ORIGINAL ARTICLE

Epidemiology of sleep disorders in pregnant subjects: A questionnaire based survey

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Abstract

Introduction

There are several changes which occur during the pregnant state that can impact directly or indirectly on breathing. A questionnaire based survey of sleep disorders amongst pregnant subjects attending a tertiary care hospital in New Delhi.

Material & Methods

The study was based on a questionnaire. It contained, besides personal identification of the subject, a set of 35 questions. In addition it also had the Epworth Sleep Questionnaire. A validated questionnaire for anxiety and depression was also used. Details of present pregnancy (parity, gravida, last menstrual period, expected date of delivery and period of gestation) was also recorded. The total number of pregnant subjects interviewed was 325. They were selected randomly from those attending the ante-natal clinic of Safdarjang Hospital & Vardhman Mahavir Medical College, New Delhi.

Observations

The overall prevalence of snoring was 13.5%. It correlated positively with depression ($p<0.075$) and gestation period ($p<0.016$). The overall prevalence of SDB was 9.5%. It correlated positively with gestation period ($p<0.042$) BMI ($p<0.05$) and disorders of initiation & maintenance of sleep (DIMS) ($p<0.005$) and depression ($p<0.021$). The overall prevalence of DIMS was 47.6%. The prevalence of DIMS was maximum in the third trimester; and it showed a positive correlation with rising gestation period. The overall prevalence of Restless Leg Syndrome (RLS) was 15.7%. It was most prevalent in age group 21-25 years ($p<0.045$). It showed rising trend with increase in gestation period ($p<0.049$), increasing parity ($p<0.071$) and decreasing hemoglobin concentration ($p<0.047$). The overall prevalence of depression was 11.4%. It correlated positively with increasing parity ($p<0.045$). The overall prevalence of anxiety was 18.1%. It correlated negatively with increasing age ($p<0.057$) & BMI ($p<0.067$) and positively with increasing gestation period ($p<0.099$). The overall prevalence of excessive daytime sleepiness (EDS) was 30.5%. It correlated negatively, with

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gestation period ($p<0.005$) and parity ($p<0.001$). The overall prevalence of Sleep Deprivation was 11.0%. It correlated with the presence of disorders of initiation and maintenance of sleep (DIMS). Sleep deprivation was also found to the maximally present in the third trimester.

Conclusions

SDB that develops or worsens during pregnancy affects a significant number of pregnant subjects and can predispose them to pre-eclampsia. It can serve as a pointer towards a sinister maternal and/or fetal complication and necessary action may be taken early. In our country, women are less likely than men to report symptoms of snoring/snorting and gasping due to social/ cultural reasons. Hence OSA in pregnant women is likely to go undiagnosed. Moreover, symptoms like EDS and nocturnal insomnia are often assumed to be less discriminatory for OSA in pregnant women. Hence a high index of suspicion and vigilance is required. The indications for polysomnography in pregnant women should probably include those with hypertension, previous babies with unexplained IUGR, and persistent sleep-related symptoms (hypersomnia or insomnia) associated with snoring and/or obesity. The prevalence of such complications during pregnancy is significant in our country. In view of these facts, an awareness needs to be created amongst pregnant subjects, their caregivers and the healthcare community at large to detect typical and atypical manifestation of SDB (like anxiety, depression, RLS, DMIS, fatigue) early and undertake remedial measures.

Introduction

There are several changes which occur during the pregnant state that can impact directly or indirectly on breathing. Few of them may also result into sleep-disordered breathing. Other sleep disorders like restless legs syndrome and insomnia have also been reported to occur increasingly during pregnancy. Data regarding sleep disorders in pregnancy is almost non-existent in India. It is with this in mind, that the authors undertook a questionnaire based survey of sleep disorders amongst pregnant subjects attending a tertiary care hospital in New Delhi.

Material and Methods

The study was based on a questionnaire. It contained, besides personal identification of the subject, a set of 35 questions. In addition it also had the Epworth Sleep Questionnaire. Details of present pregnancy (parity, gravida, last menstrual period, expected date of delivery and period of gestation) was also recorded. Any past history of tuberculosis, diabetes mellitus, hypertension, epilepsy or any respiratory disorder was recorded.

The questionnaire was administered to the pregnant subject by a trained interviewer who also recorded the responses. The responses were recorded in terms of "no", "occasional" or "often" in one set of questions and "yes" or "no" in another.

The questions pertained to snoring (simple or habitual, total duration and presence prior to onset of pregnancy), daytime sleepiness, sleep disturbance, waking up un-refreshed, morning headache, difficulty in falling asleep, early morning awakening, uncomfortable (creeping/ crawling) sensation in legs while lying down and abnormal limb movements during sleep. Questions also pertained to anxiety and depressive feelings. The average hours of sleep per week-night and weekends, time taken to fall asleep and presence or absence of afternoon naps were also recorded in the questionnaire. Questions regarding restless sleep, breathing difficulty (choking) at night, presence of long stops in breathing during night, waking up to pass urine at night, consumption of sleeping pills, frequent nocturnal awakenings with difficulty in going back to sleep, mood disturbances and irritability during daytime were also included in the questionnaire.

The total number of pregnant subjects interviewed was 325. They were selected randomly from those attending the ante-natal clinic of Safdarjang Hospital & Vardhman Mahavir Medical College, New Delhi.

All those subjects who reported snoring also underwent an in-laboratory, fully supervised, whole night, complete polysomnography at the Sleep Laboratory of Safdarjang Hospital, New Delhi. Obstructive apnea was defined as cessation of airflow at the nose and mouth,

as measured by thermistor/ nasal cannula while the respiratory effort continues for at least ten seconds. Hypopnea was scored when the nasal flow signal excursions dropped by ≥ 50% of the baseline for a duration of at least 10 seconds and was associated with a drop of saturation of ≥ 3% from the pre-event baseline or if it was associated with arousal(1). Respiratory effort related arousal (RERA) was scored when there were a sequence of breaths lasting at least ten seconds characterized by increasing respiratory effort or flattening of the nasal pressure waveform, leading to an arousal from sleep when the sequence of breaths did not meet the criteria for an apnea or hypopnea (1). The term Respiratory Disturbance Index (RDI) included the sum of apneas, hypopneas and RERAs per hour of sleep. Excessive daytime sleepiness (EDS) was scored in the presence of questionnaire response of EDS along with Epworth Sleepiness Score (ESS) of ≥ 10. Sleep Disordered Breathing (SDB) was diagnosed when a patient with symptoms suggesting SDB has a respiratory distress index (RDI) of > 5 per hour. Snoring adults with RDI of less than five per hour with no clinically significant hypoxemia, hypercapnia or excessive daytime sleepiness were considered to have primary snoring(2). The diagnosis of other sleep disorders (such as restless leg syndrome, bruxism, nightmare, sleepwalking and disorders of initiation and maintenance of sleep (DIMS) was based on the criteria laid down in the International Classification of Sleep Disorders – Diagnostic and Scoring manual (3).

A validated questionnaire for anxiety and depression was used(35). The anxiety questionnaire comprised eight questions; an answer in the affirmative of ≥ 3 of the eight questions was taken as "probable" anxiety and that of ≥ 5 as presence of "imperative" anxiety where the individual would benefit by a seeking psychiatric consultation. As regards the depression questionnaire, which comprised 15 questions, affirmative answers in ≥ 4 and ≥ 6 questions were taken as "possible" and "imperative" depression respectively. Imperative depression was taken as a situation where the individual would probably derive benefit by seeking professional help (4).

Statistical Methods

All data analysis was performed using statistical software SPSS 11.0. Chi-square test and t-test were used to determine significance of correlation and testing the differences in the prevalence's by characteristics.

Observations

The questionnaires were analyzed so as to determine the prevalence of the various components of sleep derangements as outlined below. Correlation if any between these components and variables like BMI, age, hemoglobin & gestation period were deduced. The statistical significance was derived on the basis of aforementioned methods.

Snoring

The overall prevalence of snoring was 13.5%. It correlated positively with depression ($p<0.075$) and gestation period ($p<0.016$). (Table 1)

Table 1: Snoring and its correlates

Correlate	Snoring - 13.5%			p-value
Gestation Period	<=12 wks 5.0	13-24 wks 15.1	>=25 wks 21.7	.016
DIMS	No 11.1	Yes 16.0		.429
EDS	No 14.1	Yes 12.5		.838
Anxiety	No 15.0	Yes 23.5		.113
Depression	No 13.2	Yes 24		.075

Sleep disordered breathing (SDB)

The overall prevalence of SDB was 9.5%. It correlated positively with gestation period ($p < 0.042$) BMI ($p < 0.05$) and DIMS ($p < 0.005$) and depression ($p < 0.021$) (Table 2)

Table 2: Sleep disordered breathing (SDB) and its correlates

Correlate	SDB - 9.5%				p-value
BMI	<18.5 3.4%	18.5-24.9 7.8%	25-29.9 8.8%	>=30 20.0%	.05
Gestation Period	<=12 wks 4.9%	13-24 wks 11.0%	>=25 wks 14.8%		.042
DIMS	No 3.6	Yes 16.0			.005
Anxiety	No 6.0	Yes 21.1			.002
Depression	No 7.0	Yes 18.4			.021

Disorders of initiation & maintenance of sleep (DIMS)

The overall prevalence of DIMS was 47.6% (Table 3). The prevalence of DIMS was maximum in the third trimester; and it showed a positive correlation with rising gestation period ($p < 0.0005$).

Table 3: DIMS and its correlates

Correlate	DIMS - 47.6%				p-value
BMI	<18.5 55.2	18.5-24.9 46.1	25-29.9 52.9	>=30 60.0	0.733
HB	<=8 45.0	9-11 48.2	>=12 58.8		0.666
Gestation Period	<=12 wks 30.2%	13-24 wks 35.1%	>=25 wks 60.3%		0.0005
Parity	1 46.6	2 50.0	3 45.2	>=4 38.5	0.642

Restless leg syndrome (RLS)

The overall prevalence of RLS was 15.7%. It was most prevalent in age group 21-25 years ($p < 0.045$) (Table 4). It showed rising trend with increase in gestation period ($p < 0.049$), increasing parity ($p < 0.071$) and decreasing hemoglobin concentration ($p < 0.047$)

Table 4: Restless leg syndrome and its correlates

Correlate	RLS - 15.7%				p-value
BMI	<18.5 17.2	18.5-24.9 13.0	25-29.9 14.7	>=30 20.0	.921
Age group	18-20 8.3	21-25 20.3	26-36 8.1		.045
HB	<=8 18.5	9-11 14.7	>=12 9.8		.047
Gestation Period	<=12 wks 9.8%	13-24 wks 16.0%	>=25 wks 20.2%		.049
Parity	1 7.7%	2 14.8%	3 16.1%	>=4 19.1%	.071

Depression

The overall prevalence of depression was 11.4%. It correlated positively with increasing parity ($p<0.045$). (Table 5)

Table 5: Depression and its correlates

Correlate	Depression (Imperative) - 11.4%				p-value
BMI	<18.5 24.1	18.5-24.9 13.0	25-29.9 5.9	>=30 0	.199
Gestation Period	<=12 wks 11.5%	13-24 wks 12.3%	>=25 wks 11.5%		.107
Parity	1 12.5	2 12.6	3 12.9	>=4 15.4	.045

Anxiety

The overall prevalence of anxiety was 18.1%. It correlated negatively with increasing age ($p < 0.057$) and BMI ($p < 0.067$) and positively with increasing gestation period ($p < 0.099$). (Table 6)

Table 6: Anxiety and its correlates

Correlate	Anxiety (Imperative) - 18.1%				p-value
BMI	<18.5 24.1	18.5-24.9 20.9	25-29.9 11.8	>=30 20.0	.067
Age group	18-20 25.0%	21-25 21.1%	26-36 9.7%		.057
Gestation Period	<=12 wks 16.4%	13-24 wks 20.5%	>=25 wks 19.7%		.099
Parity	1 18.2%	2 19.4%	3 16.1%	>=4 15.4%	.971

Excessive daytime sleepiness (EDS)

The overall prevalence of EDS was 30.5%. It correlated negatively, with gestation period ($p<0.005$) and parity ($p<0.001$) (Table 7)

Table 7: Excessive daytime sleepiness and its correlates

Correlate	EDS - 30.5%				p-value
BMI	<18.5 31.0%	18.5-24.9 32.7%	25-29.9 20.6%	>=30 20.0%	.281
Gestation Period	<=12 wks 42.0%	13-24 wks 31.0%	>=25 wks 24.0%		.005
Parity	1 41.9%	2 23.9%	3 25.8%		.001
Sleep deprivation	<=5 18.2%	6 35.7%	7 36.8%	8 17.6%	.046

Sleep Deprivation

The overall prevalence of Sleep Deprivation was 11.0%. It correlated with the presence of disorders of initiation and maintenance of sleep (DIMS). Sleep deprivation was also found to the maximally present in the third trimester. (Table 8)

Table 8: Sleep deprivation and its correlates

Correlate	Sleep deprivation – 11.0%			p-value
DIMS	No 3.6%	Yes 19.0%		.000
Gestation Period	<=12 wks 8.2%	13-24 wks 11.5%	>=25 wks 12.3%	.560
Depression	No 27.3%	Yes 20.8%		.865

The overall prevalence of sleep disorders are outlined in Table 9

Table 9 : Overall prevalence of sleep disorders

S.No.	Sleep Disorder	Prevalence (%)
1	Snoring	13.5
2	Sleep disordered breathing	9.5
3	Disorders of initiation and maintenance of sleep (DIMS)	47.6
4	Restless Leg Syndrome	15.7
5	Depression	11.4
6	Anxiety	18.1
7	Excessive daytime sleepiness (EDS)	30.5
8	Sleep Deprivation	11.0

Discussion

Various population surveys have shown that sleep complaints increase with each decade of life and women are affected more than men in the same age group (5). Yet women with sleep disorders remain persistently under diagnosed. This could be primarily due to the gender bias, when it comes to diagnosing and researching sleep disorders and partly due to difference in the way women perceive their symptoms (5, 6). It has been shown clearly that female hormones have significant influence on sleep and circadian rhythms. Sleep in turn affects the production of gonadotropin hormones (7, 8). These gender related differences in sleep regulation may pose special risks for sleep disorders (9,10). The epidemiological studies conducted in the last two decades have shown different prevalence of common sleep disorders during various life stages. This could be due to the effect of constantly changing hormonal profile of women as they move through puberty, menstrual cycle, pregnancy, lactation and menopause(11). The characteristic physiological changes that occur during these stages can have a significant impact on sleep quality, daytime functioning and quality of life (9,10). Because of these changes sleep disorders such as insomnia, restless leg syndrome (RLS) and EDS are more commonly seen in pre menopausal women, where as, sleep apnea syndrome affects postmenopausal women more than premenopausal and those suffering from polycystic ovarian disease.

Pregnancy is associated with several physiological, hormonal and physical changes distinct from other phases of life which can predispose the women to enhanced risk of sleep disorders. A majority of pregnant women are likely to experience disorders of initiation and maintenance of sleep (DIMS) in the later part of the pregnancy (12,13,14,15) and higher incidence of post partum blues (12,16). Other sleep disorders such as RLS (13,15,17,18,19), periodic limb movement disorder (PLMS) and SDB are also more prevalent or in fact may start during pregnancy(13,15,20). Pregnancy induced changes in upper airway anatomy and pharyngeal dilator muscle control can increase the risk of snoring & SDB(20,21,22). It has been well established in the general population that SDB is closely linked to the development of several cardio-vascular morbidities like hypertension, ischemic heart disease and cerebro-vascular accidents. Thus, those pregnant women who snore or have significant SDB may be indirectly predisposed to develop serious cardio-vascular morbidities like pregnancy induced hypertension (PIH), pre-eclampsia (20,21,22) and may also be at risk of poorer maternal and fetal outcomes of pregnancy like low birth rate, intra-uterine growth retardation (IUGR) and fetal death(23,24,25). The authors, in an another study conducted in the same hospital on pregnant women, found a significantly higher prevalence of PIH, pre eclampsia and babies with low birth weight and IUGR in women with significant SDB(35).

Keeping in view these facts it is important to study the prevalence of sleep disorders in pregnancy and their impact on maternal and fetal outcomes not only during the pregnancy period but also on the later life of women.

Snoring and sleep disordered breathing

Self reported snoring and habitual snoring has been reported to be 11-23% and 41% amongst pregnant subjects (26,27,28). Snoring is more commonly seen in pregnant subjects than in non-pregnant females(20). Also associated with snoring during pregnancy are symptoms like awakening with sensation of choking(20). In a study at two US army hospitals, 14% of pregnant women reported frequent snoring vs 4% of the non pregnant women(26). In a survey of Swedish women 23% reported snoring at the time of delivery, whereas 4% reported snoring before pregnancy. Snoring has often been seen to increase during the third trimester and resolve several months after delivery(20,28). In a study by Pien et al 27% of otherwise healthy women reported snoring in the third trimester (15). In our study, the overall prevalence of snoring was 13.5%, with 21% of pregnant women having habitual snoring in the last trimester, whereas only 5% of pregnant subjects reported snoring in the early pregnancy.

The high prevalence of snoring during pregnancy suggests that prevalence of SDB in likely to be higher. There is very little data on the prevalence of SDB in pregnancy. About 2% of adult women and 4% of men were found to suffer from OSA syndrome (i.e. AHI ≥5 with EDS) in the famous study by Tery Young & colleagues (29). In another study by Bixler et al (30), the prevalence of SDB (an AHI ≥ 10 and daytime hypersomnolence), was 1.2% for women and 3.9% for men; pre menopausal women had a prevalence of 0.6% and post menopausal women had 1-9%. They also noticed it to be lower in post menopausal women on hormone replacement therapy (HRT) i.e. 0.5% vs 2.7% in women who were not on HRT. These findings again substantiate the impact of female hormones on the genesis of SDB. The data on the prevalence of snoring and SDB in pregnancy is very limited. In our study the overall prevalence of significant SDB (i.e. an RDI of ≥5 with EDS or sleep disruption) was found in 9.5% of pregnant women. A large number of our patients did not show frank apneas or hypopneas, but demonstrated an evidence of increased upper airway resistance as shown on the nasal flow signal by long episodes of flow limitation followed by arousals. Similar PSG findings were observed by Conmolty and his colleagues (31). About 14.8% of snoring women had significant SDB during the third trimester of pregnancy. Thus the prevalence of SDB in the pregnant women is far above the prevalence of SDB in the non pregnant women of the same age. The higher prevalence of SDB in our study could be due to the use of RDI instead of AHI as an index of SDB severity. Several mechanisms have been suggested that may predispose the female subject to episodes of snoring and upper airway resistance. They include diffuse pharyngeal oedema of pregnancy, excessive weight gain and the effect of sleep deprivation on pharyngeal dilator muscle activity (20).

It has observed that snoring and SDB often not recognized in female subjects. This may be due to multiple reasons. Firstly, there may be a gender bias against recognition of this disorder in women. Secondly, there may be under-reporting of snoring among women due to social and cultural reasons. Thirdly, it is well known that SDB in women may have a different symptomatology which is in sharp contrast to the classical manifestations seen in males. These "atypical" manifestations of SDB in women include insomnia, anxiety, depression, morning headaches, fatigue, myalgia, amenorrhea and dysmenorrhea (39,40,41,43). In the present study, snoring was observed to correlate significantly with the presence of depression ($p<0.010$). Also, SDB was found to be present in as many as 36.4% subjects with depression ($p<0.017$) against only 4.2% of those without depression. SDB was also found to correlate significantly and positively with the presence of disorders of initiation and maintenance of sleep (DIMS) ($p<0.0005$) and anxiety. These observations made in the present study and also cited in literature emphasis strongly the need to look for symptoms like anxiety, depression and insomnia in pregnant subjects, in whom a high index of suspicion of SDB should be maintained.

Excessive daytime sleepiness as a complaint is more frequently seen in women than men of all age groups after the puberty. A number of population based studies have confirmed this finding(32,33,34). This gender difference could be due to the effect of female hormones or a higher prevalence of anxiety or depression in them(32,33,34). In pregnancy EDS has been frequently seen in the first trimester (15). In the present study EDS was observed in 30% of pregnant women which was maximum during the first trimester.

In this study, EDS was found to be significantly high in primigravida ($p < 0.001$). It was less often found in anemic subjects that in those with a normal hemoglobin.

Restless leg syndrome (RLS) is an another important sleep disorder seen more commonly in females(36,37,38). RLS has also been shown to increase in the pregnant state (0% in pre-pregnancy to 12.5% in first trimester to 23% by third trimester in one study) (15). Its peak incidence is during the sixth month, most severe during seventh and eight months and it rapidly declines by one month post partum (5).Reduced iron, ferritin and/or folate levels that are seen during pregnancy may account for this increase. In the present study RLS was seen in 15.7% of pregnant women and its prevalence increased with increasing gestation period, parity and decreasing hemoglobin levels.

Prevalence of RLS has also been observed to increase with advancing age (42). The raising trends in the prevalence of RLS in tandem will fall in hemoglobin and increase in gestation period and parity are quite similar to observations made in other studies cited above. RLS is often known to be associated with other sleep disturbances like initiation insomnia/DIMS. Pregnant subjects with features of RLS & DIMS should therefore be judiciously screened for SDB. These are possible in the subjects who may be potential candidates to develop more sinister complications like pregnancy induced hypertension, and IUGR later in the course of pregnancy.

Disorders of initiation and maintenance of sleep (DIMS) was observed in about 47.6% of the pregnant subjects. In the present study the prevalence of DIMS was maximum in the third trimester of pregnancy. In large majority of other studies also, insomnia has been reported to be present mainly during the third trimester of pregnancy. Factors responsible for DIMS are multiple. They include nausea, backaches and urinary frequency during the first trimester; foetal movement and heartburn during the second trimester; increased urinary frequency, backaches, shortness of breath, leg cramps, frightening dreams & itchy skin during the third-trimester problem. Initiation insomnia has often been found in pregnant subjects who have RLS. In another study by the author of prevalence of sleep disorders in adult population, DIMS was found to be more prevalent in female population in general (35). This study included no-pregnant subjects and causes could include factors like hormonal influence and dysmenorrheal, anxiety & depression etc. Similar trends have also been reported in other studies. Pregnant subjects may under-report symptoms pertaining to DIMS. However, those pregnant subjects with manifestations of DIMS should again be screened for other sleep disorders which can result into worsens maternal morbidity and fetal outcome.

Anxiety & depression

The overall prevalence of depression in female subjects observed in the present study was 11.4% and that of anxiety was 18.1%. Anxiety, depression and social isolation may often be the only "atypical" manifestation of SDB in women (42,43,40). In the present study depression and anxiety symptoms were observed to correlate positively with rising gestation period and parity. Some of these pregnant subjects with anxiety and depression may again be suffering from an underlying SDB. Therefore all such pregnant subjects with anxiety and depressive symptoms need to be screened from this angle to prevent an ensuring high risk event during pregnancy. The same facts were confirmed in the present study (Table 6).

Conclusions

Several conclusions can be derived from the present study. Some of them have also been reported by studies conducted elsewhere (31). Some important facts highlighted by the present study are as follows.

1. SDB was present in nearly one-tenth of pregnant subjects. SDB that develops or worsens during pregnancy affects a significant number of pregnant subjects and can predispose them to pre-eclampsia. It can serve as a pointer towards a sinister maternal and/or fetal complication and necessary action may be taken early
2. EDS was seen in 30.5% of pregnant subjects in the present study. EDS is reported by several pre-menopausal women as well. In our country, women are less likely than men to report symptoms of snoring/ snorting and gasping due to social/ cultural reasons. Hence OSA in pregnant women is likely to go undiagnosed. Moreover, symptoms like EDS and nocturnal insomnia are often assumed to be less discriminatory for OSA in pregnant women. Hence a high index of suspicion and vigilance is required.
3. The indications for polysomnography in pregnant women should probably include those with hypertension, previous babies with unexplained IUGR, and persistent sleep-related symptoms (hypersomnia or insomnia) associated with snoring and/or obesity. The prevalence of such complications during pregnancy is significant in our country.

The importance of sleep related breathing disorders during pregnancy in Indian subjects is profound. Its impact on maternal morbidity & mortality and fetal outcome may be immense. In view of these facts, an awareness needs to be created amongst pregnant subjects, their caregivers and the healthcare community at large to detect typical and atypical manifestation of SDB (like anxiety, depression, RLS, DMIS, fatigue) early and undertake remedial measures. Treatment of SDB can be a fairly simpler step to prevent sinister complications associated with pregnancy (like PIH, IUGR etc). There is also an urgent need to develop cost-effective modules for the diagnosis and treatment of such disorders in a developing country like India.

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