Concern about tall stature during adolescence and depression in later life

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Abstract

Objective

This retrospective cohort study aimed to examine the long-term psychosocial outcomes for women assessed or treated during adolescence for tall stature. .

Method

Women assessed or treated for tall stature identified from the records of Australian paediatricians were eligible to participate. Psychosocial outcomes were measured using the depression, mania and eating disorders modules of the Composite International Diagnostic Interview (CIDI), the SF-36, and an index of social support.

Results

There was no significant difference between treated and untreated women in the prevalence of 12 month or lifetime major depression, eating disorders, scores on the SF-36 mental health summary scale, or the index of social support. However, compared with the findings of population-based studies, the prevalence of major depression in both treated and untreated tall girls was high (12 month prevalence untreated 10.5%, treated 10.5%; lifetime prevalence untreated 29.3%, treated 30.5%). Factors significantly associated with lifetime major depression in this study were self-reported difficulties during adolescence being the reason for seeking a medical assessment of height (OR 2.25, 95% CI 1.4-3.6) and a negative experience of the assessment or treatment procedures (OR 2.04, 95% CI 1.4-3.0).

Conclusion

Long-term follow-up of a large cohort of tall girls showed that psychological outcomes among both treated and untreated women were poor and that the intended psychosocial

benefit of treatment may not have been realized. The findings highlight the importance of attending to the mental health of adolescents presenting for management of conditions where self-concept and body image are a primary focus.

Keywords

Tall girls, mental health, major depression, oestrogen

Background

Concern about negative psychosocial consequences of tall stature in girls has prompted the use of hormone treatment to reduce adult height since the 1950s (Binder et al., 1997; Goldzieher, 1956; Trygstad, 1986). This treatment, available in the USA, Australia, and Europe (Barnard et al., 2002; Conte et al., 1978; de Waal et al, 1995; Normann et al., 1991; Wettenhall, 1981), is based on the observation that oestrogen leads to epiphyseal fusion of long bones in normal female pubertal development. High doses of oestrogen given in puberty appear to reduce final height by accelerating this process.

The reasons a medical assessment of height was sought have been reported to include the girl experiencing difficulties at school; and, a family's concerns about the girl's ability to find a partner or to enter certain professions such as ballet (Crawford, 1978; Drop et al., 1998; Wettenhall et al., 1975). In general, girls whose predicted height was greater than 177cm (or 183cm in some series) were considered eligible for treatment. The treatment is still available but the number of girls treated in recent years in less than in the 1960s-1980s, possibly because of greater social acceptance of tall stature (Barnard et al., 2002).

Little is known about the psychosocial effects of tallness and its treatment. Only one study, conducted in the Netherlands, has examined psychological functioning in adulthood. The study had a relatively short period of follow-up: participants had a mean age of 25.5years for treated women and 24.6 years for untreated women. No significant differences were found between treated and untreated women or population norms on a measure of general psychological well-being (de Waal, 1996).

The aim of the present study was to examine the longer-term psychological outcomes in a large cohort of Australian tall girls and to determine whether they were associated with treatment or height.

METHODS

Subjects

This retrospective cohort study identified women from the records of Australian paediatricians who treated tall girls from 1959 to 1993. Most women were identified through the records of one paediatric endocrinologist. These records comprised a complete cohort of all girls seen for tall stature during clinical practice. Other treating doctors (n=50) were identified through professional networks and by treated women but only three were able to identify eligible participants and were willing to assist.

Women whose parents had sought a medical opinion about their tall stature and who had had a radiological assessment (hand and wrist x-ray) of their skeletal age were eligible to participate. They included girls who received oestrogen treatment (3mg diethylstilbestrol daily or 150μg ethinyl estradiol daily) in adolescence to reduce their adult height (treated group) and those who did not (untreated group). Girls with an estimated mature height prediction of greater than 177cm tall were generally considered eligible for treatment although in some cases girls with a lesser height prediction were treated. Further detail about the sample and other study outcomes has been published elsewhere (Pyett et al., 2005; Venn et al., 2004) . The mean age of participants at assessment was 11.3 years (range 1-18) and at follow-up was 38.7 years (range 23-55).

Data collection

Women were traced with the use of electoral rolls and telephone listings then contacted by mail and invited to complete a postal questionnaire and computer assisted telephone interview (CATI). Non-respondents were sent a reminder letter and telephoned. At the commencement of the study five focus groups were conducted with treated and untreated women to inform the development of the study measures. The postal questionnaire sought demographic information and details of the experience of assessment and treatment. It included the SF-36 and a measure of social support. The CATI included questions about reproductive history, fertility problems, sexual history and the depression, mania and eating disorders modules of the Composite International Diagnostic Interview (CIDI). Treatment details were abstracted from medical records, subject to availability, for those women who provided consent. The study had ethics committee approval and participants gave written informed consent.

Study measures

Given that the treatment was offered primarily for psychosocial reasons, examination of mental health outcomes was an *a priori* aim. No formal psychological assessment was made at the time of the initial assessment in adolescence.

The CIDI is a highly standardized diagnostic interview for the assessment of mental disorders according to ICD-10 and DSM-IV diagnostic criteria. It was developed to be administered by non-clinical interviewers and has been used in a number of research settings (Australian Bureau of Statistics, 1997a; Kessler, 1994; Robins et al., 1988; Wittchen, 1994). The CIDI-Auto (ver. 2.1) is a computerized version of the interview that can be administered by telephone (Wittchen, 1994). This paper presents DSM-IV criteria. While the CIDI contains modules that measure a range of mental health outcomes, the depression, mania and eating

disorders modules were used as these were the outcomes of primary interest to this study. Estimates of both 12 month and lifetime prevalence were obtained.

The SF-36, a standard international instrument of generic measure of health status, comprises 36 items that are scored as 8 multi-item scales and from which two summary measures - the mental and physical health summary scales are computed. Lower scores on these summary scores indicate lower levels of functioning (McHorney et al., 1994; Ware, 1992; Ware et al., 1994).

The 15 item Index of Perceived Social Support (Henderson et al., 1978) was designed to assess respondents' perceptions of the social interaction available to them and their satisfaction with it. For each item, women were asked to rate on a scale of 1 to 5 how strongly they agreed or disagreed with each statement. Developed in Australia, the language and concepts are relevant to Australian participants.

The questionnaire asked women to reflect on their experiences as a tall adolescent and of the assessment and treatment procedures. Women were asked to recall the reason for seeking a medical opinion about her height. Precoded responses, developed from the focus group data were provided. For the purpose of analysis these were subsequently grouped into responses that related to difficulties the tall girl was having at the time of assessment (e.g. she was unhappy, or was having difficulties at school) or to other concerns (e.g. mother's or father's concern about daughter being too tall). Other questions included: 'Are you satisfied with your current height?', 'Are you satisfied with the decision to have (or not have) treatment?', 'Do you feel you had an active say in the decision regarding treatment?'.

The assessment procedures involved measurement of height and weight, a complete physical examination including assessment of the girl's stage of pubertal development, x-rays to assess skeletal age and to estimate mature height (Wettenhall et al., 1975). Occasionally a photographic record was also taken. Women who were treated were reviewed using the same procedures at regular intervals (Wettenhall et al., 1975). In the questionnaire women were asked how they felt during these procedures using pre-specified responses developed from the focus group data. A summary variable was computed for women who reported a negative experience of these procedures (intrusive, scary, distressed and painful were considered to be negative responses).

Statistical methods

Stata software (version 8) (StataCorp, 2003), was used for all statistical analyses. Differences between groups on continuous variables (e.g. SF-36, index of perceived social support) were tested using non-parametric measures (two groups: Wilcoxon ranksum test, three groups: Kruskal-Wallis test). Differences between groups on categorical variables (e.g. major depression) were tested using the chi-square statistic and unadjusted odds ratios. Statistical significance was inferred at a p value < 0.05.

SPSS syntax files produced by the World Health Organization CIDI Centre in Sydney, Australia were used to generate DSM-IV and ICD-10 classification criteria for the depression, mania and eating disorders modules of the CIDI.

The association between lifetime major depression and treatment status, controlling for possible confounding factors is reported as an adjusted odds ratio. All relevant variables that were associated at a univariable level with lifetime major depression, or where there was a

difference between treated and untreated women at a p value of 0.2 or below, were entered into the initial logistic regression model. Variables were removed manually if there was no significant change in the log likelihood ratio. Variables that were not significant at $p \leq 0.2$ at the univariable level were then entered into the model one at a time to check for confounding (Hosmer et al., 2000). Current age and estimated mature height estimate were entered for *a priori* reasons and remained in the model regardless of statistical significance.

The Physical Component Summary (PCS) and Mental Component Summary (MCS) scores of the SF-36 were calculated using norms from the 1995 Australian National Health Survey (Australian Bureau of Statistics, 1997b) using female age-group subscale means appropriate for this cohort of tall girls.

Responses to the 15 item Index of Perceived Social Support were summed to form a scale with a possible range from 15-75, with higher scores indicating more positive responses (Henderson et al., 1978).

Assuming untreated women have a similar lifetime prevalence of depression to women in the general population (18.6%), a power calculation demonstrated that the study could detect with 80% power (alpha 0.05) a decreased odds of 0.6 or an increased odds of 1.7 among treated women.

Results

Characteristics of study participants

A cohort of 1,252 eligible subjects (413 treated and 835 untreated) was identified from the records of paediatric endocrinologists. A total of 1,069 (88% of treated and 84% of untreated)

were traced and invited to participate in the study. Of these, 284 treated and 429 untreated women returned the questionnaire and 259 treated women (71% of those traced) and 391 (56%) untreated women completed the telephone interview. Therefore, data on mental health outcomes (provided in the telephone interview) were available for 650 women.

There was no significant difference between responders and non-responders in current age or age at initial visit. There was a small but significant difference in the mean estimated mature height (EMH) prediction between the two groups (responders 176.2 cm, SD 5.1, non-responders 175.1 cm, SD 4.9, $p<0.001$). Among responders the mean age of treated women was significantly older than untreated women (mean age of treated women 40.0 years, untreated 37.8 years, $p<0.001$) and the mean current height of treated women was significantly taller (179.4cm versus 176.5cm, $p<0.001$). As expected treated women had a significantly greater EMH prediction than untreated women (treated 179.6cm, untreated 174.1cm, $p<0.001$). There was no significant difference between treated and untreated women on employment status, income or smoking.

Is treatment associated with mental health outcomes?

There was no significant difference between treated and untreated women in the prevalence of either 12 month or lifetime affective disorders, major depression, the SF-36 or the index of perceived social support (Table 1). Among all respondents the lifetime prevalence (DSM-IV) of affective disorders (depression, mania and dysthymia) was 29.7%, of major depression was 28.3% and dysthymia was 0.9%. Using ICD-10 criteria gave similar results. The mean age of onset of major depression was 27 years (range 8 to 52 years) and there was no significant difference in age of onset between treated and untreated women. There was no difference in

the prevalence of depression among treated women according to age at commencement, type or duration of treatment

Insert Table 1

Insert Table 2

Table 2 reports the association between lifetime major depression and treatment status taking into account a number of potential confounders. Once these factors relating to women's experiences and reflections on the assessment or treatment process were taken into account treated women still had a similar odds of experiencing an episode of lifetime major depression to untreated women (OR 0.96, 95% CI 0.62-1.49) (Table 2).

Given that no significant difference in the prevalence of depression was observed by treatment status even after adjusting for potential confounders, further analysis was undertaken to examine other factors that were associated with depression in this cohort.

Views of the assessment/treatment process and prevalence of depression

After controlling for the other variables in the model, the factors that remained significantly associated with an increased odds of lifetime major depression were: the girl having difficulties being the reason for seeking a medical opinion about height, reporting a negative experience of the assessment or treatment procedures and not having an 'active say' in the treatment decision (Table 2). Other factors tested but found not to be significantly associated with depression were**:** satisfaction with current height, difference between current height and recalled EMH, difference between current height and EMH based on medical record**,** person

who made the decision about treatment, age at menarche, age at first assessment, pubertal development at first assessment (Tanner score), height of mother, and height of father (data not shown).

Is height associated with mental health outcomes?

Table 3 reports mental health outcomes by height. There was no relationship between height and having an episode of lifetime major depression (Table 3). However, there was a suggestion that taller women had poorer current mental health (12 month prevalence of affective disorders, chi-square for trend 3.45, p=0.06 and mean SF-36 MCS p=0.06). When height was analyzed as a continuous variable (adjusting for age and treatment status) there was a small but not significant increase in the odds of having a diagnosis of an affective disorder in the last 12 months for every 2.5 cm (1 inch) increase in height (OR 1.10, 95% CI 0.95-1.28).

Insert Table 3

Discussion

This unique study is the first to have investigated long-term psychosocial outcomes in a large cohort of women who were assessed or treated as adolescents for tall stature. No significant differences were found between treated and untreated women in their history of affective disorders or major depression. The two groups were similar in their SF-36 summary scores for mental and physical health, and on the index of perceived social support.

While there were no significant differences between treated and untreated women, both groups had a significantly higher prevalence of 12 month and lifetime major depression than

women of a similar age included in population-based studies (Australian Bureau of Statistics, 1997a; Blazer et al., 1994; Weissman et al., 1996). For example, 26.7% of 45-54 year old women in this study had experienced lifetime major depression compared with 21.8% of 45-54 year olds in the USA National Comorbidity Study (Blazer et al., 1994). Twelve month prevalence of affective disorders reported in the Australian Survey of Mental Health and Wellbeing (Australian Bureau of Statistics, 1997a) was 8% (ICD-10) compared with 14.1% in the current study. While the apparent increase in prevalence is quite striking, differences in study designs, measurement tools, classification systems and population characteristics must be acknowledged.

The finding of a significantly increased risk of depression in comparison to population rates raises the question of whether this may be due to responder bias. This question can be examined in two ways. Firstly, the study also included a small group of women (n=129) who heard about study from a variety of sources who self-referred to the study. We did not include them in the current analysis due to concerns about representativeness. The lifetime prevalence of major depression among these women was significantly higher than among women identified from medical records (38.0% versus 28.3%, p=0.03). They were not significantly different on current age, self-reported current height, marital status or history of smoking. While there appears to be a suggestion that women who self-referred to the study may have been motivated to participate due to mental health concerns or concerns about the experience in general this is unlikely to be the case among women contacted via medical records, the majority of whom had no prior knowledge of the study. While it is possible that women with a history of depression were more likely to agree to participate in the study, other studies of mental health suggest that women who are depressed may be less likely to respond (Cox et al., 1977). The second way is to conduct a sensitivity analysis that examines the

potential effect of selective participation in either the treated or untreated groups on the findings. These results suggest that selective participation in either the group is unlikely to have explained the significantly increased prevalence in comparison to population-based studies. An estimate of the lifetime prevalence of depression in this cohort, assuming that all non-respondents had the same prevalence of depression as the general female population of the same age, indicates that the prevalence would still be higher than expected in the tall girl's cohort.

Only one study, conducted in The Netherlands, examined psychosocial outcomes among a cohort of treated and untreated tall girls in the medium term (de Waal, 1996). They found no increased risk of psychological problems in treated or untreated women compared to population norms (de Waal, 1996). Our study incorporated a longer period of follow-up (mean age of participants 38 years compared with 25 years in the Dutch study) and the mean age of onset of depression in our study was 26.4 years, older than the mean age of participants in the Dutch study. Our study used the CIDI which allows classification according to clinically significant diagnostic criteria. The Dutch study used the Delft Questionnaire, which measures general unspecified psychological problems. It may measure a dimension similar to the mental health summary score on the SF-36, with which we also found no difference compared with population norms.

The high prevalence of lifetime major depression among both treated and untreated tall girls in this cohort is a striking finding. Possible explanations include: a high rate of underlying mental health problems already present at the time of assessment, selection bias in the families that sought assessment, the experience of the assessment and treatment procedures may have predisposed women to depression, and tall stature itself may have been a risk factor.

No systematic psychological evaluation was carried out prior to assessment so we cannot fully address the possibility that amongst this cohort there was a high rate of underlying mental health problems during adolescence prior to seeking assessment. When women were asked the reason the family sought a medical assessment of tall stature, only 17.5% indicated the reason was because they were unhappy or were having difficulties at school.

Families that sought clinical assessment for their tall daughters are likely to have differed from those that did not. However, the aim of this study was to investigate psychological outcomes in girls who were assessed or treated for tall stature. An assessment was sought because either the parents or the girl were concerned that the girls' body might disadvantage her in some way. Underlying concerns, not addressed by hormone treatment alone may then become manifest later in life as a depressive disorder. Short-term follow-up studies of individuals treated during adolescence for eating disorders have also suggested higher rates of subsequent depression (Johnson et al., 2002; Ohring et al., 2002). The findings have important implications not only for the treatment of those presenting to paediatricians with tall stature but also for a range of other problems of body image such as short stature and obesity.

Another possibility is that the assessment or treatment procedures predisposed women to depression either because it medicalised the issue of their height or because of the intrusiveness of the assessment and treatment and its effect on adolescent girls. In this study there was evidence that women who reported a negative experience of assessment or treatment procedures were significantly more likely to have a history of depression than women who did not, which is consistent with other studies of the role of negative life experiences on the onset of depression (Kendler et al., 2002; Kessler, 2000; Kessler et al.,

1997; Patton et al., 2003; Wilhelm et al., 2003). It is, however, also possible that women who have experienced depression may recall early life events more negatively than women who have not experienced depression.

A final explanation is that tall stature itself may be associated with depression. This study is not able to address this question completely as all women in the study were by definition 'tall'. However, within this cohort of tall women, an examination of outcomes by final adult height showed that while there was a suggestion that current mental health was poorer in the tallest women (those greater than 181cm); the difference was not statistically significant and was not seen for prevalence of lifetime major depression.

Conclusion

In summary, the dual premise for treating 'tall girls' with estrogens was that their predicted mature height was more likely to be associated with substantial psychosocial problems and that treatment to reduce their height would help prevent those outcomes. That dual premise is not supported by the study findings: women in this cohort whether treated or untreated had a significantly higher prevalence of depression than population samples in Australia and the US. It questions the rationale behind medical treatment and suggests that societal attitudes towards height and body image in general should be considered thoughtfully. The findings highlight the importance of attending to the mental health of adolescents presenting for management of conditions where self-concept and body image are a primary focus. Both the treatments of pre-existing and emerging mental disorders, as well as a respectful, empowering and minimally intrusive engagement of the young patient seem likely to be important aspects of management.

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Table 1 – Psychosocial outcomes in study participants by treatment status

Outcome	Treated (n=259)		Untreated (n=391)		
	Number	**%**	**Number**	**%**	p value
CIDI – DSM-IV criteria					
12 month prevalence					
Affective disorders	30	11.6	46	11.8	0.9
Major depression	29	11.2	42	10.7	0.9
Dysthymia	0	0	2	0.5	
Lifetime					
Affective disorders	73	28.2	120	30.7	0.5
Major depression	69	26.6	115	29.4	0.4
Dysthymia	3	1.2	3	0.8	0.2
Anorexia nervosa	2	0.8	0	0	
Bulimia nervosa	1	0.4	10	2.6	0.04
SF-36	**mean**	**95% CI**	**mean**	**95% CI**	
Mental Health Summary Score (MCS)	49.7	48.5-50.9	49.5	48.5-50.5	0.7
Physical Health Summary Score (PCS)	51.0	50.1-52.0	50.1	49.3-50.9	0.08
Index of perceived social support	61.8	60.8-62.9	61.3	60.4-62.2	0.7

Table 2: Association between treatment factors and lifetime major depression

	Depressed (n=184)		Not depressed (n=466)		Unadjusted odds ratio		Adjusted odds ratio	
	Number	%	Number	%	OR	95% CI	OR	95% CI
Treatment status								
Treated	69	26.6	190	73.4	0.87	0.61-1.24	0.96	0.62-1.49
Untreated	115	29.4	276	70.6	1.0		1.0	ref
Estimated mature height								
<177cm	105	29.8	248	70.3	1.0	ref	1.0	ref
177.1-182.9	64	27.8	166	72.2	0.91	0.63-1.32	0.92	0.59-1.42
183+	14	21.9	50	78.1	0.66	0.35-1.25	0.64	0.31-1.33
Missing	1	33.3	2	66.7				
Reason for seeking medical opinion – girl having difficulties								
Girl unhappy or having difficulties at school	46	40.4	68	59.7	1.95	1.28-2.97	2.25	1.40-3.63
Other reasons	138	25.8	397	74.2	1.0	ref	1.0	ref
Missing	0		1					
Active say in making decision whether or not to have treatment								
Did not have active say	98	33.1	198	66.9	1.0	ref	1.0	ref
Had active say	73	24.5	225	75.5	0.66	0.46-0.94	0.64	0.42-0.96
Missing	13	23.2	43	76.8	0.61	0.31-1.19	0.48	0.22-1.05
Satisfaction with decision to proceed (or not) with treatment							Not entered	
Not satisfied	39	39.4	60	60.6	1.0	ref		
Satisfied	137	26.1	389	74.0	0.54	0.34-0.85		

Missing	8	32.0	17	68.0				
Experience of assessment/treatment – negative experiences reported								
No	86	22.7	293	77.3	1.0	ref	1.0	ref
Yes	98	36.3	172	63.7	1.94	1.37-2.74	2.04	1.39-2.99
Missing	0		1					
Explanation about what treatment involved							NS	
Never	51	41.1	73	58.9	1.0	ref		
Ever	111	25.8	319	74.2	0.50	0.33-0.76		
Missing	22	22.9	74	77.1	0.43	0.23-0.77		
Who first suggested medical assessment of height							NS	
Doctor	50	29.8	118	70.2	1.25	0.88-1.78		
Family friend	17	41.5	24	58.5	1.87	1.02-3.43		
Parents	104	26.3	292	73.7	1.0	ref		
Other	9	32.1	19	67.9	1.36	0.66-2.82		
Missing	4	23.5	13	76.5				

*Adjusted odds ratios (n=611) due to missing values. Adjusted odds ratios adjusted for age and the other variables shown in the final model
NS=not significant

Table 3 – Psychosocial outcomes in study participants by final adult height

Characteristic	<177cm (n=226)		177-180 (n=277)		181.0+ (n=146)		P value
	Number	**%**	**Number**	**%**	**Number**	**%**	
CIDI – DSM-IV criteria							
12 month prevalence							
Affective disorders	22	9.7	30	10.8	24	16.4	0.1
Major depression	22	9.7	29	10.5	20	13.7	0.5
Dysthymia	0	0	0	0	2	1.4	Not calculated
Lifetime							
Affective disorders	69	30.5	72	26.0	52	35.6	0.1
Major depression	68	30.1	69	24.9	47	32.2	0.2
Dysthymia	0	0	2	0.7	4	2.7	Not calculated
SF-36	**mean**	**95% CI**	**mean**	**95% CI**	**Mean**	**95% CI**	
Mental Health Summary Score (MCS)	50.7	49.5-51.8	49.4	48.2-50.7	48.16	46.5-49.8	0.06
Physical Health Summary Score (PCS)	50.2	49.1-51.2	51.0	50.0-51.9	50.0	48.5-51.4	0.3
Index of perceived social support	62.1	60.9-63.2	61.3	60.3-62.3	61.2	59.6-62.8	0.6