








Research Article

Predictive abilities of acculturation for differences in self-rated health among international medical students from Medical University – Sofia

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Summary

Despite the various theoretical frameworks of acculturation, the mechanisms by which acculturation affects health and well-being remain unclear. This cross-sectional study explores the role of acculturation in self-rated health (SRH) among international medical students. The study was conducted in 2024 at the Medical University – Sofia and included 326 participants. The Stephenson Multigroup Acculturation Scale (SMAS) was employed to assess cultural influences from both the host and home countries, focusing on two dimensions: Ethnic Society Immersion (ESI) and Dominant Society Immersion (DSI). SRH was measured using a five-category Likert scale. Covariates included perceived stress, social support, and health behaviour factors. Logistic binary regression was applied for analysis. The findings revealed that most international medical students rated their health as good (56.4%). Poor health was significantly associated ($p < 0.05$) with lower ESI (Mdn = 3.4), higher stress levels (Mdn = 22), and a lack (31.9%) or insufficiency (54.2%) of physical activity (PA). ESI emerged as a significant predictor of good health ($\text{Exp}(B) = 0.403$; $p = 0.004$). The impact of DSI on poor SRH was mediated by PA ($\text{Exp}(B) = 4.629$ and $\text{Exp}(B) = 2.699$, $p < 0.05$ for both risk groups). The results of this study can be useful in planning health and social services for international students, considering their specific needs.

Key words: Acculturation, binary logistic regression, health behaviour, international medical students, self-rated health

Introduction

The number of international medical students has significantly increased worldwide over the last few decades (OECD 2019). In 2021, 1.52 million international students in the European Union were pursuing tertiary-level studies in health and welfare fields, accounting for 13.1% of the total student population (Eurostat 2023). Since Bulgaria joined the EU in 2007, student mobility has been greatly facilitated. In the 2023/2024 academic year, Bulgaria hosted 15 093 international students, with 8603 (57%) studying medicine, making Bulgaria the leading EU country in this regard (Ministry of Education and Science and Open Society Institute 2023). Studying abroad



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presents numerous challenges beyond the high academic demands. International students must adjust their beliefs, values, and behaviours to align with those of the host country. Acculturation is a complex, dynamic, and multi-dimensional process of adaptation that occurs at both individual and group levels (Iorga et al. 2020; Karyanta 2020; Schumann et al. 2020; Umami et al. 2022; Lai et al. 2023). Among international university students, three types of adaptation have been identified: academic, psychological and sociocultural. Individuals typically employ one of four strategies to adapt to their new environment: integration, assimilation, separation, or marginalisation (Iorga et al. 2020; Lai et al. 2023). Despite various theoretical frameworks of acculturation, the mechanisms by which acculturation affects health and well-being remain unclear. This ambiguity arises partly from the conceptual models used (unidimensional or multidimensional), the different factors and covariates selected, and the specific characteristics of the populations studied. Acculturation influences health indirectly through factors such as health behaviour, access to health services, social support, self-esteem, and stress. The adaptation process to a new environment is often associated with high levels of stress, which can negatively impact both physical and mental health, leading to issues such as immune system breakdowns, diabetes, anxiety, depression, and eating disorders (Stephenson 2000; Iorga et al. 2020; Karyanta 2020; Schumann et al. 2020).

This study is the first in Bulgarian aimed to investigate the role of acculturation on self-rated health (SRH) among international medical students. We hypothesise that acculturation has an indirect impact on SRH.

Material and methods

Study design and participants

A cross-sectional study was conducted in 2024 among 326 international medical students at Medical University – Sofia. Participation in the online survey was anonymous and voluntary. The study received approval from the Ethics Committee of Medical University – Sofia (Protocol No 17/6.08.2024).

Variables and measurements

The *dependent variable* was self-rated health (SRH). Participants were asked, “How would you assess your current health, in general?” and chose one of five categories on the World Health Organization (WHO) scale (from very good to very poor) (Mikolajczyk et al. 2008; Todorova et al. 2013). For statistical analysis, SRH was recoded into a dichotomous variable: good health (combining very good and good) and poor health (combining very poor, poor, and fair). The *independent variable* was acculturation. The Stephenson Multigroup Acculturation Scale (SMAS) was used to assess the type and degree of individual acculturation. Two dimensions of acculturation were measured (with scores ranging from 4 = True to 1 = False): Ethnic Society Immersion (ESI) and Dominant Society Immersion (DSI), representing the extent to which the culture of the native or host country influences

the individual. Higher scores indicate greater retention of the values and practices of one's ethnic group or greater adoption of the dominant society's culture (Schumann et al. 2020; Stephenson 2000). In this study, Cronbach's alpha was $\alpha = 0.800$ for ESI (after removing questions 4 and 6) and $\alpha = 0.839$ for DSI, demonstrating high internal consistency (value > 0.70), coherent with previous studies (Schumann 2020; Umami et al. 2022). *Covariates* included were as follows: perceived stress, health behaviour (physical activity, smoking status, alcohol consumption, fruit and vegetable intake, BMI), and social support. *Continuous variables* were age (years), perceived stress, body mass index (BMI, kg/m²), and social support (number of people one relies on). *Categorical variables* included were sex (male/female), country of origin (Central and Eastern Europe/Western Europe/America/Asia/Africa), frequency of physical activity (never/ <5 times per week/ ≥ 5 times per week), smoking status (non-smoker/ex-smoker/current smoker), alcohol consumption (abstainer/light-to-moderate drinker/heavy drinker), and fruit/vegetable intake (daily/less than daily). Heavy drinking was defined as consuming four or more alcoholic drinks per day for males and three or more for females. Light and moderate drinkers were combined into a single "light-to-moderate drinker" category. Respondents were classified into four BMI categories: underweight (<18.5 kg/m²), normal weight (18.5–24.9 kg/m²), pre-obesity (25.0–29.9 kg/m²), and obesity (≥ 30.0 kg/m²) (Mikolajczyk et al. 2008; Deindl et al. 2023). Perceived stress over the past month was measured using the Perceived Stress Scale (PSS-10, 1983). The total score (0–40 points) out of 10 items was categorized into low (0–13 points), medium (14–26 points), and high (27–40 points) stress levels (Shahnawaz et al. 2020). The study's Cronbach's alpha for the PSS-10 was high ($\alpha = 0.828$), confirming previously reported results.

Statistical analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 25 (SPSS Inc., Chicago, IL, USA). Categorical variables were presented as counts and percentages, while continuous variables were expressed as the Mean and Standard Deviation for normally distributed data or as the Median with Minimum and Maximum values for skewed data. Group differences were assessed using Student's *t*-test, Pearson's chi-squared test, Mann-Whitney *U* test, and Kruskal-Wallis *H* test, with a significance level set at $p \leq 0.05$. Univariate and multivariate logistic regression analyses were conducted to examine the role of acculturation as a predictor of SRH. The Hosmer-Lemeshow test was used to assess the goodness of fit for logistic regression models.

Results

The study included 326 international medical students from 36 countries. Table 1 provides the basic characteristics of the participants. The median age was 20 years, with the majority being female (57.5%) and coming from Western European countries (80%).

Table 1. Basic characteristics of the respondents (N = 326).

| Variable | Category | Mdn (Min, Max) | N | (%) |
|-----------------------------------|----------------------------|-------------------|-----|------|
| Sex | Male | | 138 | 42.5 |
| | Female | | 187 | 57.5 |
| Age (years) | | 20.0 (18, 51) | | |
| Country of origin | Central and Eastern Europe | | 6 | 2.1 |
| | Western Europe | | 235 | 80.7 |
| | America | | 7 | 2.4 |
| | Asia | | 36 | 12.4 |
| | Africa | | 7 | 2.4 |
| Perceived stress | | 18.5 (2, 35) | | |
| Social support (Mean ± SD) | | 2.1 ± 0.933 | | |
| Physical activity | Never | | 56 | 17.3 |
| | <5 times per week | | 161 | 49.7 |
| | ≥5 times per week | | 107 | 33.0 |
| Smoking | Non-smoker | | 208 | 63.7 |
| | Ex-smoker | | 27 | 8.3 |
| | Current smoker | | 91 | 28.0 |
| Alcohol consumption | Abstainer | | 211 | 65.5 |
| | Light-to-moderate drinker | | 35 | 10.9 |
| | Heavy drinker | | 76 | 23.6 |
| Fruit intake | Every day | | 64 | 19.7 |
| | Less | | 261 | 80.3 |
| Vegetable intake | Every day | | 76 | 23.5 |
| | Less | | 300 | 76.5 |
| BMI (kg/m²) | | 22.8 (14.6, 40.0) | | |
| Underweight | | | 23 | 7.3 |
| Normal weight | | | 208 | 65.5 |
| Pre-obesity | | | 69 | 21.8 |
| Obesity | | | 17 | 5.4 |
| Acculturation | ESI | 3.5 (1.8, 4) | | |
| | DSI | 1.9 (1, 4) | | |
| SRH | Very good | | 70 | 21.5 |
| | Good | | 184 | 56.4 |
| | Fair | | 59 | 18.1 |
| | Poor | | 12 | 3.7 |
| | Very poor | | 1 | 0.3 |

Mdn (Min, Max) = Median (Minimum, Maximum); SD = standard deviation; BMI = body mass index; ESI = Ethnic Society Immersion; DSI = Dominant Society Immersion.

Perceived stress, social support and health behaviour

As shown in Table 1, the median level of stress in the sample was 18.5 (range: 2–35). On average, students relied on 2.1 ± 0.933 people for support. Nearly half of the participants reported insufficient physical activity (PA) in the past week, with 28% identifying as current smokers and 23.6% as heavy drinkers. Approximately 80% reported low fruit and vegetable intake, not complying with WHO recommendations of consuming a minimum of 400 grams of fruit and vegetables per day. The median BMI was 22.8 (range: 14.6–40.0), with 21.8% classified as overweight and 5.4% as obese.

Acculturation and related factors

As shown in Table 1, the study found a high level of adherence to the values and practices of one's own culture (ESI = 3.5; range: 1.8–4) and a low level of adoption of the host country's culture (DSI = 1.9; range: 1–4). To understand better the acculturation effect on SRH, we investigated the associations between acculturation (ESI and DSI) and different covariates (perceived stress, social support, and six factors of health behaviour). Results from the Mann-Whitney *U* test and, respectively, Kruskal-Wallis *H* test revealed that only PA ($H = 14.940.2$, $df = 2$, $p = 0.001$) and fruit intake ($U = 6787.0$, $p = 0.022$) were significantly associated with the second dimension of acculturation (Table 2). We observed a lower median DSI (indicating lower immersion in the host culture) among non-physically active respondents (1.7; range: 1.0–3.5) and those with less frequent fruit consumption (1.9; range: 1.1–3.6).

Table 2. Factors of health behaviour significantly associated with acculturation (DSI).

| Variable | DSI* | <i>p</i> | Variable | DSI* | <i>p</i> |
|---------------------------|----------------|----------|-----------------------------|----------------|----------|
| Physical activity§ | | 0.001 | Alcohol consumption§ | | 0.331 |
| Never | 1.7 (1.0, 3.5) | | Abstainer | 1.9 (1.0, 3.6) | |
| <5 times per week | 1.9 (1.0, 3.6) | | Light-to-moderate drinker | 1.9 (1.2, 4.0) | |
| ≥5 times per week | 2.0 (1.0, 4.0) | | Heavy drinker | 2.0 (1.1, 3.4) | |
| Smoking§ | | 0.370 | Fruit intake# | | 0.022 |
| Non-smoker | 1.9 (1.0, 4.0) | | Every day | 2.1 (1.0, 4.0) | |
| Ex-smoker | 2.0 (1.0, 3.2) | | Less | 1.9 (1.1, 3.6) | |
| Current smoker | 2.0 (1.0, 3.6) | | | | |

DSI = Dominant Society Immersion; *Average values of DSI were described by Mdn (Min, Max). Statistical analysis was performed using #Mann-Whitney *U* test and §Kruskal-Wallis *H* test.

SRH and associations with the acculturation and covariates

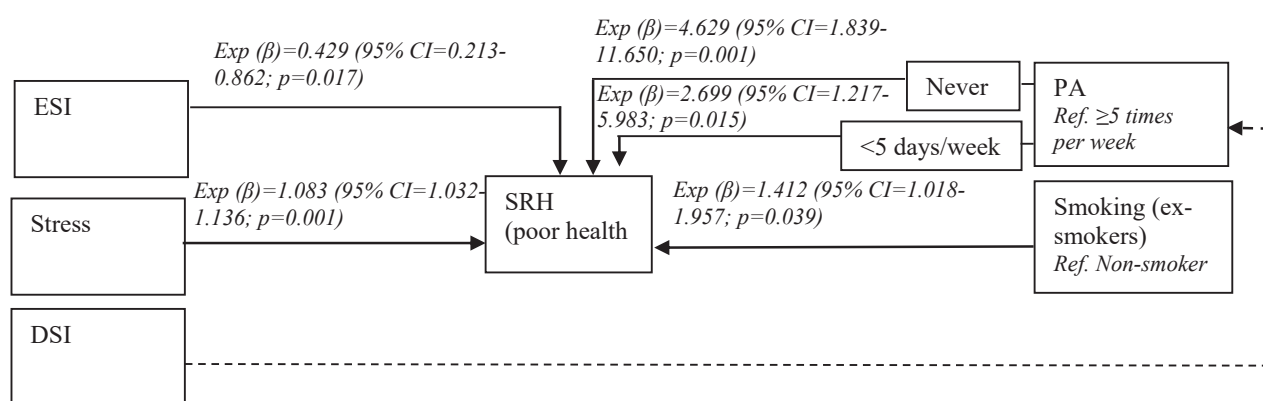
The majority of international medical students (184 or 56.4%) rated their health as good, while only 13 (4.0%) rated it as poor or very poor (Table 1). Univariate analysis of SRH and related factors (Table 3) showed statistically significant differences in SRH based on acculturation ($U = 7361.5$, $p = 0.013$), stress levels ($U = 5803.5$, $p = 0.001$), PA ($\chi^2 = 22.149$, $df = 2$, $p = 0.001$), smoking ($\chi^2 = 8.693$, $df = 2$, $p = 0.013$), and vegetable intake ($\chi^2 = 4.512$, $df = 1$, $p = 0.034$). Poor SRH was significantly associated with a lower median ESI score (3.4; range: 1.8–3.8), higher stress levels (22; range: 4–34), lack of PA (31.9%), and insufficient PA (54.2%). Among students with good health, the proportions of non-smokers (67.3%) and daily vegetable consumers (73.8%) were significantly higher ($p < 0.05$).

The next step was to develop a binary logistic regression model to test whether acculturation is a prognostic marker of SRH. The dependent variable, SRH, was dichotomized as 0 = good health and 1 = poor health (event). In the univariate logistic regression analysis, ESI was significantly associated with general health (Exp(B)=0.403; 95% CI = 0.216–0.754; $p = 0.004$). All independent variables that showed statistically significant associations with general health (Table 3), along with factors related to DSI (Table 2), were included in the multivariate logistic regression model using the Enter method: ESI, perceived stress, vegetable intake, PA+DSI, smoking, and fruit intake+DSI (Fig. 1).

Table 3. Results from unifactorial analysis of SRH and its related factors.

| Variable | Good health (n = 254) | | Poor health (n = 72) | | p |
|--------------------------------|-----------------------|------|----------------------|------|--------------|
| | n | % | n | % | |
| Acculturation* | | | | | |
| ESI | 3.5 (1.9, 4) | | 3.4 (1.8, 3.8) | | 0.013 |
| DSI | 1.9 (1, 4) | | 1.9 (1.1, 3.1) | | 0.327 |
| Stress* | 17 (2, 35) | | 22 (4, 34) | | 0.001 |
| Social support§ | 2.1 ± 0.937 | | 2.0 ± 0.919 | | 0.606 |
| Physical activity# | | | | | |
| Never | 33 | 13.1 | 23 | 31.9 | 0.013 |
| <5 times per week | 122 | 48.4 | 39 | 54.2 | |
| ≥5 times per week | 97 | 38.5 | 10 | 13.9 | |
| Smoking# | | | | | |
| Non-smoker | 171 | 67.3 | 37 | 51.4 | 0.751 |
| Ex-smoker | 22 | 8.7 | 5 | 6.9 | |
| Current smoker | 61 | 24.0 | 30 | 41.7 | |
| Alcohol consumption# | | | | | |
| Abstainer | 167 | 66.5 | 44 | 62.1 | 0.286 |
| Light-moderate drinker | 27 | 10.8 | 8 | 11.3 | |
| Heavy drinker | 57 | 22.7 | 19 | 26.6 | |
| Fruit intake# | | | | | |
| Every day | 200 | 79.1 | 61 | 84.7 | 0.034 |
| Less | 53 | 20.9 | 11 | 15.3 | |
| Vegetable intake# | | | | | |
| Every day | 186 | 73.8 | 61 | 85.9 | 0.198 |
| Less | 66 | 26.2 | 10 | 14.1 | |
| BMI (kg/m²)* | 22.6 (14.6, 65) | | 23.7 (16.1, 34.7) | | |

ESI = Ethnic Society Immersion; DSI = Dominant Society Immersion; Statistical analysis was performed using: *Mann-Whitney U test; #Pearson's chi-squared test; §Student's t-test.



SRH=self-rated health; ESI=Ethnic Society Immersion; DSI=Dominant Society Immersion; PA=Physical activity; Exp (β)=regression coefficient; 95% CI: 95% confidence interval; Ref.=Reference category

The Hosmer-Lemeshow test ($\chi^2=11.074$, $df=8$, $p=0.198$) was not statistically significant.

Figure 1. Multivariate logistic regression model (the Enter method) of the relationships between SRH, acculturation, perceived stress and some factors of health behaviour.

The effect of DSI on SRH was mediated through PA and fruit intake. An increase in ESI by one unit decreased the risk of poor health by 0.429 times (95% CI = 0.213–0.862; $p = 0.017$). The probability of poor health was greater with increased stress levels ($\text{Exp}(B) = 1.083$; $p = 0.001$), among non-physically active respondents ($\text{Exp}(B) = 4.629$; $p = 0.001$) and those with insufficient PA ($\text{Exp}(B) = 2.699$; $p = 0.015$), and among ex-smokers ($\text{Exp}(B) = 1.412$; $p = 0.039$). The role of DSI on SRH was mediated only by PA.

Discussion

Self-rated health (SRH) is a widely used, straightforward, and valuable indicator of overall health, capable of accurately predicting various health outcomes, including mortality and morbidity. It encompasses multiple dimensions, bridging the gap between biological and cultural factors. Differences in SRH can sometimes reflect cultural variations in the understanding and evaluation of health (Mikolajczyk et al. 2008; Todorova et al. 2013; Karyanta 2020).

Our study aimed to clarify the impact of acculturation on SRH among international medical students. Previous research (Umami et al. 2022) has shown that this effect is mediated by factors such as stress, health behaviour, social support, self-esteem, and access to health services. Despite numerous studies on this topic, the mechanisms of acculturation remain not fully understood. Some researchers (Karyanta 2020) have focused on international students as immigrants, emphasizing the stressors associated with migration, while others (Iorga et al. 2020; Amanvermez et al. 2024) have concentrated on acculturative stress and its various sources. The conceptualization of acculturation, whether as a unidimensional continuum or a multidimensional phenomenon, also influences the approach and outcomes of research (Schumann et al. 2020; Umami et al. 2022). In this study, we examined acculturation using a contemporary model that includes two independent dimensions: Ethnic Society Immersion (ESI) and Dominant Society Immersion (DSI).

Out of all 326 international medical students studied, only 13 (4.0%) rated their health as poor or very poor. These findings align with those of Mikolajczyk et al. (2008) and Deindl et al. (2023) but differ from those of Todorova et al. (2013) and Umami et al. (2022). These discrepancies may be attributed to differences in the populations studied, the health status of participants, or methodologies used to assess SRH. Subjective health ratings are inherently complex and influenced by various respondent criteria, including age, gender, social status, and overall health (Todorova et al. 2013; Karyanta 2020).

Our findings suggest that ESI is a predictor of good general health, consistent with the results of Umami et al. (2022). However, this association cannot be fully explained by the factors we studied (perceived stress, social support, and health behaviour), as no statistically significant associations were found with this dimension of acculturation ($p > 0.05$). Previous research (Iorga et al. 2020) has shown that international students who maintain contact with family and friends experience lower levels of perceived stress and anxiety in the host country. A positive relationship between ethnic identity and mental health has also been established. However, a strong ethnic identity may lead some immigrants to perceive themselves as outsiders in the host country, hindering their full participation in society and exposing them to discriminatory treatment (Karyanta 2020).

We found that the DSI dimension of acculturation was associated with SRH, mediated by PA. Lower DSI scores were linked to poor health among the non-physically active individuals and those with insufficient PA. Perceived stress was a predictor of poor SRH, although it was not directly related to either ESI or DSI ($p > 0.05$). It is worth noting that we used the PSS-10 scale instead of a specialized tool for measuring acculturative stress. Acculturative stress is a well-known risk factor for substance use, and high levels of such stress among international students have been associated with limited coping resources (e.g., poor social networks) and maladaptive coping strategies (e.g., smoking and alcohol use), leading to adverse outcomes like anxiety and depression (Yan 2020; Lai et al. 2023).

Our findings partially corroborate existing research (Yan 2020) on the high prevalence of smoking and alcohol consumption among international students from certain regions. Cultural background plays a significant role in shaping health behaviours and related motivations, such as the acceptability of alcohol consumption or conformity-related smoking. Conversely, high levels of acculturation may have a protective effect on health by promoting healthy behaviours: increasing PA due to environmental and socio-cultural factors, discouraging smoking and alcohol consumption due to the high cost and restrictions, etc. However, there are cases where international students may adopt unhealthy diets or female students reduce sports participation due to changing perceptions of femininity (Yan 2020). Academic stressors in medical studies, such as long study hours, high expectations, and tight deadlines, also significantly impact their overall well-being (Iorga et al. 2020).

These findings underscore the need for further research into the specific acculturation strategies that international medical students employ to adapt to host cultures and how these strategies relate to their health outcomes. Separation and marginalization have been associated with better academic adaptation, while integration and assimilation have been linked to better sociocultural adaptation (Karyanta 2020).

Conclusions

Our study is the first one in Bulgaria, aiming to investigate the role of acculturation on self-rated health among international medical students. Our findings highlight the relationship between acculturation and SRH, utilizing both dimensions – ESI and DSI. This approach provides a nuanced understanding of how both home and host cultures influence health.

We confirmed that ESI is a significant predictor of good health, while PA moderated the impact of DSI on poor health. More precise tools for measuring acculturative stress are needed to gain a clearer understanding of the relationship between acculturation and SRH.

Future research will focus on exploring acculturation strategies and their effects on health. The results of this study can be useful in the development of health and social services for international students, addressing their specific needs and facilitating their integration and overall well-being.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statements

The authors declared that no clinical trials were used in the present study.

The authors declared that no experiments on humans or human tissues were performed for the present study.

The authors declared that no informed consent was obtained from the humans, donors or donors' representatives participating in the study.

The authors declared that no experiments on animals were performed for the present study.

The authors declared that no commercially available immortalised human and animal cell lines were used in the present study.

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Author contributions

Conceptualization: JIS. Data curation: JIS. Formal analysis: JIS. Funding acquisition: JIS. Investigation: JIS. Methodology: JIS, ASV. Validation: JIS. Visualization: JIS. Writing – original draft: JIS. Writing – review and editing: JIS, ASV.

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Data availability

All of the data that support the findings of this study are available in the main text.

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