Well-being in 15-year-old adolescents: a matter of relationship with school

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ABSTRACT

Background Psychosomatic health complaints are significant indicators of adolescent well-being. The aim of this study is to describe the full set of interactions between health complaints and the presence of subjective resources, represented by the quality of relationships with parents and peers and by a positive school perception, in a population of 15-year-old adolescents. Smoking and alcohol consumption were also included in the analyses.

Methods Bayesian networks were built for males and females separately, in order to understand the interactions among all considered variables in a representative sample of 16 018 Italian adolescents participating in the Health Behaviour in School-Aged Children survey 2009–10.

Results The resulting networks show that school is the crucial node linking adolescents' well-being with parents and peer relationships, as well as with smoking and alcohol consumption.

Conclusions Adolescents' well-being, as well as the prevalence of typical risk behaviours, such as smoking and alcohol consumption, is mediated by the adolescents' academic stress. Therefore, public health interventions, to be effective, should consider addressing the school environment by making it a more inclusive environment promoting critical thinking and sense of belonging rather than just focusing on personal behaviours.

Keywords adolescents, health behaviours, lifestyle, school environment

Background

Traditionally, research on adolescents' health has focused on behaviours (i.e. smoking, alcohol consumption and unhealthy diet) associated with negative health outcomes in both adulthood and adolescence.[1–3] However, the most recent literature has started to look also at protective factors, such as having good relationships in school and in the family environment; these factors have been found to be associated with a lower probability of both negative health outcomes and the onset of well-known risk factors.[4–7]

In the late 1970s, Bronfenbrenner[8] pointed out that to fully understand the aetiology of positive and negative health outcomes, one should favour a systemic approach, whereby each subject is analysed within his or her own 'ecological environment'. Highest importance is given to those social systems to which the subject belongs, which characterize his or her day-to-day relationships. For an adolescent, these systems can normally be broken down into school, family and

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peers. Recently, the non-parent relationships which function as mentors of youths, namely teachers, coaches or neighbours, have received a great deal of attention. Adolescents who feel more accepted by their parents and mentors are more likely to acquire a broad range of positive skills to effectively cope with common stressors.[9,10]

Accepting this approach, we may assume that the quality of relationships the adolescents have within these systems could significantly affect their health, as well as the onset of other behavioural risk factors. Qualitative studies which have explored adolescents' health from this point of view have shown that adolescents assign psychological well-being a crucial role in their life. Furthermore, when they are asked to assess the causes for the decrease in their well-being, they focus mainly on stress resulting from continuous interaction with their environment, where their 'significant adults' play a crucial function.[11]

Population-based studies across different countries have explored the determinants of adolescents' health from this point of view and have reported that a supportive family environment and the presence of a peer network are positively associated with lower levels of stress and depression.[4,12,13] The role of these relationships with respect to smoking and alcohol consumption is however less clear. For some authors, a higher prevalence of drug consumption is associated with parental social support based on control,[14,15] while others found just the opposite, that is drug consumption was associated with greater autonomy support.[16] Other studies suggest that peer relationships not balanced by adequate familial support are likely to favour the adoption of common unhealthy behaviours.[9]

School relationships also seem to be associated with adolescents' health. A school environment that adolescents perceive as positive is associated with lower levels of stress and health complaints,[5,17] as well as a lower propensity to adopt unhealthy behaviours.[18]

To describe the construct underlying the interaction between the quality of relationships and adolescent health, one can explore the perception adolescents have of their well-being by asking them about the symptoms they suffer from.[19,20]

As well-being is as a multidimensional construct, which can be described by applying different approaches,[21] it is of foremost importance to define what is being measured. Among the available definitions, Dodge[22] suggests that well-being represents a balance in which 'individuals have the psychological, social and physical resources they need to meet a particular psychological, social and/or physical challenge'. Therefore, when individuals have more challenges than resources, this imbalance affects their subjective well-being.[22]

Based on these premises, the objective of our study was to describe the full set of interactions between physical and psychological well-being (represented by health complaints) and the presence of subjective resources (represented by the quality of relationships with parents and peers and by a positive school perception) in a population of 15-year-old adolescents. Smoking and alcohol consumption, frequently described as part of this set of interactions, were also taken into account.

Methods

The Health Behaviour in School-Aged Children (HBSC) international study[23] is a 4-year wave World Health Organization collaborative Cross-National Survey involving, in 2014, 43 different countries across and outside Europe. The survey is conducted by means of a standardized, self-completed questionnaire administered by *ad hoc* trained personnel in each sampled school. Participation is voluntary, and anonymity and confidentiality of all participants is ensured.[24]

Study population

Data were obtained from the HBSC survey wave 2009–10. A representative sample of 77 113 students aged 11, 13 and 15 was recruited from 3555 school classes spread throughout all Italian regions (response rate: 95.8%).[25] To obtain a reliable estimate of smoking and alcohol consumption prevalence, the analyses included only the 15-year-old participants (7692 males and 8326 females).

Human subjects approval statement and parent(s) or guardian(s) consent

According to the HBSC study's international research protocol,[24] written information about the study was sent to school directors. The teachers of the classes included in the sample were informed and asked to deliver (i) an information sheet, containing basic information about the survey, to each student, who in turn had to give it to parents or guardians and (ii) an opt-out form to be signed and sent back only in case of refusal to participate. The Italian study protocol and the questionnaire were approved by the Ethics Committee of the Istituto Superiore di Sanità (Ministry of Health). Data were collected anonymously, and standard protection measures were ensured to preserve confidentiality.[25]

Variables considered in the model
Subjective well-being

Well-being was measured by using the HBSC health complaints checklist,[26] which assesses the occurrence of eight

physical and psychological symptoms: headache, stomach ache, backache, feeling low, irritability or being bad tempered, nervousness, dizziness and sleeping difficulties. A summary variable was created dichotomizing on the basis of whether the student suffered weekly from at least two of the aforementioned symptoms. These health complaints were used as a reasonable, and significant, list of symptoms representing an organic reaction to psychosocial stress.[27]

Quality of relationships with parents and peers

Relationships with mother and father were assessed through the question: 'How easy is it for you to talk to the following person about things that really bother you?' measured on a 5-point scale (1 = very easy; 5 = very difficult). The item has been used and validated in several national and international studies as a valuable measure of communication and as an indicator of the quality of relationship with family members.[28]

Relationships with peers were assessed using two questions: classmate support 'Other students accept me as I am' measured on a 5-point scale (1 = strongly agree; 5 = strongly disagree) and peer network 'How many close friends do you have?'. The first question measures the student's perception of his or her schoolmates' support, and the second the student's network of friends. For the latter question, responses ranged from 'none' to 'three or more'. 'True friends' refers to having three or more friends of the same gender. These items were previously used to measure social support from classmates.[29]

Academic stress

Academic stress was measured using three different variables: school attachment, schoolwork pressure and relationships with teachers. School attachment was measured on a 5-point scale (1 = I like a lot; 5 = do not like at all) by the question 'How do you feel about school at present?'; schoolwork pressure was measured on a 5-point scale (1 = not at all; 5 = a lot) by asking 'How pressured do you feel by the schoolwork you have to do?'; relationship with teachers was evaluated through the question: 'Do you agree that teachers treat students fairly?' measured on a 5-point scale (1 = strongly agree; 5 = strongly disagree). These items have been used to assess adolescent social support and school sense of belonging[29,30] and were used, since the first HBSC survey, to measure the students' school attachment and academic stress.[31]

Smoking and alcohol consumption

Current smoking status was measured on a 4-point scale (1 = never, 2 = less than once a week, 3 = at least once a week but not every day, 4 = every day) by the question: 'How often do you smoke tobacco at present?'. Self-reported smoking

prevalence is considered to be a reliable indicator of the actual smoking status in population studies.[32]

Alcohol consumption was measured through five items: 'How often do you drink: beer, wine, spirits/liquor, alcohol pops, any other alcoholic beverage?'. An overall alcohol consumption variable on a 5-point scale (1 = never consuming any alcohol, 5 = consuming at least one alcoholic beverage per day every week) was created, based on the answers to the above five items. This summary variable has been used as a reliable indicator of drinking in other studies.[33]

Statistical methods

Bayesian networks

We used a Bayesian network (BN) analysis approach to explore the full set of interactions between subjective well-being, individual resources (quality of relationships with parents and peers, and academic stress), and smoking and alcohol consumption.

BN analyses have received considerable attention over the last few decades from scientists across a number of different disciplines in the medical field to address problems in diagnosis[34,35] up to decision theory mapping.[36,37] They offer compact and intuitive graphical representation of the uncertain relationships among domain factors[38] and have become the basis of many probabilistic expert systems.[39]

Figure 1 depicts a simplified example of BN. Each node of the BN represents a random variable, which denotes an attribute or a state about which there may be uncertainty. A direct arc between variables A and C and between B and C implies that C is caused by A and B. In turn, B is assumed to be the effect of A. Finally, following the same pattern, C gives rise to D and E. Beyond the graphical structure, a BN contains also
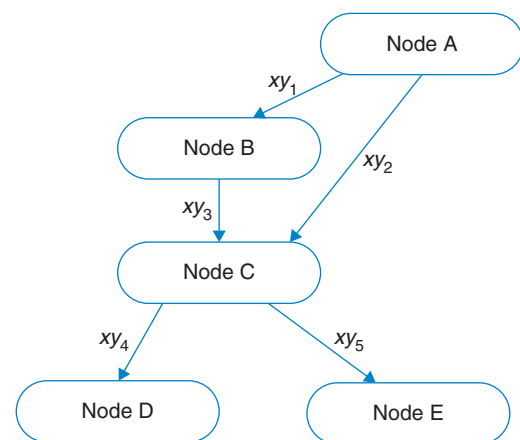

Fig. 1 An example of Bayesian network. Nodes represent random variables, lines represent the arc of causation, xy_n represent the mutual information value computed for any pair of linked variables.

numerical data that are encoded in a set of probability distribution tables. The arcs determine what probability information is required to specify the probability distribution (see Fig. 1 'xy_n') among the random variables in the network. *A priori* probabilities for root nodes can be assigned when prior knowledge on the domain under study is available; otherwise when large data set is available,[40] they can be learned directly from the data sets. Therefore, we followed the latter approach and used the Greedy Thick Thinning algorithm[41] to learn the structure of the BN and conditional probabilities via the Expectation–Maximization algorithm.[42]

BN implementation was carried out using GeNIe 2.0 and Netica 4.02 (GeNIe 2.0. Pittsburgh, PA: Decision Systems Laboratory (DSL), http://genie.sis.pitt.edu; Netica[TM] v4.02, Norsys Software Corporation, http://www.norsys.com/netica.html, 2006), and a sensitivity analysis computed mutual information between nodes, quantifying the strength of the relationships among variables .

Results

Our analyses were conducted on 16 018 fifteen-year-old adolescents participated in the HBSC Italian survey. Figure 2 illustrates the males and the females' networks revealed using the BN analysis. Males and females BNs have a high proportion of overlapping results, with regard to nodes, arcs (represented in Fig. 2 with solid lines) and observed probabilities.

Values reported, respectively in bold for female and in italic for males, represent the strength of the observed relationships between nodes: the higher the value the stronger the relationship observed in each pair of linked variables.

Subjective well-being was, in both males and females BNs, shown to be directly linked with academic stress through the variable 'schoolwork pressure'. In both sexes, the feeling of being under pressure due to schoolwork was strongly linked to the other two variables representing the academic stress, which are also strongly correlated with each other (Kendall correlation coefficient $= 0.25$ for males and 0.28 for females, in both cases $P < 0.001$). School attachment and relationships with teachers play a different role in male and female adolescents: schoolwork pressure is directly linked with school attachment in males (dashed lines and italic values) while it is linked with the relationships with teachers in females (dotted lines and bold values).

Our results show that the whole network is shaped around the nodes representing the academic stress. In particular, in both sexes, BN nodes have the same level of aggregation. Risky behaviours (on the left of Fig. 2) are mutually dependent and linked to school attachment; quality of relationship with mother and father (on the up-right of the figure) are linked and contingent on school attachment; relationship with peers (on the right of the figure) depends directly on the quality of relationship with teachers, namely the perception of being treated fairly by teachers.
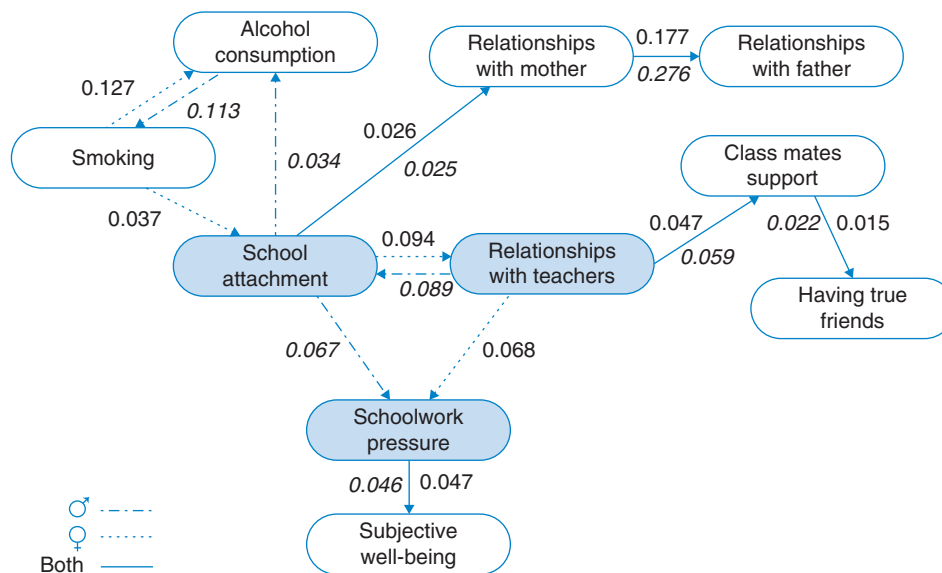

Fig. 2 Bayesian networks of all considered variables for males and for females (solid, dotted and dashed lines[§]). Numbers are mutual information values, respectively, computed for any pair of linked variables for females and for males (italics). [§], Males (♂) network is represented by dashed lines; Females (♀) network is represented by dotted lines. Solid lines represent the overlaps between Males and Females networks: subjective well-being is represented by health complaints; alcohol consumption—at least one drink per week; smoking—at least once a week; Males' mutual information values are in italic numbers; grey nodes are the variables representing adolescents academic stress.

Table 1 Conditional distribution of psychosomatic symptom complaints given school attachment, in 15-year-old males

School attachment: Do you like school?	Psychosomatic symptom complaints		
	At least two symptoms per week (%)	Less than two symptoms per week (%)	Missing values (%)
A lot	31.4	65.4	3.2
Quite a lot	32.1	64.8	3.1
Not quite	35.0	61.7	3.3
Not at all	40.5	55.8	3.7
Missing values	37.0	53.5	9.5

Table 2 Conditional distribution of psychosomatic symptom complaints according to the feeling that teachers treat students fairly, in 15-year-old females

Do you agree teachers treat students fairly?	Psychosomatic symptom complaints		
	At least two symptoms per week (%)	Less than two symptoms per week (%)	Missing values (%)
I strongly agree	56.0	41.4	2.6
I agree	56.6	41.0	2.5
I neither agree nor disagree	60.1	37.5	2.4
I disagree	63.7	33.8	2.4
I strongly disagree	67.6	29.8	2.6
Missing values	47.8	42.1	10.1

Accordingly, Tables 1 and 2 report the conditional distribution of psychosomatic symptoms within the different categories of, respectively, school attachment for males and being treated fairly by teachers for females. The probability of having at least two symptoms per week increases as school perception worsens in males and as the feeling of being treated unfairly by teachers strengthens in females.

Finally, BNs were used to assess the increased probability of reporting two or more symptoms weekly, declaring difficult relationships with parents, having low classmate support, having true friends, and smoking and drinking at least once a week among those who have a low school attachment and among those who feel they are not treated fairly by their teachers (see Table 3).

A low school perception was, in males, significantly associated with an increased risk of (i) health complaints (OR = 1.24, 95% CI 1.14–1.35), (ii) having poor relationships with

parents both mother (OR = 1.65, 95% CI 1.50–1.80) and father (OR = 1.28, 95% CI 1.14–1.42), (iii) being pressured by schoolwork (OR = 2.03, 95% CI 1.89–2.17), (iv) smoking at least once a week (OR = 1.26, 95% CI 1.12–1.40) and (v) consuming at least one alcoholic drink per week (OR = 1.82, 95% CI 1.67–1.98). In females, the pattern was similar, with the only difference being a non-significant association of a low school attachment with health complaints (OR = 1.08, 95% CI 0.98–1.18).

Having bad relationships with teachers was, in females, significantly associated with an increased risk of (i) health complaints (OR = 1.31, 95% CI 1.19–1.44), (ii) having a low classmate support (OR = 2.32, 95% CI 2.12–2.53) and (iii) smoking at least once a week (OR = 1.36, 95% CI 1.16–1.55). The pattern of associations for males was non-significant for almost all variables, with the exception of classmate support (OR = 1.28, 95% CI 1.14–1.42).

Discussion

Main finding of this study

High academic stress is associated with lower physical and psychological well-being and with lower quality of relationships with parents and peers. The whole network of interactions among the considered variables is shaped around academic stress. Furthermore, our results show that risky behaviours, namely smoking and drinking, are also strongly and directly connected with perceived academic stress. Hence, the school seems to represent the main factor influencing subjective well-being in 15-year-old adolescents.

What is already known on this topic

Previous studies demonstrated that 'feeling connected', having a low level of conflict and an environment where the expression of emotions is encouraged are protective factors for pre-adolescent emotional disorders.[43] The perception of a supportive environment is also a factor that can diminish psychosocial stress among children and adolescents.[44] Furthermore, recent studies carried out in the USA and China have shown the crucial role played by school and family in reducing high-risk behaviours in adolescents.[45] In accordance, our results show that subjective well-being is strongly related to the availability of some crucial resources,[9,12,13] described in our study by school attachment, schoolwork pressure and relationships with teachers.[29–31] Our results are in agreement with previous studies; as academic stress decreases, health complaints decrease in both males and females, underlining the fact that school is perceived as a resource by the student.

Table 3 Odds ratio of health complaints, poor quality of relationships with parents, teachers and peers and smoking and drinking among a population of 15-year-old adolescents who (a) have a low school attachment (in comparison to those who have high/neutral school attachment) and (b) feel not being treated fairly by teachers (in comparison to those who feel treated fairly/neither fairly nor unfairly

	Females			Males		
	OR	95% CI	P-value	OR	95% CI	P-value
a. Low school attachment						
Health complaints[a]	1.08	0.98–1.18	0.072	1.24	1.14–1.35	<0.001
Poor quality of relationship with mother[b]	1.85	1.75–1.96	<0.001	1.65	1.50–1.80	<0.001
Poor quality of relationship with father[b]	1.27	1.15–1.38	<0.001	1.28	1.14–1.42	<0.001
Low class mates support[c]	1.28	1.04–1.51	0.019	1.10	0.96–1.25	0.090
Having true friends[d]	0.99	0.84–1.15	0.529	1.01	0.90–1.17	0.456
Perceiving schoolwork pressure[e]	1.27	1.15–1.39	<0.001	2.03	1.89–2.17	<0.001
Smoking at least once a week	2.75	2.60–2.90	<0.001	1.26	1.12–1.40	<0.001
At least one alcoholic drink per week	1.49	1.34–1.63	<0.001	1.82	1.67–1.98	<0.001
b. Not being treated fairly by teachers						
Health complaints[a]	1.31	1.19–1.44	<0.001	1.02	0.87–1.16	0.414
Poor quality of relationship with mother[b]	1.15	0.95–1.37	0.088	1.08	0.94–1.22	0.132
Poor quality of relationship with father[b]	1.01	0.84–1.17	0.467	1.06	0.93–1.19	0.198
Low class mates support[c]	2.32	2.12–2.53	<0.001	1.28	1.14–1.42	<0.001
Having true friends[d]	1.05	0.89–1.20	0.274	1.05	0.88–1.23	0.275
Perceiving schoolwork pressure[e]	2.69	2.54–2.84	<0.001	1.14	1.02–1.27	0.019
Smoking at least once a week	1.36	1.16–1.55	0.001	1.02	0.84–1.21	0.389
At least one alcoholic drink per week	1.12	0.91–1.32	0.140	1.09	0.95–1.23	0.108

Odds ratios (ORs) and 95% confidence intervals (95% CI) and P-value for each variable considered in the model.

[a]OR of suffering weekly from at least two of the following symptoms: headache, stomach ache, backache, feeling low, irritability or being bad tempered, nervousness, dizziness and sleeping difficulties.

[b]Declaring difficult or very difficult to talk with mother/father about things that really bothers.

[c]Being accepted by other school mates (disagree/strongly disagree).

[d]Having three or more friends of the same gender.

[e]Feeling pressured by schoolwork (some/a lot).

What this study adds

Our study builds on earlier work, focusing attention on protective factors (family, peer relationship and 'significant' adults) rather than risk factors, to better understand adolescents' health.

Indeed, our results seem to show adolescents' well-being is strictly dependent on positive school perception and on the quality of relationships with parents and peers. A supportive school environment is also negatively associated with high-risk behaviours, such as smoking and alcohol consumption.

This findings indicate that health promotion interventions in the school setting should focus on formalizing, into a coherent pedagogical practice, activities which promote critical thinking, a sense of belonging, self-esteem and the feeling of being part of a supportive society, in accordance with published recommendations,[46,47] rather than structuring a curriculum that is simply promoting healthy choices.[48,49]

Traditionally, schools and society have focused on risk behaviours (smoking, drugs and alcohol consumption) as though they were the underlying causes of adolescents' psychosomatic stress. However, it is clear from our analysis, also confirmed by a discussion with groups of adolescents from different schools in our city (data from a research protocol aimed at validating the socio-economic scale of the HBSC survey, not published), that they consider adopting high-risk behaviours as a way to express their unease; as a 'trivial' consequence of problems originating elsewhere, and where school relationships, even more than family relationships at this age, seems to play the crucial role. Consequently, school relationships, which appear to be at the very centre of this network, should become the preferred venue where these feelings can be aired, giving rise to positive processes that can promote adolescent health. School policies, therefore, should foster a culture of inclusiveness, ensuring that all young people's concerns are addressed and favouring an

organization-wide approach giving youth the opportunity of contributing to decisions that may impact on their well-being.[46]

Limitations of this study

Some limitations of this study have to be considered.

The first and most important one is linked to the fact that our data are cross-sectional, therefore not allowing for causal inference.

The second one has to do with the representativeness of our sample which, though quite large and representative of the school population, does not include the 'out-of-school' adolescent population. This group is quite limited in size, but is likely to have different characteristics compared with those attending school.

The third limitation concerns the external validity of our observation, as the study took place within the Italian socio-cultural and school organizational context. This may however be seen as an opportunity for further developing and adapting our model of analysis to different environments and national contexts. Furthermore, future research may also benefit from the use of mixed methods to better understand the complexity underling this issue and to lead effective interventions.[50]

Authors' contributions

F.C. contributed to the study concept and design of the analysis and critically reviewed the manuscript; P.B. conducted the statistical analysis and wrote the methods; L.C., P.D., A.V. and G.L. reviewed the manuscript and contributed to the discussion. Each author reviewed the final version of the manuscript and approved it for publication.

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