

Risks and Comorbid Factors of Frequent Headaches during Childhood and Adolescence

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Abstract

Background: The prevalence of headache during adolescence is very high. In most studies, the prevalence of headache is higher in females.

The objective of the present study was to evaluate statistically significant associations between high headache frequency and multiple variables obtained in a National Survey.

Methods: The included variables were demographic and socioeconomic; other health complaints; sleep characteristics and complaints; current adolescents' habits concerning multimedia/electronic tools and nutrition variables; risk behaviors; social support and school satisfaction with the final purpose of building a risk association model for adolescents' frequent headaches by means of a logistic regression.

This survey is a component of the Health Behavior in School-Aged Children (HBSC) study. The Portuguese HBSC survey included 3476 pupils (53.8 % girls) in the 8th (45.9%) and 10th grades (54.1%) with a mean age was 14.9 years ($SD=1.26$).

Results: The prevalence of high-frequency headaches was 22.2% and their major comorbidities were other health complaints with special reference to abdominal pain and dizziness and psychopathological symptoms, namely sadness, irritability, nervousness and low energy. Furthermore, they had lower family support, lower academic success, unfair treatment, loneliness and nobody to share or to worry about their problems and lower quality of life; e-media and excessive mobile phone use, tobacco and alcohol use, and some violent behaviors were also associated with the presence of frequent headaches.

Conclusion: In spite of these significant associations, the logistic regression model explaining 38% of the variance included mostly other health complaints.

Keywords: Headache; Adolescence; Health; Sleep; Screen time; Risk behaviors; Social support; Nutrition

Abbreviations: HBSC: Health Behavior in School-Aged Children; BMI: Body Mass Index; USA: United States of America; OD: Odds Ratios; CDC: Center for Disease Control.

Introduction

The prevalence of headache during adolescence is very high. In a prospective study using headache diaries, 85% of the students between the 6 and 9th grade reported headaches during a 3 week period [1]. In another study, the overall 3-month prevalence of headache was 69.4% with 4.4% of the adolescents suffering from frequent and severe headaches [2]. Frequent headaches including a migraine have a prevalence of 24.8% to 32% [3-7].

Their impact on quality of life and school attendance is negative [8]. At this age headaches are associated with other pain complaints [9,10] namely abdominal pain [11] with psychological and behavioral problems [12,13,15,16] and with psychiatric symptoms (depression, anxiety, etc) [8,10,16-18] and also suicidal ideation especially in migraine patients [19,20]; with sleep deprivation [21,22]; with sleep habits and sleep disorders [23-25] and epilepsy [26,27].

In most studies, the prevalence of headache is higher in females [1,2,4,28] and increases with early menarche [29]. Several health or life factors increase the risk of migraine and or tension headache namely: higher blood pressure [30]; anxiety and depression for migraine [31] while anxiety alone increases the risk of both a migraine and tension headache [32]; loneliness and victimization [33]; physical and sexual abuse [34].

The high prevalence of headache depression and atopic conditions in adolescents not getting enough sleep the week before the study was proven in a large epidemiological study in the USA [35]. Irregular intake of meals (especially irregular breakfast) and sleep disturbances [36] or sleep disturbances alone [37-40] are also associated with higher headache prevalence. Among sleep disturbances, Periodic Limb Movements of Sleep [25] are particularly relevant for A migraine while sleep apnea is more likely to induce chronic morning headaches both in adults and children [40].

Taking these data into consideration the objective of the present work was to evaluate the associations between high headache frequency and multiple sets of variables obtained in the HBSC National Survey. The included variables were demographic and socioeconomic; other health complaints; sleep characteristics and complaints; current adolescents' habits concerning multimedia/electronic tools and nutrition variables; risk behaviors as defined by the Center for Disease Control (CDC) [41]; social support and school satisfaction with the final purpose of building a risk association model for adolescents' frequent headaches.

The hypothesis was beside the conventional parameters associated with:

Methods

Procedures

This survey is a component of the Health Behavior in School-Aged Children (HBSC) study [42-45].

The Portuguese HBSC survey included 3476 pupils (53.8% girls). In the 8th (45.9%) and 10th grades (54.1%) with a mean age was 14.9 years ($SD=1.26$. min 12.5. max 19.0); they were randomly chosen from 139 schools. in a national sample geographically stratified by Education Regional Divisions. The school response rate was 89.9%.

The overall procedure concerning has been described elsewhere together with validation work and detailed methods [42,44,46]; briefly this study has the approval of a scientific committee an ethical national committee and the national commission for data protection and followed strictly all the guidelines for protection of human rights; adolescents' participation in the survey and completion of the questionnaires was voluntary and anonymity was assured.

Instrument

This study used a Health Behavior in School-Aged Children (HBSC 2010) [45] questionnaire and was included in the present work questions that inquired about: 1) gender and grade. parents education and profession; 2) sociodemographics and self-reported weight and height, for BMI computation; 3) Headache frequency; 4) Other health complaints frequency (backaches. fatigue. sadness. irritability. anxiety and difficulty to fall asleep); 5) Sleep deprivation (defined as a difference in sleep duration higher than 3hours between weekdays and weekends) [22] and weekdays sleep duration; 6) Habits concerning TV, computer, the internet and mobile phone use; 7) Risk behaviors (alcoholic beverages; drunkenness. tobacco and. physical inactivity); 8) Nutrition variables (breakfast during week and weekends. fasting. low consumption of fruit and vegetables. high consumption of sweets and colas); 9) Social support, school satisfaction, life satisfaction and quality of life (Kids-10) [47]. Most answers were obtained by Likert scales of 4 to 8 cells.

The analysis included descriptive analysis of the Likert scales, after which they were recorded into a Yes/No.Frequent/Rare. Low/High parameterization, as follows:

Headache and health complaints frequencies were coded as almost daily, several times per week, almost weekly, almost monthly, rarely or never; the frequent (Headache Yes) included those that occurred: daily, several times per week, and almost weekly and the infrequent "Headache No" category those that were almost monthly, rare or absent.

TV and computer time were evaluated in terms of usage hours during the week and during the weekends and recorded according to usage: higher or equal to 3h per day, or lower than that value. Mobile phone use was considered "yes" whenever the frequency of communications or messaging with friends occurred daily and several times a day.

Alcoholic beverages in the last 30 days, drunkenness, tobacco and drugs consumption, fights, bullying and carrying weapons to school were coded into "No" equivalent to "never" or "Yes" equivalent to the behavior ever been practiced; physical inactivity was coded as "No" when never or infrequently practiced and "Yes" as otherwise. Nutrition variables coding was as follows: None or infrequent consumption of vegetables, fruits, and sweets was considered as "No" and "Yes" for the remaining; idem for taking the breakfast during weekdays and weekends, having or not fasting periods along the day going hungry to bed at night.

Statistical analysis

The averages of the continuous variables, namely life satisfaction quality of life and social support were compared with ANOVA for independent

samples. Pearson chi-square with z-transformation of the occurrence frequencies and Bonferroni correction and Odds ratio computation were used in the dichotomic variables in order to evaluate the association between the presence/absence of headache and the remaining variables also subdivided into 2 categories.

During logistic regression using as dependent variable Headache (Yes/No)and as covariates the variables with high Odds Ratios, the following parameters were computed: pseudo R-square model, fitting information, cell probabilities, classification table, goodness-of-fit, parameter estimates and likelihood ratio tests at 95% confidence intervals; the model assumed having headaches as reference, SPSS (IBM corporation, Armonk NY. USA) version 21 for windows was used in the statistical computations.

Results

Headaches had a high prevalence when considering all types of frequency; 4.2% of the students had "daily headaches" (more than 15/month); 18% had Several times per week or weekly complaints and for 17.3% headaches occurred on a monthly basis; this means that headaches occurred on a regular basis in 39.5% of the students. Headaches were more prevalent in females ($F=159.513$; $p<.001$) and the prevalence of all frequency types increased with grade ($F=18.427$; $p<.001$).

In what concerns the parents educational and professional levels and the fact of having either the father or the mother unemployed were not associated with higher headache prevalence with odds ratios close to 1; mothers were, however, more often unemployed and had a lower academic education (Table1).

Table 2 shows the association with other health complaints and with sleep characteristics; the Odds ratios are high for all the complaints but are especially high for abdominal pain ($OR=12.1$) and dizziness ($OR=11.3$); the OR for back and shoulder and neck pain were 4.8 and 3.5 respectively. The association between headaches and psychic complaints is also high with OR of 4.4. 3.9 And 4.6 for sadness, irritability and nervousness respectively. Sleep initiation difficulties and sleep deprivation are also significantly associated with headache (OR equal to 3.9 and 1.3. respectively), but for sleep duration in weekdays in spite of a higher prevalence of headache the OR is not significant). Fatigue is also strongly associated with headaches with $OR=3.1$.

Psychological variables showed important influences in headache prevalence and significant associations namely: "not feeling in good shape" $OR=4.8$, feeling "low energy" $OR=5.1$. "sadness the week before" $OR=4.5$, "loneliness" $OR=2.6$, "no time for him/herself" $OR=2.7$, "no time for activities" $OR=3.1$, "feeling pressure at school" $OR=2.4$, "having poor family relations" $OR=6.1$, feeling no justice $OR=1.8$, marks at school $OR=1.9$ (Table3).

Only some of the different dimensions of social support show significant associations with frequent headaches; among which the inability of having fun with friends, having nobody to share, to support or to worry; not receiving help from friends or considering it as not good.

Both life satisfaction (6.67 vs 7.35 ; $F=29.781$. $p<.001$) and quality of life (35.29 vs 39.58 ; $F=13.110$. $p<.001$) are significantly lower in those suffering from frequent headaches while the social support quotation is higher in the headache group (13.4 vs 12.55 ; $F=4.046$. $p<.01$).

Headaches are more prevalent in those using computers for more than 2 hours during weekdays and mostly at weekends but the corresponding odds ratios are low. Adolescents with frequent use of mobile phone have significantly more headaches ($p<.001$; $OR=1.6$); the same occurs for those with frequent use of alcoholic beverages ($OR=2.2$) and frequent episodes of drunkenness ($OR=1.5$) and tobacco ($OR=1.6$). However carrying

Table 1: Headache and socio demographic variables

| Health complaints | | % within HA | % without HA | Chi2 | p | OR |
|-------------------------|------|-------------|--------------|------|-------|--------------|
| Family SES | | | | | | |
| Father unemployment | 8.9 | 8.9 | .002 | .517 | .994 | .740 – 1.334 |
| Mother unemployment | 23.9 | 21.4 | 2.143 | .079 | 1.155 | .952 – 1.402 |
| Father profession level | 41.3 | 42.6 | .085 | .423 | .947 | .656 – 1.367 |
| Mother profession level | 50.7 | 52.6 | .267 | .330 | .925 | .688 – 1.243 |

Table 2: Headache health complaints and sleep features

| Health complaints | % within HA | % without HA | Chi2 | p | OR | Confidence intervals |
|---------------------------|-------------|--------------|---------|---------|--------|----------------------|
| Pain complaints | | | | | | |
| Abdominal pain | 26.9 | 2.9 | 449.19 | .000*** | 12.100 | 9.189 – 15.933 |
| Back pain | 49.2 | 16.6 | 345.66 | .000*** | 4.839 | 4.065 – 5.762 |
| Shoulder and neck pain | 37.3 | 14.7 | 185.57 | .000*** | 3.464 | 2.879 – 4.168 |
| Psychic complaints | | | | | | |
| Sadness | 46.4 | 16.4 | 300.425 | .000*** | 4.398 | 3.692 – 5.239 |
| Irritability | 48.0 | 19.0 | 262.412 | .000*** | 3.929 | 3.309 – 4.666 |
| Nervousness | 59.7 | 24.2 | 343.629 | .000*** | 4.621 | 3.902 – 5.474 |
| Sleep complaints | | | | | | |
| Sleep initiation | 47.7 | 19.0 | 259.119 | .000*** | 3.895 | 3.280 – 4.624 |
| Sleep deprivation | 22.8 | 17.9 | 8.712 | .003** | 1.357 | 1.107 – 1.663 |
| Sleep duration<7h | 24.7 | 20.3 | 9.489 | .001*** | .773 | 0.656 – .911 |
| Sleep duration<6h | 28.0 | 21.0 | 12.578 | .000*** | .689 | 0.561 – .847 |
| Other | | | | | | |
| Fatigue | 60.5 | 32.2 | 184.055 | .000*** | 3.121 | 2.637 – 3.691 |
| Dizziness | 28.8 | 3.5 | 462.299 | .000*** | 11.270 | 8.695 -14.609 |

Table 3: Headache, Psychological aspects and Social support (family and friends)

| Psychological aspects | % within HA | % without HA | Chi2 | p | OR | Confidence intervals |
|------------------------------|-------------|--------------|---------|---------|-------|----------------------|
| Not in good shape | 19.7 | 3.9 | 144.954 | .000*** | 4.794 | 3.643 – 6.307 |
| Low energy | 27.2 | 6.8 | 164.629 | .000*** | 5.116 | 3.911 – 6.692 |
| Sadness last week | 41.5 | 13.6 | 175.927 | .000*** | 4.505 | 3.565 – 5.694 |
| Loneliness | 19.2 | 8.5 | 53.206 | .000*** | 2.573 | 1.982 – 3.340 |
| No time for himself | 30.4 | 14.0 | 74.799 | .000*** | 2.674 | 2.218 – 3.360 |
| No time for activities | 37.9 | 16.2 | 122.499 | .000*** | 3.153 | 2.557 – 3.887 |
| Pressure at school | 73.7 | 53.9 | 94.732 | .000*** | 2.394 | 2.202 – 2.863 |
| Family relations | 19.7 | 3.9 | 10.847 | .000*** | 6.061 | 1.858 – 9.770 |
| Justice | 15.1 | 9.0 | 18.522 | .000*** | 1.805 | 1.375 – 2.369 |
| Marks at school | 19.9 | 11.7 | 18.561 | .000*** | 1.874 | 1.404 – 2.502 |
| Family and Friends | | | | | | |
| No fun with friends | 8.3 | 3.5 | 25.915 | .000*** | 2.493 | 1.735 – 3.581 |
| Nobody present | 25.0 | 18.7 | 2.604 | .070 | 1.450 | .922 – 2.282 |
| Nobody to share | 31.7 | 22.4 | 3.858 | .035* | 1.605 | .998 – 2.579 |
| No family support | 17.9 | 12.4 | 3.839 | .035* | 1.542 | .998 – 2.385 |
| No family emotional support | 22.7 | 18.4 | 1.999 | .095 | 1.307 | .901 – 1.894 |
| No family comfort | 24.6 | 23.3 | .110 | .409 | 1.076 | .697 – 1.661 |
| No friends to help | 19.2 | 13.1 | 4.457 | .025* | 1.575 | 1.030 – 2.407 |
| Bad help from friends | 20.7 | 14.3 | 4.230 | .028* | 0.641 | .418 - .982 |
| No talks with family | 24.2 | 22.2 | .467 | .272 | 1.114 | .817 – 1.519 |
| No friends to share | 25.4 | 19.2 | 2.473 | .075 | 1.433 | .914 – 2.248 |
| Nobody worries | 28.5 | 19.3 | 4.845 | .021* | 1.665 | 1.054 – 2.629 |
| No decision family support | 24.1 | 18.5 | 3.005 | .053 | 1.395 | .956 – 2.035 |
| No friends to share problems | 26.4 | 21.0 | 2.280 | .081 | 1.348 | .914 – 1.987 |

weapons to school has a higher headache prevalence (OR=1.4); physical inactivity is more prevalent in the headache group but the association is not significant (Table 4).

Missing breakfast during the week and at weekends fasting/missing meals or not eating fruit routinely have higher headache prevalence but with no significant OR; eating no vegetables or too many sweets and colas had no influence (Table 4).

The significant covariates in binominal logistic regression using as dependent variable Headache dichotomized (with a referent value YES) and as independent variables Kidscreen 10 (Quality of Life) gender, abdominal pain, back pain, sadness, nervousness, sleep initiation difficulties, dizziness and fatigue.

With this model the final likelihood ratio tests have a chi-square equal to 12.76, with 8 degrees of freedom and p=.125; and Nagelkerke R-square

Table 4: Headache, habits and risk behaviors, nutrition habits

| Behaviors | N | % within HA | % without HA | Chi2 | p | OR | Confidence intervals |
|----------------------------|------|-------------|--------------|--------|---------|-------|----------------------|
| Screen times | | | | | | | |
| TV>3h | 3383 | 45.1 | 43.8 | .352 | .290 | 1.051 | .892 – 1.237 |
| TV WE>3h | 3341 | 74.8 | 75.6 | .225 | .334 | 0.950 | .792 – 1.153 |
| PC play>3h | 3378 | 17.8 | 20.7 | 3.212 | .040* | 0.826 | .669 – 1.018 |
| PC play WE>3h | 3327 | 36.4 | 43.6 | 12.174 | .000*** | 0.741 | .625 – .877 |
| PC use>3h | 3382 | 33.1 | 31.2 | 1.011 | .168 | 1.093 | .919 – 1.299 |
| PC use WE>3h | 3324 | 53.5 | 53.6 | .000 | .512 | 0.999 | .848 – 1.177 |
| Mobile phone | 3422 | 80.6 | 72.1 | 21.932 | .000*** | 1.604 | 1.315 – 1.957 |
| Toxics | | | | | | | |
| Alcoholic beverages | 3383 | 5.5 | 2.6 | 16.097 | .000*** | 2.213 | 1.487 – 3.294 |
| Drunkenness | 3439 | 22.7 | 16.1 | 18.019 | .000*** | 1.532 | 1.257 – 1.868 |
| Tobacco | 3432 | 24.3 | 16.8 | 22.07 | .000*** | 1.589 | 1.308 - 1.920 |
| Violence | | | | | | | |
| Fights | 3417 | 28.6 | 25.9 | 2.239 | .069 | 1.151 | 0.962 – 1.377 |
| Weapons to school | 3280 | 7.4 | 5.3 | 4.382 | .025* | 1.415 | 1.021 – 1.962 |
| Physical inactivity | | | | | | | |
| Activity <3days/week | 2439 | 21 | 14.4 | 13.433 | .000*** | .632 | .494 - .809 |
| Nutrition habits | | | | | | | |
| Breakfast/fasting | | | | | | | |
| Week-days | 670 | 56.5 | 48.5 | 3.538 | .035* | .725 | .520 – 1.012 |
| Weekend | 3419 | 10.9 | 7.6 | 8.543 | .003** | .671 | .512 – .878 |
| Fasting/Hungry | 3296 | 3.7 | 0.6 | 44.450 | .000*** | .151 | .080 – .266 |
| Nutrients | | | | | | | |
| No fruit | 1794 | 18.3 | 14.0 | 4.573 | .021* | .726 | .541 – .975 |
| No vegetables | 2154 | 18.5 | 18.2 | .024 | .462 | .979 | .753 – 1.274 |
| Sweets | 2130 | 23.0 | 22.8 | .013 | .477 | .986 | .772 – 1.259 |
| Colas | 2092 | 36.0 | 34.0 | .593 | .237 | .918 | .737 – 1.142 |

Table 5: Independent variables gender: wellbeing and the variables with higher association values in previous analysis: physical and psychological symptoms.

| HEADACHE - YES | B | S.E. | Wald | df | Sig. | OR | 95% C.I. for OR | |
|----------------|--------|-------|---------|----|-------|---------|-----------------|----------|
| | | | | | | | Inferior | Superior |
| Abdominal | -1.548 | 0.172 | 80.534 | 1 | 0 | 0.213 | 0.152 | 0.298 |
| Backache | -0.704 | 0.114 | 38.25 | 1 | 0 | 0.494 | 0.396 | 0.618 |
| Sadness | -0.315 | 0.127 | 6.216 | 1 | 0.013 | 0.729 | 0.569 | 0.935 |
| Slinitiation | -0.393 | 0.116 | 11.427 | 1 | 0.001 | 0.675 | 0.537 | 0.848 |
| Dizziness | -1.432 | 0.164 | 76.051 | 1 | 0 | 0.239 | 0.173 | 0.33 |
| Fatigue | -0.377 | 0.108 | 12.121 | 1 | 0 | 0.686 | 0.555 | 0.848 |
| Nervousness | -0.577 | 0.115 | 24.977 | 1 | 0 | 0.561 | 0.448 | 0.704 |
| kIDS_10 | -0.047 | 0.01 | 20.395 | 1 | 0 | 0.954 | 0.935 | 0.974 |
| Gender | -0.664 | 0.11 | 36.21 | 1 | 0 | 0.515 | 0.415 | 0.639 |
| Constant | 4.924 | 0.391 | 158.332 | 1 | 0 | 137.544 | | |

Variable dependent: headache
R²=38.3%

was 0.383 explaining 38.3% of the variance. The parameters estimates are shown if table 5. The remaining variables even if more prevalent in the headache population, and presenting significant OR association with high headache frequency did not show significant parameter estimate either allowed significant regression models.

Discussion

CDH had a prevalence of 4.2% and monthly headaches a prevalence of 17.3% the percentage of teenagers that ever had a headache was 39.5%. These data are in line with others referred in the literature [1-7] confirming once more those headaches are the commonest neurological complaint during adolescence. Since the epidemiological study did not evaluate headache characteristics we excluded from our analysis the monthly occurrence important in a migraine but less relevant in tension-type or

other types of headaches. Therefore the prevalence of frequent headaches in our study was 22.2%. ie. Similar to what has been obtained in other studies [3]. We also observed the female gender preference [1,2,4,28] and the significant prevalence increase with age [6].

Furthermore, the study showed that the major comorbidities of frequent headaches were other health complaints and psychiatric and psychological factors. For health complaints there was a higher relevance for abdominal pain and dizziness although the OR for back shoulder and neck pain and fatigue were also quite high; the association with abdominal pain has been shown in other studies [11]. Frequent sadness irritability and nervousness are also strongly associated with frequent headaches; this in line with several other observations [8,10,16-18]; the same holds for the psychological variables investigated with special relevance for “low energy” and “low family support” and lower values for obtained marks

being mistreated in terms of fairness pressure at school no time for himself and for other activities sadness and loneliness and poor family relations.

Concerning family and friends, frequent headache sufferers had less often fun with friends complained more often of having nobody to share and no family support neither friends to help and nobody to worry about them. Life satisfaction and quality of life were significantly lower in the headache group.

Concerning daily behaviors with e-media, the only significant association is excessive mobile phone use. No significant association was found between headaches and computer use. In line with our previous results another study of the WHO cross-national Health Behavior in School-aged Children investigating adolescents in Finland, Denmark and France found a relation between computer use for more than 2 hours in weekdays and increased health complaints but not with headaches [48]. Among risks behaviors only carrying weapons to school, wine consumption and frequent drunkenness episodes were significantly associated with frequent headaches. Bullying is usually considered as a cause for a headache but in agreement with others [49], this was not found in our study. Mobile phone and weekdays, computer use and all risks behaviors are however associated with sleep deprivation [50]. The nutrition patterns investigated showed no significant association in spite of the fact that some of them are more prevalent among headache sufferers (namely fasting/missing meals and missing breakfast during weekdays and weekends).

In spite of the significant associations only gender, quality of life and several health complaints were significant in a binominal regression model; the model achieved showed significant likelihood ratio and pseudo R-square, explaining between 25 to 38% of the variance; there is a lack of significant values in model parameters estimates relating headaches with psychological factors, electronic media utilization, risk behaviors and nutrition suggesting an organic/intrinsic pathogenesis of frequent headaches in adolescents.

In synthesis, the prevalence of a frequent headache is high and there is a cluster of high Odds Ratio associated factors namely: other health complaints, with special reference to abdominal pain and dizziness; psychopathological symptoms: sadness. Irritability, nervousness and low energy; social and family support: lower family support, lower academic success, higher school pressure, unfair treatment, loneliness and nobody to share or to worry about their problems; lower quality of life; e-media and excessive mobile phone use; tobacco and alcohol use and violent behaviors.

This multivariable cluster enhances the negative impact of frequent headaches upon adolescents' daily life. The clinical implications are obvious namely in what concerns the need of prophylactic measures, early detection, and efficient treatment. Furthermore, it is clear that clinical evaluation must take into account other health complaints and implies a proper evaluation of a large scope of behavioral, school and family issues.

Conflict of Interest

No conflict of interests to be mentioned.

Key Messages

The prevalence of frequent headaches among adolescent is high and impacts upon their quality of life and life satisfaction.

- Headaches are statistically associated with a large cluster of health complaints, family and school issues and behaviors concerning excessive mobile phone use and some risk behaviors among which consumption of alcohol and tobacco, and violent behaviors.
- The logistic model used explained 38% of the variance integrated only gender, quality of life and health complaints.

- Clinical evaluation of headache adolescents' sufferers implies a proper evaluation of a large scope of clinical, Behavioral, school and family issues.

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