Research Square

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Mental Health and Personality Profiles of Medical & Military College Students: A Multicenter Study

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Abstract

Background

This study aimed to identify distinct psychological profiles of first-year students based on their levels of perceived stress, depressive symptoms, and overall well-being, and to determine whether these profiles differed in terms of personality traits.

Methods

A total of 384 first-year students from the Military Technological College and Sultan Qaboos University participated. Students completed self-report measures, including the Perceived Stress Scale (PSS-10), the Patient Health Questionnaire (PHQ-9), the WHO-5 Well-being Index, and the Big Five Inventory (BFI-44). K-means clustering was applied to classify students based on mental health indicators. Analysis of variance (ANOVA) was then used to examine differences in personality traits between the identified clusters.

Results

Two distinct clusters emerged. Cluster 1 (Emotionally Stable; n = 248, 64.6%) was characterized by low levels of stress and depressive symptoms, and high levels of well-being. Cluster 2 (Emotionally Distressed; n = 136, 35.4%) was characterized by high levels of stress and depressive symptoms, and low levels of well-being. Significant differences were observed between clusters on agreeableness ($F(1, 382) = 29.8$, $p < .001$), conscientiousness ($F(1, 382) = 51.9$, $p < .001$), extraversion ($F(1, 382) = 59.3$, $p < .001$) and neuroticism ($F(1, 382) = 107.1$, $p < .001$). Students in Cluster 1, Emotionally Stable, exhibited higher levels of agreeableness, conscientiousness, and extraversion, and lower levels of neuroticism compared to students in Cluster 2, Emotionally Distressed.

Conclusions

The findings reveal distinct psychological profiles among first-year university students, closely linked to personality traits. Identifying these subgroups may aid in tailoring early mental health interventions in universities.

Introduction

The transition from school to university represents a critical period in one’s development as it usually involves profound psychological, social, and academic changes. New college students may encounter a constellation of challenges including relocating away from their parent’s home, fitting into a new environment, creating a new social network, managing financial strain, and responding to higher academic expectations and obligations (1). These obstacles, particularly when accompanied by inadequate coping mechanisms, make it a pivotal window of psychological vulnerability causing several emerging mental health

issues, especially stress, anxiety, depressive symptoms, and impairment of their well-being (2). Several studies have shown that students' mental health is poorer during their first year of college compared to pre-college baselines (3,4). When talking about military and medical students, they have their own distinctive experiences. Military students face additional stressors including physical training, strict academic standards, and the adaptation to military life (5). Likewise, medical students tend to exhibit higher stress levels and psychological distress as a result of a heavy academic load, frequent exams, and a poor work-life balance (6,7). Given these multilevel stressors, the university transition is a complicated biopsychosocial process rather than just a simple change in the educational level.

Over the last few years, there has been a growing interest in the awareness of students' mental health across the Middle East, largely due to reports of high levels of stress, depression, and anxiety among university students (8). In response, many studies have paid special attention to mental health among students in Oman. A recent study on medical trainees in Oman found that 51.4% experienced high levels of perceived stress (9). Moreover, the connection between stress, resilience, and meaning in life was a hot topic to delve into. To illustrate, a study divided the students in Oman during the COVID-19 pandemic into three clusters (A, B, and C) based on sociodemographic, perceived stress, resilience, and meaning in life. The study concluded that students in cluster C showed higher levels of perceived stress, a greater tendency to search for meaning in life, and lower resilience compared to other clusters, making them candidates for early psychological interventions (10). Another study found that resilience mediated the relationship between the search for meaningful living and stress among college students during the COVID-19 pandemic, such that increased searching for meaning was linked to higher stress through lowered resilience (11). Despite the increasing interest in exploring the mental health profiles of Omani college students, studies are still scarce, especially, among military college students.

Beyond environmental stressors that emerge during the transition to college, it is important to shed light on the impact of personality traits on mental health outcomes, particularly stress, depression, and well-being. The most influential personality theoretical model in the world is the "Big Five" personality model which includes an individual's level of extraversion, neuroticism, agreeableness, conscientiousness, and openness to new experiences (12). It was found that neuroticism and extraversion are more linked with mental health outcomes (13,14). Previous studies showed that individuals with higher trait neuroticism have a greater baseline of perceived stress, emotional instability, and rumination compared to their counterparts (15,16). Conversely, extraversion and conscientiousness exhibit more adaptive emotional behavior and greater well-being (17). It is, therefore, essential to consider students' personality profile when developing

psychological interventions, as it offers valuable insights in both clinical and educational settings.

The present study is informed by the Transactional Vulnerability–Stress Model, which conceptualizes stress responses as arising from dynamic interactions between individual vulnerabilities and environmental demands. Within this framework, personality traits such as higher neuroticism and lower extraversion have been empirically associated with heightened threat appraisal, reduced perceived coping capacity, and increased risk for stress-related psychological distress (18,19). In high-demand academic and military contexts, these traits may therefore contribute to differential stress experiences and mental health outcomes.

Our study employed cluster analysis, a person-centered statistical approach that identifies subgroups of individuals with similar psychological profiles based on shared characteristics. Unlike variable-centered approaches, which examine associations between specific variables across an entire sample, person-centered methods emphasize heterogeneity within populations by characterizing distinct profile patterns (20). In the current study, this approach allowed for the identification of psychologically meaningful subgroups among first-year students, which may inform future research on risk stratification and the development of targeted mental health support strategies.

A person-centered analytic approach is conceptually aligned with transactional perspectives on stress, as it allows for the identification of subgroups of individuals who may respond differently to comparable environmental demands due to underlying vulnerability factors. In this context, the Transactional Vulnerability–Stress Model provides a useful interpretive lens for understanding heterogeneity in psychological profiles rather than a framework for hypothesis testing.

Research that integrates stress, depression, well-being, and personality traits in the Omani context remain scarce. To our knowledge, only a few studies addressed this topic using a variable-centered approach rather than a person-centered approach. To tackle this gap, our study aimed to identify psychological profiles based on levels of stress, depressive symptoms, and well-being among first-year students in Oman, and to examine the association between these profiles and personality traits using a cluster analytic approach.

Methods

Study Design and Study Setting

A cross-sectional study was conducted in October 2024. The study population included first-year students who are enrolled at either the Military Technological College (MTC) or the College of Medicine at Sultan Qaboos University (SQU) in Oman. Both institutions are

recognized for their rigorous academic programs and competitive admission standards. MTC program offers a combination of engineering education, vocational training and military activities. The college serves as a key provider of technically skilled and professionally trained personnel for the Ministry of Defense, the Sultan's Armed Forces of Oman, and multiple national security and defense agencies. Moreover, SQU is a top leading public university in Oman that offers a wide range of undergraduate and postgraduate programs across nine colleges. It's College of Medicine provides internationally accredited medical and health sciences education that strives for academic excellence and innovation. Data collection was done during the months of September and October 2024.

Data Collection

The inclusion criteria is that students must be in their first year of college either majoring in medicine at SQU or studying at MTC. The questionnaire was developed in English and administered online using Google Forms. The study was conducted under conditions of full anonymity and confidentiality. Participants were informed that they could withdraw from the survey at any time and for any reason without consequences.

Exclusion criteria

The study excluded all students who were not in their first year of enrollment or who were not officially enrolled at either MTC or the College of Medicine at SQU. Participants who did not sign the electronic consent form or failed to complete the questionnaire were excluded from analysis.

Outcome Measures

Background characteristics

The individual characteristics included sociodemographic variables (age, gender, major, marital status, high school score), and basic family factors (family financial conditions, family history of mental illness).

Measurement of depression

The Patient Health Questionnaire (PHQ-9) was used as a screening tool for depressive symptoms (21). The PHQ-9 is an increasingly employed measure of depressive symptoms that targets the nine diagnostic criteria for major depressive disorder of the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (22). The answers are rated on a 4-point Likert scale: 0 (*not at all*), 1 (*several days*), 2 (*more than half the days*), 3 (*nearly every day*). Previous studies assessing PHQ-9 has shown satisfactory psychometric and

screening properties in both patient and nonpatient samples (23,24). In the present study, the PHQ-9 demonstrated good internal consistency (Cronbach's α = .82).

Measurement of stress

The Perceived Stress Scale 10 (PSS-10), a self-reported questionnaire consisting of ten questions measuring the degree of stress individuals perceive in general or during specific experiences (25). The questions in this scale ask about your feelings and thoughts during the last month, with the answers measured on a 5-point Likert scale: 0 (*never*) up to 4 (*very often*). The possible range of scores is 0–40 with higher scores indicating greater perceptions of stress. Four items (4, 5, 7, and 8) were positively stated items and require reverse coding. According to a systematic review, the PSS-10 Cronbach's alpha values fall within the range of .78 to .91 (26). However, several studies conducted in Middle Eastern contexts have documented lower internal consistency (27,28). For instance, a study involving Emirati university students reported a Cronbach's alpha of .67 (28). The Cronbach's alpha reliability in this study is .68.

Measurement of well-being

The WHO-5 Well-being Index is a short self-reported questionnaire consisting of five positively worded items assessing subjective psychological well-being (29). The WHO-5 scale has adequate validity both as a screening tool for depression and as an outcome measure in clinical trials (30). Each item is rated on a 6-point Likert scale ranging from 0 (*at no time*) to 5 (*all of the time*). Higher numbers indicate greater well-being. A study conducted on Arab populations found that a WHO-5 cut-off value of 9.5 achieved optimal performance in identifying depression, with sensitivity at 80% and specificity at 70% (31). As a result, the current study applied this cut-off score to categorize participants as depressed. Moreover, the internal consistency in the current study was Cronbach α of .86.

Measurement of personality traits

Personality traits are measured using the Big Five Inventory (BFI), which assesses five key dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism (32). The responses were rated on a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The Cronbach's alpha reliability coefficients for the five traits were: extraversion (α = .47), agreeableness (α = .65), conscientiousness (α = .67), neuroticism (α = .73), and openness (α = .56). While the Cronbach's alpha values for some BFI subscales in this study (notably extraversion and openness) were lower than expected, this is not uncommon in cross-cultural applications of the BFI or in shorter versions of the scale with low number of items per subscale (33–35).

Statistical Analysis

Descriptive statistics to describe the participants demographic characteristics were employed. The clustering technique used was K-means cluster analysis, a method that identifies patterns and groups in data based on similarities (36). The goal is to maximize homogeneity within clusters while maximizing heterogeneity between clusters. First, an elbow plot was examined to determine the optimal number of clusters. Additionally, we evaluated clustering solutions with two to five clusters, as models with more than six clusters were expected to produce small group sizes (i.e., fewer than 20 participants). K-means clustering was chosen for its capacity to detect significant effects even in small samples. Once the clusters had been identified, subsequent analyses were carried out to compare the groups. We used one-way analysis of variance (ANOVA) to detect differences in personality traits between the clusters. A chi-square test of independence was performed to evaluate whether the distribution of gender differed significantly across the identified clusters. A value of $p < .05$ was considered to be statistically significant. All analyses were performed using R version 4.1.1.

Sample Size

All 700 first-year students who began in October 2024 at the Military Technological College and SQU's College of Medicine were invited to participate (census design). A k-means heuristic (≥ 5–10 observations per variable across nine psychosocial measures) indicated that at least 90 cases were needed (37). Power analysis (G*Power; α = 0.05, f = 0.25) showed that 252 respondents would give 80 % power for a three-cluster one-way ANOVA; factoring 15 % non-response raised the target to ~300 (38). Of the 392 students who opened the survey, 384 completed it which exceeds both thresholds. The resulting clusters (n = 248; n = 136) thus had stable centroids and adequate power for post-cluster comparisons.

Ethical Approval

The ethical approval for the study was granted by the Medical Research Ethics Committee at Sultan Qaboos University on August 7th, 2024 and the Military Technological College Research Committee on May 12th, 2024. The study was conducted in accordance with the tenets outlined in the Declaration of Helsinki (39).

Results

Of the 392 participants who responded, 8 were excluded due to providing incomplete answers. As shown in Table 1, the majority of participants were: 17 to 19 years old, male (83.6%), military students (69.3%), and not in a marital relationship (99.2%). Detailed responses are presented in Table 1.

Table 1. Characteristics of the participants.

Characteristics	$N = 384$
Age (mean, range)	18.59 (17-24)
Gender (n, %)	
Male	321 (83.59)
Female	63 (16.41)
Major (n, %)	
Medicine	118 (30.73)
Military	266 (69.27)
Highschool score (mean, range)	88.0 (59-100)
Chronic physical illness (n, %)	11 (2.87)
Family history of mental illness (n, %)	19 (4.95)
Past or current mental illness diagnosis (n, %)	7 (1.82)
Current financial difficulties (n, %)	94 (24.48)
Past alcohol misuse (n, %)	3 (0.78)
Past drug misuse (n, %)	6 (1.56)
Marital status	
Single	381 (99.22)
Divorced	2 (0.52)
Widowed	1 (0.26)

The elbow plot did not exhibit a clear inflection point, indicating uncertainty regarding the optimal number of clusters (Figure 1). Consequently, multiple clustering solutions ranging from two to five clusters were examined, as k-means clustering requires the number of clusters to be specified a priori. The two-cluster solution was selected based on a combination of interpretability, parsimony, and internal validation indices. Among the evaluated solutions, the two-cluster model yielded the highest silhouette coefficient (0.37), indicating moderate cohesion and separation. While this value suggests acceptable internal structure, it also highlights the need for further validation in future studies.

Based on all analyses, the two-cluster solution was identified as the most suitable model with satisfactory separation between the clusters in the internal validation. The first cluster, *Emotionally Stable* (n = 248), was characterized by low levels of stress, and

symptoms of depression and high levels of well-being. The second cluster, *Emotionally Distressed* (n = 136), was characterized by high levels of stress and symptoms of depression and low levels of well-being As shown in Table 2.

As shown in Table 3, the ANOVA tests examining potential cluster differences based on personality traits found significant differences. Significant differences were observed between clusters on agreeableness ($F(1, 382) = 29.8$, $p < .001$), conscientiousness ($F(1, 382) = 51.9$, $p < .001$), extraversion ($F(1, 382) = 59.3$, $p < .001$) and neuroticism ($F(1, 382) = 107.1$, $p < .001$). Students in Cluster 1, *Emotionally Stable*, exhibited higher levels of agreeableness, conscientiousness, and extraversion, and lower levels of neuroticism compared to students in Cluster 2, *Emotionally Distressed*. No significant differences were found between clusters on openness ($F(1, 382) = 1.1$, $p = .295$).

No significant differences in gender distribution were observed between the two clusters, (df $= 1$, $X^2 = 2.23$, $p = .135$), with the first cluster including 213 males (85.9%), and the second 108 (79.4%) Moreover, the distribution of academic major did not differ significantly across clusters, (df $= 1$, $X^2 = 0$, $p = 1.0$), with the first cluster including 172 military students (69.4%), and the second 94 (69.1%).

Table 2. Characteristics of the identified clusters.

	Cluster 1	Cluster 2
	Emotionally Stable	Emotionally Distressed
n	248 (64.6%)	136 (35.4%)
PHQ-9[a]		
M (SD)	5.26 (3.14)	12.84 (5.08)
Min-Max	0-16	0-27
PSS-10[b]		
M (SD)	12.49 (4.53)	20.09 (4.49)
Min-Max	0-24	6-38
WHO-5[c]		
M (SD)	17.85 (4.09)	11.27 (4.47)
Min-Max	0-25	0-20

Note. [a]Patient Health Questionnaire. [b]Perceived Stress Scale 10. [c]Well-being Index.

Table 3. Differences in personality traits between the two clusters.

	Cluster 1		Cluster 1			
	Emotionally Stable		Emotionally Distressed		*F*	*p*-value
	M	SD	M	SD		
Extraversion	25.99	4.17	22.62	3.98	59.3	< .001
Neuroticism	18.79	5.08	24.31	4.83	107.1	< .001
Agreeableness	34.86	5.63	31.77	4.63	29.8	< .001
Conscientiousness	33.16	5.43	29.12	4.91	51.9	< .001
Openness	33.27	5.59	32.65	5.33	1.1	0.295

Discussion

The current study aimed to identify possible clusters of first-year medical and military students on depression, stress, and well-being and to evaluate if these clusters differed in terms of personality traits. Two clusters were identified: the emotionally stable profile and the emotionally distressed profile. Over half of the participants (64.6%) fell into the emotionally stable cluster, which is characterized by low perceived stress, minimal depressive symptoms, and high well-being. In comparison, the rest (35.4%) formed the emotionally distressed cluster with the opposite pattern (high stress and depressive symptoms, low well-being).

To the best of our knowledge, this is the first study to cluster medical and military students based on psychological well-being and personality traits. Our findings shed light on a novel area of research that has been largely unexplored in Middle Eastern contexts.

Our results are consistent with the findings of recent studies that report a substantial level of perceived stress, depression, and anxiety among Middle Eastern university students (40–42). For instance, a survey conducted in the United Arab Emirates reported prevalence rates of 29% for stress, 38% for depression, and 55% among university students (40). Specifically, depression, anxiety, and stress among medical students are often underrecognized and undertreated (43). A study conducted in Egypt found that among first-year medical students, 58% reported stress, 64% depression, and 78% anxiety (42). In line with these findings, a recent study showed that about half of Omani medical students scored in the critical threshold of perceived stress (9).

Although the present study did not find significant differences in cluster membership by academic major, existing literature suggests that medical and military students are exposed to distinct but comparably demanding stressors during their first year. Medical

students are exposed to several stressors that are unique to their academic environment such as the heavy academic load, frequent examinations, high expectations of the parents, and poor work–life balance (44). For instance, a Jordanian survey of 1,800 medical students found that the most stressful domain among medical students was academic-related stressors (45). Similarly, military students must meet academic requirements while dealing with intense physical training demands and constant performance evaluations (46). In the United States, first-year military students were found to report significantly higher perceived stress compared to their civilian college counterparts (47).

One of the key findings in our study was the identification of differences in the clusters based on personality trait profiles. In our sample, the emotionally distressed group scored higher on neuroticism and lower on agreeableness, conscientiousness, and extraversion compared to the emotionally stable students, while no difference was observed in openness. Neuroticism has been recognized as the most crucial risk trait for depression and anxiety symptoms in college students, while agreeableness was the most central protective trait (48). Interventions aimed at reducing neuroticism and enhancing agreeableness may be more effective in alleviating symptoms of anxiety and depression compared to the other personality traits (48). In college students, higher conscientiousness is negatively associated with uncontrollable worry (48). Individuals high in conscientiousness tend to exhibit self-discipline, orderliness, and reliability in the pursuit of work completion (49), which enhances their ability to manage excessive worry through self-control (50). Moreover, extraversion has been associated with higher levels of positive emotions and stronger social connections, both of which contribute to emotional resilience and lower risk of depression and stress (51).

In line with the Transactional Vulnerability-Stress Model, our findings indicate that students in the emotionally distressed cluster exhibited personality profiles that may predispose them to heightened stress. Specifically, they demonstrated significantly higher neuroticism and lower agreeableness, conscientiousness, and extraversion which are traits known to influence stress reactivity and coping mechanisms. These results support the model’s assumption that individual differences in personality can shape how academic and military demands are perceived and managed, thereby influencing overall well-being.

Although gender differences in mental health outcomes are widely reported in the literature, gender was not significantly associated with cluster membership in the present study. This may reflect the predominance of male participants, shared institutional stressors, or contextual factors specific to first-year military and medical training environments. Previous literature suggests that female medical students have higher rates of symptoms of depression, anxiety, and stress, as compared to male students (43). The results align with literature among the general population that has repeatedly shown a higher prevalence of anxiety and depression diagnoses in women compared to men (52).

Women are more likely to experience depression or other internalizing disorders such as bulimia, often linked to traits like neuroticism and rumination (53). In contrast, anxiety in men tends to co-occur with externalizing disorders, including substance abuse, attention deficit and hyperactivity disorder, and intermittent explosive disorder (53).

Moreover, there were no significant differences in major distribution between the two clusters. This suggests that military and medical students may experience similar levels of depression, stress, and well-being. Both groups also tend to display high resilience and rely on adaptive coping strategies (e.g. seeking social support or combining multiple self-care approaches), which are linked to better well-being in both populations (5,54). Additionally, comparable contextual pressures such as heavy academic workloads, strict schedules, and high performance expectations likely contribute to similar psychological outcomes (44,55). Furthermore, cultural stigma surrounding mental health in both military and medical settings may further reduce help-seeking and reinforce shared emotional profiles (56,57). Thus, the absence of a significant difference across clusters may reflect a convergence of academic pressure, coping behaviors, and cultural norms.

Future Directions

The findings of high levels of stress, depressive symptoms, and low well-being among first-year students have important implications for mental health policy in academic and military educational institutions. They highlight the urgent need to implement campus-wide mental health strategies, including proactive screening, awareness initiatives, and accessible support services for those facing psychological distress. Medical schools that adopted pass/fail evaluation in preclinical years report lower stress, better overall mood, and greater group cohesion without compromising learning (58). Additionally, peer-mentoring programs in which senior students support freshmen have been shown to enhance resilience and promote mental well-being among medical students (59). Therefore, professionals and counselors should consider meaning-based interventions to cultivate resilience and help individuals overcome inevitable stress (11). These initiatives are not only critical for safeguarding student well-being and academic success but also essential for fostering a productive and supportive learning environment. In high-pressure academic and training settings such as medical and military colleges, such measures are integral to promoting student resilience, retention, and long-term professional readiness.

Limitations

Several limitations should be considered when interpreting these findings. The cross-sectional design precludes causal inference and limits interpretation of personality traits as vulnerability factors, as state effects related to stress or depressive symptoms cannot be excluded. The predominantly male sample reduced statistical power to detect gender differences and limits generalizability, particularly to female and more gender-balanced

student populations. Interpretation of personality-related findings is further constrained by suboptimal internal consistency for some measures and the exclusive reliance on self-report instruments, which may be influenced by response bias and stigma, especially in military settings. Although the study was informed by a transactional stress framework, key theoretical components such as cognitive appraisal, coping, and social support were not directly assessed. In addition, the use of k-means clustering yielded only moderate internal separation and lacked external validation. Finally, the restricted institutional and cultural context and the absence of stressor-specific measures limit broader generalizability and mechanistic interpretation. Collectively, these limitations indicate that the findings are descriptive and exploratory, and should be viewed as hypothesis-generating rather than confirmatory.

Conclusion

In the present study, we identified two meaningful clusters: the emotionally stable, and the emotionally distressed. These results are roughly in line with previous reports on the mental health of first-year students. The findings may be a steppingstone toward early intervention strategies and the personalization of treatment to better address the individual needs of each student. These insights can help psychiatrists, counselors, and student support services in colleges and universities to better screen, triage, and support high-risk student groups. Ultimately, such tailored approaches may foster more resilient campus communities and reduce the long-term burden of mental health challenges during the critical early years of higher education.

Declarations

Acknowledgments

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Data Availability

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate

The ethical approval for the study was granted by the Medical Research Ethics Committee at Sultan Qaboos University on August 7th, 2024 and the Military Technological College Research Committee on May 12th, 2024. All study participants completed an informed consent before participation. The study was conducted in accordance with the tenets outlined in the Declaration of Helsinki (39).

Consent to Publish declaration:

Not applicable

Authors Contribution

A.A.H. contributed to the conceptualization, formal analysis, methodology, and drafting of the original manuscript. T.A.-M. , R.R led the conceptualization, data collection, supervision, project administration, and manuscript review and editing. A.A.J. assisted with investigation, data collection, resources, and drafting of the original manuscript. A.A.Ho. supported data collection, project coordination, and manuscript review and editing. S.A.S., R.R contributed to data collection, participant recruitment, and administrative support. M.A.Z. contributed to data curation, and manuscript review and editing. M.A.A. provided senior supervision, methodological guidance, critical review, and manuscript editing.

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Figures

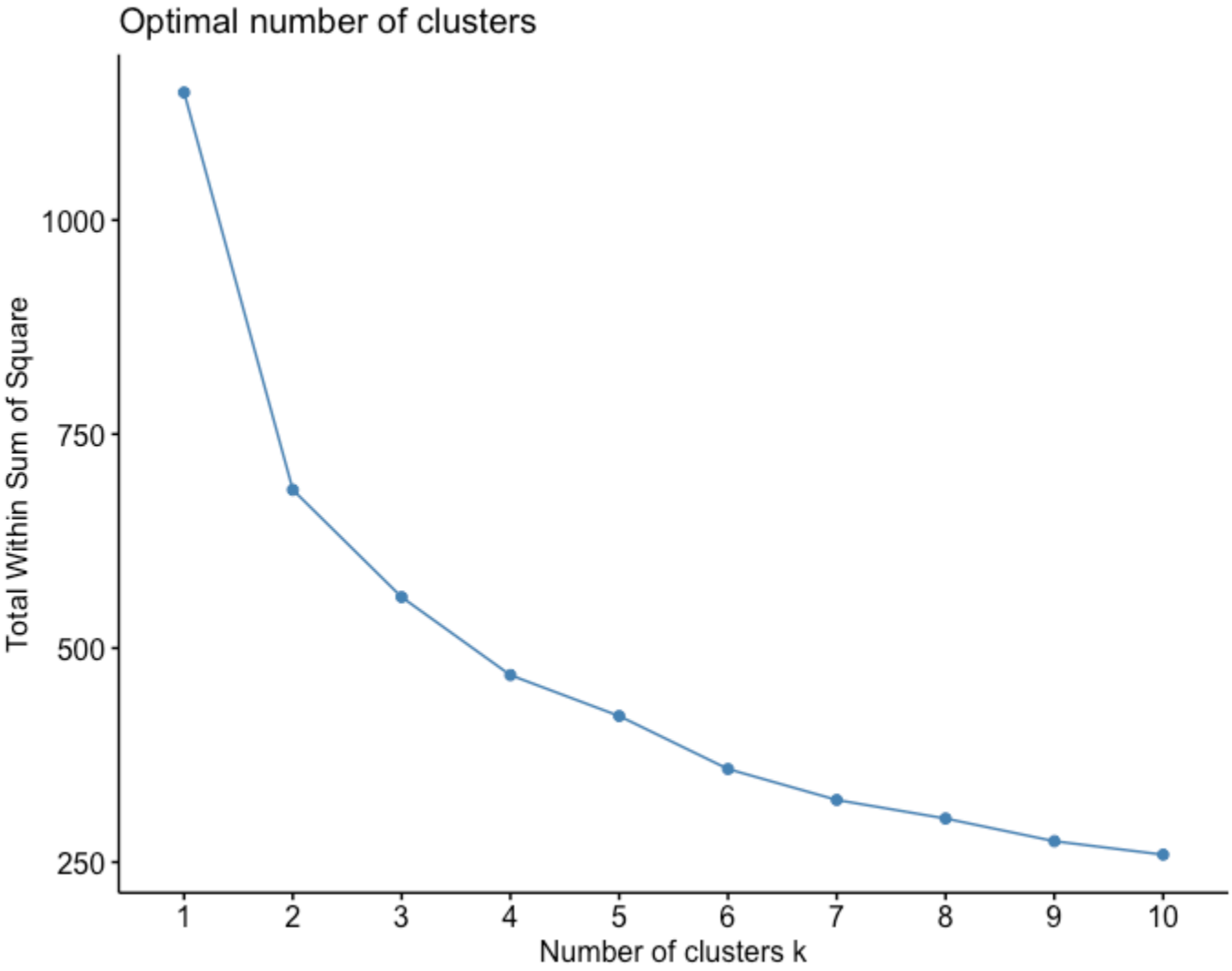


Figure 1

Elbow-plot for identification of the optimal number of clusters.