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Mental health and academic performance of students at tertiary level: the role of housing

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This study was designed to investigate the impact of inappropriate housing on the emotional wellbeing and academic performance of university students. The cognitive development, mental health outcomes, and educational achievements of children are significantly influenced by the quality of their housing conditions. A cross-sectional study was conducted with a sample of 211 undergraduate and graduate university students. The primary aim of this study was to evaluate the impact of inadequate housing and mental health on students' academic performance, using a validated survey tool. Findings from the structural equation model show that inadequate housing is significantly associated with poorer mental health among students, highlighting housing quality as a critical social determinant of student wellbeing in Pakistan. Additionally, mental health is positively associated with academic performance, with findings suggesting that poor housing is related to lower academic performance through its association with poorer mental health.

KEYWORDS

inappropriate housing, mental health, academic performance, confirmatory factor analysis, structural equation model

1 Introduction

Higher education institutions play a crucial role in producing skilled individuals with the expertise required to address practical challenges faced by communities (Idris et al., 2012). Education serves as a powerful catalyst for transformation, enhancing wellbeing and economic sustainability while fostering societal cohesion. At the individual level, a positive correlation exists between higher education attainment and improved living standards, primarily due to enhanced productivity (Tan, 2014). Among the numerous factors influencing students' long-term academic success, housing plays a vital role in their wellbeing, character development, and academic performance (Khan et al., 2019; Bene et al., 2021). Given the profound importance of the residential environment for human beings, it is essential to investigate the potential impact of housing on individuals' mental wellbeing. There is a prevailing belief that students may gain greater academic benefits from residing in suitable housing located within or near their educational institution (Sotomayor et al., 2022). Inappropriate housing affects not only students' academic performance but also their mental and physical health (Solari and Mare, 2012). Such housing is typically characterized by issues including overcrowding, poor maintenance, limited living space, high occupancy, lack of security, and inadequate access to basic amenities such as electricity, sanitation, and running water (Raymond et al., 2011; Solari and Mare, 2012). It has been noted that certain features of housing have the capacity to exert an influence on

the mental wellbeing of individuals (Kan et al., 2022). Poor mental health encompasses several different issues, such as negative affect, psychological distress, and psychiatric conditions, all of which, in turn, negatively impact students' academic performances.

In contemporary society, attaining a college degree is essential for both personal and professional success. However, the academic trajectory of college students is impacted by various factors beyond classroom instruction. Among these, housing quality and mental health status have emerged as significant contributors to students' overall academic performance. The primary objective of this study was to examine the impact of inadequate housing conditions and mental health disorders on the academic achievement of college students. When combined, insufficient housing and mental health issues can create a complex set of pressures that may hinder students' ability to fully engage in their academic pursuits properly. This study aimed to elucidate the underlying mechanisms linking housing quality and mental health to variations in academic performance by investigating their interdependent relationship. Accordingly, the following research objectives were established:

1. To examine the association between substandard housing conditions and the academic performance of university students.
2. To assess the association between inadequate housing conditions and mental health outcomes.
3. To assess the association between academic performance and the mental health of university students.

2 Literature review

Several studies have found that housing plays a crucial role in fulfilling the occupants' bodily requirements, such as air, water, food, and shelter, as well as their psychological and social wellbeing. Housing is commonly seen as the primary financial outlay for a household (Olsen, 2003). The provision of secure housing safeguards individuals within a family unit against potential harm stemming from exposure to various environmental hazards, including but not limited to chemicals and allergens (Weitzman et al., 2013; Bonnefoy, 2007). Additionally, it serves as a preventive measure against unintentional accidents (Jacobs, 2011). The provision of healthy housing has the potential to facilitate the wellbeing of individuals across many life phases by fostering physical health and safety, as well as promoting mental and emotional wellbeing (Kent and Thompson, 2014). On the other hand, it is essential to note that substandard housing conditions are a contributing factor to the prevalence of infectious and chronic diseases as well as injuries and can affect the development of children (Shaw, 2004; Bonnefoy, 2007). The presence of moisture in the ceiling and walls of an enclosed space can lead to reduced air quality and contribute to the development of respiratory ailments, such as asthma and allergies, potentially resulting in suffocation inside the indoor environment (Lee et al., 1996). Inadequate living conditions have the potential to subject students to a range of risks, such as the presence of mold and moisture, as well as suboptimal indoor air quality. Extended exposure to these conditions may result in the development of respiratory ailments and other related illnesses (Krieger and Higgins, 2002).

Raymond et al. (2011) characterized inadequate housing by its essential architectural composition and infrastructure, whereas unhealthy housing is distinguished by its susceptibility to pollutants and various environmental elements. The term *inadequate housing* refers to a housing unit that is currently occupied but has significant physical problems, including flaws in sanitation, heating, electrical systems, hallways, and overall maintenance (Ranson et al., 1988). The study conducted by the Department of Community Health Sciences at Aga Khan University in Karachi, Pakistan, in 1997 (D'souza, 1997) and further supported by Shafi et al. (2019) elucidates the correlation between housing conditions and physical health outcomes. Engaging in physical activity enhances an individual's emotional wellbeing, facilitates weight management, mitigates the likelihood of disease onset or progression, fortifies musculoskeletal structures, and enhances overall functional capacity for daily tasks (Lawton et al., 2017). Substandard housing can contribute to adverse physical health effects. The body's capacity to control its internal temperature can be affected by frequent fluctuations in indoor temperature. Additionally, it is linked to disrupted sleep patterns, impaired cognitive development, and heightened susceptibility to cardiovascular ailments at subsequent stages of life (Flynn et al., 2000). Jackson et al. (2019) in a study to assess the impact of inadequate housing conditions on the quality of sleep, concluded that students residing in impoverished housing situations encounter challenges in achieving adequate sleep due to disruptions caused by varying schedules, heightened noise levels, and uncomfortable sleeping arrangements. The impact of sleep disruption on students encompasses various aspects, including their physical and emotional wellbeing and their overall quality of life (Szentkirályi et al., 2009). The presence of poor amenities and insufficient maintenance in student housing might undermine the standards of cleanliness and sanitation (Matte and Jacobs, 2000). Consequently, this may heighten the susceptibility of students to various health issues, including infectious diseases, skin infections, and gastrointestinal problems, thereby negatively impacting their physical wellbeing (Khoshaim, 2017; Shafi et al., 2019). The association between physical fitness and mental health and its impact on student academic performance has been thoroughly studied by Chigozie et al. (2021).

Furthermore, students who maintain good physical fitness are less susceptible to illnesses, resulting in fewer absences from school (Lawton et al., 2017). Similarly, optimal mental health equips students with the resilience and coping mechanisms necessary to effectively manage academic pressures and challenges (Kornbluh et al., 2022). In addition to physical fitness and mental health, the quality of housing in which students reside also exerts a significant influence on their overall wellbeing, both mentally and physically (Kan et al., 2022; Ahmad et al., 2022). Inappropriate housing conditions have been found to affect individuals' mental health detrimentally, leading to decreased confidence levels and diminished productivity and creativity (Weitzman et al., 2013). However, prolonged exposure to substandard housing conditions can have a detrimental effect on students' cognitive capacities, encompassing memory, attention, and problem-solving proficiency (Bonnefoy, 2007). According to Friedman (2010), this phenomenon not only negatively impacts students' academic achievement but also undermines their total

potential. Similarly, Adeyemi et al. (2024) explored a strong correlation between inadequate living conditions and diminished moral discipline, concentration, and learning outcomes. For a detailed systematic review of the impact of housing conditions on students' physical, mental, and emotional wellbeing, we refer to Franzoi et al. (2023).

2.1 Theoretical foundation

This study is based on a solid theoretical foundation and is in line with several previous studies, a selection of which will be examined and debated. Taking into account variables related to poverty and low socioeconomic status (Contreras Guajardo et al., 2019) attempted to determine whether overcrowding affects students' academic performance, using data from 15 Latin American countries' international SERCE tests. Evidence from several specifications and robustness tests showed that overcrowding negatively and statistically impacts a child's academic performance more than certain levels of maternal education. Barnes et al. (2013) examined the impact of inadequate housing and below-standard living circumstances on the physical and emotional wellbeing of students and found that a significant proportion of children reside in housing situations that fail to meet the basic standards necessary for their wellbeing. The long-term effect of inadequate living conditions on individual health outcomes was examined by Pevalin et al. (2017) using 13 yearly waves of the British Household Panel Survey spanning from 1996 to 2008. They examined whether facing poor housing conditions, even for one year, affects mental health. Furthermore, Pillay (2017) conducted a study that examined the impact of accommodation on children's academic performance and revealed a significant association between the quality of housing and academic achievement. The cohort study was done by Hansen et al. (2021) to investigate the association between overcrowding and health with a cohort of 1,282 participants from Greenland. It was concluded that individuals residing in poor housing are more prone to encountering health issues compared to those residing in suitable housing. Hence, the following conceptual framework showing the relationship of variables was developed for testing in our case.

2.2 In-depth contextual analysis

When Pakistan gained independence in 1947, there were only a few educational institutions, including two universities. In Pakistan, only a few madaris existed, having male-dominated students. Similarly, the University Grant Commission (UGC) existed, which was later replaced by the Higher Education Commission (HEC). HEC started to work as a governing body for higher education in Pakistan. Currently, there are more than Degree Awarding Institutions (DAIs). Similarly, the notion of male dominance in schools, colleges, and universities has also been reversed with female dominance. However, the country has faced economic crises for the last decade, and higher education institutions have no exemption. As a result, fees were raised and students faced different issues, including mental health, which resulted in a negative effect on academic performance. Furthermore, the COVID-19 pandemic also added to lockdowns and the closure of educational institutions in Pakistan.

3 The data and methods

3.1 Design, sample, and sampling technique

The study design is cross-sectional with a population of university students enrolled in public and private sector universities in the Punjab province. A total of 211 students were sampled through a convenience sampling technique due to the unavailability of a sampling frame and time constraints.

3.2 Instrument and measures

A well-structured questionnaire was used to collect quantitative data on housing situations, mental health state, and academic performance. Inappropriate housing was measured by evaluating specific factors identified through a comprehensive literature review (Zuhaib et al., 2018). The 13-point questionnaire was carefully designed to measure inappropriate housing, including questions to assess overcrowding and indoor environment quality (IEQ). The mental health of students was measured by a valid instrument called GHQ-12 (del Pilar Sánchez-López and Dresch, 2008). It is a widely used self-reported screening instrument for evaluating the mental health and general wellbeing of individuals. The GHQ-12 is a 12-item questionnaire that gathers data on a range of mental health topics, including general psychological distress, anxiety, depression, and social functioning. Finally, students' academic performance considers their academic, curricular, and extracurricular participation, such as questions about GPA, timely submissions, and sports participation. Table 1 further elaborates the three factors and their underlying variables.

3.3 Reliability analysis

The reliability of data collected through a designed questionnaire is checked using Cronbach's alpha, whose value is higher than 0.6, which is acceptable to determine the reliability of data (George, 2011). For this study, the range is 0.6–0.7, as shown in Table 2 for various constructs of the questionnaire.

3.4 Statistical analysis techniques

The study employs a range of statistical analyses, encompassing descriptive statistics, confirmatory factor analysis, and structural equation modeling. The confirmatory factor analysis (CFA) is a multivariate technique used to test, based on collected data, how well the considered scale measures the unobserved constructs such as inappropriate housing, mental health, and academic

TABLE 1 Variables related to inappropriate housing, mental health, and academic performance.

Inapropriate housing	
IAH1: assessing over-crowding	IAH8: presence of unpleasant odors
IAH2: household maintenance	IAH9: inadequate amount of fresh air.
IAH3: comfort of residence in summers	IAH10: indoor air quality
IAH4: comfort of residence in winter	IAH11: indoor lightning
IAH5: discomfort due to change in temperature	IAH12: Noise level
IAH6: evaluating poor ventilation infrastructure	IAH13: perception of being affected by the noise level.
IAH7: sense of being affected due to poor ventilation	
Mental health	
MH1: concentration level	MH7: pleasant attitude toward life.
MH2: restlessness	MH8: efficiently facing problems
MH3: sense of purpose	MH9: unhappy or depressed
MH4: good at decision making	MH10: low self-confidence
MH5: stressed	MH11: low self-esteem
MH6: helplessness	MH12: feeling of being happy despite the situation
Academic performance	
AP1: current GPA	AP5: timely submissions of homework
AP2: hours of studying	AP6: feeling of being satisfied with your homework
AP3: good attendance	AP7: active participation in extracurricular activities.
AP4: active participation in curricular activities	

TABLE 2 Cronbach's alpha for inappropriate housing (IAH), mental health (MH), and academic performance (AP).

Construct	Cronbach's alpha
IAH	0.726
MH	0.774
AP	0.677

performance for students. Mathematically, the CFA model is defined by

$$\mathbf{Y} = \mathbf{M}\xi + \epsilon, \tag{1}$$

where $\mathbf{Y}$ is a $p \times 1$ matrix of observed variables, ξ is a vector of $k \times 1$ unobserved latent constructs, $\mathbf{M}$ is a $p \times k$ weight matrix, and ϵ is an error term. The primary estimation procedure for such models is the maximum likelihood method. For more details on CFA, we refer the reader to Collier (2020).

After implementing the CFA, the following step is to establish a structural equation model (SEM). The SEM model here is used to identify the structural relationship between unobserved constructs, namely, inappropriate housing, mental health, and academic performance, considering observed variables of these constructs. Different criteria are available in the literature to assess the goodness of fit of the SEM. For more details of SEM and goodness-of-fit criteria, we refer the readers to Kline and Santor (1999) and Browne and Cudeck (1992). Finally, we have used IBM SPSS 27 software for data entry, preparation, and descriptive analysis; STATISTICA 10.0 for the CFA; and AMOS 24 to employ structural equation modeling.

3.5 Data sensitivity

This study addresses a crucial topic, sparking a debate about the impact of housing and mental illness on students' academic performance. The data have been collected, and the measurement tool has also been pretested. Further, this study also employed CFA and SEM techniques to measure the direct and indirect effects of the proposed model. The results have been interpreted in a very simple way. Researchers believe that this study will be a new contribution to the existing body of literature. It will also provide a roadmap for forthcoming scholars in terms of employing CFA and SEM based on the nature and sensitivity of the data.

4 Results and discussion

4.1 Descriptive statistics

Upon receiving a dataset, the initial course of action entails a thorough examination and exploration of its diverse variables. To perform descriptive statistics, the collected data from the questionnaire, after coding, were explored from various angles using statistical techniques and tools. These tests were conducted with the help of the widely used statistical software SPSS 23. The descriptive statistics of the overall data are as follows: The sample size taken for the underlying study was 211 participants, of whom 122 were men and 89 were women. No non-responses were observed in the collected data. Moreover, the maximum and minimum ages of the participants were 16 and 34 years, respectively. The majority of candidates who participated were 22 years old. The majority of students were in their senior year (129). Out of the 211 total participants, 54 of them resided in a hostel and 157 were day scholars. The family members ranged from a minimum of 2 to a maximum of 25 members living in their respective houses. Furthermore, the majority of participants had a living space of 6–10 Marla. The detailed results are shown in Table 3.

4.2 Confirmatory factor analysis (CFA)

In order to confirm the manifest variables of unobserved constructs such as inappropriate housing, mental health, and academic performance, the confirmatory factor analysis was conducted using statistical software STATISTICA 10.0. The hypothesis to be tested is

H_0 : *The underlying observed variable is not significant*

TABLE 3 Descriptive statistics of socio-demographic variables.

Variable	Category	Frequency	Percentage
Gender	Male	122	57.8
	Female	89	42.2
Academic year	Freshman year	31	14.7
	Sophomore year	17	8.1
	Junior year	34	16.2
	Senior year	129	61.1
Residence	Hostelite	54	25.6
	Day scholar	157	74.4
	Hostel room	45	21.3
Residence size	Up to 3 Marla	32	15.2
	4–5 Marla	48	22.7
	6–10 Marla	53	25.1
	More than 10 Marla	33	15.6

The CFA in STATISTICA 10.0 highlighted final decisions about the hypothesis through the p-values. The universally adopted criterion is used to reject the H_0, i.e., reject H_0 when the $p < 0.05$ or $t > 1.965$. The results on unobserved constructs IAH, MH, and AP are shown in Table 4. We observed that all the manifest variables in the IAH model, except IEQ11, exhibited statistical significance based on the requirements of a probability value <0.05 and a t-statistic more than 1.965. Therefore, it is necessary to exclude IEQ11 during the development of a model to get a good model fit. Similarly, for the case of mental health, the CFA confirmed all the considered variables except MH8, which is also excluded during the process of constructing an SEM model. Finally, by the criterion of a probability value <0.05 and a t-statistic of more than 1.965, the results of the CFA indicated that AP1 of the construct academic performance should not be incorporated into the development of the SEM model.

4.3 Structure model of inappropriate housing, mental health, and academic performance

The conceptual framework employed encompasses a set of constructs and manifest variables, as shown in Table 5 and Figure 1.

The initiation of an SEM investigation involves the establishment of a model, thereby classifying it as a confirmatory approach rather than an exploratory one. For this study, the SEM was developed using SPSS and Amos 24 (2017). In the model, IAH is specified as the independent variable, whereas AP and MH are included as the dependent variables. The output provided by the software shows both standardized and unstandardized estimates. Both estimates are employed to assess the magnitude of association between independent and dependent variables in the regression model. To decide which one to use, Goyal (2021) suggested that the unstandardized coefficients cannot be used to rank predictors, as it does not eradicate the unit of measurement. Therefore, standardized estimates can be used to draw conclusions and comparisons about the exogenous variables in the model. There are various criteria to decide what manifest variables to add to the model, based on the standardized factor loadings. In this study (Spencer, 2013), the criterion was used to remove the non-significant manifest variables from the model. For a small sample size of 211, any variable having a factor loading <0.4 was omitted from the model. Thus, the manifest variables to be removed are IAH1, IAH2, IAH3, IAH4, and IAH6 from the construct IAH; MH1, MH3, MH4, MH7, and MH12 from the construct MH; and AP7 from the construct AP. The fitted model after the eradication of these variables is shown in Figure 2.

Figure 2 comprises solely the manifest variables that are accountable for generating a statistically meaningful distinction in the constructs. Furthermore, fit indices are employed to assess the overall importance of the model. Fit indices are statistical measurements that assess the extent to which a model is a suitable fit for the data that has been provided or collected. The interpretation of these values may vary depending on the specific fit index employed; nevertheless, there is significant variation in the criteria used to determine what qualifies as a satisfactory match. The overall model fit indices demonstrate statistical significance according to their respective threshold levels. Table 6 presents a reference table for fit indices together with the corresponding obtained values. The output of indices of the fitted model is also provided in Table 6 Based on these indices, we clearly see that the fit is satisfactory. This indicates that the model confirms the existence of the structural relationship between inappropriate housing, mental health, and students' academic performance.

A closer examination of the model reveals a substantial relationship between inappropriate housing and students' mental health (factor loading = 0.5), indicating that students living in compromised housing have a higher likelihood of developing mental health issues compared to those living in proper, well-structured accommodations. These findings highlight the importance of housing quality as a critical social determinant of mental health. This observation from our study aligns with previous research (Pevalin et al., 2017; Morganti et al., 2022; Kan et al., 2022; Franzoi et al., 2023). which consistently finds that individuals exposed to persistent poor housing conditions had significantly worse mental health trajectories over time. D'souza (1997) found that poor housing, contaminated water, and inadequate sanitation were associated with an increased risk of diarrhea and respiratory infections in children. However, this is the first study to explore the impact of poor housing on the mental health of students in Pakistan. Given the growing challenges related to urban housing, population density, and economic challenges, these findings underscore an urgent need for policymakers to consider housing quality as part of broader student wellbeing strategies.

The fitted model has also shown a moderately positive association between students' mental health and academic performance, as evident by the factor loading of 0.4. This highlights the importance of good mental health in supporting good academic output. This observation aligns with international research (Eisenberg et al., 2009) as well as with findings from

TABLE 4 The CFA for manifest variables of inappropriate housing, mental health and academic performance.

Inappropriate housing					Mental health					Academic performance				
Manifest variables	Parameter estimate	Standard error	*t*-statistic	*p*-value	Manifest variables	Parameter estimate	Standard error	*t*-statistic	*p*-value	Manifest variables	Parameter estimate	Standard	*t*-statistic	P-value
(IAH)-1 → [IEQ1]	0.600	0.150	3.993	0.000	(MH)-1→ [MH1]	0.397	0.115	3.450	0.001	(AP)-1→[AP1]	0.097	0.107	0.913	0.361
(IAH)-2→ [IEQ2]	0.530	0.143	3.702	0.000	(MH)-2→ [MH2]	0.747	0.119	6.282	0.000	(AP)-2→[AP2]	0.898	0.100	9.018	0.000
(IAH)-3→ [IEQ3]	0.383	0.111	3.447	0.001	(MH)-3→ [MH3]	0.374	0.116	3.210	0.001	(AP)-3→[AP3]	1.129	0.100	11.240	0.000
(IAH)-4→ [IEQ4]	0.315	0.112	2.810	0.005	(MH)-4→ [MH4]	0.439	0.102	4.292	0.000	(AP)-4→[AP4]	0.600	0.088	6.815	0.000
(IAH)-5→ [IEQ5]	0.756	0.102	7.385	0.000	(MH)-5→ [MH5]	0.885	0.111	8.007	0.000	(AP)-5→[AP5]	0.820	0.096	8.558	0.000
(IAH)-6→ [IEQ6]	0.226	0.113	2.000	0.046	(MH)-6→ [MH6]	1.005	0.112	8.946	0.000	(AP)-6→[AP6]	0.814	0.104	7.832	0.000
(IAH)-7→ [IEQ7]	0.970	0.118	8.245	0.000	(MH)-7→ [MH7]	0.558	0.110	5.067	0.000	(AP)-7→[AP7]	0.619	0.134	4.636	0.000
(IAH)-8→ [IEQ8]	1.090	0.116	9.387	0.000	(MH)-8→ [MH8]	0.142	0.118	1.211	0.226					
(IAH)-9→ [IEQ9]	0.952	0.120	7.962	0.000	(MH)-9→ [MH9]	1.189	0.114	10.406	0.000					
(IAH)-10→ [IEQ10]	1.095	0.122	8.996	0.000	(MH)-10→ [MH10]	1.302	0.111	11.714	0.000					
(IAH)-11→ [IEQ11]	−0.135	0.115	−1.173	0.241	(MH)-11→ [MH11]	1.310	0.118	11.134	0.000					
(IAH)-12→ [IEQ12]	0.976	0.118	8.253	0.000	(MH)-12→ [MH12]	0.361	0.107	3.374	0.001					
(IAH)-13→ [IEQ13]	1.108	0.121	9.142	0.000										

10.3389/feduc.2025.1627192

TABLE 5 Potential manifest variables for unobserved constructs IAH, MH, and AP.

Unobserved constructs	Manifest variables	Insignificant variables
Inappropriate housing	IAH1 to IAH13	IEQ11
Mental health	MH1 to MH12	MH8
Academic performance	AP1 to AP7	AP1

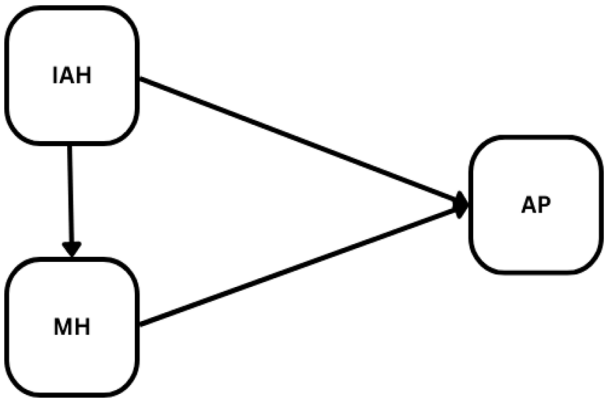

FIGURE 1
Conceptual framework of the study. IAH, inappropriate housing; MH, mental health; AD, academic performance.

Pakistan reported by Mohamad et al. (2018) and Tabassum et al. (2024).

Interestingly, the model also reveals that there is a very weak direct relationship between poor housing conditions and academic performance. This suggests that substandard housing environments may diminish students' academic success not by directly affecting study habits or learning environments alone, but primarily through the stress, anxiety, and psychological strain they induce. Several aspects of living conditions, including hygiene and sanitation, access to electricity and water, and population density, have a substantial impact on the academic performance of students, according to the study's findings. The subsequent factors with a strong correlation are thermal comfort, which may be attributable to overpopulation, privacy, indoor air quality, safety, and visual comfort.

The findings of this study highlight the need for government intervention to address the poor housing conditions in different areas of Punjab, as inadequate living environments have been shown to adversely affect students' academic performance and mental wellbeing. A key priority should be improving access to clean water, uninterrupted electricity, adequate ventilation, proper sanitation facilities, and reducing overcrowding. These improvements are essential for establishing a stable and healthy home environment that fosters effective learning and cognitive development.

Furthermore, there is a pressing need to enhance community-based mental health outreach programs in collaboration with

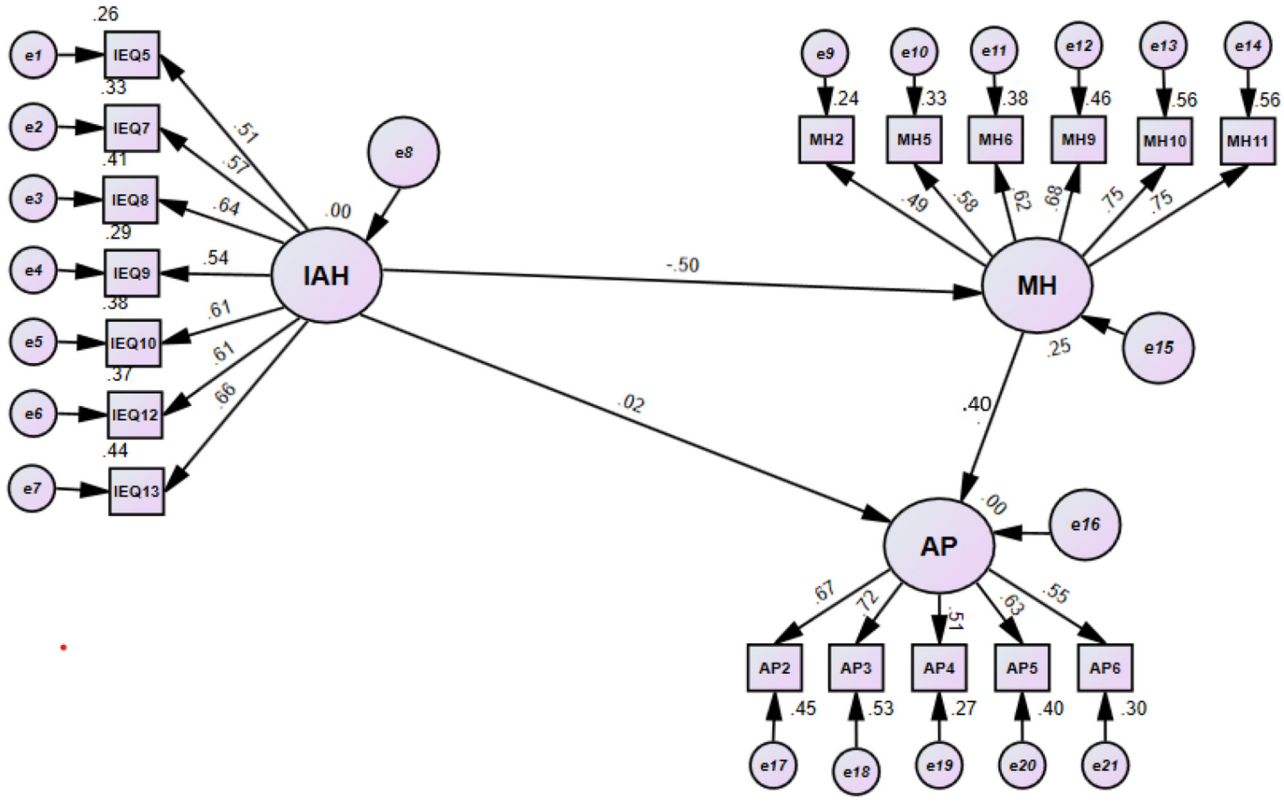

FIGURE 2
Fittted SEM model to predict AP for IAH and MH.

TABLE 6 Goodness of fit indices of the fitted model.

Fit indices	Recommended	Obtained value
CMIN/df	≤ 3 = acceptable fit	1.749
	≤ 5 = reasonable fit	
GFI	1 = perfect fit	0.897
	≥ 0.95 = excellent fit ≥ 0.9 = acceptable fit	
AGFI	≥ 0.90 = acceptable fit	0.866
	≥ 0.80 = acceptable fit	
PGFI	1 = perfect fit	0.692
	≥ 0.5 = acceptable fi	
IFI	1 = perfect fit	0.902
	≥ 0.95 = excellent fit	
	≥ 0.9 = reasonable fit	
TLI	1 = perfect fit	0.884
	≥ 0.9 = acceptable fit	
	≥ 0.8 = acceptable fit	
	in less complex models	
	and smaller samples	
CFI	1 = perfect fit	0.900
	≥ 0.95 = excellent fit	
	≥ 0.90 = acceptable fit	
PNFI	≥ 0.5 = acceptable fit	0.689
PCFI	≥ 0.6 = acceptable fit	0.777
RMSEA	≤ 0.05 = excellent fit	0.060
	0.05 − 0.08 = acceptable fit	
	0.08 − 0.1 = borderline fit	
	≥ 0.1 = poor fit	

educational institutions, local health facilities, and non-governmental organizations. These initiatives should aim to provide students and their families with access to qualified mental health professionals. Promoting emotional wellbeing through such interventions is crucial for supporting students in low-income households, enabling them to thrive both academically and personally.

4.4 Limitations and future directions

This study is limited to students residing in Punjab, an economically more developed province relative to other regions of Pakistan, such as Balochistan, Khyber Pakhtunkhwa, and interior Sindh. Consequently, the findings may not fully reflect the experiences of students from less developed areas. Future research should consider expanding the geographic scope by including samples from other provinces, allowing for a more comprehensive and contextually diverse understanding of the phenomena under investigation. Such an expansion would also increase the sample size, thereby enhancing both the statistical power and the generalizability of the findings. In light of the gender-based differences observed in this study, further investigation into the moderating role of gender in the relationship between housing conditions, mental health, and academic performance is needed. Moreover, geographically focused studies should be conducted to identify hotspot areas where this issue is most severe, facilitating targeted interventions by government organizations. Finally, longitudinal research designs are recommended to examine the long-term effects of these factors.

5 Conclusion

The study concludes that insufficient housing arrangements and compromised mental wellbeing exert a significant influence on students' academic achievement. The findings confirmed a notable association, indicating that as housing quality declines, students' academic performance also deteriorates. A similar pattern was observed in the correlation between students' mental health and their academic achievement. Several aspects of living conditions, including hygiene and sanitation, access to electricity and water, and population density, were found to have a substantial impact on students' academic performance. Moreover, a negative relationship between inappropriate housing and mental health was identified, indicating that students living in compromised housing are more likely to develop mental health issues than those living in proper, well-structured accommodations.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The study was approved by the Research Ethics Committee (REC) of Government College University Lahor. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

MM: Conceptualization, Writing – original draft, Data curation, Formal analysis, Software. MF: Conceptualization, Writing – original draft, Methodology, Supervision. MI: Data curation, Writing – original draft, Formal analysis, Software. MA: Funding acquisition, Methodology, Validation, Writing – review & editing. NF: Formal analysis, Funding acquisition, Methodology, Software, Writing – review & editing.

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