Original research article

Psychosocial determinants of clustering health-compromising behaviors among Saudi male adolescents

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A R T I C L E   I N F O

A B S T R A C T

Background and objectives: To assess whether the clustering of six specific health-compromising behaviors, namely, low fruit consumption, high sweet consumption, infrequent tooth brushing, physical inactivity, fighting and smoking, varied by different psychosocial determinants such as life satisfaction, peer relationships, self-confidence, and future orientation among male adolescents in Saudi Arabia.

Patients and methods: A representative stratified cluster random sample of 1335 Saudi Arabian male adolescents living in the city of Riyadh answered a questionnaire on health-related behaviors. Poisson regression models were constructed separately for younger (13-14-years-old) and older (17-19-years-old) adolescents to assess variations between explanatory psychosocial variables and the clustering of six health-compromising behaviors, adjusting for father's education.

Results: Older adolescents who perceived high levels of life satisfaction had a lower rate of clustering of multiple health-compromising behaviors compared to those reporting lower levels (RR: 1.22; 95%CI: 1.09−1.37), and the respective difference between those with high and those with middle levels of satisfaction was marginally non-significant (RR: 1.08; 95%CI: 0.98−1.19). Younger adolescents who reported that they felt "less than always" self-confident were more likely to have high clustering of health compromising behaviors compared to those who were always confident (RR: 1.08; 95%CI: 1.01−1.21). The clustering of multiple health-compromising behaviors was marginally associated with the frequency of evening meetings among older adolescents (RR: 1.03; 95%CI: 1.01−1.04 for each extra meeting), while the respective association among younger adolescents was marginally non-significant (RR: 1.02; 95%CI: 0.99−1.05). The association between clustering of health-compromising behaviors and future orientation was non-significant among both younger and older adolescents.

Conclusions: Clustering of health-compromising behaviors was found to be associated with perceived life satisfaction and peer relationships among older male Saudi adolescents and with self-confidence among younger male Saudi adolescents in Riyadh.

1. Introduction

Adolescents engage in multiple health-compromising behaviors [1–3], and those behaviors adopted in adolescence tend to track into adulthood [4]. Health-related behaviors tend to cluster in different patterns [5–11]. The clustering of health-related behaviors is not random, and there are common underlying detrimental factors [12,13]. The Problem Behavior Theory argues that health-compromising behaviors may be due to a common underlying construct of unconventionality related to a number of personality and environmental factors [14–16]. Moreover, Jessor [16] extended the problem behaviors theory and suggested a psychosocial model that involves interactions between risk factors and protective factors within the domains of social environment and personality traits. Psychosocial models provide a broader conceptual explanation of how individuals' feelings relate to social risk factors and thereby put them at greater risk of undertaking health-compromising behaviors [17]. For example, the fact that nicotine can maintain a constant mood in stressful situations might

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predispose people towards smoking cigarettes [18].

Health-related behaviors such as smoking, unhealthy diet, physical inactivity, alcohol consumption and violence are responsible for most chronic diseases, disabilities and deaths [19–22]. Clustering of multiple risk factors is usually associated with increased risk of cancer and cardiovascular disease [11]. The risk of chronic diseases increases with an increasing number of clustering health-compromising behaviors [23]. For example, the co-occurrence of four health–compromising behaviors (smoking, alcohol intake, physical inactivity and fruit and vegetable intake) predicts a four-fold difference in mortality [24] and more than a two-fold difference in the incidence of stroke in adults [25].

Most Saudi children and adolescents did not meet the minimal weekly requirements of moderate to vigorous physical activity necessary for cardiovascular health [26,27], and their diets were rich in sugars and deficient in fiber [28]. The frequency of tooth brushing twice or more per day was 36% among Saudi students in public school and 59% for those in private schools [29]. Consistent findings across studies showed that the overall prevalence of cigarette smoking among Saudi male adolescents was high (approximately 20–30%) [30–35]. To our knowledge, very few studies on behavioral clustering have been conducted in developing nations. Such studies may provide useful insights into understanding the clustering of multiple health-related behaviors and their determinants among adolescents in a developing country.

One cross-sectional survey that assessed clustering of health-related behaviors in Seychelles found that smoking, alcohol consumption and cannabis use clustered among adolescents [36]. Other studies have shown that clustering of health-compromising behaviors increases with the increasing age of adolescents [37,38], and that males showed increased clustering of risky behaviors compared with females [39]. Individuals from lower socioeconomic status (SES) tend to have more clustering of multiple health-compromising behaviors than those from higher SES [38,40]. A number of studies on adolescents have addressed the role of psychosocial factors on adopting risky behaviors. For example, low perceived life satisfaction was significantly associated with particular behaviors such as, smoking, marijuana use and alcohol consumption [41], as well as physical fighting, being injured and carrying weapons [42]. Adolescents with high self-esteem were less likely to have multiple behavioral risks [38]; those with more positive plans about their future were less likely to use drugs and drink alcohol [43], and brushed their teeth more frequently [44]. Adolescents' behaviors can also be influenced by their peers [45]. The frequency of evening meetings with friends was associated with smoking and alcohol consumption [46]. Moreover, adolescents whose peers smoked or drank alcohol had a higher probability of undertaking other risky behaviors such as substance abuse [47]. On the other hand, supportive peer relationships can have beneficial effects [48].

Studying the psychosocial determinants of the clustering of health-compromising behaviors is important because of the cumulative and synergistic adverse effects of behaviors [25,49]. Moreover, exploring why risky behaviors cluster is critical for designing tailored health promotion programs because interventions that focus on multiple behaviors promise to have a greater impact on public health than interventions focusing on a single behavior [50–55]. Most of the research on clustering of health-related behaviors has taken place in developed nations such as Western Europe and North America. A relatively large number of these studies have examined the variations on clustering by demographic and socio-economic determinants, but only a few studies have explored the associations of clustering behaviors with different psychosocial factors. Moreover, most of the previously reported studies focused on the associations of psychosocial

characteristics with single health-compromising behaviors, but not with the clustering of multiple health-compromising behaviors. Therefore, the objective of this study was to assess whether the clustering of six health-compromising behaviors, namely, low fruit consumption, high sweet consumption, infrequent tooth brushing, physical inactivity, fighting and smoking, varied by four different psychosocial determinants among male adolescents in Saudi Arabia.

2. Patients and methods

2.1. Sample

The study population consisted of male students in schools in urban areas in Riyadh, the capital and largest city in the Kingdom of Saudi Arabia. The population of Riyadh is estimated to be approximately five million, and it has a fast rate of economic growth. Subjects included in the study were Saudi 8th grade (13-14-years-old) students in intermediate schools and 12th grade (17-19-years-old) students in secondary schools. The first of these age groups represents the onset of physical and emotional changes in early adolescence and the second covers the period when they are about to choose their future careers in later adolescence [56]. The sampling frame was the list of all 515 schools in urban areas in Riyadh. It was divided into four strata (public intermediate schools, public secondary schools, private intermediate schools, and private secondary schools). Consistent with the international protocol of the Health Behavior in School-Aged Children (HBSC) study [57], the sample was selected by a stratified clustered random sampling method to produce a more precise and representative study population. All Grade 8 and 12 classes in the selected schools were recruited.

The sample size was calculated based on pilot study data for differences in the count of clustered health-related behaviors between the groups of exposure variables: life satisfaction, peer relationships, self-confidence, and future career orientation. Assuming a significant level at 5% and 80% power, the minimum sample size was 680 students. Considering a design factor of 1.2 for cluster sampling and 20% over-sampling for non-response, the required minimum sample size was 980 students. To have a representative sample of the related population in Riyadh, a self-weighting sample was used to select male adolescents from each stratum with the same proportion as in the general population in urban areas in Riyadh [58]. That resulted in an increase to a minimum sample size of 1100 boys. Twenty-two schools (11 public, 11 private) agreed to participate in the study. The total number of students in the sampled classes was 1660. There were 174 non-Saudi students and 45 older students in grade 8 (15–16 years old) who were excluded because they did not fulfill the inclusion criteria. Eighty-seven students were absent on the days that the data collection occurred. We invited 1354 eligible students to participate. There were no refusals by either the students or their parents. Only 19 questionnaires were excluded because they were not fully completed. The response rate was 98.5%. Therefore, the analytical sample was 1335 students.

A self-administered classroom-based questionnaire used in the WHO cross-national study Health Behavior in School-Aged Children (HBSC) was adapted for this study [57]. The overall goal of the HBSC survey was to gain new insights into and increase the understanding of health behaviors, lifestyles and their context in young people [57]. The HBSC questionnaire has two parts; one mandatory and one optional. The mandatory part comprises 74 questions, includes behavioral questions relevant to major health problems such as smoking, alcohol, eating habits, and physical activity, and it covers demographic characteristics, family structure,

parent's occupation/education, peer groups, and school environment. Most of the health behavioral questions were included in the questionnaire of this study except for questions about alcohol consumption and sexual health, because they were not appropriate for use in a Saudi Arabian society. The optional part comprises 41 questions, changes for each wave of the survey and includes several modules from which each participating country is free to choose [57]. Overall, the questionnaire used in the present study consisted of 55 questions. It was developed in English and was first translated to Arabic by two qualified Arabic speakers proficient in English. The Arabic questionnaire was then backward translated into English [59]. The backward translation was reviewed and compared with the original English version and then tested in a pilot study.

This study was approved by the University College London Research Ethics Committee, United Kingdom and the Administration General of Education at Riyadh Region, Saudi Arabia. Consent forms and information sheets were distributed through schools to parents and guardians prior to data collection to obtain informed written consent. To improve the quality of the data we followed common procedures stipulated in the HBSC protocol [57]. Students were informed that participation in the study was voluntary. They were assured about anonymity and the confidentiality of their responses. They were also given appropriate instructions verbally by the researcher and in text written at the beginning of the questionnaire. The anonymized questionnaire was administered in the classroom. Students were not allowed to talk or to see each other's answers and were not rushed, as this would affect the validity of their answers. Time for answering the questionnaire varied between students. Students who required less time were instructed not to disturb other students who had not finished. After completion, the researcher collected the questionnaires from the students. The data collection was carried out over a period of three months, with an average of two days spent for data collection at each school.

3. Measures

3.1. Dependent variables

Six health-compromising behaviors were assessed (Table 1). The dietary behaviors included were weekly frequency of eating: a) fruit and b) sweets (never, less than once a week, once a week, 2–4 days a week, 5–6 days a week, once a day every day, more than once every day) [57]. Tooth brushing frequency was reported as: more than once a day, once a day, at least once a week but not daily, less than once a week, never [60]. Physical activity was assessed through the 60 min Moderate-to-Vigorous Physical Activity (MVPA) measure [61]. Frequency of fighting in the past year was reported as "I have not been in a physical fight in the past 12 months" to "four times or more" [62]. Smoking was measured by "How often do you smoke

tobacco at present?" Response options ranged from: "Every day" to "I do not smoke" [57].

3.2. Independent variables

These refer to demographic, socioeconomic and psychosocial characteristics (Table 2). Students were asked about their age. Socioeconomic status was assessed by asking respondents about their parents' educational levels (from illiterate to postgraduate education), school type (public or private) and Family Affluence Scale (FAS). The FAS was based on four questions; car ownership, persons per bedroom, owning home computers and going on holidays [57].

Life satisfaction was derived from the measurement of the Cantril ladder [63]. This has ten steps: the top of the ladder indicates the best possible life, and the bottom the worst possible life. Adolescents were asked to indicate the step of the ladder at which they would place their life at the present time [63]. The frequency of evening meetings with friends was used as a proxy for peer

Table 2
Demographic, socioeconomic and psychosocial characteristics of Saudi male adolescents (n = 1335).

	n	%
Age		
13-14 years	613	45.9
17-19 years	722	54.1
Father's education level		
High education (Master, PhD)	410	30.7
University (BA, Diploma)	430	32.2
Secondary school or lower education	495	37.1
Mother's education level		
University or higher education	602	45.1
Secondary school	408	30.6
Intermediate school or lower education	325	24.3
Family affluence level		
High	679	50.9
Middle	509	38.1
Low	147	11
School type		
Private	640	47.9
Public	695	52.1
Self-confidence		
Always	618	46.29
Less than always	717	53.71
Future orientation		
University	1033	77.38
Less than university	302	22.62
Life satisfaction		
High	918	68.8
Middle	265	19.9
Low	152	11.4
Evening meetings		
Mean(SD)	2.14(1.8)	

Table 1
Categorization of six health-related behaviors based on public health recommendations.

Health-compromising behaviors	Categories
Low fruit consumption	0-Once or more daily
	1-Less than once daily
High sweet consumption	0-Less than once daily
	1-Once or more daily
Infrequent tooth brushing	0-Twice or more daily
	1-Less than twice daily
Physical inactivity	0-MVPA score 5 days or more per week
	1-MVPA score less than 5 days per week
Physical fighting (in last 12 months)	0-None
	1-One time or more
Smoking	0-Do not smoke
	1-At least once or more per week

relationships (*How many evenings per week do you usually spend out with your friends?*) [57]. Self-confidence wa*s* measured by the following question: *"how often do you feel confident in yourself?"* (response options: *always, often, sometimes, rarely and never*) [64]. Future orientation in relation to career aspiration was measured by the following question: *"what do you think you will be doing when you finish high school?" (response options: college or university, vocational or technical school, apprenticeship/trade, working, unemployed, don't know)* [64].

3.3. Analysis

The six health-related behaviors were categorized into binary variables (0 = health-enhancing behavior; and 1 = health-compromising behavior) based on public health recommendations [65—69] (Table 1). The main outcome variable in this analysis was the aggregate total count of clustering of health-compromising behaviors, by summing the six individual behaviors (potential range from 0 to 6).

The explanatory variables were life satisfaction, meetings with friends, self-confidence, and future orientation. Life satisfaction was categorized into high (score 7—10), middle (score 5—6), and low (score 0—4). Evening meetings with friends ranged from zero to seven evenings. Self-confidence was dichotomized into "always" versus "less than always" (often, sometimes, rare or never), and future orientation into "University" (for adolescents who planned to go to university) versus "less than University" (for the rest of the sample).

Depending on the nature of the variables, descriptive statistics were expressed as either a percentage or mean and standard deviation. First, the distributions of the clustering count of health-compromising behaviors (zero to six) by self-confidence, future orientation, life-satisfaction, and peer relationship were examined using the Spearman's rho and the Kruskal-Wallis tests. Then, the psychosocial variations in the count of the clustering of behaviors were assessed using Poisson regression through prevalence rate ratios (RR) that estimated the rate ratio of clustering of health-compromising behaviors for a one unit change in the psychosocial variable. Poisson models were preferred to the negative binomial and zero inflated models because the outcome variable did not show over-dispersion and did not have excessive number of zeros. Initially, we used unadjusted Poisson models and then we adjusted for father's education level only. This is because father's education level was significantly associated with the outcome. Models were run separately for younger (13-14-years-old) and older (17-19-years-old) male adolescents. The level of statistical significance was set at $P \leq 0.05$. The statistical analysis was carried out using STATA version 12.0 (STATA Corp, College Station, Texas, USA).

4. Results

One thousand three hundred and thirty-five Saudi male adolescents participated in the study. Six hundred and thirteen students were 13-14-year-olds, and 722 were 17-19-year-olds (Table 2). Fifty-two percent of the adolescents attended public schools, and 48% attended private schools. In relation to parental education, 31% of adolescents' fathers held a postgraduate degree (Masters or PhDs), 32% had university graduate education, and 37% had secondary school or less. Forty-five percent of mothers held university and postgraduate degrees, 30% were at the secondary school level, and 24% had an intermediate school or lower educational level. Half of the participants reported a high level of family affluence, 38% had middle level and 11% had low level. Approximately two thirds of the participants reported a high level of life

satisfaction. Regarding the frequency of evening meetings with their friends, the average was two nights. Forty-six percent reported always being self-confident, while 77% planned to go to a university (Table 2).

In relation to the prevalence of health-compromising behaviors, 85% of adolescents ate fruit less than once daily, 74% brushed their teeth less than twice daily, 64% engaged in low physical activity, 51% had been involved in physical fighting at least once or more in the last 12 months, 43% ate sweets once daily or more and 23% smoked tobacco. Focusing on the clustering count of health-compromising behaviors, less than 1% of the adolescents reported none of the six health-compromising behaviors, 4% had one, 17% had two, 32% had three, 28% had four, 15% had five, and 3% reported all six health-compromising behaviors (Table 3).

Table 4 shows the distribution of the clustering count of health-compromising behaviors by different psychosocial variables. Adolescents who reported "always" being self-confident had significantly less clustering of health-compromising behaviors compared to those who reported being self-confident "less than always". Future orientation was significantly related to the clustering count of health-compromising behaviors, with adolescents who planned to go on to university education reporting fewer health-compromising behaviors compared to those who did not plan to go to university. Life satisfaction showed an inverse trend with the clustering count of health-compromising behaviors, with lower levels of clustering at each higher level of life satisfaction. Finally, the frequency of evening meetings with friends showed a positive correlation with the clustering count of health-compromising behaviors.

Younger male adolescents who reported that they felt "less than always" self-confident were more likely to have high clustering of health compromising behaviors compared to those who were always confident (RR: 1.08; 95%CI: 1.01—1.21). There were no significant differences in behavioral clustering between adolescents who planned to go to university compared with those who planned not to go to university (RR: 0.98; 95%CI: 0.88—1.10), and the same was true for the respective association with life satisfaction. Evening meetings with friends was marginally non-significant with clustering of health-compromising behaviors in younger male adolescents (Table 5).

There were no significant differences in health compromising behavioral clustering among older adolescents between different groups in terms of self-confidence or future orientation. Older male adolescents who had low life satisfaction had a greater rate of behavioral clustering compared to those with high levels of life satisfaction (RR: 1.22; 95%CI: 1.08—1.37), though the respective

Table 3
Prevalence of single behaviors and the clustering count of health-compromising behaviors among Saudi male adolescents (n = 1335).

	N	%
Health-compromising behaviors		
Low fruit consumption (Less than once daily)	1130	84.6
High sweet consumption (Once or more daily)	579	43.4
Infrequent tooth brushing (Less than twice daily)	991	74.2
Physical inactivity (Less than 5 days per week of MVPA)	850	63.7
Physical fighting (Once or more per 12 months)	677	50.7
Smoking (At least once or more per week)	312	23.4
Clustering (count) of health-compromising behaviors		
0	9	0.7
1	55	4.1
2	226	16.9
3	428	32.1
4	377	28.2
5	200	15.0
6	40	3.0

Table 4
Distributions of clustering count of health-compromising behaviors by psychosocial variables (n = 1335).

Psychosocial variables	N	Clustering of health-compromising behaviors	
		Mean(SD)	P
Self-confidence			.001[a]
Always	618	3.29(1.23)	
Less than always	717	3.50(1.12)	
Future orientation			.005[a]
University	1033	3.35(1.15)	
Less than university	302	3.85(1.24)	
Life satisfaction			<.001[a]
High	918	3.26(1.16)	
Middle	265	3.56(1.09)	
Low	152	3.94(1.17)	
Evening meetings			
Mean (SD)	2.14(1.8)	3.4(1.17)	<.001[b]

[a] Kruskal-Wallis test.
[b] Spearman's rho (Correlation Coefficient: 0.16).

5. Discussion

This study examined variations in clustering of health-compromising behaviors by different psychosocial factors among Saudi male adolescents. The results show that the clustering of health-compromising behaviors varied significantly by levels of life satisfaction and peer relationships among older male adolescents and by levels of self-confidence among younger male adolescents. However, these associations were relatively weak in general.

Previous studies found relationships between life satisfaction with single health-related behaviors, such as smoking, alcohol consumption, and cocaine use [70]. The same was true for peer relationships for single risk behaviors such as smoking and alcohol consumption [46]. Our results highlight the influence of life satisfaction and peer relationships on the clustering of multiple health-compromising behaviors among older male adolescents.

Our findings also confirm that younger male adolescents who perceived high self-confidence were less likely to have clustering of health-compromising behaviors compared to adolescents who

Table 5
Poisson regression models for the associations between the clustering count of health-compromising behaviors and psychosocial variables among younger male Saudi adolescents (13—14 years) (n = 613).

Psychosocial variables	N	Model 1[a]		Model 2[b]	
		IRR (95%CI)	P	IRR(95%CI)	P
Self-confidence					
Always	310	1		1	
Less than always	303	1.09(1.01—1.21)	.02	1.08(1.01—1.21)	.02
Future orientation					
University	468	1		1	
Less than university	145	1.01(0.90—1.12)	.85	0.98(0.88—1.10)	.84
Life satisfaction					
High	468	1		1	
Middle	88	1.04(0.99—1.19)	.55	1.02(0.90—1.16)	.68
Low	57	1.11(1.08—1.37)	.18	1.11(0.95—1.29)	.16
Evening meetings Mean(SD)	1.66(1.64)	1.02(0.99—1.05)	.07	1.02(0.99—1.05)	.06

[a] Model 1 unadjusted.
[b] Model 2 adjusted for father's education level.

differences between the middle and high satisfaction groups were marginally non-significant. Finally, older male adolescents who had more frequent evening meetings with friends were more likely to report high clustering of multiple health-compromising behaviors (RR: 1.03; 95%CI: 1.00—1.05) (Table 6).

perceived low self-confidence, consistent with previous studies of adolescents [38]. Moreover, Wiefferink et al [71] found that self-esteem, which included self-confidence as a component, was positively associated with single health-related behaviors such as eating healthily, not smoking, and low alcohol consumption. All

Table 6
Poisson regression models for the associations between the clustering count of health-compromising behaviors and psychosocial variables among older male Saudi adolescents (17—19 years) (n = 720).

Psychosocial variables	N	Model 1[a]		Model 2[b]	
		IRR (95%CI)	P	IRR(95%CI)	p
Self-confidence					
Always	308	1		1	
Less than always	414	1.00(0.92—1.08)	.95	1.00(0.92—1.08)	.95
Future orientation					
University	565	1		1	
Less than university	157	1.05(0.96—1.16)	.24	1.04(0.94—1.15)	.41
Life satisfaction					
High	450	1		1	
Middle	177	1.09(0.99—1.19)	.07	1.08(0.98—1.19)	.08
Low	95	1.22(1.08—1.37)	.001	1.22(1.09—1.37)	.001
Evening meetings Mean(SD)	2.54(1.86)	1.03(1.00—1.05)	.006	1.03(1.00—1.05)	.004

[a] Model 1 unadjusted.
[b] Model 2 adjusted for father's education level.

these findings highlight the importance of self-confidence at this important age.

Future orientation was not significantly associated with clustering of multiple health-compromising behaviors among both younger and older adolescents. Some studies have found links between positive future orientation with a particular single behavior such as alcohol use [43].

A stratified cluster random sampling was used in the present study to ensure a good degree of representativeness among male adolescents in urban areas of Riyadh. A relatively large sample was recruited, and the high response rate reduced selection bias. The adoption of the standardized HBSC questionnaire and methodology improved the quality of the survey [72,73]. However, this study had certain limitations. It was conducted in only one city, which may explain the relatively homogeneous sample of highly educated and affluent students. Therefore, the results of the study cannot be extrapolated to male adolescents in Saudi Arabia, particularly those living in rural areas or other cities. For logistical reasons, female students were not included as the education system in Saudi Arabia separates schools for girls and boys. Girls have their own schools and female staff, while males are not allowed to enter the schools for girls. The male researcher tried unsuccessfully to find a female team to conduct the study in girls' schools. Consequently, female students were not included in this study. This limits the generalizability of the study findings and highlights the need for further studies among Saudi female adolescents.

The data were self—reported and may overestimate or underreport health-related behaviors or future career aspirations [74]. However, previous research showed that confidentiality and anonymity of self-reports reduced biases and provided reliable and valid data [75]. Younger adolescents might not know their parents' precise education levels or occupations. However, these questions have been used in HBSC cross-national surveys among children at ages 11, 13 and 15. The six health-related behaviors were dichotomized which might have led to loss of information about individual differences [76]. However, from a public health perspective, dichotomization based on public health recommendations was considered appropriate for defining the threshold that differentiates between health-enhancing and health-compromising behaviors in populations. The aggregate outcome variable of health-compromising behaviors implies giving equal weight to different health-related behaviors, and this has been criticized [77]. Nevertheless, later studies reported similar results when using equally and unequally weighted health-risk factors [78]. Finally, the cross-sectional nature of this study does not allow for causal claims in the association between different psychosocial factors and the clustering of health-compromising behaviors.

The current study has important implications for health promotion policy and practice and for research. By identifying significant variations in clustering of health-compromising behaviors with adolescents' life satisfaction, peer relationships and self-confidence, this study supports a social determinants approach to promote adolescents' health [79]. Creating favorable conditions at home and school will ensure good health for the adolescents. Health and well-being should be of concern to policy makers in every sector, not only those involved in health policy [79]. Future studies should assess clustering of multiple health-compromising behaviors among female adolescents. Lastly, longitudinal surveys will help explore clustering of multiple health-related behaviors over time and identify the role of key determinants.

6. Conclusions

The clustering of multiple health—compromising behaviors was significantly associated with life satisfaction and peer relations among older male adolescents and with self-confidence among younger male Saudi adolescents in Riyadh.

Conflicts of interest

The authors have no conflict of interest to report.

Authors' contributions

SGA, AS, GT and RGW conceived the original research question. SGA undertook the research and data analysis with the support of GT. All authors were involved in drafting and finalizing the paper.

Ethical clearance

Acknowledgments

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