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Role of parents in adolescent self-rated health: Norwegian Nord-Trøndelag Health Study

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Background: Self-rated health (SRH) is a known important predictor of later mortality, morbidity, and health service attendance. From adolescence onwards, this multifactorial composite seems to be relatively stable. Therefore, it is important to study how SRH is also shaped and influenced by parental factors.

Methods: Analyses were based on data from the Nord-Trøndelag Health studies in Norway during 1995–1997 among adolescent children aged 13–19 years and their parents. Cross-table analyses were made for parental and adolescent SRH. Proportional odds logistic regression analyses with parental SRH and a broad spectrum of other parental covariates were conducted, with adolescent SRH as the dependent variable, both unadjusted and adjusted.

Results: Lower level of education, living alone, smoking, low general well being, and low life satisfaction were the most important parental factors associated with lower SRH in adolescents. However, the associations between parental SRH and adolescent SRH were rather weak, and in adjusted multivariable analyses lost significance for both genders. The net effect of genetics and early vertical family influence on adolescents' SRH thus seems to be moderate. Notably, the association between more specific health-related and lifestyle variables in parent and adolescent SRH was rather weak.

Conclusion: SRH in adolescents seems to be shaped only partly by parental influence, and is less "deterministic" than might be expected from some genetic studies. SRH may therefore be modifiable by health-promoting efforts in early life.

Keywords: self-rated health, parents, adolescents, children, parent-child relationship

Introduction

The World Health Organization defines health as a resource for living a productive life, and considers self-rated health (SRH) to be a more appropriate measure of adolescent health than traditional morbidity and mortality measures.[1] Among adults, SRH is a known important predictor of later mortality, morbidity, and health service attendance, and is also associated with sickness absence from work.[2] Childhood and adolescence are important stages in life for possible control over diseases, particularly those with strong psychosocial components.[3] The Council of the European Union states that "parents play a vital role in the well being and healthy environment of young people".[4]

In an earlier study based on the same Nord-Trøndelag Health (HUNT) study material from Norway, the authors found adolescent SRH to be a multifactorial composite associated with a broad spectrum of medical, psychologic, social, and lifestyle factors for both genders.[5] A further longitudinal study also showed SRH to be a relatively stable construct during adolescence, and one that deteriorated consistently with a lack

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of general well being, disability, and health-compromising behavior.[6] Thus, if SRH is best understood as an enduring self-concept, and found to be mainly established prior to adolescence, an important question is to what extent it could be inherited genetically or socially from parents.

In adolescence, individuals are influenced by genes (genetically inherited vulnerability), the early "vertical" influence of parents and family, and later the increasing demands from and influence of peers, school, and wider society, including mass media ("horizontal" influence). The various factors probably also interact, but for effective health promotion aimed at improving SRH among adolescents, it is useful to know which of these three influences is most important during this period.

A longitudinal Finnish twin study found 63% heritability of SRH at the age of 16 years, declining to 33% at the age of 25 years. The residual variation was due to unshared environments.[7] Furthermore, Romeis et al found in American male twins that over one third of the variability in SRH could be attributed to genes, and that health conditions accounted for only 15% of the variation.[8]

In contrast, other twin studies from Scandinavia have concluded that environmental factors are the dominant explanation, accounting for 60%–90% of the variation in SRH.[9–11] Leinonen et al from Finland concluded that there were no specific genetic effects on SRH, but an influence through the effect on chronic diseases, functional limitation, and mood.[12]

Given this background, the objectives of the present study were firstly to examine the association between parental SRH and adolescents' SRH and, secondly, to identify other parental factors possibly associated with adolescent SRH.

Material and methods

Study populations

In 1995–1997, the county of Nord-Trøndelag in central Norway had approximately 127,000 inhabitants. In this period, all inhabitants aged 13 years and older were invited to join a large population study, the second Nord-Trøndelag Health (HUNT 2) study, and approximately 70,000 (70%) participated.

Students at junior and senior high schools, aged 13–19 years, were invited to participate in the adolescent part of the study, known as Young-HUNT 1. A total of 9131 students participated, representing a 90% response rate. Data on SRH from mothers who participated in HUNT in 1995–1997 were available for 7092 adolescents, while data on SRH from fathers were available for 6008 adolescents. Merging of data from adolescents and their parents participating in the HUNT study was made possible through the Norwegian Family Register using the 11-digit personal number by which every Norwegian citizen is registered.

Methods

The results from the adult and the adolescent populations were linked, enabling comparison of factors between the parents and their adolescent children. All HUNT participants completed questionnaires and attended a clinical examination, including measurement of weight and height. The questionnaires included questions on somatic and mental health, lifestyle, quality of life, use of medication, and use of health services (http://www.ntnu.no/hunt/english/data/que). Height and weight were measured without shoes by specially trained nurses using standardized equipment and protocols. Details about the study have been reported previously.[13]

Adolescents in Young-HUNT completed the self-administered questionnaire during one school hour in an examination setting. The dependent variable in this study was based on the self-reported global health question: "How is your overall health at the moment?" The question had four answer categories, ie, "very good", "good", "not very good', and "poor". The predictor variables, except for the age of the adolescent, were the parents' answers to the questionnaires and the BMI results from 1995–1997.

Table 1 shows the list of questions used as dependent and predictor variables in our analyses. Some of these were single items, but most of the predictor variables were composite scores constructed from a set of questions. These covered both somatic and psychologic health, disability, general mood and well-being, health-related lifestyle, education level, and marital status. Subjective health complaints were assessed on an eight-question scale for common psychosomatic symptoms. Psychologic (mental) health, a measure of anxiety and depression, was based on a short version of the SCL-25.[14] Four questions on self-esteem were based on Rosenberg's scale.[15] General well being was a five-item quality of life scale validated in earlier HUNT studies.[16] For mental health complaints and general well being, Cronbach's alphas are given in Table 1, showing acceptable internal consistencies. All answers were recoded to yield the same direction (increasing values for increasing problems) in the composite scores.

All participants gave their written consent to participate in the study. For students under 16 years of age, parents also

Table 1 Variables used in the analyses, including response options and Cronbach's alphas for the two psychometric sum scores

Dependent variable	Response options	Cronbach's alpha
How is your health at the moment?	4	
Independent variables		
Gender (parents and adolescents)	2	
Age (adolescents in years)	Number	
How is your health at the moment?	4	
What is your highest level of education?	5	
–Secondary school, 7–10 years		
–High school, intermediate, 1–2 years		
–Junior college, qualifying)		
–University less than four years		
–University/college more than four years		
Do you live alone or with others (spouse or partner)?	2	
Do you suffer from or have you suffered from any of the following illnesses?		
–Asthma	2	
–Myocardial infarction (heart attack)	2	
–Angina pectoris (chest pain)	2	
–Stroke or cerebral hemorrhage	2	
–Diabetes	2	
–Epilepsy	2	
–Cancer	2	
During the last year, have you had pain and/or stiffness in your muscles and limbs that has lasted for at least 3 consecutive months?	2	
Have you ever been diagnosed with		
–Fibromyalgia (fibrositis/chronic pain syndrome)?	2	
–Another long-term skeletal or muscular disease?	2	
Do you suffer from any long-term illness of a physical or psychologic nature that impairs your functioning in everyday life (slight, moderate or severe)?		
–Motor ability impairment	4	
–Vision impairment	4	
–Hearing impairment	4	
–Impairment due to physical illness	4	
–Do you have or have you ever had mental health problems for which you sought help?	4	
–Do you suffer from long-term impairment due to mental health problems?	4	
In the last two weeks, have you felt:		Mother 0.79 Father 0.81
–Troubled by anxiety?	4	
–Down/depressed?	4	
How many glasses of beer, wine or spirits do you usually drink in the course of two weeks?	Number	
Do you smoke (daily)?	2	
Body mass index > 30 (clinical data)	2	
In the past year, for how much of your leisure time have you been physically active (hours per week)?		
–Low physical activity (no sweating/not out of breath)	2	
–Vigorous physical activity (sweating/out of breath)	2	
In the last two weeks, have you felt	4	Mother 0.81 Father 0.84
–Confident and calm?		
–Happy and optimistic?	4	
–Nervous and restless?	4	
–Irritable?	4	
–Lonely?	4	
Thinking about your life at the moment, would you say that you are by and large satisfied with life, or that you are mostly dissatisfied with your life?	7	

gave their written consent. The study was approved by the Regional Committee for Medical Research Ethics and the Norwegian Data Inspectorate.

Statistics

Answers were rescaled in the same direction from the positive to the negative end. Each subscale was based on one to seven items, as shown in Table 1. Each of these items had answer scores from 1 (best) to k (worst). The number of alternative answers for each item varied from 2 to 4. The item score was rescaled as (score − 1)/(k − 1), giving a rescaled score from 0 (best) to 1 (worst). An average of these for the subscale was computed if at least half of the items on the subscale were answered, giving a subscale score in the range 0 to 1.

We used proportional odds logistic regression to examine parental covariation with adolescent SRH. The odds ratio (OR) here has the same interpretation as the OR in standard (binary) logistic regression if a cutoff were made between any two categories of the dependent variable. Covariates included parental SRH, age of the adolescent, and a broad spectrum of variables among the parents. We carried out separate analyses for each gender, both for parents and adolescents. Unadjusted analyses, adjusted analyses for subgroups (clusters) of variables, and also multivariable analyses with all independent factors using a modified backward elimination method were conducted.

Interactions were investigated using Bonferroni correction and were found to be nonsignificant. Two-sided P values <0.05 were considered significant. Results are

reported as OR with 95% confidence intervals (CI) for the effect on reduced SRH, and Wald *P* values. The SPSS 17.0 was used for statistical analysis.

Results

The distributions of SRH of parents and adolescents (number and percent) are shown in Table 2, for all four combinations with gender. Only a few individuals in these four groups described their SRH as poor. The association between parental SRH and that of their adolescent children was clearly significant for both genders. Girls' SRH was more strongly impacted by parental SRH than boys' SRH, with OR of 1.37 and 1.29 for mother and father, respectively, compared with 1.18 and 1.18 for boys, but the CI were overlapping. However, the correlation between parents and adolescents was quite low, with a Spearman rho of 0.095 (mother)/0.071 (father) for girls versus 0.053 (mother)/0.055 (father) for boys.

The unadjusted results for all independent variables (covariates) are shown in Table 3. Many of these show significant associations with lower adolescent SRH, with the highest OR for covariates measuring psychologic problems, life dissatisfaction, and lack of general well being among mothers. Among the fathers, psychologic problems, lack of general well being, and also living alone, are associated with the highest OR for impaired SRH among their adolescent children.

It is noteworthy that somatic illness, musculoskeletal illness (except for girls), high alcohol consumption, and physical inactivity among mothers were not significantly associated with their adolescent childrens' SRH. We found a similar lack of impact for fathers who, in addition, showed no impact on their children's SRH for a body mass index over 30.

The association between parental and adolescent SRH was further studied in several models adjusting for different clusters of parental factors separately (data not shown). Structural variables were entered in the first model (adolescent age, parental education, and parent living alone). In the second model, incorporating health-related variables, we adjusted for diagnosed illnesses, musculoskeletal illness, disability, and psychologic problems among parents. In the final model we adjusted for lifestyle variables, ie, high alcohol intake, smoking, obesity, and physical inactivity among parents. All categories of variables had a modest attenuating effect on the association between parental and adolescent SRH, with the exception of the lifestyle variables among fathers.

Table 2 Cross-table for parents SRH (HUNT 2) and adolescent children's SRH (Young-HUNT), expressed as numbers and percentages

	SRH mother	**Very good**	**Good**	**Not very good**	**Poor**	**Total**
SRH boys/girls	Very good	256/204 (39.6/31.0)	749/503 (34.0/22.7)	202/121 (31.3/18.6)	8/5 (19.5/15.6)	1215/833 (34.4/23.4)
	Good	335/396 (51.8/60.1)	1240/1465 (56.3/66.1)	380/442 (58.9/67.8)	30/20 (73.2/62.5)	1985/2323 (56.2/65.3)
	Not very good	50/57 (7.7/8.6)	200/238 (9.1/10.7)	58/83 (9.0/12.7)	3/7 (7.3/21.9)	311/385 (8.8/10.8)
	Poor	6/2 (0.9/0.3)	12/9 (0.5/0.4)	5/6 (0.8/0.9)	0/0 (0.0/0.0)	23/17 (0.7/0.5)
	Total	647/659 (100/100)	2201/2215 (100/100)	645/652 (100/100)	41/32 (100/100)	3534/3558 (100/100)
	SRH father	**Very good**	**Good**	**Not very good**	**Poor**	**Total**
SRH boys/girls	Very good	180/148 (37.1/30.8)	703/458 (35.1/23.0)	141/111 (27.8/23.8)	14/5 (40.0/12.8)	1038/722 (34.2//24.3)
	Good	259/291 (53.4/60.6)	1125/1335 (56.1/67.1)	303/289 (59.8/61.9)	18/26 (51.4/66.7)	1705/1941 (56.3/65.2)
	Not very good	43/40 (8.9/8.3)	163/191 (8.1/9.7)	59/64 (11.6/13.7)	3/8 (8.6/20.5)	268/303 (8.8/10.2)
	Poor	3/1 (0.6/0.2)	13/7 (0.6/0.4)	4/3 (0.8/0.6)	0/0 (0.0/0.0)	20/11 (0.7/0.4)
	Total	485/480 (100/100)	2204/1991 (100/100)	507/467 (100/100)	35/39 (100/100)	3031/2977 (100/100)

Notes: OR (CI) boy-mother 1.18 (1.07–1.30) $P = 0.001$ Spearman's rho 0.053 ($P = 0.002$).
OR (CI) girl-mother 1.37 (1.23–1.53) $P < 0.001$ Spearman's rho 0.095 ($P < 0.001$).
OR (CI) boy-father 1.18 (1.05–1.31) $P = 0.005$ Spearman's rho 0.055 ($P = 0.003$).
OR (CI) girl-father1.29 (1.14–1.46) $P < 0.001$ Spearman's rho 0.071 ($P < 0.001$).

Abbreviations: OR, odds ratio; CI, confidence interval; SRH, self-reported health; HUNT (Nord-Trøndelag Health Study).

Table 3 Unadjusted ordinal regression analyses with adolescent SRH as dependent variable, and separate analyses for boys and girls. Reference category, best SRH

	Boys/girls (n)	OR (CI) boys	*P* value boys	OR (CI) girls	*P* value girls
Father					
Lower SRH	3031/2977	1.18 (1.05–1.31)	0.005	1.29 (1.14–1.46)	<0.001
Lower education	3017/2954	1.54 (1.25–1.90)	<0.001	1.49 (1.19–1.86)	<0.001
Living alone	3008/2956	2.06 (1.35–3.14)	0.001	1.98 (1.28–3.08)	0.002
Diagnosed somatic illness	4441/4389	1.05 (0.86–1.27)	0.643	0.95 (0.76–1.18)	0.634
Musculoskeletal illness	4441/4389	1.10 (0.97–1.24)	0.143	0.95 (0.84–1.08)	0.465
Disability	4441/4389	1.34 (0.97–2.04)	0.177	1.85 (1.80–2.90)	0.008
Psychologic problems	3034/2981	1.51 (0.92–2.49)	0.099	2.21 (1.28–3.81)	0.004
High alcohol intake (>85 pct)	2667/2598	1.01 (0.83–1.23)	0.923	1.15 (0.93–1.43)	0.194
Smoking	2916/2886	1.42 (1.21–1.67)	<0.001	1.15 (0.97–1.35)	0.103
BMI > 30	3041/2997	1.15 (0.94–1.42)	0.179	1.06 (0.85–1.32)	0.595
Physical inactivity	2957/2908	1.18 (0.92–1.50)	0.200	1.19 (0.92–1.54)	0.191
Life dissatisfaction	3032/2988	1.40 (1.13–1.72)	0.002	1.47 (1.17–1.86)	0.001
Lack of general well being	2882/2866	2.45 (1.51–3.97)	<0.001	2.65 (1.62–4.34)	<0.001
Mother					
Lower SRH	3534/3558	1.18 (1.07–1.30)	0.001	1.37 (1.23–1.53)	<0.001
Lower education	3529/3565	1.59 (1.30–1.94)	<0.001	1.57 (1.30–1.89)	<0.001
Living alone	3501/3547	1.34 (1.13–1.60)	0.001	1.57 (1.30–1.89)	<0.001
Diagnosed somatic illness	4441/4389	1.13 (0.93–1.38)	0.206	1.22 (0.99–1.51)	0.600
Musculoskeletal illness	4441/4389	1.01 (0.89–1.13)	0.926	1.16 (1.02–1.31)	0.020
Disability	4441/4389	1.68 (1.09–2.59)	0.019	2.32 (1.47–3.67)	<0.001
Psychologic problems	3536/3574	1.85 (1.27–2.69)	0.001	2.78 (1.84–4.21)	<0.001
High alcohol intake (>85 pct)	2898/2927	0.90 (0.74–1.09)	0.276	1.08 (0.88–1.34)	0.465
Smoking	3379/3429	1.29 (1.13–1.48)	<0.001	1.59 (1.37–1.83)	<0.001
BMI > 30	3551/3590	1.28 (1.06–1.55)	0.011	1.32 (1.08–1.61)	0.006
Physical inactivity	3417/3485	1.19 (0.93–1.53)	0.164	1.24 (0.96–1.61)	0.101
Life dissatisfaction	3523/3556	1.60 (1.08–2.35)	0.018	3.34 (2.22–5.12)	<0.001
Lack of general well being	3367/3410	1.97 (1.31–2.97)	0.001	2.33 (1.50–3.63)	<0.001

Abbreviations: OR, odds ratio; CI, confidence interval; SRH, self-reported health; BMI, body mass index.

Table 4 gives the results after adjusting for all original independent variables, and then using a modified backward elimination method of nonsignificant variables. Parental SRH was kept in the analyses. Variables that significantly predicted adolescent SRH in at least one of the four analyzed comparisons were also used in the multivariable model. The associations between parental and adolescent SRH then vanished compared with the unadjusted model in Table 3. The remaining significant variables among mothers were lower education, living alone, smoking (for girls), and lower life satisfaction (for girls). Among fathers, the remaining significant variables were lower education, living alone (for girls), smoking (for boys), and lower general well being (for girls).

Some of the parental covariates in our study were strongly correlated, notably life dissatisfaction and lack of general well-being (Spearman rho 0.6). Because of the possibility of multicollinearity, we also conducted the final multivariable analyses, entering only one of these two variables at a time. With general well being excluded from the model, maternal life dissatisfaction strongly impacted daughters' SRH (OR = 2.58, $P < 0.001$) but not sons' SRH. Paternal life dissatisfaction impacted boys' SRH (OR = 1.75, $P = 0.025$). With life dissatisfaction excluded from the model, general well being among mothers did not significantly impact their adolescent children's SRH, whereas fathers' well being strongly impacted both their daughters' (OR = 2.06, $P = 0.011$) and their sons' SRH (OR = 1.90, $P = 0.019$).

Discussion

In this study we found a rather weak association between parental SRH and adolescent children's own SRH rating. This association was also modestly attenuated when adjusted for several clusters of covariates, with the exception of health behavior among fathers. Several parental factors other than SRH were more strongly associated with adolescent children's SRH in unadjusted analyses. Among these were psychologic problems, living alone, disability, and life

Table 4 Ordinal regression analyses adjusted for all independent variables in four separate groups with adolescent SRH as the dependent variable. Backward elimination until variables are significant in at least one group and parental SRH included in all groups

Mothers				
Boys (n = 3107) Girls (n = 3158)	**OR (CI)**	***P* value**	**OR (CI)**	***P* value**
Age of adolescent	1.05 (1.01–1.09)	0.014	1.05 (1.01–1.09)	0.024
Lower SRH mother	1.10 (0.98–1.24)	0.114	1.13 (1.00–1.29)	0.055
Lower education mother	1.38 (1.10–1.71)	0.005	1.35 (1.07–1.70)	0.012
Mother living alone	1.26 (1.04–1.53)	0.016	1.40 (1.14–1.70)	0.001
Smoking mother	1.14 (0.98–1.32)	0.089	1.40 (1.20–1.64)	<0.001
Life dissatisfaction mother	0.71 (0.41–1.23)	0.222	3.14 (1.73–5.70)	<0.001
Lack of general well being mother	1.64 (0.93–2.88)	0.087	0.72 (0.40–1.32)	0.295
Fathers				
Boys (n = 2696) Girls (n = 2675)				
Age of adolescent	1.04 (1.00–1.08)	0.084	1.08 (1.04–1.13)	<0.001
Lower SRH father	1.06 (0.92–1.22)	0.419	1.15 (1.00–1.34)	0.057
Lower education father	1.33 (1.06–1.67)	0.014	1.32 (1.03–1.68)	0.027
Father living alone	1.23 (0.98–1.55)	0.071	1.48 (1.15–1.91)	0.002
Smoking father	1.28 (1.08–1.52)	0.004	1.06 (0.89–1.26)	0.549
Life dissatisfaction father	1.66 (0.91–3.02)	0.095	0.88 (0.47–1.64)	0.658
Lack of general well being father	1.39 (0.73–1.95)	0.318	2.34 (1.19–4.60)	0.014

Abbreviations: OR, odds ratio; CI, confidence interval; SRH, self-reported health.

dissatisfaction. Furthermore, lack of general well being among parents seemed especially important. In a final multivariable analysis, lower education, living alone, smoking, and less general well being among parents remained significant factors for adolescents' SRH. It is notable that typical medical and lifestyle variables among parents seemed to lack importance for adolescent SRH. The associations were generally stronger for girls than for boys for both parents, although the CI for these factors overlapped.

A study in Slovak and Dutch adolescents demonstrated both gender and country differences in parental influence on SRH.[17] The gender differences in parental influence in our study were not conspicuous. The results of our study contrast with the strong genetic influence on SRH found in several twin studies.[9–11] The adolescents in our study carried with them both a genetic and a social heritage from their parents, but their SRH seemed less impacted by parental factors. Thus, it may be that the impact on SRH from the many "horizontal" influences in the adolescent period of life is especially strong. This observation means that health-promoting actions from wider society have a greater chance of success during adolescence. The importance of a more proactive health promotion from early life in the building of a new framework for health and for disease prevention has also been underscored by other authors.[18]

In our previous research, we have found that adolescent SRH is a broad multifactorial composite, although one in which typical medical conditions are not the most important factors.[5,6] The current study shows the same results for medical conditions among the adolescents' parents too, as well as for several parental lifestyle variables, except for smoking. This contrasts with a Swedish twin study where heredity was found to be an important component behind individual differences in lifestyle connected to physical activity.[19] For parental smoking, however, our results agree with a Danish study,[20] although we should be aware that smoking is also associated with socioeconomic status.

In contrast, high parental alcohol intake was not associated with adolescent SRH in our study. This agrees with another Danish study where no association could be shown between early onset of alcohol consumption and parental smoking, drinking, and socioeconomic or marital status.[21–26]

The significant associations between structural factors, such as parental education and living alone, in our final multivariable analyses indicate that other parental social factors can be more important for adolescent SRH than parental SRH. These point to the well-known influence of socioeconomic status on SRH. A role of parental education, as well as adolescents' own education, school achievement, and perceived socioeconomic status on SRH has been found in several studies.[23–26] A Canadian study found lower SRH in single fathers compared with partnered fathers, but this was found to be due to the economic and social disadvantages associated with raising children alone.[27]

The strong association in our study between lack of parental well being and especially adolescent girls' SRH is striking.

Interestingly, general well being also showed the highest OR for the construct of adolescent SRH in our earlier studies.[5,6] Happiness and life satisfaction have also been found by others to predict better SRH later in life.[28] In conclusion, we have found only limited associations between parental SRH and that of their adolescent children. More traditional health-related and lifestyle factors, with the exception of parental smoking, also seem to be of little significance, whereas social factors such as parental educational level, living alone, and parental well-being seem to be most important.

The response rate was good in the survey among adolescents, but the combination of parental and adolescent data led to a substantial loss of subjects. This may limit both the external and internal validity of the study. It is possible that information from parents with impaired SRH was underreported, so that associations between parental and adolescent SRH might be stronger than estimated by our study. The external validity of the study may also be restricted by the fact that data for our study were collected 15 years ago. Also, the study cannot rule out a stronger association with parental SRH as the adolescents grow older and reach adult age.

SRH is a central target for mass strategies in public health promotion, and can also serve as a simple way of measuring the success of these strategies. As SRH in our study seems less predetermined by "nature" than by "nurture"[29] during adolescence than might be expected from a number of genetic studies, greater efforts directed to the important context factors contributing to positive SRH among both parents and adolescents is recommended.

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Disclosure

The authors report no conflicts of interest in this work.

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