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Sense of coherence and factors associated with school performance of adolescents

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Abstract School performance is a key aspect for future professional and social success. The objective of the present study was to investigate factors associated with adolescents' school performance including sense of coherence (SOC) and oral health status. Three hundred eighty one schoolchildren between 15 and 18 years of age from the city of Campo Grande, Mato Grosso do Sul, Brazil, participated in the study. The outcome variable was school performance, assessed through the final grades of the Portuguese and Mathematics disciplines in 2013. Independent variables were sociodemographic data, self-perception of oral health, use of dental services and sense of coherence, obtained through a self-applied questionnaire. In addition, in a clinical assessment, the number of decayed, missing and filled teeth (DMFT index) was evaluated. Logistic regression analyses were performed, based on a hierarchical model. The mean age of students was 16 years; mean DMFT value 4.1, and SOC 44.5. In the final adjustment, the male subjects ($p = 0.0021$); those with the largest number of people residing at home ($p = 0.0021$) and weak SOC ($p = 0.0005$) showed an association with poorer school performance. In conclusion, school performance is a complex phenomenon associated with SOC and oral characteristics.

Key words Oral health, Psychology, Education

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Introduction

Studies have demonstrated that during adolescence school performance is an important social and occupational predictor in adult life^{1,2}. However, the educational process is complex and it is determined by a series of factors, such as socioeconomic status, family dynamics, school relationships and the emotional and cognitive development of the students^{3,4}.

More recently, from a perspective of the protective factors, researchers have turned to investigating the resources that protect children and adolescents from the effects of adversities faced in the school environment, and consequently, contribute to better their academic performance^{5,6}. Studies have pointed out the importance of understanding how the schoolchildren could overcome the daily emotional and academic difficulties by using their individual coping resources. One way of investigating and understanding these individual mechanisms is by means of the salutogenic theory⁷.

The focus of the salutogenic theory is the study of resources that facilitate coping with adversities throughout life. The sense of coherence (SOC), a central construct of that theory, represents an essential attribute for this process. SOC consists of a global orientation that expresses the personal sense of seeing life structured, manageable and with an emotional sense⁶. This concerns an individual form of thinking, feeling and acting with self-confidence that leads persons to identifying and using the resources available for dealing with the challenging situations of life^{7,8}. The individual sense of coherence is composed of three elements: cognitive (ability to clearly understand the nature of the problem to be faced), behavioral (notion that the resources suitable for dealing with the situation exist and can be under your own control, or under the control of persons in your social network); and motivational (capacity to make emotional sense of the situations experienced). To perceive an understandable, manageable world that has emotional significance makes it easier to face the adversities of life⁷.

Antonovsky⁷ initially developed an ordinal scale with 29 items to measure SOC (SOC-29) to be applied in the format of an interview or by self-applied questionnaire. The shortest version of this scale (SOC-13) contains 13 items and was transculturally adapted in Brazil by Bonanato *et al.*⁹. The sense of coherence score is obtained by means of the sum of scores of the items. The hi-

gher the score is the stronger is the sense of coherence.

High levels of SOC^{2,10} and good oral health conditions¹¹⁻¹⁴ have been pointed out as being resources that favor better school performance among youngsters. Therefore, considering that the school environment may be an important source of stress for adolescents due to the pressure to obtain good results in exams, SOC plays an important role in their wellbeing.

Some authors have emphasized that SOC may present a certain stability as from 15-16 years of age, and may therefore, contribute to the mediation of stressor factors during adolescence^{15,16}. Evidences have shown that high SOC levels were associated with reduction in stress and decrease in the internalizing and externalizing problems experienced by adolescents in this stage of psychological and cognitive changes in their individual lives¹⁷.

It is especially important to understand this coping mechanism in adolescents of a low socioeconomic stratum, bearing in mind the negative consequences that socioemotional and behavioral problems, and family adversities generate on the learning process of this social group¹⁸.

Although there are studies that have investigated the complexity of factors implicated in school performance^{9,20}, none of them have included oral variables and psychosocial resources, such as sense of coherence, in one and the same model, as protective resources for this outcome.

Investigating the role of SOC and oral health in academic performance of adolescents may provide managers with evidences enabling them elaborate policies in the educational and health field that would favor the development of adolescents' resources, benefit their learning skills, and generate health benefits to individuals in this age group.

In view of the relevance of this topic, the aim of this study was to analyze whether there were associations between the sense of coherence, oral health conditions, sociodemographic characteristics and access to dental services with school performance of adolescents of a low socioeconomic stratum.

Materials and methods

Ethical aspects

This project was approved by the Research Ethics Committee of the Federal University of

Mato Grosso do Sul (CEP/UFMS). The study was conducted in compliance with all the normative and ethical procedures such as signature of the Free and Informed Consent Term (FICT) and official authorization from the Secretary of State for Education of Mato Grosso do Sul for performing data collection.

Type of study

An Analytical Cross-Sectional Study.

Population and sample

The participants of this study were 381 adolescents of a low socioeconomic stratum, aged from 15 to 18 years who were randomly selected from among students enrolled in public schools in the city of Campo Grande, Mato Grosso do Sul, Brazil, in the year 2013.

According to the data from the State Secretary for Education of Mato Grosso do Sul, at the time of the research, the city of Campo Grande had 76 State-funded schools distributed among 8 urban areas of the city, namely: Anhanduizinho (5), Bandeira (6), Sul (12), Hércules (8), Segredo (12), Central (12), Imbirussu (13), Lagoa (8). Schools that did not have high school groups, indigenous schools and those belonging to the rural zone were excluded, totaling 61 participating schools and 27,274 pupils enrolled in high schools.

A probabilistic sampling technique by conglomerates was applied to select the schools by macroregion. The first draw of schools was based on the division of the city into urban centers. Some schools showed resistance to application of the research (Segredo, Sul and Hércules regions).

At the end of the study, there were a total of nine participating schools: two in the region of Anhanduizinho; four, in Bandeira; one each for the Central, Imbirussu and Lagoa, respectively. The sample size was calculated considering a sampling error of 5%, level of confidence 95%, and response distribution of 50%, totaling 385 pupils randomly selected at the schools participating in the study.

Inclusion criteria

Inclusion criteria were as follows: those who were drawn and enrolled at the selected public schools and aged from 15 to 18 years; who accepted participating in the research and brought

with them the FICT signed by their parents or guardians; and who were present on the day of the survey. Three students were excluded from the study because they had five or more teeth with orthodontic bands in place.

Instruments

A questionnaire adapted from the national oral health survey *SB Brasil 2010 Project*²¹ was used for sociodemographic data collection (age, gender, years of schooling, monthly family income, number of persons living in the residence), information about self-perception of oral health and use of dental services by adolescents.

Dental treatment need was evaluated by means of the following question: "Do you think you need dental treatment?" The impact of oral conditions on daily activities was also investigated by means of the following questions: "In the last 6 months, did you have difficulties with eating or drinking because of your teeth?"; "In the last 6 months, did you feel any discomfort when brushing your teeth; "In the last 6 months, did you feel ashamed to smile or speak?". The alternative responses were yes or no.

Use of dental service was evaluated by means of the following questions: "Have you ever been to a dentist?" (yes/ no/ I've never been to the dentist) and "What was the reason for the consultation?" (routine consultation/ curative consultation/ or others).

Sense of coherence was evaluated by means of the validated version of SOC-13⁹ composed of 13 questions, each with five response options on a Likert scale. The total SOC-13 score was obtained by means of adding up the scores of all the dimensions of the instrument, and its absolute value could range from 13 to 65. The highest score values would represent an individual's greater capacity to face stressful situations and stay healthy⁷.

For calculating the students' school performance, the sum of final grades with reference to the disciplines of Mathematics and Portuguese for the year 2013 were considered, which ranged from 0 to 10 each, according to the regulations of the schools evaluated. Students' school performances were obtained **from documents available by the schools.**

For application of the questionnaires, the students were called from their classroom in pairs and were taken to a comfortable room on the school building, which offers appropriate privacy for students to respond truthfully.

Clinical exam criteria

After filling out the questionnaire, the clinical oral exam was performed by using the DMFT index in accordance with the World Health Organization²² codes and criteria. The exam was performed by two previously calibrated examiners, assisted by two note-takers, under natural light, with the student seated and the examiner standing; with the use of complete individual protective equipment (IPE): white coat, cap, mask, protective goggles and disposable gloves. Ball point type probes were used only for plaque removal, a duly sterilized oral mirror, and in some cases, a wooden tongue depressor.

Training and calibration

The training and calibration process was carried out by means of an exposition and dialog with examiners according to the guidelines of SB Brasil²¹. At this opportunity, a pilot study was also conducted with 40 students for the purpose of adjusting the questionnaire and check difficulties by the adolescents with filling it out.

Intra and inter-examiner agreement necessary for applying the clinical exam (DMFT index) was obtained by means of the *Kappa* coefficient. The inter-examiner *Kappa* value was 0.84, and intra-examiner value, 0.89 and 0.92, respectively.

Data analysis

School performance was considered the outcome variable. The independent variables were sociodemographic conditions (age, gender, years of schooling, monthly family income, number of persons living in the residence), SOC, self-perception of oral health, use of dental services and the DMFT index.

Descriptive analysis was performed by means of the table of frequencies and measures of central tendency and dispersion. After this, simple and multiple regression models were estimated by means of the PROC GENMOD procedure of the statistical program SAS (SAS, 2001). Initially the empty model was estimated (Model 1), without inclusion of the variables, to evaluate the reduction in variance in comparison with the final model. The variables that presented $p \leq 0.20$ in the individual analysis were tested in the multiple analyses. A final model was adjusted with the variables that remained with $p \leq 0.05$, after adjustment of the other variables.

Results

Table 1 presents the mean, standard deviation, median, minimum and maximum value of the variable age, DMF-T, sense of coherence, school performance, educational level, number of persons in the residence and monthly family income

Of the total sample, 61.4% of the adolescents were female, 62.8% perceived dental treatment need, 97.1% had previously been to the dentist, 68.3% of the individuals had sought the dentist for a routine consultation and 18.9% for curative consultation. The majority of the participants (83.5%) reported no discomfort when brushing their teeth, and was not ashamed to smile or speak (79.0%). Furthermore, 62.8% of the individuals reported no difficulties with eating or drinking because of their teeth (Table 2).

Table 3 presents the estimated parameters of the individual and multiple regression analysis adjusted for describing the influence of the variables on school performance. In the final model, the female individuals presented better school performance than male ($p = 0.0014$). Relative to the number of persons in the family, the students that lived in residences with a larger number of persons had a worse school performance ($p = 0,0013$). The adolescents with higher SOC presented better school performance ($p = 0.0009$). Those who had difficulties with eating or drinking because of their teeth had worse performance than those without any difficulty ($p = 0.0580$).

Discussion

This study showed that the school performance of adolescents was related to the demographic, socioeconomic, psychosocial and oral factors. Both the psychosocial factor, measured by the SOC¹⁰, and the oral condition, evaluated by questions about the impact on daily activities^{12,23}, have been associated with school performance in previous studies.

Some studies have sought to investigate the factors associated with low performance, or the learning difficulties of the students^{24,25}. With reference to gender, Osti and Martinelli²⁵, pointed out that boys presented greater unsatisfactory performance in the learning process, felt themselves to be more criticized, and were seen by teachers as undisciplined students, whose origins of bad behavior were attributed to their families. On the other hand, the girls received more support, and less disapproval by the teachers, which could

Table 1. Mean, standard deviation (SD), median, minimum value (MV) and maximum value (MXV) of variables analyzed.

Variables	Mean	SD	Median	MV	MXV
Age (years)	16.2	1.2	16.0	14.0	18.0
DMF-T	4.1	3.4	4.0	0.0	15.0
Sense of Coherence	44.5	6.4	44.0	24.0	65.0
School Performance	12.8	2.2	13.0	4.5	18.5
Years of Schooling	12.5	2.1	11.0	11.0	14.0
Number of persons in residence	4.5	1.2	4.0	2.0	8.0
Monthly Family Income (In Reais)	2109.1	1798.5	1600.0	350.0	17000.0

Table 2. Distribution of frequencies of variables analyzed.

Variable	n	%
Sex		
Female	234	61.41
Male	147	38.58
Visit to Dentist		
Yes	368	97.09
No	11	2.90
Reason for visit to dentist		
Never been to a dentist	12	3.19
Routine consultation	257	68.35
Curative consultation	71	18.88
Others	36	9.57
Treatment Need		
Yes	223	62.81
No	132	37.18
Difficulty with eating or drinking because of the teeth		
Yes	140	37.23
No	236	62.76
Discomfort when brushing teeth		
Yes	58	15.46
No	317	83.53
Ashamed of smiling or speaking		
Yes	79	21.01
No	297	78.98

increase their motivation for their studies. These facts corroborate the findings of the present study, in which the boys were related to worse school performance, thus reinforcing the need to discuss the ties between pupils and teachers.

Although there is a general consensus that even among more vulnerable children the main cause of repetition and school drop-out resides in their behavior and not in their mental deve-

lopment; the effects of unfavorable conditions of life on their failure at school are undeniable²⁶. From this aspect, family agglomeration, which is one of the characteristics of low income groups, was related to the worst school performance in the present study, in some way revealing that grouping people in a house with few rooms could decrease the youngsters' concentration and discipline to study, probably as a consequence of a disorderly family environment.

Low socioeconomic conditions are known to contribute to individuals' exposure to factors that interfere in their oral health, self-perception of health and quality of life²⁷⁻²⁹. The schoolchildren who participated in the research presented a DMFT indices close to that of the national mean (4.25 teeth with dental caries experience)²¹, and association was observed between the impact of the oral condition and school performance. The relationship between difficulty with eating or drinking because of the teeth and low school performance revealed that oral health could compromise learning, as has been shown by other studies^{13,14,30,31}. This is because the poor oral condition interferes in self-esteem, socialization and concentration at school¹². Moreover, studies have pointed out that dental problems are causes of absences from school, which reduce the opportunity to learn^{14,32}.

Elevated levels of sense of coherence of the adolescents were associated with higher school performance. This finding may indicate that even among adolescents of low socioeconomic strata, an elevated SOC is an important resource for their coping with the adversities of the school environment. The literature has pointed out that many children perceive school setting as an important source of stress, either due to pressure to achieve good school results and also as a result of the competition among schoolchildren and the high expectations of their parents³³.

Table 3. Individual and Multiple analyses for school performance as outcome variable.

	Individual analysis			Multiple Analysis					
	Estimate	Standard-Error	p-value	Modelo 1 (modelo vazio)			Final Model		
				Estimate	Standard-Error	p-value	Estimate	Standard-Error	p-value
Intercept				12.8018	0.1138	<.0.0001	10.9868	0.8996	<.0.0001
Socio-demographic Variables									
Sex (Ref = Male)	0.5823	0.2320	0.0121				0.7437	0.2322	0.0014
Age (years)	-0.0900	0.0971	0.3541						
Ed.Level(Years of Schooling)	0.0067	0.0207	0.7453						
Number of persons in family	-0.2414	0.0799	0.0025				-0.2514	0.0784	0.0013
Monthly Family Income (Reais)	0.0000	0.0001	0.8469						
Psychosocial Variable									
Sense of Coherence	0.0533	0.0176	0.0025				0.0584	0.0176	0.0009
Variables related to access to health service									
Visit to dentist (ref = no)	-0.1250	0.6812	0.8544						
Reason for visit to dentist (ref = others)									
Never been to a dentist	0.3139	0.7437	0.6730						
Routine consultation	0.2578	0.3970	0.5162						
Curative consultation	0.0241	0.4565	0.9579						
Variables of impact of oral health on daily activities									
Difficulty with eating or drinking because of the teeth (ref = no)	-0.4427	0.2373	0.0621				-0.4398	0.2320	0.0580
Discomfort when brushing teeth (ref = no)	0.1547	0.3193	0.6279						
Ashamed of smiling or speaking (ref = no)	-0.2874	0.2825	0.3091						
Clinical Variables									
DMF-T	-0.0181	0.0340	0.5943						
Treatment Need	-0.3822	0.2368	0.1066						
AICC				1693.7070			1638.6696		

AICC: Akaike Information Criterion.

Nevertheless, for those with a high sense of coherence, the school environment may not be perceived as a stress-generating factor, but rather as a challenge to be faced. When the stimuli are understood to be experiences that can be overcome, these events are considered challenges to be transcended⁷. The elevated sense of coherence therefore motivates people to have confidence that the result achieved will be reasonable, therefore, encouraging the quest for resources to deal with the situation. Therefore, the schoolchildren with high SOC are capable of mobilizing adequate resources for managing the challenges of school, and consequently, have a better academic performance.

In this sense, in addition to SOC, the availability of generalized resistance resources (GRR) may also have contributed to more effective coping with the adversities by adolescents with high SOC. GRR refer to factors that facilitate individual ability to deal effectively with stressors⁷. The present study did not intend to identify other resources that the adolescents used to deal with academic questions, apart from SOC and oral health condition. However, social support, a family environment that favors communication and the establishment of affectionate relationships with parents significantly contribute to the events of life - among them coping with the school environment - being perceived as understandable, manageable and having emotional meaning¹⁷. Future studies need deepen investigation into the complex interactions that involve the set of resources (salutogenic factors) that favor school performance.

It is important to emphasize that SOC is the fruit of a process of development during childhood and adolescence, and is therefore a consequence of individual life experience, the learning process and influences of the environment. Thus, interventions in the school environment that offer to children and adolescents opportunities to acquire generalized resistance resources could generate positive consequences not only on their school performance, but mainly on their health, well-being and quality of life. For this purpose the interventions must involve actions in various domains, including changes in the school curricula, and reinforcement of resources that are fundamental for structuring SOC in adolescence,

which would be: empowerment, reinforcement of self-esteem and self-confidence of schoolchildren, closer relationships of the schoolchildren with the school, teachers, community and particularly, the family³⁴. The support of teachers, classmates, and models of group behavior have been demonstrated to play a relevant role in structuring SOC during adolescence³⁵, improving their school performance and generating sustainable changes that are favorable to health over the course of time.

The authors emphasize that this study presented some limitations. Because of its cross-sectional design, it was not possible to define the causal relations among the variables analyzed. A better school performance may possibly be exerting an influence on the adolescents' sense of coherence. The literature has previously confirmed findings of this nature³⁶. Longitudinal studies are necessary to elucidate this relationship. Moreover, the study sample involved adolescents of low socioeconomic strata and the results cannot be extended to other social groups with difference socioeconomic and cultural characteristics. Future studies must be conducted with the purpose of exploring the complex relations between SOC, generalized resistance resources, oral health and their effects on school performance. Lastly, the authors wish to emphasize that the results found are important, because this was the first study relating SOC in the presence of oral alterations, such as dental caries, and its relationship with school performance in adolescents. Improvement in the oral conditions of adolescents allied to reinforcement of the sense of coherence could contribute to school performance. However, the development of public social policies aligned with the salutogenic perspective is fundamental for making it feasible to have access and availability of resources that contribute to academic performance and generate positive results for the well-being and quality of life of less favored groups.

Conclusion

School performance in adolescents is a complex phenomenon associated with SOC, oral status and sociodemographic characteristics.

Collaborations

MIG Oliva: Was the senior author who proposed the study design, contributed to data analysis and interpretation, and drafting first minute of the article. IP Cunha, NA Silva, FL Miallhe, KL Cortellazzi and MC Meneghim: Contributed to data interpretation and writing the final article. TC Coelho: Contributed to data analysis and interpretation, in addition to writing the final article. VR Lacerda: Proposed the hypothesis, design, data analysis and interpretation, and wrote the first version of the manuscript. All the authors of this article contributed to, and approved the final version of the manuscript.

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