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ORIGINAL ARTICLE

A longitudinal study of adolescent dysmenorrhoea into adulthood

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Abstract

Dysmenorrhoea is the most common gynaecological symptom in adolescents. Secondary dysmenorrhoea is mostly due to endometriosis. There are no known follow-up studies of dysmenorrhoea into adulthood. Cases of endometriosis often have a long history of dysmenorrhea; however, studies to date have been retrospective. This longitudinal cohort study aimed at analysing the long-term outcomes of dysmenorrhoea and associated rate of endometriosis identified in this cohort. Participants of a study of adolescents seen for dysmenorrhoea were followed-up at an average of 10.24 years. Of those contactable (74), 70 (94.6%) were included. As adults, 19 (27.1%) had slight or no pain with menstruation. Increased age of menarche was found to be associated with no menstrual pain in adulthood (OR 2.10, $p = 0.034$). No adolescent characteristic studied was found to be associated with severe or very severe dysmenorrhoea as an adult. At follow-up, 13 young women (18.6%) had been diagnosed with endometriosis. All cases of endometriosis were mild. The use of the oral contraceptive pill as an adolescent and feeling an improvement in symptoms with treatment as an adolescent were found to be associated with a diagnosis of endometriosis.

Conclusion: These findings are important for counselling adolescents regarding this common presentation.

What is Known:
- *Dysmenorrhoea is the most common gynaecological complaint for adolescents*

What is New:
- *Dysmenorrhoea from adolescence resolves in 1 in 4 of young women and no adolescent characteristics predict severe or very severe pain with menstruation in adults.*
- *Only 1 in 5 of women were found to have endometriosis (all mild disease), despite a mean of 10 years of preceding dysmenorrhoea.*

Keywords Adolescents · Dysmenorrhoea · Endometriosis · Gynaecology · Laparoscopy

Abbreviations

DIE	Deep infiltrating endometriosis
HMB	Heavy menstrual bleeding
NSAIDs	Non-steroidal anti-inflammatory drugs
OCP	Oral contraceptive pill

Introduction

Dysmenorrhoea is the most common gynaecological presentation in adolescents [16, 33]. It is estimated to impact 20–90% of young women [17, 33] and is the leading cause of missed school [5]. Dysmenorrhoea is typically classified as primary or secondary depending on the absence or presence, respectively, of an underlying organic pathology such as fibroids, endometriosis, adenomyosis or uterine anomalies [35]. Primary dysmenorrhoea is more common in adolescents [22].

Data on the natural history of dysmenorrhoea is lacking. Although there are follow-up studies of adolescents with endometriosis [1], adults with dysmenorrhoea [21, 40, 47, 48] and dysmenorrhoea in adolescents over less than 12 months

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[14, 30], there are no identified studies of adolescents with dysmenorrhoea into adulthood. It is a recognized gap in the literature [8, 18, 33]. Available data have demonstrated improvements with age and childbearing [48], consistent with a lower prevalence of dysmenorrhoea in adults [32].

Endometriosis is thought to be the leading cause of secondary dysmenorrhoea in women [16]. Estimates of the prevalence in reproductive age women between studies vary widely from 2 to 43% [10, 18, 25, 29, 35], but most commonly cited at 10% [11, 34, 44]. While there are retrospective studies of endometriosis reporting a 5 to 10-year delay in diagnosis from onset of symptoms [13, 15], there are no studies to date that have analysed the rates and associations of endometriosis in those who have experienced severe dysmenorrhoea in adolescence.

We therefore hypothesized that, in this population which had a history of significant dysmenorrhoea requiring review at a tertiary center and often multiple treatments, there would be higher rates in adulthood of chronic pain, endometriosis and infertility.

Information regarding the experiences of these young women into adulthood is important for counselling adolescents, as well as guiding decision-making regarding investigation and treatment in this population.

Methods

This is a follow-up of participants from a study of adolescents referred with dysmenorrhoea to a tertiary children's hospital and a private paediatric and adolescent gynaecology practice. The original study was a retrospective audit of patients seen between 1997 and 2004. Young women from the original study were contacted to participate in the follow-up via directly via mail or telephone or through tracing letters to their parents, with 'permission to contact' letters sent first. Interest in participating was then returned via mail, email, text or phone call. Exclusion criteria included cases with complete obstruction of menstrual flow, pre-menarcheal presentations of pelvic pain, other medical conditions that they felt might impact their ability to give an accurate account of their symptoms and women who could not be located (following mail, state electoral roll search and failed telephone contact).

Questionnaires were completed via standardised telephone interview (with verbatim transcription of responses), email (via Survey Monkey) and mail. The questionnaire (Appendix I) included the Menstrual Disorders of Teenagers (MDOT) questionnaire [32] as well as additional questions regarding operative procedures for pelvic pain, fertility and pregnancy history. Permission to access operation reports was requested and formalised with release of information forms. Data was collected and analysed regarding basic demographics, dysmenorrhoea rates and severity, menstrual characteristics, management of dysmenorrhoea, impact of dysmenorrhoea on work/study and sport/social activities, adolescent features associated with severe or very severe dysmenorrhoea as an adult and features associated with the diagnosis of endometriosis.

Microsoft Excel, Survey Monkey and JASP (version 0.8.6) were used for data collection and analysis. Chi-squared tests (or Fisher's exact test when the sample size was less than five) and t tests were used for comparative analysis. Regression analysis was used to analyse for features associated with the presence of dysmenorrhoea into adulthood and also the presence of endometriosis on laparoscopy. Consent was obtained from participants, and ethics approval completed via the tertiary children's hospital research and ethics committee.

Results

Study cohort

Of 148 in the original cohort, 77 women could be contacted, 62 were untraceable, one woman was deceased and eight lost to middle person communication (Fig. 1). Three women self-excluded for conditions they felt rendered answering the questionnaire too difficult: one woman was pregnant, another reported Crohn disease with associated abdominal and pelvic pain and the third reported an intellectual disability and her carer was not available for the survey. Four women declined to participate; thus, 70 of 74 (94.6%) contactable women participated, 55 (79%) by phone interview and 15 (21%) by completing the survey online. The follow-up interval was 4 to 14 years, with a mean of 10.24 years. The mean age of participants was 26.04 years (ranging 17–37 years, SD 3.25 years).

Those included were found to be comparable to those not included from the original dysmenorrhoea cohort regarding mean number of visits, age of initial presentation, age of menarche, duration of symptoms, school absenteeism rates, days of dysmenorrhoea greater than two, presence of heavy menstrual bleeding (HMB) and level of satisfaction with treatment. There was no significant difference found between pain scores for those followed-up at 4 years compared with those at 14 years ($p = 0.8$).

Of participants, 13 (16%) were amenorrhoeic at the time of completing the questionnaire. Of this group, six (46%) were suppressing periods with hormonal therapies, another 5 (38%) were pregnant or breast feeding, one woman was symptomatic with PCOS and another was likely anovulatory secondary to athletic training. This group was found to be similar to the remainder of the

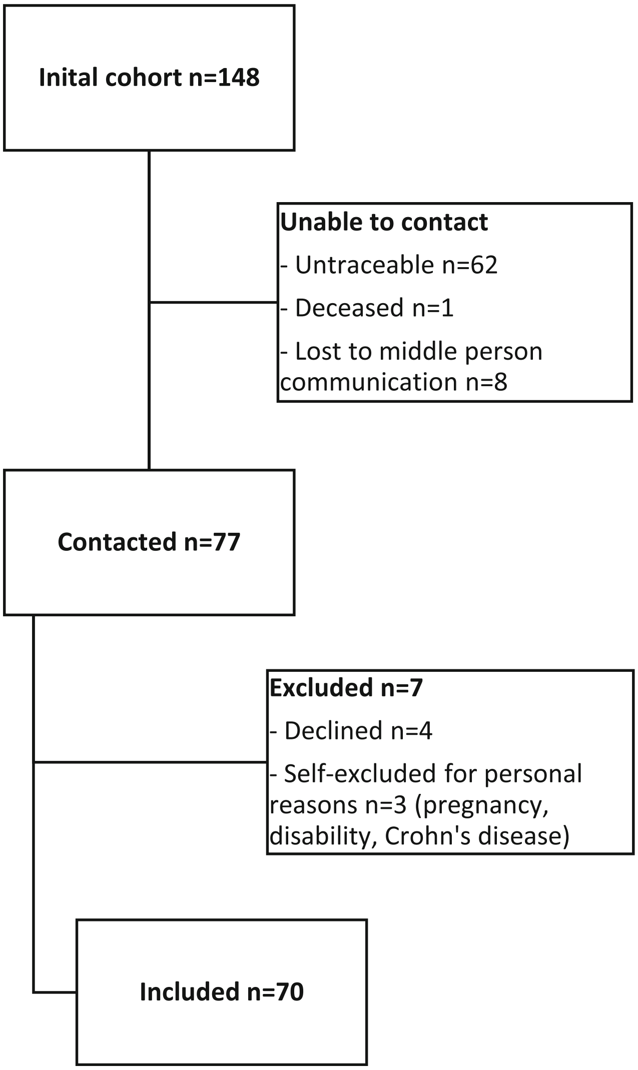

Fig. 1 Flow chart of recruitment to the study

cohort in terms of the majority of adolescent characteristics (including age of menarche, menses impact on school attendance, satisfaction with treatment, undergoing laparoscopy, heaviness of period, family history of dysmenorrhoea), and adult characteristics (including heaviness of period, undergoing laparoscopy, finding of endometriosis, missing work/study or social/sport due to dysmenorrhoea). However, those in the amenorrhoeic group were found to have had a significantly higher number of visits to the gynaecologist as adolescents (mean of 6.38 as compared with 3.8, $p = 0.03$) and reported more than 2 days of pain with menses as an adolescent (102 (69%) as compared with 10 (18%), $p < 0.001$).

Dysmenorrhoea rates, menstrual characteristics and management of dysmenorrhoea

As adults, 11 (15.7%) reported experiencing very severe dysmenorrhoea and 22 (31.4%) reported severe dysmenorrhoea. No pain to slight pain was reported by 19 (27.1%). Participants' menstruation characteristics and associated features are outlined in Table 1. At follow-up, more participants reported diarrhoea associated with menses than they did as adolescents (30 as compared with 19, $p = 0.004$). There were no significant differences found in rates of non-cyclical pain, irregular cycles, HMB, nausea, vomiting, bloating or headaches.

Table 1 Characteristics of menstruation and associated features

Characteristic	Percentage (number)
Length of menstruation	
Less than 3 days	5.9% (4)
3 to 7 days	72.6% (51)
8 to 10 days	20% (14)
More than 10 days	1.5% (1)
Presence and severity of pain with menses	
None	12.9% (9)
Slight	14.3% (10)
Moderate	25.7% (18)
Severe	31.4% (22)
Very severe	15.7% (11)
Heaviness of menstrual flow	
Light	7.1% (5)
Moderate	45.7% (32)
Heavy	32.9% (23)
Very heavy	14.3% (10)
Regularity of menses	
Regular	69.9% (48)
Irregular	30.4% (21)
Associated symptoms	
Nausea	50% (35)
Vomiting	7.1% (5)
Headache	58.6% (41)
Bloating	80.0% (56)
Lower backache	71.4% (50)
Diarrhoea	42.9% (30)
Indigestion	5.7% (4)
Dyschezia	23.4% (17)
Sexually active in preceding 3 months	71.4% (50)
Of those pain experienced with intercourse:	
Never	54.0% (27)
Sometimes	18.0% (9)
Most times	16.0% (8)
Always	12.0% (6)

Data are given as percentage (absolute value)

Management of dysmenorrhoea is summarised in Table 2. Of adult participants, 41 (58.6%) reported seeking further medical management for dysmenorrhoea and 43 (61.4%) reported being happy with treatment.

Table 2 Management of dysmenorrhoea—used cumulatively as an adolescent compared with use as an adult in the last 3 months

Management of dysmenorrhoea	Management as adolescent ($n = 148$)	Current management ($n = 61$)	p value
Pain killers	81% (121)	80.3% (49)	0.646
OCP	79% (117)	44.3% (27)	< 0.001**
Cyklokapron	20% (30)	1.6% (1)	< 0.001**
Oral progesterone	15% (22)	0*	0.001*
DMPA	5% (8)	0	0.1082
Hot water bottle/heat pack	No reliable data	24.6% (15)	NA
Naturopathic medications	2% (3)	8.2% (5)	0.0485*
Etonogestrel implant	1% (2)	4.9% (3)	0.1499
Levonorgestrel IUD	1% (1)	4.9% (3)	0.0757
Diet, supplements	7% (11)	3.3% (2)	NA
Exercise	No reliable data	4.9% (3)	NA
Acupuncture	No reliable data	1.6% (1)	NA
Homoeopathy	No reliable data	1.6% (1)	NA

Data expressed as percentage of that total group number, n, and (value); *p value < 0.05, **p value < 0.001

Impact of menses on work/study and sport/social activities

There was a significant difference in the number of participants missing study or work due to pain with periods (21 or 34%) compared with those missing social or sporting activities (35 or 57%) as an adult ($p = 0.007$). There was no significant difference found between rates of adolescents missing school (15 or 25%) and adults missing study or work (20 or 33%) ($p = 0.49$), see Fig. 2.

Adolescent features associated with severe or very severe dysmenorrhoea as an adult

No adolescent characteristics analysed (HMB, days of schools missed, menarche, presence of endometriosis as an adolescent, parity, satisfaction with treatment, use of the oral contraceptive pill (OCP) (cyclical or continuous), associated menstrual symptoms, number of gynaecology visits) were found to be predictive of severe or very severe dysmenorrhoea as an adult. Increased age of menarche was associated with having no pain with menstruation as an adult (OR 2.10, $p = 0.034$).

Dysmenorrhoea in adolescence and endometriosis in adulthood

Since the initial study, 24 (34%) participants had had laparoscopy. Endometriosis was found at 13 of these (19%), ovarian cysts at five (7%) and no abnormalities at three (4%). All cases of endometriosis were reported as mild in the operation notes. The finding of endometriosis at laparoscopy in adulthood was significantly associated with severe or very severe dysmenorrhoea as an adult (OR 4.93, $p = 0.025$) and reporting improvement with treatment as an adolescent (OR 7.83, $p = 0.04$). Those found to have endometriosis were less likely to have

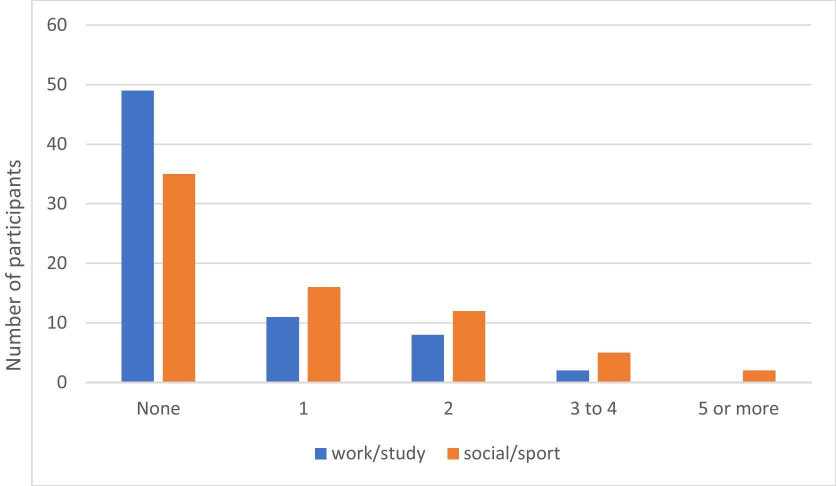

Fig. 2 Number of participants in adulthood missing school/work or social/sporting activities, by number of days missed in the preceding 3 months in adulthood

reported to be happy with treatment in adolescence (OR 0.162, $p = 0.011$). There was no significant relationship found between diagnosis of endometriosis and age of menarche, heaviness of menses, days of pain more than two as an adolescent, use of the OCP at any time, number of visits to the gynaecologist, and reported levels of distress, nor associated symptoms as an adolescent. Features as an adult associated with having had laparoscopy or not and the diagnosis of endometriosis at laparoscopy are compared in Table 3.

Of participants, 19 (27%) had been pregnant, four of whom had known endometriosis, with 19 babies born to the cohort. Two participants, one of whom had endometriosis, had been trying for more than 1 year to conceive.

Discussion

Study cohort

This study is the first of its kind to shed light onto the experiences of adolescents with dysmenorrhoea into adulthood. Of those who could be contacted, we had a notably high participation rate of 90% at an average of 10.24 years.

Dysmenorrhoea rates, menstrual characteristics and management of dysmenorrhoea

Interestingly, despite a protracted history of dysmenorrhoea that had required referral to a gynaecologist in adolescence, the overall rate of dysmenorrhoea as adults (73%) was within the range reported for all reproductive-age women (30–80%) [20, 48]. The rates of severe dysmenorrhoea (16%) were similar to those in the general population (10–25% [20, 40]), despite this being a presumably higher risk population due to the presence of significant symptoms in adolescence resulting in their referral to a tertiary adolescent gynaecology service. Our study found resolution of dysmenorrhoea in 27% of participants, consistent with lower rates of dysmenorrhoea reported in adults generally [40]. Resolution may potentially in part reflect treatment received as adolescents, although other factors may include changes in perception and reporting with age. More generally, it is theorised that it is secondary to maturation of the hypothalamic-pituitary-ovarian axis; however, this is complicated by higher rates of anovulatory cycles in adolescents which are purported to be painless [48].

Associated menstrual symptoms experienced were similar in adolescence and adolescents, excepting higher rates of diarrhoea as adults. Diarrhoea is sometimes used as an indicator of severity (as in the Multi-dimensional Scoring System [42]); however, the small sample size and limited questionnaire does not allow this to be disentangled from other possible gastrointestinal causes. A relatively high number reported dyspareunia as adults, with 20% having pain with intercourse on most occasions or always. Global figures range from 8 to 22% [24].

Non-steroidal anti-inflammatory drugs (NSAIDs) and the OCP are the evidenced-based treatment of dysmenorrhoea [28]. Response rates to NSAIDs have been reported between

Table 3 Features as an adult who has had (a) no laparoscopy compared with laparoscopy and no finding of endometriosis, (b) no laparoscopy compared with laparoscopy and findings of endometriosis, (c) laparoscopy and no findings of endometriosis compared with laparoscopy and findings of endometriosis

Features as an adult	No laparoscopy ($n = 46$)	Laparoscopy ($n = 24$)		Comparison of		
		No endometriosis ($n = 11$)	Endometriosis ($n = 13$)	(a) No laparoscopy with laparoscopy and no endometriosis p value	(b) No laparoscopy with laparoscopy and endometriosis p value	(c) Laparoscopy no endometriosis with laparoscopy and endometriosis p value
Severe or very severe pain	39% (18/46)	45% (5)	77% (10)	0.3522$^{\#}$	0.026*	0.206
4 or more days of pain	26% (12)	27% (3)	46% (6)	1	0.1874$^{\#}$	0.4225
Not satisfied with treatment	30% (14)	45% (5)	62% (8)	0.3424$^{\#}$	0.0406$^{\#}$*	0.4307$^{\#}$
Missed work/study	28% (13)	27% (3)	38% (5)	1	0.4806$^{\#}$	0.6792
Missing social/sport activities	44% (21)	45% (5)	69% (9)	0.9906$^{\#}$	0.2092	0.4081$^{\#}$
Dyschezia	13% (6)	27% (3)	62% (8)	0.3537$^{\#}$	< 0.001**	0.1228
Dyspareunia	24% (11)	11% (2)	77% (10)	1	< 0.001**	0.0123*
Intermenstrual pain	37% (17)	36% (4)	85% (11)	1	0.0037*	0.0327*

Data expressed as percentage of that total group number, n, and (value); *p value < 0.05, **p value < 0.001; $^{\#}$ chi-squared analysis performed

64 and 100% [28, 33]. However, despite this and the majority of this cohort having used these therapies as teenagers, we found a significant decrease in the use of the OCP and NSAIDs into adulthood. There are a number of possible explanations for this. It may be secondary to lower rates of dysmenorrhoea or women planning or post pregnancies. Some may have not found these therapies effective. It may also be that as more adult women were choosing to use non-pharmaceutical (heat packs or exercise) or alternative approaches, with a significant increase in use of these less effective approaches. This may unfortunately reflect, as others have noted, that dysmenorrhoea is often poorly and haphazardly managed [33, 49] which may be due to concerns regarding stigmatisation, normalisation of menstrual pain [49], misconceptions surrounding long-term or continuous OCP use [2], or the absence of support and advocacy from parents or family [36].

Impact of menses on work/study and sport/social activities

Dysmenorrhoea has been demonstrated to be the leading cause of lost school and work days among adolescents and young women [5]. While reported rates of school absenteeism in adolescence secondary to dysmenorrhoea [9] are generally higher than those for missing work or study as adults [40], for those with ongoing dysmenorrhoea in our study, there was no significant difference between study or work missed as an adult compared with school missed as an adolescent. As adults, they were more likely to miss sporting or social activities than work or study because of menstrual pain, similar to previous studies [3, 6]. While data regarding rates of missed sporting or social activities was not available in this study, high levels have been reported in an earlier study of teenagers [32]. Understanding these broader impacts of dysmenorrhoea is important in counselling and managing adolescents and young women.

Adolescent features associated with severe or very severe dysmenorrhoea as an adult

Our study found that increased age of menarche was associated with reporting no pain with menstruation as an adult. This is in keeping with numerous retrospective and follow-up studies in adults reporting early menarche as a risk factor for dysmenorrhoea [14, 40, 48]. It is notable however that Yosef et al. [50] conversely found that older age of menarche was associated with chronic pelvic pain and as such this needs to be explored further. While others report associations with family history [14, 20, 40], irregular or heavy periods [14, 20, 40], or improvement with OCP use [40], these were not significant in our study, possibly due to small sample sizes.

Dysmenorrhoea in adolescence and endometriosis in adulthood

Recent reports highlight concerns regarding delays in diagnosis of endometriosis in young women with a long history of dysmenorrhoea, especially due to potential implications for fertility, disease progression, scarring and chronic pain [13, 15]. Rates of endometriosis as high as 38% have been reported in adolescents with chronic pain [43]. Adolescent dysmenorrhoea however is common, so the early presence of menstrual pain is not specific. This study presented an opportunity to analyse a population of adolescents with a long history of dysmenorrhoea that was severe enough to require gynaecology referral. Thus, this cohort may be considered to be more likely to have had underlying endometriosis. We found that endometriosis rates in adulthood in the cohort were only marginally more than that of the general population [41] and all were mild disease. While it is possible that there are cases of endometriosis undiagnosed in the group who had not undergone laparoscopy, our analysis of features, comparing those who had laparoscopy (and findings or endometriosis or not) with those who did not, found no significant differences between the group who had no endometriosis diagnosed at time of laparoscopy and those who did not have a laparoscopy (Table 3). With regard to infertility, it has been estimated that 30–50% of women with endometriosis have significant problems with fertility [26]. Only one of the 13 women with diagnosed endometriosis had been trying for more than a year before falling pregnant, and three others had successful pregnancies without significant issues.

Aside from known surgical risks with laparoscopy [27], there is also evidence building of limited benefit in dysmenorrhoea and pelvic pain, with particular concern regarding recurrence [12]. Vignali and co-workers [45] demonstrated in a multivariate analysis that a significant predictor of pain recurrence was age at laparoscopy. Cheong and colleagues [7] report a 54% reoperation rate; thus, it follows that early first surgery is a risk factor for further surgery [39]. Given that the overall rate of endometriosis was found to be similar to the general population and only cases of mild disease, with relatively low rates of infertility, this preliminary study highlights the need for further research into the role and value of invasive surgery in adolescents.

A number of risk factors for endometriosis have been previously reported [37, 41]. We did not find any association with endometriosis and early onset of menarche, despite reports in a number of retrospective studies to date [37, 41]· This study however did identify an association of late age of menarche with the absence of dysmenorrhoea as an adult. Use of the OCP at any time as an adolescent and reporting that symptoms improved with treatment as an adolescent did have a positive association with the diagnosis of endometriosis as an adult. This may reflect the efficacy of the OCP for endometriosis treatment while it was being used. Interestingly, Chapron and colleagues [4] reported an association between OCP use during adolescence and deep infiltrating endometriosis (DIE) in adults; however, there were no DIE cases in our study. It has been noted that the severity of pelvic pain was a better predictor of a repeat laparoscopy than the finding of endometriosis [19], which raises the question as to whether teenagers who avoided a laparoscopy due to medical treatment are simply presenting as young adults with continuing pain and undergoing laparoscopy at that age.

Future research

This longitudinal study of adolescents with dysmenorrhoea is a preliminary study. There are no other identified longitudinal studies of adolescent dysmenorrhoea to date of this duration. This research is also notable for a high participation rate. Further studies in the area are needed. Limitations of this research include the relatively small sample size, data from a single institution and use of a non-validated questionnaire. While the MDOT questionnaire was designed for the adolescent population and used previously, it has not been validated. Furthermore, the need for appropriate validated questionnaires for adolescents that encapsulate features beyond pain levels, such as quality of life scoring, has been noted previously [23]. This would enable assessment of the broader impact of this condition as well as explore potential associations into adulthood. Similarly, while we explored other potential associated factors in adolescence with chronic pain (such as reported distress with menstrual pain and number of visits to gynaecologist), it would be useful to also include pain catastrophisation scale [31]. There is increasing evidence regarding the role of pain sensitisation in endometriosis [16, 46], and studies in adults with dysmenorrhoea have demonstrated higher such scores [38]. Analysis from adolescence into adulthood would enable a greater understanding of the development of this condition, and thus ultimately improve approaches to management.

In conclusion, this preliminary study is the first to follow-up adolescents with dysmenorrhoea into adulthood. We found similar rates of dysmenorrhoea to the general population, and notably no cases of severe endometriosis were identified. The findings are important for counselling young women. Ideally a larger study should be performed although undertaking studies of this duration is challenging. More research into the role of invasive investigation and management of this young population is needed.

Authors' contributions Benita Knox performed the literature search and data analysis, and wrote the final manuscript draft. Yi Chen Ong was involved in the initial conceptualisation of the study and literature review, and undertook the follow-up study collecting all the data for the study. Mardiha Abu Bakar undertook the original cohort study and hence provided the comparison data from adolescence. Sonia R Grover conceptualised and designed the study, and contributed to and supervised the literature review, data analysis and manuscript completion.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

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