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An examination of adolescent mental and physical well-being in Scottish school children: A cross-sectional study

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Abstract

Recent research has suggested that Scottish girls are more at risk of higher levels of psychosomatic symptomatology and lower levels of mental well-being that their male peers. We report the results of a cross-sectional study examining mental well-being and psychosomatic symptomatology in Scottish adolescents. Participants were 2,504 school children (*M* age = 15.6 (SD = 0.67); Male = 1229 [49.1%], Female = 1265 [50.5%], Gender missing = 10 [0.4%]), attending high schools in Glasgow and Inverclyde Local Authority areas. Both unadjusted and fully adjusted analyses revealed that females reported significantly lower levels of mental well-being and higher levels of psychosomatic symptomatology than males. Other measures that were significant in terms of well-being and symptomatology included: self-rated health, subjective life expectancy, and birth order. Frequency of physical exercise, free school meals entitlement (a proxy for socio-economic status) and ethnicity were not consistently related to health outcomes.

Introduction

Adolescent mental health problems continue to present a serious public health challenge [1,2] in terms of the real cost to the individual, the real cost to society, and the potential cost into the future. Adolescence is a period characterised by intense physical, emotional and psychological development [3], and the challenges that these developments present can be stressful [4]. During adolescence, an individual acquires the physical, cognitive, emotional, and social resources that are the foundation for health and well-being in later life [3]. Given the magnitude of the neurological developments in adolescence, this period is also an important period for the development of mental well-being, with evidence suggesting that problems with mental ill-health which emerge in adolescence, are often sustained through into adulthood [5-7].

Both adolescent mental well-being and psychosomatic symptomatology have been the subject of much international study, with national variation in the findings [8]. Prevalence estimates using a variety of indicators have suggested that in the United States around 40% of 11-17 year olds reported past year and 23% reported past 30 day caseness of mental health problems [1]. Elsewhere in Australia (≈ 20%) [9] and in Germany (≈18%) [10] the figures are also high. However, mental well-being has come to be understood as more than the absence of mental illness or mental disorder [11], and is associated with the ability to withstand day-to-day stressors, and to make a productive contribution in everyday life. Recent studies have demonstrated the positive effect of mental well-being on other constructs important in adolescence including resilience [12]. In terms of psychosomatic symptomatology, Whitehead *et al.* report variations in mean scores by nation and time. Accordingly, in a study of adolescents in 33 countries, mean scores varied in 2002 ($7.60 \leq M_{symptomatology} \leq 13.53$) and in 2014 ($8.89 \leq M_{symptomatology} \leq 13.49$) [8]. Whitehead *et al.* further reported that Scottish youth scored among the highest levels of psychosomatic symptomatology in 2014, and that Scottish girls reported the highest rise in psychosomatic symptomatology between 2002 and 2014, in the whole study.

In a series of reports over many years, the Scottish Government have made the improvement of children's and young people's mental well-being a national priority [13-17]. For these macro-level strategies to have the best chance of success it is important to repeatedly examine the context-specific nature of mental well-being and psychological distress, and further to examine what other variables or constructs are significantly related to them. There has been a considerable amount of research into adolescent well-being in Scotland, much of which has been in the context of the Health Behaviour in School-aged Children (HBSC) [18] study, an international survey conducted in collaboration with the WHO Regional Office for Europe. More recently, research using the Warwick-Edinburgh Mental Well-being Scale (WEMWBS [19]) reported that among 13- to 15-year olds, males (Mean = 52.0) scored a little higher than females (Mean = 49.9) [20]. Results from the most recent HBSC report [18] showed that females reported higher levels of psychological stress than boys. However, while overall life satisfaction was high in the whole sample, it reduced with age, especially for girls. It therefore seems important to continue to investigate what factors are significantly associated with psychosomatic symptomatology and mental well-being in a Scottish setting.

As in many areas, research into adolescent mental well-being has yielded discrepant findings, largely as a result of the use of different measures to assess it, the nature of analyses (adjusted or unadjusted),

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and the geographical location. For example, while it is widely accepted that inequities, including those linked to poverty and gender, shape all aspects of adolescent health and well-being [3], some studies have reported differential results for different socio-economic indicators. For example, Kessler *et al.* [1] reported higher rates of depressive symptomatology for children in higher socio-economic status (SES). Moreover, Ford *et al.* [21] found no evidence of inequalities in adolescent mental health, while West and Sweeting [22] showed a reversed SES gradient. Therefore, it appears that the means by which SES is determined can itself affect the relationship between it and well-being.

In addition to structural factors there are individual level behavioural factors that may influence the gender differences observed in adolescent mental well-being and psychosomatic symptomatology. The wider public health literature indicates that long-term positive health outcomes are linked to physical exercise. For exercise, Biddle and Asare [23], in a review of reviews, reported that the relationship between physical activity and mental well-being in adolescents was a relatively (compared to the relationship in adults) understudied area, but that in general terms, those adolescents who were physically active appeared less likely to suffer from mental health problems. A recent Australian study ($n \approx 8{,}000$) reported that those adolescents who met physical activity guidelines were significantly less likely to report depressive symptoms than their peers [24]. Elsewhere, this has been shown to be a more salient issue for males than for females [25]. Specifically in the Scottish context, Campbell-Jack *et al.* [20] suggested a positive association between physical activity and well-being in school-aged children.

Psychological factors can also influence the observed gender differences. For example, future orientation is one measure of how individuals perceive their future in relation to their present circumstances that can be measured through their subjective (or self-estimated) life expectancy (SLE). Brouwer and van Exel [26] reported that the weight people attach to future health gains may be related to their beliefs about growth rates of life expectancy. These authors also reported that those who believe they live healthier lives than others also expect to live longer than those who believe their lifestyles to be less healthy. There has been some research on the relationship between adolescents' SLE and health-related behaviour. McDade *et al.* [27] reported that expectations for the future predicted the extent to which individuals engaged in health promoting behaviours, and in particular, adolescents who perceived lower probabilities of dying before age 35 years engaged in higher levels of regular physical activity and consumed fewer cigarettes in young adulthood than their peers. Elsewhere lower expectations for future survival have also been found to be associated with delinquency, high risk sexual activity, and illegal drug use [28-30].

Given results elsewhere [8,18,20,23] we hypothesised as follows; (1) that females would report significantly higher levels of psychosomatic symptomatology, and significantly lower levels of mental well-being than males in univariate analyses, (2) that higher WEMWBS scores would additionally be significantly associated with higher SLE, more frequent physical exercise, and a higher self-rated health, (3) and that both higher psychological and (4) somatic symptomatology would additionally be significantly associated with lower SLE, less frequent physical exercise, and a lower self-rated health. However, given the extant literature, and some of the discrepant findings described above, we made no hypotheses regarding socio-demographic indicators.

Methods

Participants

Participants were S5 (post-primary year 5) pupils in 35 post-primary or high schools in Glasgow Local Authority area and Inverclyde Local Authority area (an area approximately 20 miles west of Glasgow City centre). Paper-and-pencil surveys were administered under examination-like conditions in each individual school. Both pupil and parental consent were obtained before the data were collected.

Measures

Psychosomatic symptoms were measured using the Health Behaviour of School Children symptom checklist [8,17], which includes eight common symptoms: Head-ache, stomach-ache, dizziness, backache, feeling low, irritability/bad temper, difficulty sleeping, and nervousness. These symptoms can be thought of as constituting two dimensions that differ qualitatively; somatic and psychological symptoms [31]. Children were asked how often in the last six months they had felt any of the symptoms with the following response categories: *about every day = 5, more than once a week = 4, about every week = 3, about every month = 2, rarely or never = 1*. Items within the scale have shown adequate content validity and test-retest reliability [32]. Internal consistency coefficients were acceptable for Psychological ($\alpha_{\text{current study}} = .77$), and Somatic ($\alpha_{\text{current study}} = .73$).

The Warwick-Edinburgh Mental Well-being Scale (WEMWBS) was used to measure positive mental well-being. This is a 14-item scale assessing positive affect, satisfying interpersonal relationships and positive functioning [19], summed to provide a single score ranging from 14 to 70 with higher scores reflecting greater well-being. The WEMWBS has displayed content and criterion validity, and acceptable test–retest reliability over one week [19]. Internal consistency was acceptable for this study ($\alpha_{\text{current study}} = .89$).

For SLE, participants answered a single question concerning their subjective probability of expecting to live to age 75. Participants were asked, "On a scale of 0 to 100, where 0 equals no chance, and 100 equals definitely, how likely do you think that it is that you will live to be 75 years old?" Integer options of "5s" (0, 5, 10, 15, 20, etc.) were available between 0 and 100.

Physical activity was assessed by asking participants, "Over the past seven days, on how many days were you physically active for a total of at least 60 minutes per day?" Responses ranged from 0 to 7. Self-rated health was assessed by asking participants, "In general, how would you rate your health? Responses options ranged from 1 = *poor*, to 5 = *excellent*. Information was also gathered on gender, ethnicity, number of older siblings, and free school meals entitlement (FSM), an imperfect proxy for low-income families, and thus SES [33]. We gathered data on number of older siblings, as birth order has been found to be related to adolescent life satisfaction in unadjusted analyses in a Scottish context, but non-significant in fully adjusted models [34].

Statistical analysis

All analyses were undertaken using SPSS (v23). Because of the non-independence of responses (clustering at school level), three regressions using the linear mixed models function were performed individually for WEMWBS score, and scores on psychological and somatic symptomatology. In each case the school variable was entered as the clustering variable. In all three models gender, number of older siblings, FSM entitlement, location (Glasgow or Inverclyde), ethnicity,

frequency of exercise, and SLE, were entered as covariates. To correct for type 1 error as a result of multiple comparisons in all statistical analyses, Benjamini-Hochberg's [35] q was derived from calculating the false discovery rate. The null hypothesis was rejected if and only if $p < q$ and the 95% confidence interval did not contain zero. We applied the guidelines of Ferguson [36] to the interpretation of correlation coefficients. Accordingly, the recommended minimum practical effect is a coefficient of ≥.20, a coefficient of ≥.50 represents a moderate effect size, and a coefficient of ≥ .80 represents a strong effect.

Results

A total of 2,504 school children participated (*M*age = 15.6 (SD = 0.67); Male = 1229 [49.1%], Female = 1265 [50.5%], Gender missing = 10 [0.4%]). In terms of FSM entitlement, the following was observed (Yes = 552 [22.0%], No = 1476 [58.9%], Unsure = 435 [17.4%], and Missing = 41 [1.6%]). In terms of ethnicity, White British accounted for 74.6% of the sample, with British Pakistani accounting for 7.1%. Ethnicity data was not provided by 13.3% of respondents, meaning that all other ethnicities in total accounted for 5.0% of the sample. These were grouped for analytical purposes as "other".

Table 1 displays descriptive statistics and analyses of variance for these socio-demographic variables and the three outcome measures. We had hypothesised (1) that higher levels of psychological and somatic symptomatology and lower levels of mental well-being would be associated with being female. Results show that while there were numerous univariate differences that were statistically significantly different, only the gender differences consistently met Ferguson's (2009) practically significant threshold.

Table 2 displays the results of bivariate Pearson's correlations between measures. Results were all in the expected directions, with higher WEMWBS score associated with lower reported levels of both psychological and somatic symptomatology, and a higher self-rating of health. However, applying Ferguson's [36] criteria, only one coefficient was in the moderate range namely, that between psychological and somatic symptoms.

Table 3 displays the results for the first linear mixed models regression. We had hypothesised that (2) higher levels of mental well-being would be associated with higher SLE, more frequent physical activity, and higher self-rated health. Results show that higher mental well-being scores were significantly associated with being male, having fewer older siblings (therefore being older in the sibship), having a higher self-rated health, and having a higher SLE.

Table 4 displays the results for psychological symptomatology. We had hypothesised that (3) higher psychological symptomatology would be significantly associated with lower SLE, less frequent physical exercise, and a lower self-rated health. Results show that higher psychological symptomatology scores were significantly associated with being female, having a lower self-rating of personal health, and a lower SLE.

Table 5 displays the results for somatic symptomatology. We had hypothesised that (4) higher somatic symptomatology would be significantly associated with lower SLE, less frequent physical exercise, and a lower self-rated health. Results show that higher somatic symptomatology scores were significantly associated with being White British (compared to "other"), being female, being entitled to a FSM, having a greater number of older siblings (being younger in the sibship), having a lower self-rating for personal health, and a lower SLE.

Discussion

The present study examined mental well-being, psychosomatic

Table 1. Descriptive data and analyses of variance (independent samples t-tests or ANOVAs) between socio-demographic and outcome measures.

	WEMWBS	Psychological Symptoms	Somatic Symptoms
Male (n = 1,229)	49.39 (8.84)	4.12 (3.57)	2.22 (2.79)
Female (n = 1,265)	44.90 (9.21)	6.08 (4.03)	4.19 (3.61)
	$p < .001$, $d = 0.50$	$p < .001$, $d = 0.51$	$p < .001$, $d = 0.61$
FSM Yes (n = 552)	46.17 (9.89)	5.47 (4.24)	3.78 (3.74)
FSM No (n = 1,476)	47.42 (9.06)	5.00 (3.79)	3.07 (3.26)
FSM Unsure (n = 435)	47.36 (9.23)	5.02 (3.87)	2.96 (3.22)
	$p = .023$	$p = .048$	$p < .001$
White British (n = 1,867)	47.27 (9.18)	5.09 (3.92)	3.22 (3.40)
British Pakistani (n = 178)	46.39 (9.71)	4.92 (3.75)	2.94 (2.96)
Other (n = 459)	46.75 (9.55)	5.33 (4.07)	3.34 (3.44)
	$p = .318$	$p = .395$	$p = .414$
Glasgow (n = 2,157)	46.94 (9.25)	5.12 (3.96)	3.28 (3.38)
Inverclyde (n = 347)	48.14 (9.48)	5.13 (3.78)	3.19 (3.38)
	$p = .026$, $d = 0.13$	$p = .984$	$p = .861$

Note: WEMWBS – Warwick-Edinburgh Mental Well-being Scale. FSM = Free school meal.

Table 2. Bivariate Pearson's Correlations (two-tailed) between measures.

	1	2	3	4	5	6
1) WEMWBS	-	-.47** (-.50, -.43)	-.30** (-.34, -.25)	.16** (.12, .20)	.33** (.36, .28)	.24** (.20, .29)
2) Psychological Symptomatology		-	.58** (.55, .61)	-.09** (-.13, -.05)	-.23** (-.18, -.27)	-.17** -.22, -.13)
3) Somatic Symptomatology			-	-.07** (-.11, -.02)	-.20** (-.15, -.24)	-.12** (-.16, -.07)
4) Physical Exercise				-	.36** (.39, .32)	.12** (.08, .15)
5) Health self-rating					-	.30** (.34, .26)
6) Subjective Life Expectancy						-

Note: WEMWBS = Warwick-Edinburgh Mental Well-being Scale.

95% bias-corrected confidence intervals are presented in parentheses

Table 3. Linear Mixed Models Regression examining statistical predictors of WEMWBS scores.

	Estimate	S.E.	95% C.I.	*p* value
Ethnicity[a1]	-0.186	0.854	-1.860, 1.489	.828
Ethnicity[2]	0.144	1.089	-1.992, 2.281	.894
Location[b]	-1.390	0.895	-3.145, 0.365	.120
Gender[c]	3.981	0.420	3.160, 4.803	<.001*
Free school meals[d3]	-0.823	0.651	-2.100, 0.485	.207
Free school meals[4]	-0.313	0.558	-1.407, 0.781	.557
Siblings older	-0.396	0.166	-0.721, -0.071	.017*
Physical exercise	0.057	0.104	-0.147, 0.261	.585
Self-rating of health	2.372	0.247	2.856, 1.887	<.001*
Subjective life expectancy	0.078	0.011	0.056, 0.099	<.001*

Note: [a]reference = other; [b]reference = Inverclyde; [c]reference = Female; [d]reference = unsure; 1 = White British; [2] = British Pakistani; [3] = no; [4] = yes.
*All values statistically significant at $p < q$.

Table 4. Linear Mixed Models Regression examining statistical predictors of Psychological Symptomatology.

	Estimate	S.E.	95% C.I.	*p* value
Ethnicity[a1]	0.366	0.373	-0.365, 1.097	.326
Ethnicity[2]	0.024	0.475	-0.908, 0.957	.959
Location[b]	-0.405	0.388	-1.167, 0.360	.297
Gender[c]	-1.762	0.183	-2.121, -1.404	<.001*
Free school meals[d3]	0.450	0.284	-0.108, 1.007	.114
Free school meals[4]	-0.012	0.243	-0.489, 0.466	.962
Siblings older	0.085	0.072	-0.057, 0.227	.239
Physical exercise	0.059	0.045	-0.030, 0.148	.192
Self-rating of health	-0.637	0.108	0.426, 0.849	<.001*
Subjective life expectancy	-0.027	0.005	-0.037, -0.018	<.001*

Note: [a]reference = other; [b]reference = Inverclyde; [c]reference = Female; [d]reference = unsure; 1 = White British; [2] = British Pakistani; [3] = no; [4] = yes.
*All values statistically significant at $p < q$.

Table 5. Linear Mixed Models Regression examining statistical predictors of scores on Somatic Symptomatology.

	Estimate	S.E.	95% C.I.	*p* value
Ethnicity[a1]	1.010	0.317	0.388, 1.632	.001*
Ethnicity[2]	0.424	0.405	-0.370, 1.218	.295
Location[b]	-0.431	0.331	-1.080, 0.217	.192
Gender[c]	-1.815	0.156	-2.121, -1.510	<.001*
Free school meals[d3]	-0.838	0.242	0.364, 1.313	.001*
Free school meals[4]	-0.157	0.207	-0.391, 0.423	.940
Siblings older	0.139	0.062	0.019, 0.259	.024*
Physical exercise	0.046	0.039	-0.030, 0.122	.234
Self-rating of health	-0.464	0.092	0.284, 0.644	<.001*
Subjective life expectancy	-0.013	0.004	-0.020, -0.005	.002*

Note: [a]reference = other; [b]reference = Inverclyde; [c]reference = Female; [d]reference = unsure; 1 = White British; [2] = British Pakistani; [3] = no; [4] = yes;
*All values statistically significant at $p < q$.

symptomatology, physical exercise, self-rating of health, and SLE in a large sample of Scottish adolescents. Some of these constructs have previously and repeatedly been examined in Scottish school children [8,18,20], however the present study is novel in terms of the combination of variables utilised and the fact that it sampled pupils in all of Glasgow's 30 Local Authority schools.

Looking first at the univariate associations between socio-demographic variables and the three main outcome measures, results show that males reported significantly higher levels of mental well-being than females (with a moderate effect size), supporting recent evidence in the Scottish context [20]. However, what is interesting is that the mean scores for males and females were somewhat lower than those recently reported in the Scottish Health Survey [20]. There are a number of possible explanations for this. Firstly, the so-called 'Glasgow effect' (explained below), and secondly, the fact that the present participants were one school year older than those surveyed, both in the HBSC [18] and the Scottish Health Survey [20]. The most recent HBSC results in Scotland suggest that feelings of stress increase and life satisfaction decreases with age when comparing 11, 13, and 15-year olds, especially for females. Furthermore, in a secondary analysis of HBSC data from 1994 to 2006, Levin *et al.* [37] found that boys reported higher levels of well-being and lower levels of psychological symptomatology. These authors also reported an overall improvement in mental well-being over the period of their analysis, as well as the emergence of some socioeconomic inequalities with regard to mental well-being. Currie *et al.* [38] argued that the gender gap in multiple health complaints was now at its widest in the past 20 years.

Results of the present study also support this discrepancy for both psychological and somatic symptomatology. These results were observed with moderate to large effect sizes in a large sample from a small geographical area, suggesting that these are quite noteworthy and important findings. These results are in line with other recent research

[8] showing that Scottish adolescent females reported significantly and meaningfully higher levels of psychosomatic symptomatology than males, and that levels of psychosomatic symptomatology had increased most notably in Scottish adolescent females over a 12 year period.

Results of univariate analyses in the present study showed no significant difference in psychosomatic symptomatology between participants from Glasgow and Inverclyde, and only a modest difference for mental well-being, with participants from Inverclyde scoring marginally higher. Glasgow has historically experienced poorer health and higher mortality rates than the rest of Scotland [39], leading to the conclusion that there is a so-called 'Glasgow effect'. In terms of this 'effect', Levin *et al.* [40] reported no such effect for mental well-being, rather they reported that mental well-being was higher in Glasgow compared with the rest of Scotland during adolescence. Indeed, it has been suggested that the poorer health experienced by Glasgow adults is only partially seen among young people in Glasgow, but where it does emerge, it is among the youngest individuals studied [41]. These authors recommended that future research investigate this 'effect'. Univariate results in the present study did reveal a negative 'effect' for Glasgow in terms of mental well-being (with a small effect size), but no such 'effect' for psychological or somatic symptomatology.

In models controlling for the effects of clustering at school level, and for a range of socio-demographic and other variables, the gender effect remained significant, underlining the importance of addressing well-being, psychological and somatic issues in young females. Said another way, being female made individuals significantly more likely to experience higher levels of psychological and somatic symptomatology, and lower levels of mental well-being, controlling for a wide range of socio-economic and lifestyle indicators.

Although the pupils in Glasgow schools reported significantly lower mean WEMWBS scores in univariate analyses, this became non-significant in the fully adjusted model, thus supporting the research of others [41] suggesting that the purported 'Glasgow effect' for negative health outcomes is not universally observed for all indicators in all age groups. The significant effects of both ethnicity and SES, were only twice observed in the multivariate models. It is possible that these findings were influenced by the nature of the SES measure (i.e. FSM entitlement), as well as the dominance of White British respondents in the current study. While some studies have reported a significant association between SES and adolescent health and well-being [42], this association has not been universally observed [43]. Essentially, the manner in which SES is assessed is influential in the level or degree of association [43]. Because FSM entitlement is a proxy measure for SES [33], it may be less able to differentiate health-related outcomes. Additionally, in terms of the ethnicity in the present study, there were relatively low proportions of the largest sub-group (British Pakistani) and the remainder of declared ethnicities ('other'). Where these variables were significant (in the somatic model), results showed that higher levels of somatic symptomatology were experienced by those self-reporting as White British, and those not entitled to FSM.

Two variables that were consistently, and perhaps unsurprisingly related to outcomes were SLE and self-rating of health. In other words, higher mental well-being and lower levels of both psychological and somatic symptomatology were significantly associated with a greater likelihood of living to age 75, and a higher rating of health. Given the cross-sectional nature of the study it is impossible to conclude that a higher SLE and/or self-rated health, leads to higher mental well-being or lower levels of psychosomatic symptomatology, merely that they are significantly associated. Finally, there were differential results for WEMWBS scores and scores on somatic symptomatology, such that having fewer older siblings (being older in the sibship) was associated with higher WEMWBS scores, but having a greater number of older siblings (being younger in the sibship) was associated with a higher somatic score. This suggests that family dynamics may be an important variable to study in future research. The reasons for the potential (dis) advantages of birth order on these measures are not clear in the current study. Contrary to our hypothesis and previous literature, frequency of physical activity did not appear to influence well-being. However, as Biddle and Asare [23] noted, the benefits are relatively small, and the measure used in the present study was perhaps too crude to capture any relationship, lacking as it did any assessment of the type and intensity of exercise undertaken.

As this is a cross sectional study the usual caveats around the interpretation of the results apply. The study is further limited by the fact that pupils from only one school year group (year 5) were sampled, and that other variables that may directly impact on well-being indicators were not assessed. The utility of FSM as a proxy for SES is always debateable but within the (ethical) constraints of data collection from the children themselves it is an easily obtained and quantifiable measure. Even then, a large number did not appear to know, which suggests that future research may need to think of alternative ways of recording SES that do not rely on self-report alone.

Conclusions

The current study supports previous research showing that there are gender differences in mental well-being and psychosomatic symptomatology in Scottish school children. The observed differences were greater than in previous studies, indicating that there are robust gender differences that need to be addressed. By adding additional variables and running multivariate analyses, the gender effect was confirmed and further research is suggested, particularly looking at birth order and family dynamics.

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