be made with caution. Future research would benefit from more comprehensive and systematic data collection to better elucidate the role of family relationships in shaping mental health outcomes. Third, given the relatively “weak-fair” silhouette coefficient (Peiro *et al.*, 2025), the findings should be interpreted with caution, as the underlying cluster structure may not be particularly robust. Fourth, the timeframe of data collection overlapped with the disruptions brought about by the COVID-19 pandemic, during which universities shifted to online instruction and many students remained confined to their homes or usual places of residence. Such abrupt environmental changes are likely to have influenced students’ mental health experiences, and, as a result, the findings should be approached and interpreted with caution. Future studies incorporating larger, more diverse samples across multiple institutions, along with improved data completeness, may help to strengthen cluster validity. Qualitative research focusing on each cluster group is encouraged to identify the specific needs and barriers of on- and off-campus students, enabling the development of tailored mental health interventions for each Cluster. More research should focus on the early identification of these two profile groups, and efforts should be made to improve the identification of students with mental health needs before they reach a crisis point. This could involve educational campaigns, stigma reduction, and targeted outreach to at-risk populations (Raghaven, 2014). Mental health services can work closely with accommodation teams to create a supportive psychological climate in each Cluster.

Conclusion

The study highlights the heterogeneity of mental health issues among university students in one public university in Oman. Students are facing mental health issues and seeking health services. Students in Cluster 1 are mostly male, reside off-campus, study in Natural/ Applied Sciences, have cognitive-behavioral and physiological/developmental disorders, and have fewer diagnosis changes. Students in Cluster 2 comprised on-campus female students studying in Health/Life Sciences or Social/Humanities, primarily with emotional dysregulation disorders, showing significant improvement post-intervention compared to students in Cluster 1. Improvements in mental well-being among on-campus students may partly reflect more efficient time management and easier access to academic and psychosocial support. Consistent with prior evidence, on-campus living enhance access to academic, social, and support services. These findings suggest the need for differentiated mental health strategies addressing both on- and off-campus student contexts. By recognizing the heterogeneity of students’ mental health needs, universities can foster inclusive, culturally sensitive support systems that holistically improve student outcomes. Although two clusters were identified in this study, the proposed interventions are preliminary implications requiring further validation.

Authors’ contribution statement

Study design: MAA, MFC; Data collection: ZAA, FAA, AMA, ABH, AAG; Data analysis: MFC; Manuscript preparation: MFC, MAA, ZAA, FAA, AMA, SW; Critical revision of the manuscript: AAH, HAS, MAA, SW; Supervision and oversight: MAA, AAH, HAS. All authors reviewed and approved the final manuscript.

Ethical consideration

Ethical approval was obtained from the Sultan Qaboos University, Medical Research Ethics Committee (MREC #3126).

Statements of consent

All participants provided informed consent to access their information through the TrakCare system. No names or identifying information were collected, ensuring that all data remained anonymous.

Statements of declarations

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