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ORIGINAL ARTICLE

Lifestyle and demographic correlates of poor mental health in early adolescence

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Aim: To determine the constellation of lifestyle and demographic factors that are associated with poor mental health in an adolescent population.

Methods: The Raine Study 14-year follow-up involved primary care givers and their adolescent children (n = 1860). The Child Behaviour Checklist (CBCL) was used to assess adolescent mental health. We examined diet, socio-demographic data, family functioning, physical activity, screen use and risk-taking behaviours with mental health outcomes using linear regression.

Results: Adolescents with higher intakes of meat and meat alternatives and 'extras' foods had poorer mental health status. Adverse socio-economic conditions, higher hours of screen use and ever partaking in the health risk behaviours of smoking and early sexual activity were significantly associated with increasing CBCL scores, indicative of poorer functioning.

Conclusions: By identifying the lifestyle and demographic factors that accompany poorer mental health in early adolescence, we are able to better understand the context of mental health problems as they occur within an adolescent population.

Key words: adolescent; life style; mental health; nutrition; Raine Study.

What is already known on this topic

1 Adolescence is not only a crucial period for the development of mental health problems but also a time where persistent patterns of lifestyle behaviour are established.
2 A multi-focus approach that attempts to improve mental health by improving associated lifestyle behaviours is warranted; however, such an approach must be informed by a thorough understanding of the lifestyle and demographic correlates of mental health problems during this crucial time.
3 Poor diet and inadequate nutrition appear to be linked to adverse mental health outcomes.

What this paper adds

1 This paper uses a population-based cohort of adolescents to assess the associations between poor mental health and a variety of lifestyle and demographic factors, such as diet quality, socio-demographic status, physical activity, family functioning, screen use and risk-taking behaviour.
2 This paper provides vital knowledge on the behaviours that accompany mental health in order to inform a broader focus intervention.
3 Adolescents with higher intakes of meat and extras foods had poorer mental health.

Introduction

The World Health Organization estimates a world-wide prevalence for mental health problems of approximately one in five and states that mental health in childhood and adolescence is an increasing public health concern.[1] Adolescence is a critical developmental period for mental health, with half of all lifetime cases of mental health disorders emerging by age 14.[2,3] During adolescence, life-long patterns of both positive and negative health behaviour and self-management are established, making the study of the relationships between lifestyle and demographic factors, such as diet, physical activity, risk-taking behaviour, family income and gender, and adolescent mental health of critical importance for enhancing understanding of the development of mental health problems later in adulthood.[4]

Acknowledging the impact of lifestyle and demographic factors is also vital in working towards the prevention of mental health problems as a multi-focus approach provides broader

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opportunities for intervention in comparison with single-focus approaches.[5] Diet is of increasing importance in terms of adolescent mental health, with a Western dietary pattern (high in takeaway foods, confectionary and red meat) associated with poorer mental health, including an increased risk of Attention Deficit Hyperactivity Disorder (ADHD) diagnosis.[6,7] In addition, socio-economic influences, physical activity and sedentary behaviours such as television and computer use are already known to affect mental health outcomes in adolescence.[8] Adolescent psychopathology has also been associated with an increased incidence of risky health behaviours, such as alcohol and substance abuse, tobacco use and unprotected sexual activity.[9]

This study examines a variety of lifestyle and demographic factors together in order to identify correlates with mental health measured by the total number of problem behaviours related to overall mental health and internalising (withdrawn, anxious/depressed, somatic complaints) and externalising (delinquency, aggression) mental health in early adolescence. Using the Western Australian Pregnancy Cohort (Raine) Study 14-year follow-up, we aim to present a comprehensive analysis that provides a clear description of the elements of lifestyle (including diet, family functioning, physical and sedentary activity and risk-taking behaviour) that remain significantly associated with mental health status after considering other demographic factors (including family income, maternal employment and families with a single parent) present in the adolescents' environment.

Materials and Methods

Study population

The study population was composed of 1860 adolescents and their families who participated in the 14-year follow-up of the Western Australian Pregnancy Cohort (Raine) Study. Details of the study recruitment are published elsewhere.[10] In brief, 2900 pregnant women were recruited into a randomised controlled trial to evaluate the effects of repeated ultrasound in pregnancy at approximately 18 weeks gestation between 1989 and 1992.[10] The resulting 2868 live-born children were eligible for follow-up from birth and at age one, two, three, five, eight, 10 and 14 years. Only data from the 14-year follow-up are presented in this paper as this was the first year that adolescent lifestyle data, including comprehensive dietary data, were available. Of the 1598 participants who provided complete mental health and dietary data for this study, there were 819 (51.3%) male adolescents and 779 (48.7%) females. The majority of the adolescents were of Caucasian background (n = 1461, 91.4%), and the remaining participants were from Aboriginal (n = 11, 0.7%) or other backgrounds (predominantly Asian; n = 126, 7.9%). Details on study attrition from 18 weeks gestation through to the 14-year follow-up are available elsewhere.[11]

All follow-ups of the study families were approved by the Human Ethics Committee at King Edward Memorial Hospital (KEMH) and Princess Margaret Hospital for Children in Perth and informed consent to participate in the study was obtained from the primary care giver and the study adolescent at the 14-year follow-up. The primary care giver of each adolescent completed a questionnaire that covered socio-demographic and family functioning information, a checklist of child behaviour and a 212-item food frequency questionnaire (FFQ) regarding the study adolescent's diet over the previous 12 months. The study adolescents completed a questionnaire of their own, which included numerous questions on physical and sedentary activity and risk-taking behaviour. The mean age at follow-up was 14.01 years (standard deviation = 0.20 years).

Outcomes – mental health

Adolescent mental health was measured by the parent report Child Behaviour Checklist for Ages 4–18 (CBCL/4–18), a 118-item empirically validated measure and effective screening tool for child mental health problems.[12,13] The CBCL/4–18 produces a continuous total raw score for mental health, which is then converted into standardised t-scores for total mental health, internalising mental health (relating to withdrawal, somatic complaints and/or anxious/depressed behaviours) and externalising mental health (related to delinquent and/or aggressive behaviours).[12] Continuous t-scores for these three outcomes were used in this study, where high scores represent poorer mental health. A cut-point of $t \geq 60$ can also be used to indicate the presence of mental health problems.

Lifestyle variables

Diet

We used the Commonwealth Scientific and Industrial Research Organisation (CSIRO) FFQ to measure dietary intake. This 212-item questionnaire was based on one semi-validated in adults[14] and previously applied in children[15] and was shown to measure nutrient intake correctly when validated against a three-day food record in the same cohort.[16] Materials were sent to all participating parents by post and included an introductory letter, the FFQ, a contact phone number and a reply paid envelope. Primary care givers completed the FFQ together with the study adolescent to ensure that the reported intakes were an accurate reflection of the adolescent's diet. A trained research assistant checked the FFQ for completeness and re-contacted the parents who had returned an incomplete questionnaire. Data on the adolescent's usual diet over the past year as well as seasonal variation for vegetables, fruits, soups and desserts were collected. The dietary data entry was completed by CSIRO.

From the dietary responses, we described the level of consumption of six food groups based on the number of serves of each food group consumed per day, with serving sizes based on Australian dietary recommendations. These food groups were cereals and grains, fruit, dairy products, meat and meat alternatives, vegetables and 'extras' foods, such as takeaway and snack foods. Examples of the types of foods within each of these groups are listed in Table 1.

Socio-demographic factors

We collected data regarding total family income at the time of the 14-year follow-up ($AUD per annum), in addition to whether the adolescent was living in a single-parent family (yes;

Table 1 Frequency characteristics of food groups from Food Frequency Questionnaire and examples of food group components

Food groups	Examples of components	M (SD) serves per day ($n = 1629$)	AGTHE recommended daily intake (age 12–18)
Cereals	Bread, pasta, noodles, porridge, muesli, rice	3.16 (1.46)	4–7
Fruit	Fresh fruits, canned fruits, fruit juice, dried fruit	2.62 (2.08)	3–4
Dairy	Milk, cheese, yoghurt, flavoured milk	2.19 (1.43)	3–5
Meat and meat alternatives	Beef, lamb, pork, chicken, fish, seafood, offal, luncheon meat, legumes, beans, nuts, egg	2.51 (1.06)	1–2
Vegetables	Fresh vegetables, canned vegetables, vegetable juice, olives, root vegetables, avocado	2.11 (1.20)	5–9
Extras	Meat pies, hot chips, pizza, fried food, cakes, chocolate, biscuits, mayonnaise, dressings, soft drinks, ice cream	3.85 (2.22)	1–3

AGTHE, Australian Guide to Healthy Eating.[17]

no) and whether the adolescent's mother was employed (paid employment, unpaid work in a family business or other unpaid work, no employment) at the time of the 14-year follow-up.

Family functioning

We used the General Functioning Scale (GFS) from the McMaster Family Assessment Device as a measure of family functioning.[18] This short-form scale is composed of 13 statements that were derived from an item analysis of the complete 60-item scale, including questions on problem solving, family communication, affective responsiveness and behaviour control. Sample questions include 'In times of crisis we can turn to each other for support', and 'Making decisions is a problem in our family', where responses are recorded on a four-point Likert scale (strongly disagree; disagree; agree; strongly agree). The GFS has excellent reliability (r) (Gutman split-half = 0.83) and internal consistency (Cronbach's alpha = 0.86).[19] We utilised the continuous score in our study, with lower scores representing poorer family functioning and higher scores representing better family functioning.

Physical activity and sedentary behaviour

Study adolescents were asked to rate how often they exercised outside of school hours per week, enough to get out of breath or sweat.[7] From these data, we created an ordinal variable with three levels measuring physical activity as exercise less than once a week, exercise one to three times per week exercise more than three times per week. Adolescents were also asked about their television/video viewing habits and computer use. We used these data to create a three-level variable representing combined screen use as less than two hours per day, two to four hours per day and more than four hours per day.

Risk-taking behaviour

Study adolescents were asked in a self-report questionnaire completed without parental presence about their use of cigarettes, alcohol and drugs and sexual activity.[20] These risk behaviour variables reflect the participants' engagement in behaviours, including, 'Have you ever smoked even part of a cigarette?', 'Have you ever had even part of an alcoholic drink?' and 'Have you ever had sex?', allowing possible answers of 'yes' or 'no'. Because of the low responses for other drugs such as amphetamines (7/1605, 0.4%), marijuana was the only illicit drug considered in the analysis (104/1605, 6.5%).

Statistical analysis

The frequency data for lifestyle and demographic factors were compared for boys and girls across quartiles of CBCL scores using χ^2 tests. We then used a general linear model to determine the relationships between explanatory variables and CBCL total, internalising and externalising *t*-scores. The explanatory variables (daily intake in serves for each food group (cereal, fruit, dairy, meat and meat alternatives, vegetables, and 'extras')), socio-demographic factors (family income, father not at home and maternal employment), family functioning, physical activity, screen use and risk-taking behaviours (smoking, alcohol, marijuana use and early sexual activity) were entered into a multivariable general linear model. We did not observe any interaction effects related to gender in the GLM analyses, but we did consider gender as a potential confounder, therefore we included male and female participants in our GLM model and adjusted for gender. SPSS Version 15.0 was used for the data analysis.

Results

Frequency characteristics

Of the 2337 adolescents and families eligible for the 14-year follow-up, 1860 adolescents and families participated in some component. A total of 1784 primary care givers completed the CBCL and 1598 also provided complete FFQ data for analysis. We had complete lifestyle data available on 1275 adolescent study participants. At the 14-year follow-up, 14% of the cohort showed a total CBCL score above the clinical cut-point for mental health

morbidity ($t \geq 60$), with 13% showing scores above the clinical cut-point for internalising problems and almost 16% showing clinical externalising problem scores. Our sample showed reasonable consistency with previous population studies of four- to 17-year-old Australian children and adolescents,[21] although our sample showed a slightly higher prevalence of externalising problems (13.8% in our study compared with 12.9% in population survey data), and fewer delinquency (3.1% compared with 7.1%) and attention problems (3.1% compared with 6.1%).

Table 1 presents frequency and descriptive data for the food groups and Australian dietary guidelines for the relevant age group. In comparison with Australian recommendations for dietary intake, our sample's intake of cereals and grains, fruit, dairy products and vegetables were below the recommended daily requirements for this age group.[17] The adolescents in the study exceeded the recommended daily intake level for meat and meat alternatives (Mean (M) = 2.51, Standard deviation (SD) = 1.06; recommended one to two serves per day) and 'extras' foods, with 'extras' foods showing the highest average daily intake in mean serves per day (M = 3.85, SD = 2.22; recommended one to three serves).

Cross-tabulations

Table 2 presents the percentage of male and female adolescents in the sample within each quartile of CBCL *t*-scores, with the

Table 2 Frequency characteristics of study variables by Child Behaviour Checklist *t*-score quartiles for male and female adolescents and tests for linear by linear trend

	Boys ($n = 910$)					Girls ($n = 873$)				
	%					%				
Quartiles	1	2	3	4	*P*	1	2	3	4	*P*
Family income					<0.001					<0.001
≤$25 000 pa	13.5	18.3	23	29.1		14.3	20.6	22.3	31.5	
$25 001 pa–$50 000 pa	14	23.4	31.1	23.8		19.6	25.9	22.3	26.6	
$50 001 pa–$78 000 pa	26.3	32	23.8	27.5		25	24.3	31.8	28.1	
>$78 000 pa	46.2	26.3	22.1	19.5		41.1	29.1	23.6	13.9	
Single parent										<0.001
Yes	10.8	20.5	26.7	42	<0.001	16.1	19.4	26.9	37.6	
No	25	24.6	27.4	23		25	25.3	27.8	21.9	
Mother employed										<0.001
Yes	23.5	24.8	28.1	23.6		25.1	24.7	28.2	22	
No	18.4	20.9	23.8	36.9	0.002	17.4	22.4	25.1	35.2	
Family functioning					<0.001					<0.001
<24	10.8	15.3	29.7	44.1		13.4	24.4	22.7	39.5	
>24	24.2	25.1	26.8	23.9		25.2	24.1	28.5	22.2	
Physical activity					0.016					0.004
1/week or less	17	18.9	32.1	32.1		13.2	24.2	25.3	37.4	
1–3 times/week	18.8	23.9	29.6	27.7		21.3	25.3	29.1	24.4	
4+ times/week	26.4	23.2	24.8	25.5		26.6	23.4	28.6	21.4	
Screen use					<0.001					0.008
<2 h/day	26	26	30.1	17.9		27.1	27.1	25.1	20.6	
2–4 h/day	24.3	21.9	26	27.7		19.6	21.8	30.1	28.5	
4+ h/day	16.1	23	28.9	32.1		18	24.9	30.7	26.5	
Risk-taking behaviour†										
Alcohol					0.002					0.001
Yes	16.4	20.8	31	31.9		16	22.2	30.2	31.6	
No	24.2	24.5	26.9	24.4		23.8	25.5	28.1	22.6	
Cigarette smoking					<0.001					<0.001
Yes	7.4	17.4	34.7	40.5		12.8	17.7	31.9	37.6	
No	24.7	24.5	26.9	23.9		23.8	25.9	27.9	22.5	
Marijuana					0.001					0.008
Yes	9.6	15.4	30.8	44.2		16.7	14.6	22.9	45.8	
No	22.7	23.8	27.7	25.8		21.9	25.3	28.8	23.9	
Sexual activity					0.051					0.001
Yes	13.6	9.1	36.4	40.9		9.5	9.5	19	61.9	
No	22.3	23.7	27.8	26.2		22.1	25	28.8	24	

†Ever tried. *Note:* Row percentages presented.

first quartile representing the lowest *t*-scores (good mental health) and the last quartile representing the highest *t*-scores (poor mental health). Adolescents from families in the highest income category tended to be in the lower CBCL *t*-score quartiles, particularly male adolescents, and adolescents from single parent families and those with non-employed mothers tended to be in the higher quartiles. Adolescents with poor functioning families were more likely to be in the high quartiles. Adolescents who exercised rarely were most likely to be in the last quartile, particularly females, and those adolescents in the lower quartiles had lower rates of screen use. Finally, there were a number of significant relationships evident between ever engaging in risk behaviours and being within the highest CBCL *t*-score quartile. Adolescents in the highest quartiles were more likely to have tried alcohol ($P < 0.002$), cigarette smoking ($P < 0.001$) and marijuana ($P < 0.008$), and to have engaged in sexual activity (for female adolescents only; $P = 0.001$).

Linear regression analysis

The amount of variance explained by the generalised linear model was 15% for total mental health, 10% for internalising mental health and 16% for externalising mental health. A higher intake of meat and meat alternatives was related to higher total ($b = 0.77$, 95% confidence interval (CI) = 0.12, 1.43) and externalising ($b = 1.06$, 95% CI = 0.45, 1.67) CBCL *t*-scores (Table 3). An increasing intake of foods from the 'extras' group was significantly associated with higher total ($b = 0.49$, 95% CI = 0.19, 0.79), internalising ($b = 0.32$, 95% CI = 0.03, 0.60) and externalising *t*-scores ($b = 0.53$, 95% CI = 0.24, 0.81).

Across all three outcomes in the adjusted analysis, a higher total family income and maternal employment at the 14-year follow-up were associated with lower CBCL *t*-scores, representing more positive mental health. Being in a single-parent family in early adolescence was significantly related to higher total ($b = 3.12$, 95% CI = 1.28, 4.96), internalising ($b = 2.03$, 95% CI = 0.26, 3.80) and externalising ($b = 2.71$, 95% CI = 0.98, 4.44) CBCL *t*-scores, representing poorer mental health. Family functioning was consistently inversely linked with CBCL *t*-scores.

Increasing physical activity levels showed no significant associations with lower CBCL *t*-scores; however, increasing screen use per day was linked to poorer mental health. Watching television or using a computer for four or more hours per day increased the likelihood of a higher CBCL *t*-score for total ($b = 2.80$, 95% CI = 1.24, 4.36), internalising ($b = 1.53$, 95% CI = 0.04, 3.02) and externalising mental health ($b = 1.73$, 95% CI = 0.27, 3.20). Screen use between two and four hours per day compared with less than two hours per day was linked to a higher total ($b = 1.88$, 95% CI = 0.40, 3.36) CBCL *t*-score.

Ever trying alcohol and ever trying marijuana were not related to CBCL *t*-scores in the adjusted analysis. However, ever trying cigarettes was linked to increasing total ($b = 2.79$, 95% CI = 0.88, 4.69) and externalising ($b = 3.27$, 95% CI = 1.48, 5.06) scores, and early sexual activity was associated with increasing externalising mental health *t*-scores ($b = 4.69$, 95% CI = 1.00, 8.39).

Discussion

This study suggests that poor mental health in early adolescence has a number of significant lifestyle and demographic correlates. We found that a high intake of meat and meat alternatives and 'extras' foods, social disadvantage, greater screen use and early experimentation with cigarette smoking and sexual activity were all linked to poorer mental health scores at age 14 years. These results suggest that consideration of the lifestyle and demographic markers that are linked to mental health scores in adolescence is a good starting point for developing a multi-focus intervention aimed at improving mental health.

Our results suggest that a higher intake of meat and meat alternatives and 'extras' foods was associated with higher total and externalising CBCL scores, representing poorer mental health. This finding supports two recent studies that linked a Western style dietary pattern, high in red meat, takeaway foods and confectionary, with mental health problems in early adolescence.[6,7] 'Extras' foods, such as snack and takeaway foods, are generally energy dense and low in essential micronutrients that are needed for optimal neurotransmitter function and positive mental health, and these foods are often eaten in the place of more nutrient-dense foods.[22] Lower amounts of 'extras' foods may also indicate a greater meal time structure within the family, which is linked with higher levels of psychosocial well-being in adolescence.[23] A poor quality diet has been implicated in major depressive disorder in adult women,[24] and there are a number of studies that have examined the role of omega-3 fatty acids in the development of numerous mental health disorders.[25,26] In this study, we are not attempting to determine causation; however, an association between diet and mental health is supported by this study and focusing on adolescent nutrition is likely to be an important intervention for not just improving mental health but also to benefit overall health.

Adverse socio-economic circumstances such as low family income and being from a single-parent family were related to negative mental health scores in our study. Other studies have shown that children living in families of low socio-economic status, based on official US poverty levels, had a greater likelihood for developing mental health problems, particularly externalising problems.[27] This is most likely reinforced by reduced access to material or social resources in disadvantaged families and neighbourhoods and a higher likelihood of experiencing stress-inducing events.[28,29] We also found that maternal employment in either a paid or voluntary capacity was related to lower CBCL scores at age 14, which is supported by a previous finding that maternal employment can have a positive influence on children's social and cognitive development.[30] The effects of maternal employment are complex because as employment increases family income, which our results found to be protective against adolescent mental health problems while also decreasing the availability of the mother to the child, which has been associated with poorer mental health outcomes.[31]

Longer hours of screen use were significantly related to higher CBCL *t*-scores for total and externalising mental health. Increased television viewing has been linked to poorer mental health,[32] while increasing computer use is noted to have both positive and negative effects on the social and emotional status of adolescents.[33] In today's information-based society, the use of

Table 3 Adjusted linear regression coefficients for Child Behaviour Checklist *t*-scores at 14 years for each explanatory variable

Variables	Total *b* (95% CI)	Internalising *b* (95% CI)	Externalising *b* (95% CI)
Diet†			
Cereal	0.02 (–0.48, 0.53)	–0.09 (–0.57, 0.39)	0.21 (–0.26, 0.68)
Fruit	–0.07 (–0.39, 0.25)	–0.09 (–0.39, 0.21)	–0.04 (–0.34, 0.26)
Dairy	0.21 (–0.28, 0.71)	0.11 (–0.36, 0.59)	–0.05 (–0.51, 0.42)
Meat and meat alternatives	0.77* (0.12, 1.43)	0.01 (–0.62, 0.63)	1.06** (0.45, 1.67)
Vegetables	–0.21 (–0.79, 0.36)	0.14 (–0.41, 0.69)	–0.34 (–0.88, 0.20)
Extras	0.49** (0.19, 0.79)	0.32* (0.03, 0.60)	0.53** (0.24, 0.81)
Socio-demographic factors			
Family income	–0.35* (–0.59, –0.10)	–0.35** (–0.58, –0.15)	–0.28* (–0.51, –0.05)
Single parent	3.19** (1.34, 5.03)	2.03* (0.29, 3.82)	2.75** (1.02, 4.48)
Mother employed	–2.40** (–3.88, –0.93)	–1.56* (–2.97, –0.15)	–2.70** (–4.08, –1.32)
Family functioning¶	–0.35** (–0.46, –0.24)	–0.33** (–0.43, –0.23)	–0.28** (–0.38, –0.18)
Physical and sedentary activity			
PA‡ 1–3 times/week	–0.9 (–3.09, 1.28)	–0.15 (–2.24, 1.93)	–0.63 (–2.67, 1.42)
4+ times/week	–1.91 (–4.22, 0.41)	–2.07 (–4.28, 0.14)	–0.35 (–2.52, 1.82)
Screen§ use 2–4 h/day	1.88* (0.40, 3.36)	1.24 (–0.17, 2.65)	1.33 (–0.05, 2.72)
4+ hours/day	2.80** (1.24, 4.36)	1.53* (0.04, 3.02)	1.73* (0.27, 3.20)
Risk-taking behaviour††			
Alcohol	0.56 (–0.91, 2.03)	–0.33 (–1.73, 1.08)	0.99 (–0.38, 2.37)
Cigarette smoking	2.79** (0.88, 4.69)	0.97 (–0.85, 2.80)	3.27** (1.48, 5.06)
Marijuana	–0.66 (–3.45, 2.14)	–1.21 (–3.88, 1.47)	1.16 (–1.46, 3.78)
Sexual activity	3.62 (–0.32, 7.57)	1.91 (–1.86, 5.68)	4.69* (1.00, 8.39)

Note: *$P < 0.05$ **$P < 0.005$. †Intake measured in serves per day. ‡Increasing amount of physical activity per week, reference category once per week or less; §Increasing amount of screen use per day, reference category of less than 2 h per day; ¶A continuous measure of family functioning with lower scores representing poorer functioning; ††Ever tried.

computers for both schoolwork and leisure is increasing, therefore further research into the psychological impact of increasing screen use is urgently required.[34] Much previous research has shown that greater levels of physical activity are associated with improved psychological well-being in adolescents;[35,36] however, although in our study, the regression coefficients indicated more positive mental health in those who exercised regularly compared with those exercising infrequently, the significance of these relationships were attenuated following adjustment for other lifestyle and demographic variables.

In our study, ever having tried cigarettes was associated with higher total and externalising CBCL scores and early sexual activity was related to higher externalising CBCL scores. Adolescent psychopathology is associated with an increased incidence of health-risk behaviour, such as alcohol and substance abuse, tobacco use and unprotected sexual activity,[5,8,9] and

health-risk behaviours are positively correlated with each other.[37] Adolescent smoking is known to be highly correlated with mental health disorders such as anxiety and depression and the relationship is potentially complex in effect, with tobacco use perhaps utilised as a coping strategy for mental health dysfunction.[38] In addition, smoking could represent a proxy risk factor for other negative lifestyle factors such as low socio-economic status.[39] As in our study, adolescent sexual activity, particularly risky sexual behaviour such as non-use of contraceptives and other protection against sexually transmitted infections, has been linked to a greater incidence of mental health problems.[40]

Strengths and limitations

The main strength of our study was the large sample size, which enabled rigorous analysis and generalisability for other populations of primary care givers and adolescents. We believe our use of the CBCL, a well-researched and validated measure of mental health morbidity, was also a particular strength as it has shown good internal consistency in the assessment of child and adolescent mental health in previous testing.[13] However, we note that the specificity of the CBCL, particularly in identifying internalising mental health problems, has not always been shown to be adequate.[41] Our results may have been influenced by selective attrition, given socially disadvantaged families were less likely to remain in the cohort to age 14 years;[11] however, a recent study using a similar cohort found selective attrition had a minor influence on child behavioural outcomes.[42] Because the data in this study were collected at the same time, causation cannot be inferred from our analysis and any observed relationships could be susceptible to bias. However, our aim was to determine the correlates of adolescent lifestyle and demographic factors and mental health, and a cross-sectional study is equipped to achieve this aim. Understanding the sequence of development and mechanisms of these influences on early adolescent mental health using data from future follow-ups will be important in the development of prevention, promotion and early interventions to reduce the population levels of adolescent mental health morbidity, and we hope to analyse such data in future studies.[43]

Conclusion

We have shown that there is a constellation of lifestyle and demographic factors significantly related to poor mental health in early adolescence This study enhances our understanding of how adolescent lifestyle and mental health are related and provides a starting point for designing interventions aimed systemically at improving adolescent lifestyle with the aim of achieving better outcomes for the development and promotion of good mental health in adolescence.

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IMAGE OF THE MONTH

Multiple asymptomatic facial papules

A 12-year-old boy with developmental delay presented with numerous slightly erythematous, smooth-surfaced, hyperpigmented papules (1–2 mm in diameter), symmetrically distributed on his central face, nose, nasolabial folds, cheeks and chin. The patient also had a history of seizures (for answer, see p. 65).

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