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Productivity loss due to menstruation-related symptoms: a nationwide cross-sectional survey among 32,748 women

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3 **1 Productivity loss due to menstruation-related symptoms: a nationwide cross-**
4 **2 sectional survey among 32,748 women**

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33 **Abstract**

34 Objective

35 To evaluate age-dependent productivity loss caused by menstruation-related
36 symptoms, measured in absenteeism (time away from work or school) and
37 presenteeism (productivity loss while present at work/school).

39 Methods

40 *Design/Setting:* Internet-based, cross-sectional survey conducted in The Netherlands
41 from July to October 2017.

42 *Participants:* 32,748 women aged 15 to 45 years, recruited through social-media.

43 *Outcome measures:* Lost productivity in days, divided into absenteeism and
44 presenteeism; impact of menstrual symptoms; reasons women give to their employer
45 or school when calling in sick; and women's preferences regarding conditions at work
46 and school.

48 Results

49 A total of 13.8% of all women reported absenteeism during their menstrual periods
50 with 3.4% reporting absenteeism every or almost every menstrual cycle. The mean
51 absenteeism related to a woman's period was 1.2 days per year. A total of 80.7% of
52 the respondents reported presenteeism and decreased productivity a mean of 23.2
53 days per year. An average productivity loss of 33% resulted in a mean of 8.9 days of
54 total lost productivity per year. Women under 21 were more likely to report
55 absenteeism due to menstruation-related symptoms (OR 3.3, 95% confidence
56 interval 3.1 to 3.6). When women called in sick due to their periods, only 20.1% told

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3 57 their employer or school mentor that their absence was due to menstrual complaints.
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5 58 Notably, 67.7% of the participants wished they had greater flexibility in their tasks and
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7 59 working hours at work or school during their periods.
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12 13 61 Conclusions

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15 62 Menstruation-related symptoms cause a great deal of lost productivity, and
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17 63 presenteeism is a bigger contributor to this than absenteeism. There is an urgent
18
19 64 need for more focus on the impact of these symptoms, especially in adolescents, for
20
21 65 discussions of treatment options with women of all ages, and, ideally, more flexibility
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23 66 for women who work or go to school.
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28 29 30 68 **Strengths and limitations of this study**

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33 69 • This is the largest cohort study to analyse the impact of menstruation-related
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35 70 symptoms on work and school productivity.
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37 71 • The survey was performed among the general female population and is
38
39 72 consequently not per se related to one specific gynaecological condition.
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41 73 • Due to the way of recruitment of participants, there may have been some
42
43 74 degree of selection bias.
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46 75 • The generalisability of the study may be limited to employment and school
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48 76 systems comparable to the Dutch.
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78 **Background**

79 Menstruation-related symptoms (MRSs) are diverse and widespread among women.
80 Symptoms include dysmenorrhea, heavy menstrual bleeding and premenstrual mood
81 disturbances with reported prevalence of 45% to 90%, 14% to 25%, and 20% to 29%
82 respectively.¹⁻³ Studies show that women with MRSs have lower scores on several
83 domains of quality of life such as general health and physical, mental, social, and
84 occupational functioning during their periods.^{1 4-7} Furthermore, these symptoms may
85 create considerable financial burdens on patients and their families as well as on
86 society.^{5 6 8-12} Such financial burdens are related to the costs of visits to the doctor,
87 over-the-counter drugs, and medical or surgical treatment. However, costs related to
88 productivity loss could be the largest cost driver. Productivity costs are defined as
89 costs associated with paid and unpaid production loss and the replacement of
90 productive people due to illness or disability.¹³ Productivity costs can be divided into
91 costs related to absenteeism and costs related to presenteeism. Absenteeism
92 represents the total amount of time off work or away from school, and presenteeism
93 represents the loss of productivity while present at a job or school.

94 Although the literature is scarce and the results are variable, studies on specific
95 patient groups generally show that MRSs can cause absenteeism.¹⁴⁻¹⁶ Research on
96 the association between MRSs and presenteeism is even more limited. It has been
97 suggested that research into possible impairments in quality of life caused by
98 menstrual symptoms should not focus on single symptoms but rather on a complex of
99 symptoms that vary widely but that are all related to the menstrual cycle. This
100 complex includes both standard symptoms, like heavy menstrual bleeding and
101 abdominal cramps, and also less common symptoms, like nausea and cold sweats.

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3 103 Taking all symptoms into account, it seems likely that the real impact of MRSs is
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5 104 underestimated in the general population. Despite being almost two decades into the
6
7 105 21st century, discussions about MRSs may still be rather taboo. This survey-based
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9 106 exploratory study aimed to quantify the burden of MRSs in the general female
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11 107 population, with burden defined as the number of lost days at work or school due to
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13 108 absenteeism and presenteeism. Furthermore, it was aimed to study the impact of
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15 109 specific symptoms on absenteeism and presenteeism.
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111 **Methods**

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24 112 This cross-sectional study consisted of an online survey that was distributed from
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26 113 July 12 to October 11, 2017. Approval for this study was obtained from the local
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28 114 medical ethics committee “Commissie Mensgebonden Onderzoek (CMO)” under
29
30 115 number file number 2017-3387 on July 12th 2017. All data were anonymously
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32 116 collected and stored under the privacy rules of the Radboud University Medical
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34 117 Center. Patients gave informed consent when they initiated the questionnaire.
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41 *Patient and Public Involvement*

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44 120 A group of women, including several members of the Dutch Patient Endometriosis
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46 121 Foundation, was involved in the conduct of this study at several stages; i.e. in the
47
48 122 development and dissemination of the questionnaire and in the analysis and
49
50 123 interpretation of the results. One of the authors of this manuscript, BD, is the chair of
51
52 124 the Dutch Patient Endometriosis Foundation. Additional contributions are noted in the
53
54 125 Acknowledgements section.
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3 127 *Questionnaire development*
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6 128 The questionnaire had several parts, and Appendix 1 provides details about the
7
8 129 questions. Part 1 consisted of questions about each woman's basic characteristics.
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10 130 Part 2 had questions about menstrual symptoms, and part 3 had questions related to
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12 131 absenteeism and presenteeism. Adaptive questioning was used with a maximum of 6
13
14 132 questions per page. Additional questions about absenteeism and presenteeism were
15
16 133 included that were based on the Productivity Cost Questionnaire from the Institute for
17
18 134 Medical Technology Assessment (iMTA-PCQ).¹⁹ We modified the iMTA-PCQ-
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20 135 recommended recall period of four weeks so that it was in line with the relevant time
21
22 136 period for this study and so we could include multiple menstrual periods. Visual
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24 137 analogue scales (VAS) were used to quantify the amount of pain, or the intensity of
25
26 138 the symptom, and the impairment due to pain or the other symptom. Presenteeism
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28 139 was measured by asking women to what extent they were able to be as productive
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30 140 as possible compared to a day without MRSs. This was scored on a scale from 0 to
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32 141 10, with 0 being totally unproductive and 10 fully productive.
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143 *Target population and recruitment*

144 The study population comprised of women between 15 and 45 years old. The upper
145 age limit was chosen to avoid interference from menopausal symptoms; the lower to
146 have a time margin after the average menarche age, since it is known that the first
147 periods are irregular and often accompanied with discomfort and uncertainty. A large
148 number of women were approached with the aim of obtaining a cohort that was
149 representative of the general female population in terms of level of education,
150 medical history, and/or gynaecological diagnosis. Women were invited to complete a
151 survey using an online questionnaire tool²⁰ through a campaign on social media

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3 152 platforms Facebook and Twitter. Patient organisations, colleagues, and visitors of the
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5 153 Facebook page of one of the authors (TN) were asked to share the link to the
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7 154 questionnaire in order to reach the widest possible audience.
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10 155 On July 12, 2017, a link to the questionnaire was posted on Facebook and Twitter
11
12 156 through the account of one of the authors (TN). In the post both women with and
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14 157 without MRSs were encouraged to fill in the questionnaire. Within 24 hours of the first
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16 158 posting on social media, over 6,000 respondents had filled in the questionnaire, and
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18 159 by July 18, there were 15,000 respondents, which was announced by a re-post of the
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20 160 link to the questionnaire. A third post was made on Facebook and Twitter on
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22 161 September 16, 2017, to reach women who may have been on holiday when the first
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24 162 posts were created.
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31 164 *Data analysis*

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34 165 The outcome measures were presented in a descriptive way; we used valid
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36 166 percentages in case of missing values where necessary. We distinguished between
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38 167 women who were mainly working or mainly studying. Therefore, we present these
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40 168 data for two groups i.e. for women who worked more than 5 hours per week
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42 169 (“working group”) and for women who studied more than 5 hours per week (“studying
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44 170 group”).
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48 171 We used binary logistic regression to calculate odds ratios. Absenteeism and
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50 172 presenteeism were used as dependant variables. As independent variables we used
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52 173 the following parameters: women younger than 21 versus women aged 21 and older,
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54 174 smoking yes or no, reports of absenteeism not related to MRSs, educational level,
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56 175 the use of oral contraception and the use of an levonorgestrel-releasing intra uterine
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3 176 device. All independent variables were used in an univariate as well as a multivariate
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5 177 analysis. We also studied the association between pain scores and both
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7 178 absenteeism and presenteeism, given that the literature shows that pain scores of 0
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9 179 to 4, 5 to 6, and 7 or higher have a different impact on activity, mood, and sleep.^{21 22}
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11 180 Analyses were performed using IBM SPSS Statistics version 22.00.
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16 17 182 *Assumptions and transformation of the original data*

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20 183 To present data on level of education in an international format we had to transform
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22 184 the original data, which was based on the Dutch school system.²³
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25 185 With regard to the evaluation of absenteeism and presenteeism, “the guideline for
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27 186 economic evaluations in healthcare in the Netherlands” was used.²⁴ A week of full
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29 187 time work or study accounted for 36 hours, one day was 8 hours, and in a year,
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31 188 women were able to work 1558 hours when they were working full time.
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35 189 To calculate the percentages for absenteeism, one day of absenteeism accounted for
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37 190 8 hours of lost productivity. When a woman reported to study or work more than 40
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39 191 hours per week, we transformed these hours to 40 hours. We made a few other
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41 192 transformations for categorical data. For absenteeism related to MRSs, the category
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43 193 “more than three days per cycle” was considered to be 4 days per cycle. For
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45 194 absenteeism that was not related to MRSs, the category “more than ten days in the
46
47 195 past six months” was considered to be 11 days in the past six months.
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51 196 To present yearly data, we multiplied some of these data based on the original recall
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53 197 period. The number of days for absenteeism related to MRSs was based on days per
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55 198 cycle, which were therefore multiplied by 12.7 based on the reported average
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57 199 menstrual cycle of 28.8 days, see table 1. These values were then multiplied by one
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3 200 if the woman reported that she called in sick “every period”, 0.75 if she reported
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5 201 “almost every period”, 0.5 if she reported “half of all periods”, and 0.25 if she reported
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7 202 calling in sick “only once in a while”. Values for absenteeism that was not related to
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9 203 MRS were based on a recall period of 6 months and were therefore multiplied by two
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11 204 in order to obtain the number of days per year. The values for presenteeism were
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13 205 based on a recall period of three months and were therefore multiplied by four.
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18 19 207 **Results**

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22 208 A total of 44,173 women initiated the questionnaire. We excluded participants who
23
24 209 did not report a date of birth or whose age did not fulfil the inclusion criteria (figure 1).

25
26 210 There were no duplicates of IP addresses. Women who did not answer questions
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28 211 related to absenteeism and presenteeism were excluded. Furthermore, cases with
29
30 212 extreme outliers (e.g. 10,000,000 days of presenteeism in three months or 140
31
32 213 changes of sanitary pads a day) were excluded. This resulted in a total of 32,748
33
34 214 women in the final analysis.
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36

37
38 215 Table 1 summarizes the basic characteristics of the participants. We found that
39
40 216 45.4% (n=14,839) had visited a doctor for menstrual complaints in the past, with a
41
42 217 total of 3017 (9.2%) women reporting a diagnosis of a menstrual disorder, such as
43
44 218 endometriosis or fibroids.
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48 219 The mean age of women in the working group was higher than the mean age of
49
50 220 women in the studying group. The mean number of working hours per week in the
51
52 221 working group was 27.0 (SD 11.4), and the mean number of study hours in the
53
54 222 studying group was 27.4 (SD 12.1). A total of 7,335 women (22.4%) reported both
55
56 223 working and studying more than five hours per week. In this group, 3,001 women
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224 were working more than 16 hours a week, and 5,284 women in the study group were
 225 studying more than 16 hours a week.

	Number (percentage)	Mean \pm SD	Median
Age, years		28.6 \pm 8.6	28
15-19	6,141 (18.8%)		
20-24	6,118 (18.7%)		
25-29	5,825 (17.8%)		
30-34	5,483 (16.7%)		
35-40	4,687 (14.3%)		
41-45	4,494 (13.7%)		
Level of education			
Low	4,020 (12.3%)		
Medium	12,335 (37.9%)		
High	16,229 (49.8%)		
Hours/week			
Paid work		21.7 \pm 14.7	24
Study		7.4 \pm 13.6	0
Voluntary work		0.8 \pm 3.1	0
Menstrual cycle			
Regular cycle	25,717 (78.5%)		
Duration		28.8 \pm 3.0	28
Amenorrhoea due to LG-IUD/OC	3,675 (11.2%)		
Irregular, variation >10 days per cycle	2,495 (7.6%)		
Do not know	861 (2.6%)		
Days with blood loss per cycle		5.4 \pm 1.6	5
Visited a doctor for MRSs			
No	17,873 (54.6%)		
Yes, general practitioner	10,141 (31.0%)		
Yes, gynaecologist	4,698 (14.4%)		
Diagnosis for MRSs*			
No	29,731 (90.8%)		
Yes	3,017 (9.2%)		
Endometriosis	1,120 (3.4%)		
PCOS	588 (1.8%)		
Adenomyosis	103 (0.3%)		
Fibroids	275 (0.8%)		
Other	1,901 (5.8%)		
Contraception*			
Hormonal contraception	11,993 (36.6%)		
OC	8,650 (26.4%)		
LG-IUD	2,752 (8.4%)		
Other hormonal: injection, transdermal etc.	882 (2.7%)		
No hormonal contraception	20,755 (63.4%)		
Cu-IUD	771 (2.4%)		
Female sterilisation	423 (1.3%)		
No female contraception	19,639 (60.0%)		
Nulliparous	21,585 (66.0%)		

<i>Paid work >5 hr a week</i>	26,104 (79.7%)		
Age		29.7±8.3	29
Hours of paid work/week		27.0±11.4	28
Hours of study/week		7.5±13.4	0
<i>Study >5 hr a week</i>	8,764 (26.8%)		
Age		22.0±6.2	20
Hours of paid work/week		15.5±11.3	12
Hours spent on studying/week		27.4±12.1	30

226

227 Table 1 | Basic characteristics of study participants (n=32,748) Mean duration of
 228 cycle based on women with a regular cycle. SD = standard deviation, MRSs =
 229 menstruation-related symptoms, PCOS = polycystic ovary syndrome, OC = oral
 230 contraceptive, LG-IUD = levonorgestrel-releasing intrauterine device, Cu-IUD =
 231 copper intrauterine device. *More than one possible answer.

232

233 *Absenteeism*

234 Table 2 shows the results on absenteeism due to MRSs. Although 13.8% of the
 235 women (n=4,514) reported absenteeism due to MRSs, only 1,108 women (3.4%)
 236 reported absenteeism every cycle or almost every cycle. The percentage of
 237 absenteeism in every cycle or almost every cycle was 2.4% in the working group and
 238 4.5% in the studying group. The mean absenteeism due to MRSs was 0.9 days per
 239 year for the working group and 1.6 day per year for the study group.

240 We also calculated the mean total absenteeism that was not related to MRSs. For the
 241 entire group, this was 3.3 days per year; for the working group, it was 3.5 days, and
 242 for the studying group, it was 4.3 days. The mean percentage of absenteeism that
 243 was not related to MRSs was 3.5% in the working group and 3.7% in the studying
 244 group. Consequently, absenteeism due to MRSs in our cohort accounted for, on
 245 average, 22% of the total absenteeism in the working group and 24% in the studying
 246 group.

247

	Number (percentage)	Mean \pm SD
All (n=32,748)		
Absenteeism	4,514 (13.8)	
≤ 0.5 day	538 (1.6%)	
1 day	2,259 (6.9%)	
2 days	1,171 (3.6%)	
3 days	349 (1.1%)	
>3 days	184 (0.6%)	
Total days of absenteeism per year		1.3 \pm 5.9
Work (n=26,104)		
Absenteeism	2,926 (11.2%)	
≤ 0.5 day	374 (1.4%)	
1 day	1,476 (5.7%)	
2 days	757 (2.9%)	
3 days	211 (0.8%)	
>3 days	98 (0.4%)	
Total days of absenteeism per year		0.9 \pm 3.9
Study (n=8,764)		
Absenteeism	1,715 (19.6%)	
≤ 0.5 day	234 (2.7%)	
1 day	921 (10.5%)	
2 days	423 (4.8%)	
3 days	92 (1.0%)	
>3 days	41 (0.5%)	
Total days of absenteeism per year		1.6 \pm 5.0

248

249 Table 2 | Reported absenteeism caused by menstruation-related symptoms. Women
 250 were asked to report the amount of days on which they were absent due to
 251 menstruation-related symptoms during the last 3 months. The total days of
 252 absenteeism per year was calculated. The added numbers of women in the work and
 253 study group exceed the total amount of participants, since 2,120 women reported to
 254 both study and work more than 5 hours/week. SD = standard deviation

255

256 *Presenteeism*

257 Table 3 shows the numbers reported for presenteeism. Over 80% of all women
 258 reported presenteeism during their periods. The differences between the working
 259 group and the study group were not large in terms of prevalence and lost productivity.
 260 The mean number of lost productive days per year due to presenteeism was more
 261 than seven-fold greater than the mean number of lost productive days due to
 262 absenteeism.

	Number (percentage)	Mean \pm SD	Median
All (n=32,748)			
Presenteeism	26,438 (80.7%)		
Number of days in the past 3 months		5.8 \pm 5.3	5.0
Percentage of productivity loss per day		33.0 \pm 24.8	30.0
Days/year of lost productivity		8.9 \pm 11.0	5.6
Work (n=26,104)			
Presenteeism	21,252 (81.4%)		
Number of days in the past 3 months		5.7 \pm 5.2	5.0
Percentage of productivity loss per day		31.7 \pm 24.7	30.0
Days/year of lost productivity		8.4 \pm 10.6	4.8
Study (n=8,764)			
Presenteeism	7,385 (84.3%)		
Number of days in the past 3 months		6.3 \pm 5.3	5.0
Percentage of productivity loss per day		36.8 \pm 24.2	40.0
Days/year of lost productivity		10.5 \pm 11.8	7.2

263

264 Table 3 | Reported presenteeism caused by menstruation-related symptoms. Women
 265 were asked to report the amount of days on which they were less productive and to
 266 what extent. The total days of lost productivity per year was calculated. The added
 267 numbers of women in the work and study group exceed the total amount of
 268 participants, since 2,120 women reported to both study and work more than 5
 269 hours/week. SD = standard deviation

270

271 *Factors associated with absenteeism and presenteeism*

272 Figure 2 shows the association between reported pain or discomfort scores and both
 273 absenteeism and presenteeism. As seen in detail in table 4, high VAS scores were
 274 significantly associated with higher levels of absenteeism and presenteeism. The
 275 strongest relationship was found for abdominal pain scores that were 7 or higher on a
 276 scale from 0 to ten. Odds ratios were 5.6 for absenteeism (95% confidence interval:
 277 5.0 to 6.2) and 8.8 for presenteeism (95% confidence interval: 8.1 to 9.5). Figure 3
 278 shows the association between age and both presenteeism and absenteeism. As
 279 shown in both figure 3 and table 4, we found that younger women showed
 280 significantly higher rates of absenteeism and presenteeism. A levonorgestrel-
 281 releasing intrauterine device is associated with especially less presenteeism.

		Absenteeism		Presenteeism	
		OR (95% CI)	OR after correction (95% CI)	OR (95% CI)	OR after correction (95% CI)
Age<21 years^a		3.7 (3.4-3.9)	3.3 (3.1-3.6)	1.4 (1.3-1.5)	1.3 (1.2-1.4)
Smoking^b		1.3 (1.2-1.5)	1.3 (1.2-1.4)	1.5 (1.3-1.6)	1.4 (1.3-1.6)
Absenteeism not related to MRSs in the past six months^c		2.2 (2.1-2.4)	1.7 (1.6-1.9)	1.4 (1.3-1.5)	1.3 (1.2-1.4)
Level of education^d					
	Low	4.5 (4.1-4.9)	2.7 (2.4-3.0)	1.3 (1.2-1.4)	1.1 (1.0-1.2)*
	Medium	2.2 (2.1-2.4)	1.7 (1.5-1.8)	1.3 (1.2-1.4)	1.2 (1.1-1.2)
	High	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
Oral contraception^e					
	No	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	Yes	1.2 (1.1-1.3)	1.0 (0.9-1.1)**	0.9 (0.9-1.0)	0.9 (0.8-0.9)
LG-IUD^e					
	No	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	Yes	0.7 (0.6-0.8)	0.9 (0.8-1.0)	0.5 (0.5-0.6)	0.5 (0.5-0.6)
Abdominal pain score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	2.6 (2.3-2.9)	2.2 (1.9-2.4)	5.2 (4.8-5.7)	5.3 (4.9-5.7)
	>7	7.0 (6.4-7.8)	5.6 (5.0-6.2)	8.7 (8.0-9.4)	8.8 (8.1-9.5)
Headache pain score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.5 (1.3-1.6)	1.5 (1.4-1.6)	3.0 (2.7-3.3)	3.1 (2.8-3.4)
	>7	2.0 (1.8-2.1)	2.3 (2.1-2.5)	3.5 (3.2-3.9)	3.7 (3.4-4.1)
Backache pain score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.6 (1.5-1.7)	1.4 (1.3-1.5)	3.5 (3.2-3.9)	3.5 (3.2-3.8)
	>7	2.7 (2.5-2.9)	2.2 (2.1-2.4)	4.7 (4.2-5.2)	4.5 (4.0-5.0)
Tiredness intensity score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.8 (1.7-2.0)	1.8 (1.6-2.0)	3.3 (3.1-3.6)	3.3 (3.1-3.6)
	>7	3.0 (2.8-3.2)	2.8 (2.6-3.1)	5.1 (4.7-5.6)	5.2 (4.7-5.7)
Psychological complaints intensity score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.6 (1.5-1.7)	1.5 (1.4-1.7)	2.7 (2.5-2.9)	2.6 (2.5-2.9)
	>7	2.2 (2.0-2.4)	2.1 (2.0-2.3)	4.4 (4.0-4.7)	4.3 (4.0-4.7)

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3 283 Table 4 | Odd ratios (ORs) and 95% confidence intervals (95% CIs) for factors
4 284 related to absenteeism and presenteeism. ORs >1 correlate with more absenteeism
5 285 or presenteeism. ORs <1 correlate with less absenteeism or presenteeism.
6 286 LG-IUD = Levonorgestrel-releasing intra uterine device
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8 287 ^aCorrection for smoking and absenteeism that was not related to menstruation-
9 288 related symptoms (MRSs); ^bCorrection for age, absenteeism that was not related to
10 289 MRSs, and level of education; ^cCorrection for age, smoking, and level of education;
11 290 ^dCorrection for age, smoking, and absenteeism that was not related to MRSs;
12 291 ^eCorrection for age, smoking, absenteeism that was not related to MRSs, and level of
13 292 education. *p=0.26, **p=0.73 For all other ORs, p<0.05
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293 294 *Menstruation and suggested implications for schools and workplaces*

295 From the respondent who had been calling in sick due to MRSs, 20.1% (n=908) told
296 their employer or school menstrual symptoms were the reason, 46.4% (n=2092) only
297 mentioned the presenting symptom. No reason was given by 27.7% (n=1250), while
298 5.8% (n=260) made up another reason. Women were asked to report suggestions on
299 how work places and conditions could be changed in order for them to function better
300 during their menstrual periods. There were 32,708 responses to this multiple-choice
301 question, to which each woman could give more than one answer. The majority of
302 women (67.7%, n=22,154) preferred more flexibility during their periods, such as the
303 possibility of doing less physical work (32.1%, n=10,499), the ability to work from
304 home (39.5%, n=12,917), more time for personal care (28.3%, n=9,241), or the ability
305 to take a day off and make up for it later (11.5%, n=3,756). In addition, 32.9% wished
306 they could take a complete day off without any consequences. 27.2% (n=8,890) did
307 not wish for any changes in policy. Many women (79.7%, n=26,072) were open to
308 discussing MRSs with their company doctor, and 56.7% (n=18,579) thought that
309 doing so would draw more attention to MRS-related matters.

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3 310 **Discussion**
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6 311 This survey-based study showed that menstruation-related absenteeism and, to a
7
8 312 greater extent, presenteeism are widespread in the general female population. In our
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10 313 cohort, MRSs accounted for up to 24% of total absenteeism for women who were
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12 314 working and studying. The annual productivity loss due to presenteeism was seven-
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14 315 fold times more than the annual productivity loss due to absenteeism and women
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16 316 younger than 21 years experience the largest burden. Symptom severity scores
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18 317 showed significant and strong associations with both absenteeism and presenteeism.
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20 318 When women called in sick due to MRSs, only one in five stated openly that
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22 319 menstrual symptoms were the main reason. A majority of women prefers more
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24 320 flexibility during their periods when it comes to work or school.
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28 321 There have been few studies on absenteeism and presenteeism related to MRSs in
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30 322 the general female population. To our knowledge, Tanaka's study ²⁵ is the only other
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32 323 published study on absenteeism and presenteeism due to MRSs in the general
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34 324 female population. In a cohort of 19,254 Japanese women, a total of 3,311 (17.2%)
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36 325 reported work productivity lost in the prior 3 months, mostly in the form of decreased
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38 326 efficiency (62.0%, n=2,052). Of these 2,052 subjects, the mean number of workdays
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40 327 lost due to decreased efficiency was 5.7 days in 3 months. After recalculation, this
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42 328 accounts for 2.4 days per year for the entire population. This is fewer days than the
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44 329 8.9 days per year in our cohort. On the other hand, the numbers for absenteeism
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46 330 were more similar, with a mean of 1.0 day of absenteeism per year in the entire
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48 331 Japanese cohort compared to 1.2 days in our cohort. Cultural diversity might explain
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50 332 these differences, although it has been suggested in research on musculoskeletal
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52 333 symptoms that rates of absenteeism might be lower in Japan compared to European
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3 334 countries and the United States. Consequently, presenteeism might therefore be a
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5 335 more representative variable.^{26 27}
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8 336 More data are available regarding the impact of dysmenorrhoea on quality of life and
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10 337 absenteeism. De Sanctis et al. reviewed studies on dysmenorrhea in multiple
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12 338 countries, some of which included menstruation-related absenteeism data. They
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14 339 found that the prevalence of school absences in adolescents that was due to
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16 340 dysmenorrhea varied between 7.7% and 57.8%. Since the review included 41,140
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18 341 women in 27 countries, and there was a high degree of heterogeneity in the outcome
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20 342 measures, no firm conclusions could be drawn. Hailemeskel et al. evaluated 440
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22 343 female university students in Ethiopia.²⁸ Among students with dysmenorrhea, 66.8%
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24 344 reported a loss of concentration in class, and 56.3% reported class absences during
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26 345 the last month. In a questionnaire-based study of 706 Hispanic female adolescents,
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28 346 38% reported missing school due to dysmenorrhea during the 3 months prior to the
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30 347 survey, and 59% reported a decrease in concentration in class due to dysmenorrhea.
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37 349 Absenteeism and presenteeism due to endometriosis in other studies was greater
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39 350 than in our study, which was not surprising.^{9 14 30} However, some interesting parallels
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41 351 can be drawn to findings from a recent study by Soliman et al.¹⁴ They found that the
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43 352 average number of hours of presenteeism, 5.3 hours per week, was far greater than
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45 353 the number of hours of absenteeism, which was 1.1 hours per week. Furthermore,
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47 354 younger women had significantly higher levels of lost productivity than their older
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49 355 counterparts, and more severe symptoms were associated with more absenteeism
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51 356 and presenteeism.
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55 357 Our finding that only 20.1% of women were open about their menstrual symptoms as
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57 358 a reason for calling in sick may confirm the general idea that women tend not to
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3 359 speak openly about MRSs. Wong et al. found that in a cohort of schoolgirls in
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5 360 Malaysia, 76.1% considered dysmenorrhoea a normal part of the menstrual cycle.¹⁵
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7 361 In the context of the findings noted above, our study also suggests there is a taboo
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9 362 for women in terms of discussing menstrual problems with their employers. The latter
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11 363 may therefore conclude that the impact of MRSs on their employees is negligible.
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13 364 Considering the fact that we also found that 68% of women wish that they had
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15 365 greater flexibility during their periods, either at school or at work, more openness
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17 366 about MRSs in the employment setting seems desirable. The reasons underlying this
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19 367 taboo are likely to have a historical basis; indeed, since ancient times, menstruation
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21 368 has been surrounded with mythical stories and has not been well understood.
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23 369 However, in recent years, the lay literature in developed countries has focused more
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25 370 attention on MRSs.³¹⁻³³ The prevalence and the impact of MRSs on the general
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27 371 population and the number of women who are asking for a different approach all
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29 372 reflect the need to change the view of menstrual symptoms and the way they are
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31 373 addressed in society.
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36 374 This study consisted of a large cohort, and it reached a large number of women
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38 375 within the age range that was aimed for. The questionnaire was developed in
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40 376 collaboration with patient representatives to make it understandable by and relevant
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42 377 to most women. The cohort appeared to be a representative sample of the general
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44 378 female population based on the number of working hours.³³ When we compare our
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46 379 data with the national registries the total amount of absenteeism is found to be
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48 380 comparable, regardless of whether it was related to MRSs.^{34 35} It is difficult to
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50 381 compare our numbers on women with a diagnosis explaining their MRSs with
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52 382 numbers found in other studies. We found that only 9% of the participants had such a
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54 383 diagnosis, which seems about as expected or even somewhat low.^{3 36-38} In contrast,
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56 384 45% of the women in the study reported consulting a physician for their MRSs. This
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3 385 number was relatively high compared to other studies in which, for example, the
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5 386 percentage of women with dysmenorrhoea who sought medical advice was
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7 387 approximately 15%.^{15 16} An important factor might be the Dutch health system in
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9 388 which general practitioners are available free of charge. Women with a low level of
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11 389 education were relatively underrepresented.³⁹ As our results show, especially
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13 390 absenteeism related to MRSs is associated with a low level of education, and this
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15 391 might have biased our results. We expect women with lower educational levels to do
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17 392 more physical jobs or jobs with less flexibility. Therefore our findings on work
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19 393 productivity loss might be underestimated. On the other hand, our finding could be
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21 394 overestimated due to the possibility that women with more MRSs might be more
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23 395 likely to respond to a questionnaire, as it may seem more relevant to them. Thus,
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25 396 these results must be interpreted with caution. Due to the way that the questionnaire
26
27 397 was distributed through social media, there may have been some selection bias.
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29 398 However, a recent review stated that Facebook is a useful recruitment tool for
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31 399 healthcare research.⁴⁰ Although we did not use a validated questionnaire, our most
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33 400 important outcomes were based on questions derived from the PCQ, which itself is
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35 401 based on validated questions and which is recommended by guidelines for cost
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37 402 research.²⁴ Self-reported absenteeism generally shows a good correlation with
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39 403 official records, although accuracy decreases with increasing recall period.⁴¹ This
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41 404 might have initiated a recall bias in our cohort. It is unknown to what extent recall
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43 405 bias affects reports on presenteeism.⁴² In general, although results vary among
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45 406 studies on premenstrual complaints, a prospective collection of data on symptoms is
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47 407 advisable.^{43 44} Finally, these results may not be generalized internationally due to
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49 408 variability in the regulation of social services in different countries, and this is also a
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51 409 limitation of our study. In The Netherlands, wages are paid during sick leave that has
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53 410 duration of less than 1 year, but women in other countries may not have this benefit.
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3 411 Since we know that many factors influence menstrual symptoms, including biological,
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5 412 cultural, and environmental factors, these differences might well influence both
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7 413 absenteeism and presenteeism.^{6 14 45}
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10 414 In conclusion, we have found that the impact of MRSs on work and school
11
12 415 productivity is considerable and that presenteeism contributes significantly more to
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14 416 the matter than absenteeism. Future research should identify how women affected by
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16 417 MRSs could be helped best and how their productivity can be improved in order to
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18 418 reduce the societal impact regarding absenteeism and presenteeism.
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5
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14 568 **Competing interest statement**
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17 569 All authors have completed the ICMJE uniform disclosure form at
18
19 570 www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for
20
21 571 the submitted work; no financial relationships with any organisations that might have
22
23 572 an interest in the submitted work in the previous three years; no other relationships or
24
25 573 activities that could appear to have influenced the submitted work.
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31 575 **Contributorship statement**
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33
34 576 TN, BD and JA conceived the study. MS wrote the first and successive drafts of the
35
36 577 manuscript. MS, TN and EA modelled and analysed the data. TN, EA, JM, BD and
37
38 578 JA contributed to study conception and design. MS and TN collected the data. All
39
40 579 authors revised the manuscript for important intellectual content. MS and TN had full
41
42 580 access to the data and take responsibility for the integrity of the data and the
43
44 581 accuracy of the data analysis. TN is the guarantor.
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51 583 **Data sharing statement**
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54 584 No additional data from this study are available from a repository. Data are available
55
56 585 on request from the corresponding author.
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2
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5
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7
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9
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For peer review only

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3 591 **Legends to figures**
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9 593 *Figure 1*

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11 594 Flow chart for the respondents.
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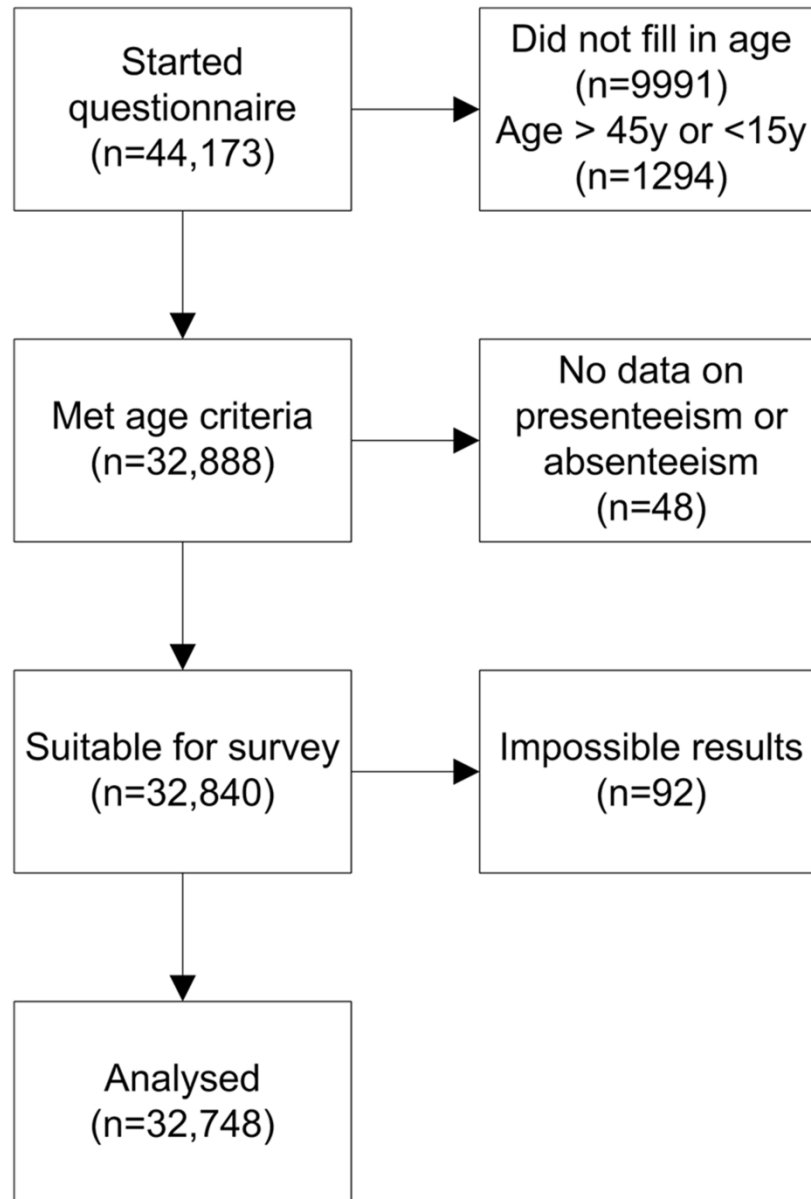
17 596 *Figure 2*

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20 597 The relationship between pain and intensity scores, related to absenteeism and
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22 598 presenteeism, in lost days per year.
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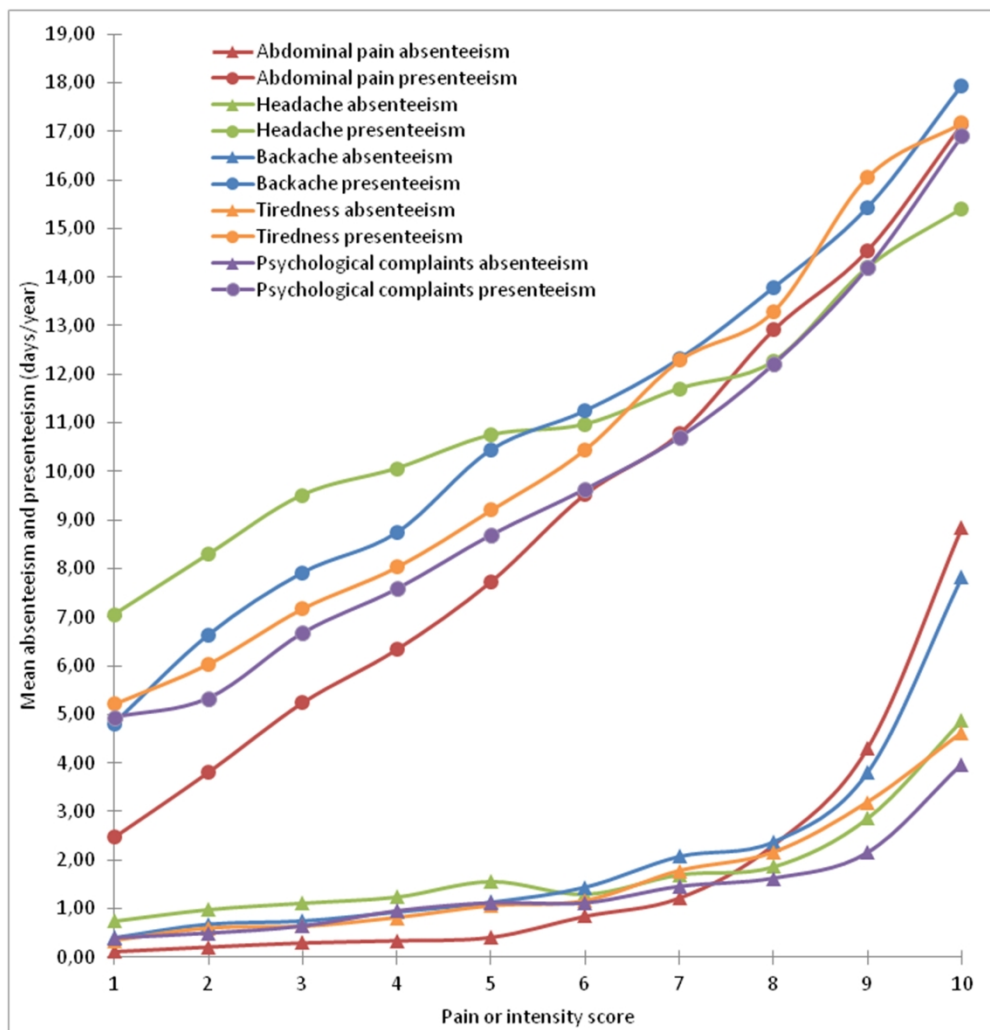
28 600 *Figure 3*

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31 601 The relationship between age and average absenteeism and presenteeism.
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Flow chart for the respondents.

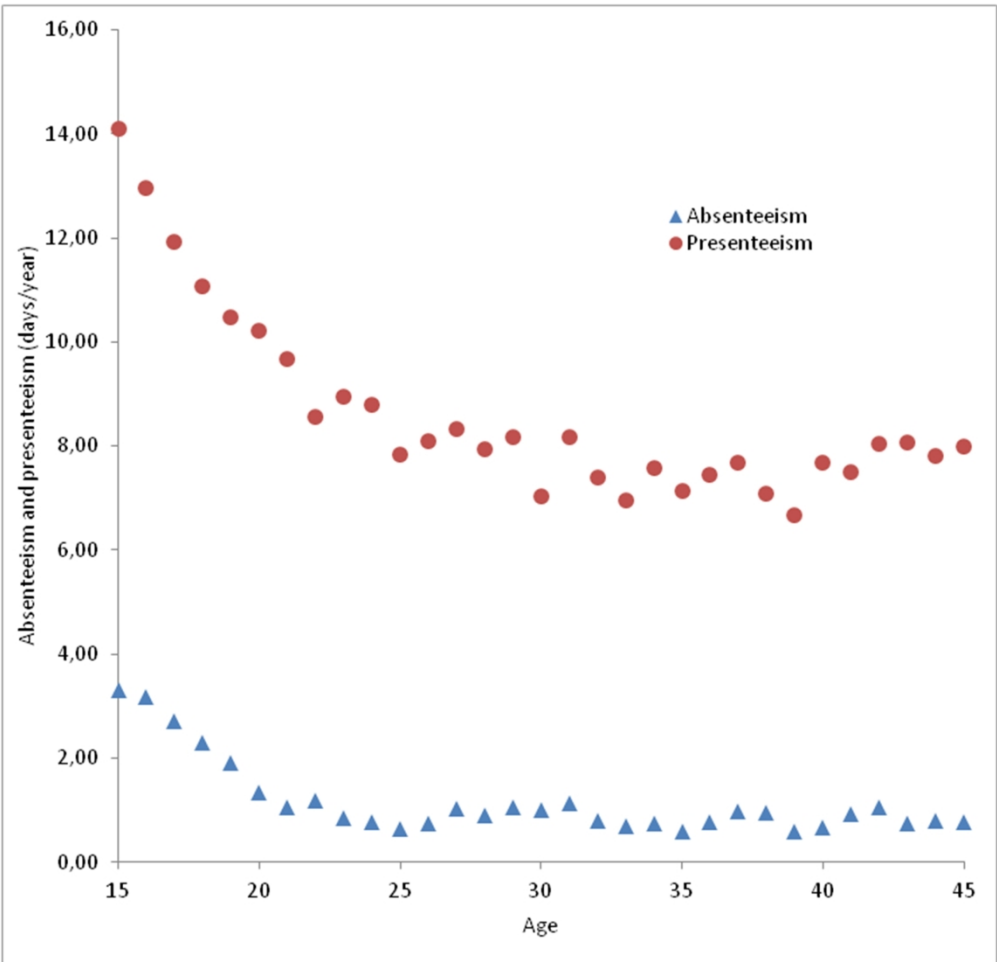
287x423mm (300 x 300 DPI)



The relationship between pain and intensity scores, related to absenteeism and presenteeism, in lost days per year.

202x209mm (300 x 300 DPI)

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The relationship between age and average absenteeism and presenteeism.

206x199mm (300 x 300 DPI)

Appendix

Summary of the questionnaire

Part 1: Questions about basic characteristics

- Age, marital status, nationality, level of education
- Work, voluntary work and study: hours per week, sector,
- Smoking, stress
- Menstrual cycle: length, number of days with blood loss, number of times needing to change pad or tampon
- Medical and obstetric history
- Contraception use

Part 2: General questions about menstruation-related symptoms

- Symptoms: abdominal pain, heavy menstrual blood loss, headache, fatigue, backache, nausea and vomiting, tender breasts, problems with stool, psychological complaints
- Symptoms: number of days the symptom was present; number of days that the symptom influenced daily functioning; the magnitude of the symptom's influence on daily functioning; pain or intensity score (not for heavy menstrual bleeding, nausea and vomiting); continuation of daily activities despite symptoms; and the extent to which women forced themselves to continue their daily activities.
- Usage of over-the-counter drugs, narcotics, painkillers, alternative medicine

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3 *Part 3: Questions related to absenteeism and presenteeism*
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- 5
- 6 - Number of days of absenteeism due to menstruation-related symptoms
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 - 8 - Number of days of presenteeism due to menstruation-related symptoms
 - 9
 - 10 - Mean amount of productivity loss due to menstruation-related symptoms during
 - 11 these days
 - 12
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 - 14
 - 15 - Number of days of absenteeism not related to menstruation-related symptoms
 - 16
 - 17 - Reasons given for absenteeism due to menstruation-related symptoms
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 - 19 - Suggestions for changes at the workplace or schools in order to function better
 - 20 during menstrual periods
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8, appendix
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	7-9
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7-8
		(b) Describe any methods used to examine subgroups and interactions	7-8
		(c) Explain how missing data were addressed	7,9
		(d) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(e) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9/Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9/Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Not reported, can be reported if desirable.
Outcome data	15*	Report numbers of outcome events or summary measures	9-11/Table 2,3
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 4
		(b) Report category boundaries when continuous variables were categorized	Table 1,4
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14-15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	n/a

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Productivity loss due to menstruation-related symptoms: a nationwide cross-sectional survey among 32,748 women

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-026186.R1
Article Type:	Research
Date Submitted by the Author:	13-Dec-2018
Complete List of Authors:	Schoep, Mark; Radboudumc, Obstetrics and Gynaecology Adang, Eddy; Radboudumc, Health Evidence Maas, Jacques; Maxima Medisch Centrum locatie Veldhoven De Bie, Bianca; Dutch Patient Endometriosis Foundation Aarts, Johanna; Radboudumc, Department of Obstetrics & Gynaecology Nieboer, Theodoor; Radboudumc, Obstetrics and Gynaecology
Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	Health economics, Health policy, Occupational and environmental medicine, Public health
Keywords:	Menstruation, Community gynaecology < GYNAECOLOGY, Menstrual cycle, Presenteeism, Absenteeism

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Manuscripts

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3 1 **Productivity loss due to menstruation-related symptoms: a nationwide cross-**
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5 2 **sectional survey among 32,748 women**
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8 3 **Schoep ME¹, Adang EMM², Maas JWM³, De Bie BLF⁴, Aarts JWM⁵, Nieboer TE⁶**
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23 29 **Word count:** 4,056
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29 31 **Key Words:** Absenteeism, Presenteeism, Menstrual cycle, Menstruation, Community
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31 32 Gynaecology
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33 **Abstract**

34 Objective

35 To evaluate age-dependent productivity loss caused by menstruation-related
36 symptoms, measured in absenteeism (time away from work or school) and
37 presenteeism (productivity loss while present at work/school).

38

39 Methods

40 *Design/Setting:* Internet-based, cross-sectional survey conducted in The Netherlands
41 from July to October 2017.

42 *Participants:* 32,748 women aged 15 to 45 years, recruited through social-media.

43 *Outcome measures:* Lost productivity in days, divided into absenteeism and
44 presenteeism; impact of menstrual symptoms; reasons women give to their employer
45 or school when calling in sick; and women's preferences regarding the implications of
46 menstruation related symptoms for schools and workplaces.

47 Results

48 A total of 13.8% of all women reported absenteeism during their menstrual periods
49 with 3.4% reporting absenteeism every or almost every menstrual cycle. The mean
50 absenteeism related to a woman's period was 1.2 days per year. A total of 80.7% of
51 the respondents reported presenteeism and decreased productivity a mean of 23.2
52 days per year. An average productivity loss of 33% resulted in a mean of 8.9 days of
53 total lost productivity per year. Women under 21 were more likely to report
54 absenteeism due to menstruation-related symptoms (OR 3.3, 95% confidence
55 interval 3.1 to 3.6). When women called in sick due to their periods, only 20.1% told
56 their employer or school mentor that their absence was due to menstrual complaints.

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3 57 Notably, 67.7% of the participants wished they had greater flexibility in their tasks and
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5 58 working hours at work or school during their periods.
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10 11 60 Conclusions

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14 61 Menstruation-related symptoms cause a great deal of lost productivity, and
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16 62 presenteeism is a bigger contributor to this than absenteeism. There is an urgent
17
18 63 need for more focus on the impact of these symptoms, especially in adolescents, for
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20 64 discussions of treatment options with women of all ages, and, ideally, more flexibility
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22 65 for women who work or go to school.
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27 28 29 67 **Strengths and limitations of this study**

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32 68
- 33 • This is the largest cohort study to analyse the impact of menstruation-related
34 symptoms on work and school productivity.
35 69
 - 36 • The survey was performed among the general female population and is
37 consequently not per se related to one specific gynaecological condition.
38 70
 - 39 • Due to the way of recruitment of participants, there may have been some
40 degree of selection bias.
41 71
 - 42 • The generalisability of the study may be limited to employment and school
43 systems comparable to the Dutch.
44 72
 - 45 • The generalisability of the study may be limited to employment and school
46 systems comparable to the Dutch.
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 - 48 • The generalisability of the study may be limited to employment and school
49 systems comparable to the Dutch.
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58 systems comparable to the Dutch.
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 - 60 • The generalisability of the study may be limited to employment and school
61 systems comparable to the Dutch.

77 **Background**

78 Menstruation-related symptoms (MRSs) are diverse and widespread among women.
79 Symptoms include dysmenorrhea, heavy menstrual bleeding and premenstrual mood
80 disturbances with reported prevalence of 45% to 90%, 14% to 25%, and 20% to 29%
81 respectively.¹⁻³ Studies show that women with MRSs have lower scores on several
82 domains of quality of life such as general health and physical, mental, social, and
83 occupational functioning during their periods.^{1 4-7} Furthermore, these symptoms may
84 create considerable financial burdens on patients and their families as well as on
85 society.^{5 6 8-12} Such financial burdens are related to the costs of visits to the doctor,
86 over-the-counter drugs, and medical or surgical treatment. However, costs related to
87 productivity loss could be the largest cost driver. Productivity costs are defined as
88 costs associated with paid and unpaid production loss and the replacement of
89 productive people due to illness or disability.¹³ Productivity costs can be divided into
90 costs related to absenteeism and costs related to presenteeism. Absenteeism
91 represents the total amount of time off work or away from school, and presenteeism
92 represents the loss of productivity while present at a job or school.

93 Although the literature is scarce and the results are variable, studies on specific
94 patient groups generally show that MRSs can cause absenteeism.¹⁴⁻¹⁶ Research on
95 the association between MRSs and presenteeism is even more limited. It has been
96 suggested that research into possible impairments in quality of life caused by
97 menstrual symptoms should not focus on single symptoms but rather on a complex of
98 symptoms that vary widely but that are all related to the menstrual cycle. This
99 complex includes both standard symptoms, like heavy menstrual bleeding and
100 abdominal cramps, and also less common symptoms, like nausea and cold sweats.

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3 102 Taking all symptoms into account, it seems likely that the real impact of MRSs is
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5 103 underestimated in the general population. Despite being almost two decades into the
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7 104 21st century, discussions about MRSs may still be rather taboo. This survey-based
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9 105 exploratory study aimed to quantify the burden of MRSs in the general female
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11 106 population, with burden defined as the number of lost days at work or school due to
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13 107 absenteeism and presenteeism. Furthermore, it was aimed to study the impact of
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15 108 specific symptoms on absenteeism and presenteeism.
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23 110 **Methods**

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26 111 This cross-sectional study consisted of an online survey that was distributed from
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28 112 July 12 to October 11, 2017. Approval for this study was obtained from the local
29
30 113 medical ethics committee “Commissie Mensgebonden Onderzoek (CMO)” under
31
32 114 number file number 2017-3387 on July 12th 2017. All data were anonymously
33
34 115 collected and stored under the privacy rules of the Radboud University Medical
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36 116 Center. Patients gave informed consent when they initiated the questionnaire.
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44 118 *Patient and Public Involvement*

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47 119 A group of women, among which were several members of the Dutch Patient
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49 120 Endometriosis Foundation, women with a linguistic education and women with a
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51 121 medical origin, was involved in the conduct of this study at several stages; i.e. in the
52
53 122 development and dissemination of the questionnaire and in the analysis and
54
55 123 interpretation of the results. One of the authors of this manuscript, BD, is the chair of
56
57 124 the Dutch Patient Endometriosis Foundation. Additional contributions are noted in the
58
59 125 Acknowledgements section.
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126

127 *Questionnaire development*

128 The questionnaire had several parts, and Appendix 1 provides details about the
129 questions. Part 1 consisted of questions about each woman's basic characteristics.
130 Part 2 had questions about menstrual symptoms, and part 3 had questions related to
131 absenteeism and presenteeism. Adaptive questioning was used with a maximum of 6
132 questions per page. Participants were asked in a lay manner how long their
133 menstrual cycle was and what the exact meaning of a menstrual cycle was. The
134 duration of the cycle was divided in 5 categories (25 days or less, 26-30 days, 31-35
135 days, 36-40 days and 41 days or more). Furthermore participants could indicate if
136 they had an irregular cycle, meaning more than 10 days difference per cycle, if they
137 were amenorrhic due to the use of an Intra-Uterine Device (IUD) or the continuous
138 use of oral contraceptives, or the option "I do not know". Additional questions about
139 absenteeism and presenteeism were included that were based on the Productivity
140 Cost Questionnaire from the Institute for Medical Technology Assessment (iMTA-
141 PCQ).¹⁹ We modified the iMTA-PCQ-recommended recall period of four weeks to
142 three months so that it was in line with the relevant time period for this study and so
143 we could include multiple menstrual periods. We assumed the amount of
144 presenteeism to be larger than the amount of absenteeism. Therefore, the recall
145 period for absenteeism was extended to six months to maintain accuracy. Visual
146 analogue scales (VAS) were used to quantify the amount of pain, or the intensity of
147 the symptom, and the impairment due to pain or the other symptom. Presenteeism
148 was measured by asking women to what extent they were able to be as productive
149 as possible compared to a day without MRSs. This was scored on a scale from 0 to
150 10, with 0 being totally unproductive and 10 fully productive. In separate questions,

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3 151 participants were asked to quantify their absenteeism that was related to MRSs and
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5 152 absenteeism for any other reason than MRSs. For the latter, we did not specifically
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7 153 ask the underlying reason.
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14 155 *Target population and recruitment*

17 156 The study population comprised of women between 15 and 45 years old. The upper
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19 157 age limit was chosen to avoid interference from menopausal symptoms; the lower to
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21 158 have a time margin after the average menarche age, since it is known that the first
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23 159 periods are irregular and often accompanied with discomfort and uncertainty. A large
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25 160 number of women were approached with the aim of obtaining a cohort that was
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27 161 representative of the general female population in terms of level of education,
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29 162 medical history, and/or gynaecological diagnosis. Women were invited to complete a
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31 163 survey using an online questionnaire tool²⁰ through a campaign on social media
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33 164 platforms Facebook and Twitter. Patient organisations, colleagues, and visitors of the
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35 165 Facebook page of one of the authors (TN) were asked to share the link to the
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37 166 questionnaire in order to reach the widest possible audience.
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43 167 On July 12, 2017, a link to the questionnaire was posted on Facebook and Twitter
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45 168 through the account of one of the authors (TN). In the post both women with and
46
47 169 without MRSs were encouraged to fill in the questionnaire. Within 24 hours of the first
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49 170 posting on social media, over 6,000 respondents had filled in the questionnaire, and
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51 171 by July 18, there were 15,000 respondents, which was announced by a re-post of the
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53 172 link to the questionnaire. A third post was made on Facebook and Twitter on
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55 173 September 16, 2017, to reach women who may have been on holiday when the first
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57 174 posts were created.
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6 176 *Data analysis*

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9 177 The outcome measures were presented in a descriptive way; we used valid
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11 178 percentages in case of missing values where necessary. We distinguished between
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14 179 women who were mainly working or mainly studying. Therefore, we present these
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16 180 data for two groups i.e. for women who worked more than 5 hours per week
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18 181 (“working group”) and for women who studied more than 5 hours per week (“studying
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20
21 182 group”).

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24 183 We used binary logistic regression to calculate odds ratios. Absenteeism and
25
26 184 presenteeism were used as dependant variables. As independent variables we used
27
28 185 the following parameters: women younger than 21 versus women aged 21 and older,
29
30 186 smoking yes or no, reports of absenteeism not related to MRSs, educational level,
31
32 187 the use of oral contraception and the use of an levonorgestrel-releasing intra uterine
33
34 188 device. All independent variables were used in an univariate as well as a multivariate
35
36 189 analysis. We also studied the association between pain scores and both
37
38 190 absenteeism and presenteeism, given that the literature shows that pain scores of 0
39
40 191 to 4, 5 to 6, and 7 or higher have a different impact on activity, mood, and sleep.^{21 22}
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43 192 Analyses were performed using IBM SPSS Statistics version 22.00.
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51 194 *Assumptions and transformation of the original data*

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54 195 To present data on level of education in an international format we had to transform
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56 196 the original data, which was based on the Dutch school system.²³ The categorical
57
58 197 data of participants’ length of menstrual cycle were transformed into averages.
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2
3 198 With regard to the evaluation of absenteeism and presenteeism, “the guideline for
4
5 199 economic evaluations in healthcare in the Netherlands” was used.²⁴ A work-day
6
7 200 accounts for 8 hours. For most sectors in the Netherlands, a full-time work-week is 36
8
9 201 hours. The maximum amount of working hours per year was set at 1558 when they
10
11 202 were working full time. We asked women to report their absenteeism due to MRSs
12
13 203 per cycle and used a recall period of six months.
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17 204 To calculate the percentages for absenteeism, one day of absenteeism accounted for
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19 205 8 hours of lost productivity. When a woman reported to study or work more than 40
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21 206 hours per week, we transformed these hours to 40 for reasons of clarity in the
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23 207 calculations and comparability with the data of the Dutch Central Bureau of Statistics,
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25 208 CBS. We made a few other transformations for categorical data. For absenteeism
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27 209 related to MRSs, the category “more than three days per cycle” was considered to be
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29 210 4 days per cycle. For absenteeism that was not related to MRSs, the category “more
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31 211 than ten days in the past six months” was considered to be 11 days in the past six
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33 212 months.
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39 213 To present yearly data, we multiplied some of these data based on the original recall
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41 214 period. The number of days for absenteeism related to MRSs was based on days per
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43 215 cycle, which were therefore multiplied by 12.7 based on the reported average
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45 216 menstrual cycle of 28.8 days, see table 1. These values were then multiplied by one
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47 217 if the woman reported that she called in sick “every period”, 0.75 if she reported
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49 218 “almost every period”, 0.5 if she reported “half of all periods”, and 0.25 if she reported
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51 219 calling in sick “only once in a while”. Values for absenteeism that was not related to
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53 220 MRS were based on a recall period of 6 months and were therefore multiplied by two
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55 221 in order to obtain the number of days per year. The values for presenteeism were
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57 222 based on a recall period of three months and were therefore multiplied by four.
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224 **Results**

225 A total of 44,173 women initiated the questionnaire. We excluded participants who
 226 did not report a date of birth or whose age did not fulfil the inclusion criteria (figure 1).
 227 There were no duplicates of IP addresses. Women who did not answer questions
 228 related to absenteeism and presenteeism were excluded. Furthermore, cases with
 229 impossible results (e.g. 10,000,000 days of presenteeism in three months or 140
 230 changes of sanitary pads a day) were excluded. This resulted in a total of 32,748
 231 women in the final analysis.

232 Table 1 summarizes the basic characteristics of the participants. We found that
 233 45.4% (n=14,839) had visited a doctor for menstrual complaints in the past, with a
 234 total of 3017 (9.2%) women reporting a diagnosis of a menstrual disorder, such as
 235 endometriosis or fibroids.

236 The mean age of women in the working group was higher than the mean age of
 237 women in the studying group. The mean number of working hours per week in the
 238 working group was 27.0 (SD 11.4), and the mean number of study hours in the
 239 studying group was 27.4 (SD 12.1). A total of 7,335 women (22.4%) reported both
 240 working and studying more than five hours per week. In this group, 3,001 women
 241 were working more than 16 hours a week, and 5,284 women in the study group were
 242 studying more than 16 hours a week.

	Number (percentage)	Mean \pm SD	Median
Age, years		28.6 \pm 8.6	28
15-19	6,141 (18.8%)		
20-24	6,118 (18.7%)		

25-29	5,825 (17.8%)		
30-34	5,483 (16.7%)		
35-40	4,687 (14.3%)		
41-45	4,494 (13.7%)		
Level of education			
Low	4,020 (12.3%)		
Medium	12,335 (37.9%)		
High	16,229 (49.8%)		
Hours/week			
Paid work		21.7±14.7	24
Study		7.4±13.6	0
Voluntary work		0.8±3.1	0
Menstrual cycle			
Regular cycle	25,717 (78.5%)		
Duration		28.8±3.0	28
Amenorrhoea due to LG-IUD/OC	3,675 (11.2%)		
Irregular, variation >10 days per cycle	2,495 (7.6%)		
Do not know	861 (2.6%)		
Days with blood loss per cycle		5.4±1.6	5
Visited a doctor for MRSs			
No	17,873 (54.6%)		
Yes, general practitioner	10,141 (31.0%)		
Yes, gynaecologist	4,698 (14.4%)		
Diagnosis for MRSs*			
No	29,731 (90.8%)		
Yes	3,017 (9.2%)		
Endometriosis	1,120 (3.4%)		
PCOS	588 (1.8%)		
Adenomyosis	103 (0.3%)		

Fibroids	275 (0.8%)		
Other	1,901 (5.8%)		
Contraception*			
Hormonal contraception	11,993 (36.6%)		
OC	8,650 (26.4%)		
LG-IUD	2,752 (8.4%)		
Other hormonal: injection, transdermal etc.	882 (2.7%)		
No hormonal contraception	20,755 (63.4%)		
Cu-IUD	771 (2.4%)		
Female sterilisation	423 (1.3%)		
No female contraception	19,639 (60.0%)		
Nulliparous	21,585 (66.0%)		
Paid work >5 hr a week	26,104 (79.7%)		
Age		29.7±8.3	29
Hours of paid work/week		27.0±11.4	28
Hours spent on study/week		7.5±13.4	0
>40 hours of paid work/week	1,047 (3.2%)		
Study >5 hr a week	8,764 (26.8%)		
Age		22.0±6.2	20
Hours spent on study/week		27.4±12.1	30
Hours of paid work/week		15.5±11.3	12
>40 hours spent on study/week	322 (1.0%)		

243

244 Table 1 | Basic characteristics of study participants (n=32,748) Mean duration of
 245 cycle based on women with a regular cycle. SD = standard deviation, MRSs =
 246 menstruation-related symptoms, PCOS = polycystic ovary syndrome, OC = oral
 247 contraceptive, LG-IUD = levonorgestrel-releasing intrauterine device, Cu-IUD =
 248 copper intrauterine device. *More than one answer possible.

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3 250 *Absenteeism*
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6 251 Table 2 shows the results on absenteeism due to MRSs. Although 13.8% of the
7
8 252 women (n=4,514) reported absenteeism due to MRSs, only 1,108 women (3.4%)
9
10 253 reported absenteeism every cycle or almost every cycle. The percentage of
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12 254 absenteeism in every cycle or almost every cycle was 2.4% in the working group and
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14 255 4.5% in the studying group. The mean absenteeism due to MRSs was 0.9 days per
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16 256 year for the working group and 1.6 day per year for the study group.
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21 257 We also calculated the mean total absenteeism that was not related to MRSs. For the
22
23 258 entire group, this was 3.3 days per year; for the working group, it was 3.5 days, and
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25 259 for the studying group, it was 4.3 days. The mean percentage of absenteeism that
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27 260 was not related to MRSs was 3.5% in the working group and 3.7% in the studying
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29 261 group. Consequently, absenteeism due to MRSs in our cohort accounted for, on
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31 262 average, 22% of the total absenteeism in the working group and 24% in the studying
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33 263 group.
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	Number (percentage)	Mean \pm SD
All (n=32,748)		
Absenteeism	4,514 (13.8)	
≤ 0.5 day	538 (1.6%)	
1 day	2,259 (6.9%)	
2 days	1,171 (3.6%)	
3 days	349 (1.1%)	
>3 days	184 (0.6%)	
Total days of absenteeism per year		1.3 \pm 5.9
Work (n=26,104)		
Absenteeism	2,926 (11.2%)	
≤ 0.5 day	374 (1.4%)	
1 day	1,476 (5.7%)	
2 days	757 (2.9%)	
3 days	211 (0.8%)	
>3 days	98 (0.4%)	
Total days of absenteeism per year		0.9 \pm 3.9
Study (n=8,764)		
Absenteeism	1,715 (19.6%)	
≤ 0.5 day	234 (2.7%)	
1 day	921 (10.5%)	
2 days	423 (4.8%)	
3 days	92 (1.0%)	
>3 days	41 (0.5%)	
Total days of absenteeism per year		1.6 \pm 5.0

265

266 Table 2 | Reported absenteeism caused by menstruation-related symptoms. Women
 267 were asked to report the average amount of days on which they were absent due to
 268 menstruation-related symptoms per cycle. The total days of absenteeism per year

269 was calculated. The added numbers of women in the work and study group exceed
 270 the total amount of participants, since 2,120 women reported to both study and work
 271 more than 5 hours/week. SD = standard deviation

272

273 *Presenteeism*

274 Table 3 shows the numbers reported for presenteeism. Over 80% of all women
 275 reported presenteeism during their periods. The differences between the working
 276 group and the study group were not large in terms of prevalence and lost productivity.
 277 The mean number of lost productive days per year due to presenteeism was more
 278 than seven-fold greater than the mean number of lost productive days due to
 279 absenteeism.

	Number (percentage)	Mean ± SD	Median
All (n=32,748)			
Presenteeism	26,438 (80.7%)		
Number of days in the past 3 months		5.8±5.3	5.0
Percentage of productivity loss per day		33.0±24.8	30.0
Days/year of lost productivity		8.9±11.0	5.6
Work (n=26,104)			
Presenteeism	21,252 (81.4%)		
Number of days in the past 3 months		5.7±5.2	5.0
Percentage of productivity loss per day		31.7±24.7	30.0
Days/year of lost productivity		8.4±10.6	4.8
Study (n=8,764)			
Presenteeism	7,385 (84.3%)		
Number of days in the past 3 months		6.3±5.3	5.0
Percentage of productivity loss per day		36.8±24.2	40.0

Days/year of lost productivity		10.5±11.8	7.2
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280

281 Table 3 | Reported presenteeism caused by menstruation-related symptoms. Women
 282 were asked to report the amount of days on which they were less productive and to
 283 what extent. The total days of lost productivity per year was calculated. The added
 284 numbers of women in the work and study group exceed the total amount of
 285 participants, since 2,120 women reported to both study and work more than 5
 286 hours/week. SD = standard deviation

287

288 *Factors associated with absenteeism and presenteeism*

289 Figure 2 shows the association between reported pain or discomfort scores and both
 290 absenteeism and presenteeism. As seen in detail in table 4, high VAS scores were
 291 significantly associated with higher levels of absenteeism and presenteeism. The
 292 strongest relationship was found for abdominal pain scores that were 7 or higher on a
 293 scale from 0 to ten. Odds ratios were 5.6 for absenteeism (95% confidence interval:
 294 5.0 to 6.2) and 8.8 for presenteeism (95% confidence interval: 8.1 to 9.5). Figure 3
 295 shows the association between age and both presenteeism and absenteeism. As
 296 shown in both figure 3 and table 4, we found that younger women showed
 297 significantly higher rates of absenteeism and presenteeism. A levonorgestrel–
 298 releasing intrauterine device is associated with especially less presenteeism.

	Absenteeism		Presenteeism	
	OR (95% CI)	OR after correction (95% CI)	OR (95% CI)	OR after correction (95% CI)
Age<21 years^a	3.7 (3.4-3.9)	3.3 (3.1-3.6)	1.4 (1.3-1.5)	1.3 (1.2-1.4)
Smoking^b	1.3 (1.2-1.5)	1.3 (1.2-1.4)	1.5 (1.3-1.6)	1.4 (1.3-1.6)
Absenteeism not related to MRSs in the past six months^c	2.2 (2.1-2.4)	1.7 (1.6-1.9)	1.4 (1.3-1.5)	1.3 (1.2-1.4)
Level of education^d				

	Low	4.5 (4.1-4.9)	2.7 (2.4-3.0)	1.3 (1.2-1.4)	1.1 (1.0-1.2)*
	Medium	2.2 (2.1-2.4)	1.7 (1.5-1.8)	1.3 (1.2-1.4)	1.2 (1.1-1.2)
	High	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
Oral contraception^e					
	No	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	Yes	1.2 (1.1-1.3)	1.0 (0.9-1.1)**	0.9 (0.9-1.0)	0.9 (0.8-0.9)
LG-IUD^e					
	No	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	Yes	0.7 (0.6-0.8)	0.9 (0.8-1.0)	0.5 (0.5-0.6)	0.5 (0.5-0.6)
Abdominal pain score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	2.6 (2.3-2.9)	2.2 (1.9-2.4)	5.2 (4.8-5.7)	5.3 (4.9-5.7)
	>7	7.0 (6.4-7.8)	5.6 (5.0-6.2)	8.7 (8.0-9.4)	8.8 (8.1-9.5)
Headache pain score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.5 (1.3-1.6)	1.5 (1.4-1.6)	3.0 (2.7-3.3)	3.1 (2.8-3.4)
	>7	2.0 (1.8-2.1)	2.3 (2.1-2.5)	3.5 (3.2-3.9)	3.7 (3.4-4.1)
Backache pain score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.6 (1.5-1.7)	1.4 (1.3-1.5)	3.5 (3.2-3.9)	3.5 (3.2-3.8)
	>7	2.7 (2.5-2.9)	2.2 (2.1-2.4)	4.7 (4.2-5.2)	4.5 (4.0-5.0)
Tiredness intensity score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.8 (1.7-2.0)	1.8 (1.6-2.0)	3.3 (3.1-3.6)	3.3 (3.1-3.6)
	>7	3.0 (2.8-3.2)	2.8 (2.6-3.1)	5.1 (4.7-5.6)	5.2 (4.7-5.7)
Psychological complaints intensity					

score ^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.6 (1.5-1.7)	1.5 (1.4-1.7)	2.7 (2.5-2.9)	2.6 (2,5-2.9)
	>7	2.2 (2.0-2.4)	2.1 (2.0-2.3)	4.4 (4.0-4.7)	4.3 (4.0-4.7)

299

300 Table 4 | Odd ratios (ORs) and 95% confidence intervals (95% CIs) for factors
 301 related to absenteeism and presenteeism. ORs >1 correlate with a higher prevalence
 302 of absenteeism or presenteeism. ORs <1 correlate with a lower prevalence of
 303 absenteeism or presenteeism.

304 LG-IUD = Levonorgestrel-releasing intra uterine device

305 ^aCorrection for smoking and absenteeism that was not related to menstruation-

306 related symptoms (MRSs); ^bCorrection for age, absenteeism that was not related to

307 MRSs, and level of education; ^cCorrection for age, smoking, and level of education;

308 ^dCorrection for age, smoking, and absenteeism that was not related to MRSs;

309 ^eCorrection for age, smoking, absenteeism that was not related to MRSs, and level of

310 education. *p=0.26, **p=0,73 For all other ORs, p<0.05

311

312 *Menstruation and suggested implications for schools and workplaces*

313 From the respondent who had been calling in sick due to MRSs, 20.1% (n=908) told

314 their employer or school menstrual symptoms were the reason, 46.4% (n=2092) only

315 mentioned the presenting symptom. No reason was given by 27.7% (n=1250), while

316 5.8% (n=260) made up another reason. Comparing women aged below 21 with

317 women aged 21 and above, we found that younger women were less open about

318 their MRSs being the reason for calling in sick (12.0%) versus women older than 21

319 (27.0%). Women were asked to report suggestions on how work places and

320 conditions could be changed in order for them to function better during their

321 menstrual periods. There were 32,708 responses to this multiple-choice question, to

322 which each woman could give more than one answer. The majority of women

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3 323 (67.7%, n=22,154) preferred more flexibility during their periods, such as the
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5 324 possibility of doing less physical work (32.1%, n=10,499), the ability to work from
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7 325 home (39.5%, n=12,917), more time for personal care (28.3%, n=9,241), or the ability
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9 326 to take a day off and make up for it later (11.5%, n=3,756). In addition, 32.9% wished
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11 327 they could take a complete day off without any consequences. 27.2% (n=8,890) did
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13 328 not wish for any changes in policy. Many women (79.7%, n=26,072) were open to
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15 329 discussing MRSs with their company doctor, and 56.7% (n=18,579) thought that
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17 330 doing so would draw more attention to MRS-related matters.
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331 **Discussion**

332 This survey-based study showed that menstruation-related absenteeism and, to a
333 greater extent, presenteeism are widespread in the general female population. In our
334 cohort, MRSs accounted for up to 24% of total absenteeism for women who were
335 working and studying. The annual productivity loss due to presenteeism was seven-
336 fold times more than the annual productivity loss due to absenteeism and women
337 younger than 21 years experience the largest burden. Symptom severity scores
338 showed significant and strong associations with both absenteeism and presenteeism.
339 When women called in sick due to MRSs, only one in five stated openly that
340 menstrual symptoms were the main reason. A majority of women prefers more
341 flexibility during their periods when it comes to work or school.

342 There have been few studies on absenteeism and presenteeism related to MRSs in
343 the general female population. To our knowledge, Tanaka's study²⁵ is the only other
344 published study on absenteeism and presenteeism due to MRSs in the general
345 female population. In a cohort of 19,254 Japanese women, a total of 3,311 (17.2%)
346 reported work productivity lost in the prior 3 months, mostly in the form of decreased
347 efficiency (62.0%, n=2,052). Of these 2,052 subjects, the mean number of workdays
348 lost due to decreased efficiency was 5.7 days in 3 months. After recalculation, this
349 accounts for 2.4 days per year for the entire population. This is fewer days than the
350 8.9 days per year in our cohort. On the other hand, the numbers for absenteeism
351 were more similar, with a mean of 1.0 day of absenteeism per year in the entire
352 Japanese cohort compared to 1.2 days in our cohort. Differences in regulations of
353 social services, a difference in attitude towards sick leave and a different method of
354 data collection might explain these differences. It has been suggested in research on
355 musculoskeletal symptoms that rates of absenteeism might be lower in Japan

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3 356 compared to European countries and the United States. Consequently, presenteeism
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5 357 might therefore be a more representative variable.^{26 27}
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8 358 More data are available regarding the impact of dysmenorrhoea on quality of life and
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10 359 absenteeism. De Sanctis et al. reviewed studies on dysmenorrhea in multiple
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12 360 countries, some of which included menstruation-related absenteeism data. They
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14 361 found that the prevalence of school absences in adolescents that was due to
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16 362 dysmenorrhea varied between 7.7% and 57.8%. Since the review included 41,140
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18 363 women in 27 countries, and there was a high degree of heterogeneity in the outcome
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20 364 measures, no firm conclusions could be drawn. Hailemeskel et al. evaluated 440
21
22 365 female university students in Ethiopia.²⁸ Among students with dysmenorrhea, 66.8%
23
24 366 reported a loss of concentration in class, and 56.3% reported class absences during
25
26 367 the last month. In a questionnaire-based study of 706 Hispanic female adolescents,
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28 368 38% reported missing school due to dysmenorrhea during the 3 months prior to the
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30 369 survey, and 59% reported a decrease in concentration in class due to dysmenorrhea.
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39 371 Absenteeism and presenteeism due to endometriosis in other studies was greater
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41 372 than in our study, which was not surprising.^{9 14 30} However, some interesting parallels
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43 373 can be drawn to findings from a recent study by Soliman et al.¹⁴ They found that the
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45 374 average number of hours of presenteeism, 5.3 hours per week, was far greater than
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47 375 the number of hours of absenteeism, which was 1.1 hours per week. Furthermore,
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49 376 younger women had significantly higher levels of lost productivity than their older
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51 377 counterparts, and more severe symptoms were associated with more absenteeism
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53 378 and presenteeism. This was in line with our findings, since we also found higher rates
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55 379 of both absenteeism and presenteeism in younger women. A taboo on talking openly
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57 380 about MRS, under-treatment and less flexibility at school might be possible
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3 381 explanations for these differences. Comparing our outcomes with studies on other
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5 382 non-gynaecological conditions is hard due to differences in methods and
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7 383 presentation of findings and the cyclic character of MRSs. However, the incidence of
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10 384 presenteeism seems to be as high as it is in patients with inflammatory bowel
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12 385 disease.³¹ Moreover, the amount of work impairment is comparable with severe
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14 386 gastroesophageal reflux (31.9%), moderate irritable bowel syndrome (36.6%) and
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16 387 allergic rhinitis (33.4%-39.8%).³²

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20 388 Our finding that only 20.1% of women were open about their menstrual symptoms as
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22 389 a reason for calling in sick may confirm the general idea that women tend not to
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24 390 speak openly about MRSs. Wong et al. found that in a cohort of schoolgirls in
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26 391 Malaysia, 76.1% considered dysmenorrhoea a normal part of the menstrual cycle.¹⁵
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28 392 In the context of the findings noted above, our study also suggests there is a taboo
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30 393 for women in terms of discussing menstrual problems with their employers. The latter
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32 394 may therefore conclude that the impact of MRSs on their employees is negligible.
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34 395 Considering the fact that we also found that 68% of women wish that they had
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36 396 greater flexibility during their periods, either at school or at work, more openness
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38 397 about MRSs in the employment setting seems desirable. The reasons underlying this
39
40 398 taboo are likely to have a historical basis; indeed, since ancient times, menstruation
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42 399 has been surrounded with mythical stories and has not been well understood.
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44 400 However, in recent years, the lay literature in developed countries has focused more
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46 401 attention on MRSs. ³³⁻³⁵ The prevalence and the impact of MRSs on the general
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48 402 population and the number of women who are asking for a different approach all
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50 403 reflect the need to change the view of menstrual symptoms and the way they are
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52 404 addressed in society.
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3 405 This study consisted of a large cohort, and it reached a large number of women
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5 406 within the age range that was aimed for. The questionnaire was developed in
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7 407 collaboration with patient representatives to make it understandable by and relevant
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9 408 to most women. The cohort appeared to be a representative sample of the general
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11 409 female population based on the number of working hours.³³ When we compare our
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13 410 data with the national registries the total amount of absenteeism is found to be
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15 411 comparable, regardless of whether it was related to MRSs.^{36 37} It is difficult to
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17 412 compare our numbers on women with a diagnosis explaining their MRSs with
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19 413 numbers found in other studies. We found that only 9% of the participants had such a
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21 414 diagnosis, which seems about as expected or even somewhat low.^{3 38-40} In contrast,
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23 415 45% of the women in the study reported consulting a physician for their MRSs. This
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25 416 number was relatively high compared to other studies in which, for example, the
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27 417 percentage of women with dysmenorrhoea who sought medical advice was
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29 418 approximately 15%.^{15 16} An important factor might be the Dutch health system in
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31 419 which general practitioners are available free of charge. Women with a low level of
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33 420 education were relatively underrepresented.⁴¹ As our results show, especially
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35 421 absenteeism related to MRSs is associated with a low level of education, and this
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37 422 might have biased our results. We expect women with lower educational levels to do
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39 423 more physical jobs or jobs with less flexibility. Therefore, our findings on work
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41 424 productivity loss might be underestimated. On the other hand, our finding could be
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43 425 overestimated due to the possibility that women with more MRSs might be more
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45 426 likely to respond to a questionnaire, as it may seem more relevant to them. Moreover,
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47 427 we were not able to provide data on presenteeism not related to MRSs nor were we
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49 428 able to correct for comorbid health conditions. Thus, these results must be
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51 429 interpreted with caution. Due to the way that the questionnaire was distributed
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53 430 through social media, there may have been some selection bias. However, a recent

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3 431 review stated that Facebook is a useful recruitment tool for healthcare research.⁴²
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5 432 Although we did not use a validated questionnaire, our most important outcomes
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7 433 were based on questions derived from the PCQ, which itself is based on validated
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9 434 questions and which is recommended by guidelines for cost research.²⁴ Self-reported
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11 435 absenteeism generally shows a good correlation with official records, although
12
13 436 accuracy decreases with increasing recall period.⁴³ This might have initiated a recall
14
15 437 bias in our cohort. It is unknown to what extent recall bias affects reports on
16
17 438 presenteeism.⁴⁴ In general, although results vary among studies on premenstrual
18
19 439 complaints, a prospective collection of data on symptoms is advisable.^{45 46}
20
21 440 Furthermore, an extrapolation of a three and six months timeframe to a yearly basis
22
23 441 may intrinsically imply some degree of uncertainty, for example when the influenza
24
25 442 season is not included in the original analysis. Finally, these results may not be
26
27 443 generalized internationally due to variability in the regulation of social services in
28
29 444 different countries, and this is also a limitation of our study. In The Netherlands,
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31 445 wages are paid during sick leave that has duration of less than 1 year, but women in
32
33 446 other countries may not have this benefit. Since we know that many factors influence
34
35 447 menstrual symptoms, including biological, cultural, and environmental factors, these
36
37 448 differences might well influence both absenteeism and presenteeism.^{6 14 47}
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44
45 449 In conclusion, we have found that the impact of MRSs on work and school
46
47 450 productivity is considerable and that presenteeism contributes significantly more to
48
49 451 the matter than absenteeism. Future research should identify how women affected by
50
51 452 MRSs could be helped best and how their productivity can be improved in order to
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53 453 reduce the societal impact regarding absenteeism and presenteeism.
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3 455 **References**
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3 590 **Funding statement**
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7
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15 594 **Competing interest statement**
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17
18 595 All authors have completed the ICMJE uniform disclosure form at
19
20 596 www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for
21
22 597 the submitted work; no financial relationships with any organisations that might have
23
24 598 an interest in the submitted work in the previous three years; no other relationships or
25
26 599 activities that could appear to have influenced the submitted work.
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33 601 **Contributorship statement**
34

35
36 602 TN, BD and JA conceived the study. MS wrote the first and successive drafts of the
37
38 603 manuscript. MS, TN and EA modelled and analysed the data. TN, EA, JM, BD and
39
40 604 JA contributed to study conception and design. MS and TN collected the data. All
41
42 605 authors revised the manuscript for important intellectual content. MS and TN had full
43
44 606 access to the data and take responsibility for the integrity of the data and the
45
46 607 accuracy of the data analysis. TN is the guarantor.
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54 609 **Data sharing statement**
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56
57 610 No additional data from this study are available from a repository. Data are available
58
59 611 on request from the corresponding author.
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3 612 **Acknowledgements**
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5

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7
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9
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For peer review only

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3 617 **Legends to figures**
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9 619 *Figure 1*
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12 620 Flow chart for the respondents.
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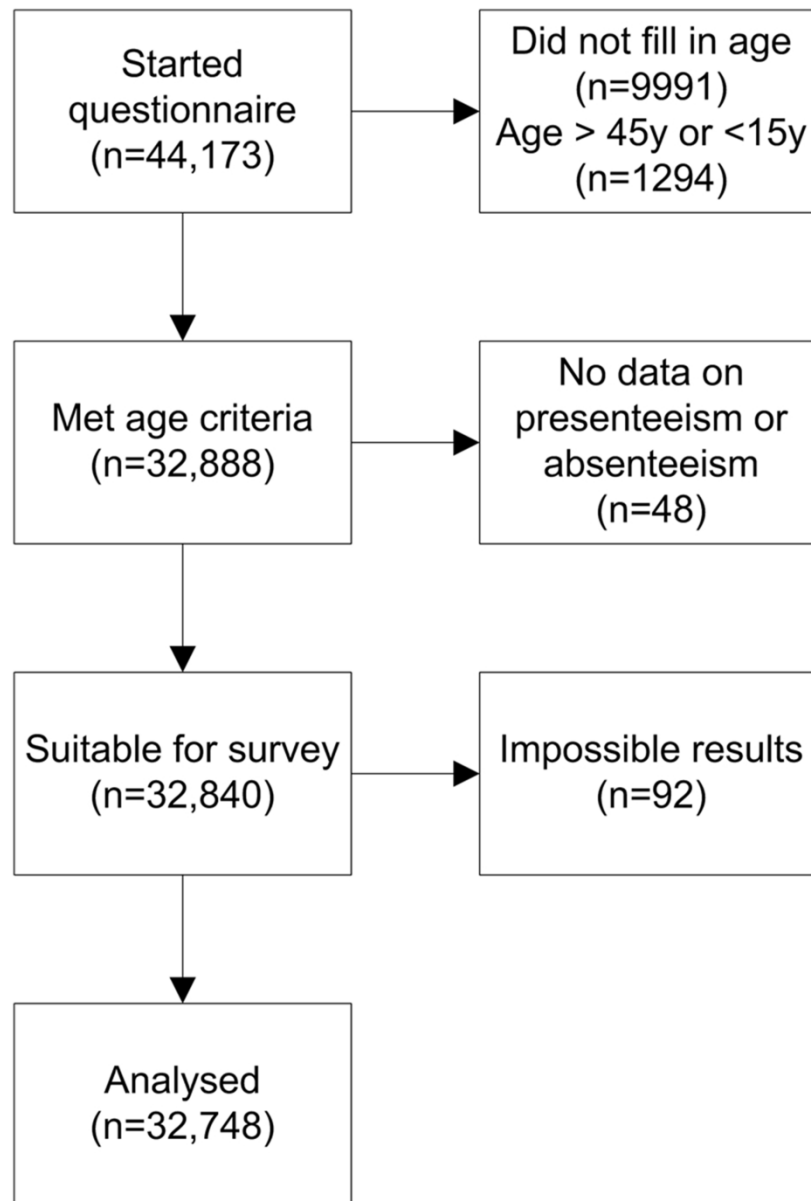
18 622 *Figure 2*
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22 623 The relationship between pain and intensity scores, related to absenteeism and
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24 624 presenteeism, in lost days per year.
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30 626 *Figure 3*
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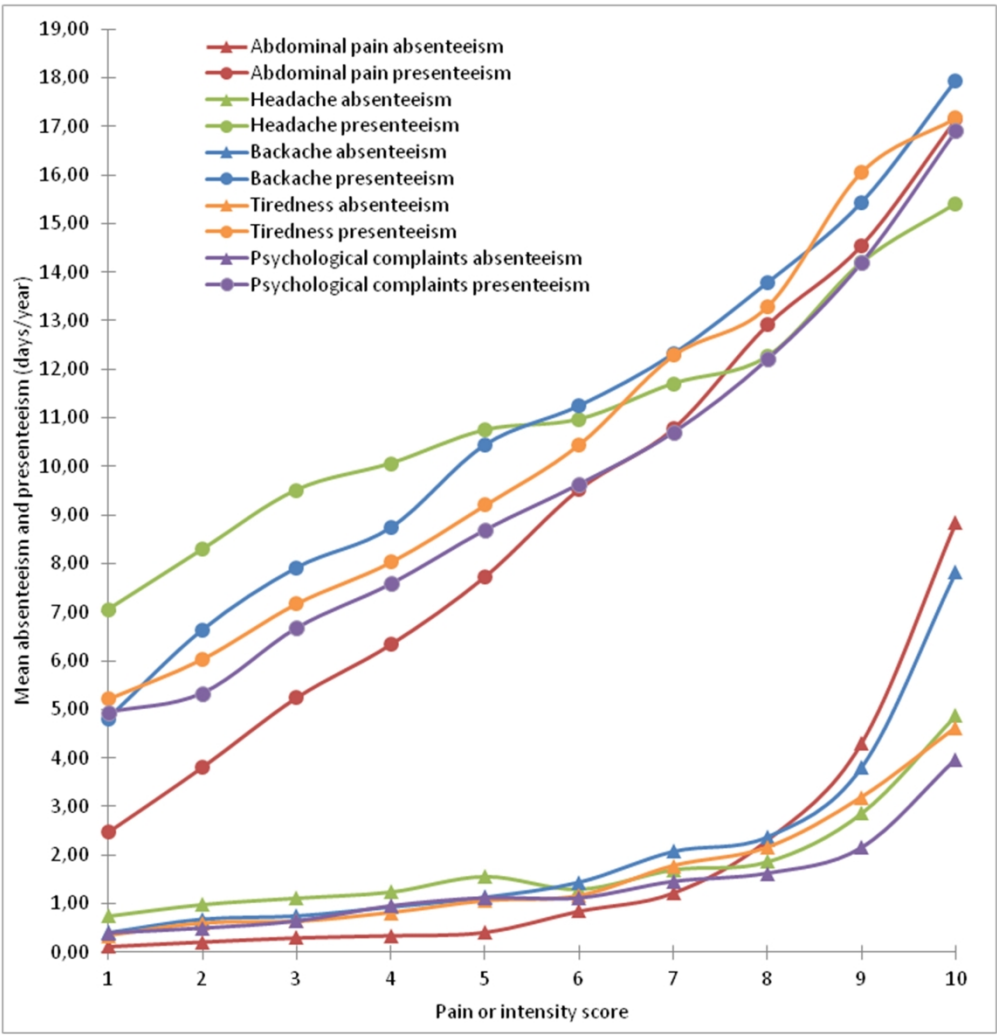
33 627 The relationship between age and average absenteeism and presenteeism.
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Flow chart for the respondents.

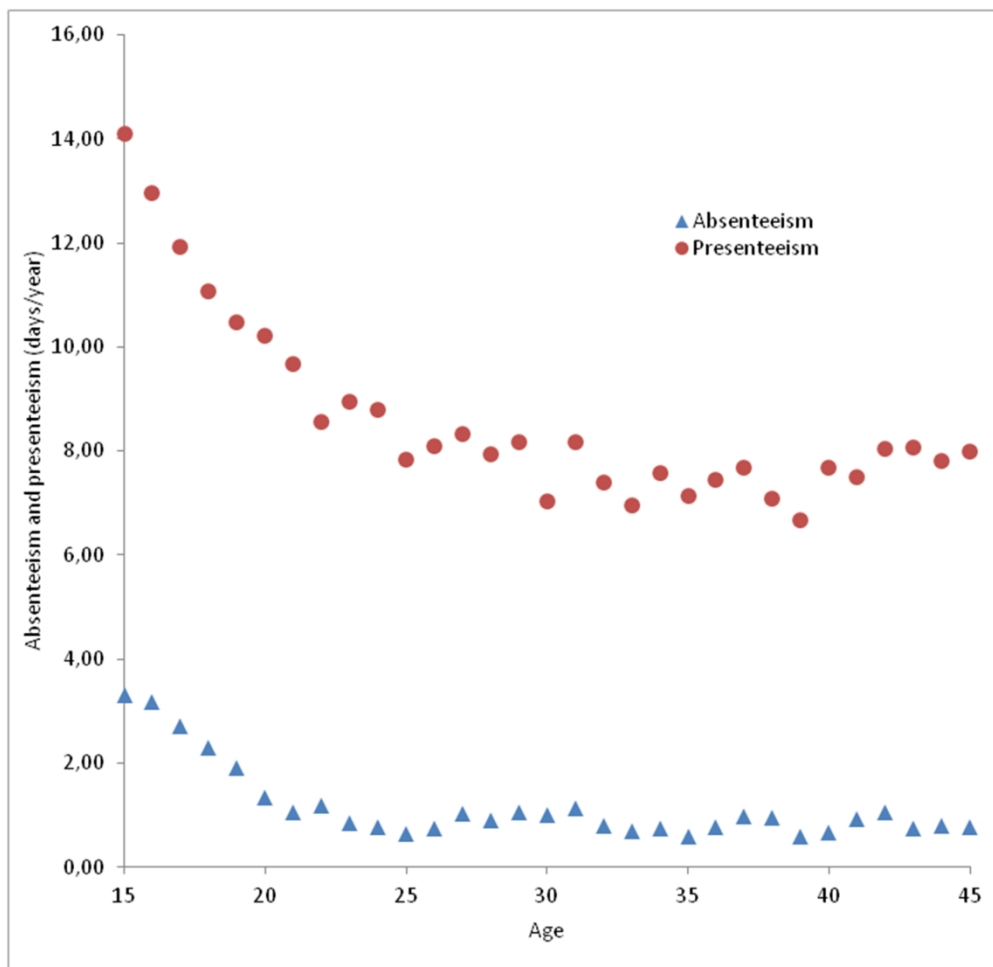
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The relationship between pain and intensity scores, related to absenteeism and presenteeism, in lost days per year.

202x209mm (300 x 300 DPI)



The relationship between age and average absenteeism and presenteeism.

206x199mm (300 x 300 DPI)

Appendix

Summary of the questionnaire

Part 1: Questions about basic characteristics

- Age, marital status, nationality, level of education
- Work, voluntary work and study: hours per week, sector, experienced stress
- Smoking
- Menstrual cycle: total length, number of days with blood loss, number of times needing to change pad or tampon
- Medical and obstetric history
- Contraception use

Part 2: General questions about menstruation-related symptoms

- Symptoms: abdominal pain, heavy menstrual blood loss, headache, fatigue, backache, nausea and vomiting, tender breasts, problems with stool, psychological complaints
- Per symptom: number of days the symptom was present; number of days that the symptom influenced daily functioning; the magnitude of the symptom's influence on daily functioning; pain or intensity score (not for heavy menstrual bleeding, nausea and vomiting); continuation of daily activities despite symptoms; and the extent to which women forced themselves to continue their daily activities
- Usage of over-the-counter drugs, narcotics, painkillers, alternative medicine

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3 *Part 3: Questions related to absenteeism and presenteeism (full text)*
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7 - How often did you call in sick due to menstrual complaints in the past six months?
8
9 ○ Every menstrual cycle
10
11 ○ Almost every menstrual cycle
12
13 ○ Half of all menstrual cycles
14
15 ○ Sometimes
16
17 ○ Never
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23 - What is the mean number of days you called in sick due to menstruation-related
24 symptoms per cycle in the past six months?
25
26 ○ More than three days
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28 ○ Three days
29
30 ○ Two days
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32 ○ One day
33
34 ○ Half a day or a few hours
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43 - What is the number of days you were present at work while being hindered by
44 menstrual complaints?
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50 - How was your performance during these days?
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52 ○ A Visual Analog Scale by means of sliding a bar was used to score the amount
53 of productivity loss, where the left end said “I could not do anything” and the
54 right end said “I could do just as much as I normally do”.
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3 - What was the number of days you called in sick because of non-menstruation-related
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5 symptoms in the past six months?
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11 - What reason do you give when you call in sick due to menstruation-related
12 symptoms?
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15 ○ Menstrual complaints
16
17 ○ Only the presenting symptom, for example abdominal pain or headache
18
19 ○ You do not give a reason
20
21 ○ You think up another reason
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27 - What measures would be desirable for women on the workplace or at school during
28 their menstrual period? It is possible to give more than one answer.
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31 ○ A day off without any consequences
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33 ○ A day off to catch up later
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35 ○ Flexibility to perform less physical work
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37 ○ More time for personal care
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39 ○ The possibility to work from home
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41 ○ None
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43 ○ Not applicable
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8, appendix
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	7-9
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7-8
		(b) Describe any methods used to examine subgroups and interactions	7-8
		(c) Explain how missing data were addressed	7,9
		(d) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(e) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9/Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9/Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Not reported, can be reported if desirable.
Outcome data	15*	Report numbers of outcome events or summary measures	9-11/Table 2,3
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 4
		(b) Report category boundaries when continuous variables were categorized	Table 1,4
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14-15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	n/a

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Productivity loss due to menstruation-related symptoms: a nationwide cross-sectional survey among 32,748 women

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Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	Health economics, Health policy, Occupational and environmental medicine, Public health
Keywords:	Menstruation, Community gynaecology < GYNAECOLOGY, Menstrual cycle, Presenteeism, Absenteeism

SCHOLARONE™
Manuscripts

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3 1 **Productivity loss due to menstruation-related symptoms: a nationwide cross-**
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5 2 **sectional survey among 32,748 women**

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36 **Abstract**

37 Objective

38 To evaluate age-dependent productivity loss caused by menstruation-related
39 symptoms, measured in absenteeism (time away from work or school) and
40 presenteeism (productivity loss while present at work/school).

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42 Methods

43 *Design/Setting:* Internet-based, cross-sectional survey conducted in the Netherlands
44 from July to October 2017.

45 *Participants:* 32,748 women aged 15 to 45 years, recruited through social-media.

46 *Outcome measures:* Self reported lost productivity in days, divided into absenteeism
47 and presenteeism; impact of menstrual symptoms; reasons women give when calling
48 in sick; and women's preferences regarding the implications of menstruation related
49 symptoms for schools and workplaces.

50 Results

51 A total of 13.8% (n=4,514) of all women reported absenteeism during their menstrual
52 periods with 3.4% (n=1,108) reporting absenteeism every or almost every menstrual
53 cycle. The mean absenteeism related to a woman's period was 1.2 days per year. A
54 total of 80.7% (n=26,438) of the respondents reported presenteeism and decreased
55 productivity a mean of 23.2 days per year. An average productivity loss of 33%
56 resulted in a mean of 8.9 days of total lost productivity per year. Women under 21
57 were more likely to report absenteeism due to menstruation-related symptoms (OR
58 3.3, 95% confidence interval 3.1 to 3.6). When women called in sick due to their
59 periods, only 20.1% (n=908) told their employer or school that their absence was due

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3 60 to menstrual complaints. Notably, 67.7% (n=22,154) of the participants wished they
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5 61 had greater flexibility in their tasks and working hours at work or school during their
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7 62 periods.
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14 64 Conclusions

16 65 Menstruation-related symptoms cause a great deal of lost productivity, and
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18 66 presenteeism is a bigger contributor to this than absenteeism. There is an urgent
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20 67 need for more focus on the impact of these symptoms, especially in women aged
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22 68 under 21, for discussions of treatment options with women of all ages, and, ideally,
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24 69 more flexibility for women who work or go to school.
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31 71 **Strengths and limitations of this study**

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35 72 • This is the largest cohort study to analyse the impact of menstruation-related
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37 73 symptoms on work and school productivity.
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39 74 • The survey was performed among the general female population and is
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41 75 consequently not per se related to one specific gynaecological condition.
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43 76 • Due to the way of recruitment of participants, there may have been some
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45 77 degree of selection bias.
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47 78 • Outcomes are based on self reported data and consequently lack objectivity
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49 79 regarding productivity loss
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51 80 • The generalisability of the study may be limited to employment and school
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53 81 systems comparable to the Dutch.
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83 **Background**

84 Menstruation-related symptoms (MRSs) are diverse and widespread among women.
85 Symptoms include dysmenorrhea, heavy menstrual bleeding and premenstrual mood
86 disturbances with reported prevalence of 45% to 90%, 14% to 25%, and 20% to 29%
87 respectively.¹⁻³ Studies show that women with MRSs have lower scores on several
88 domains of quality of life such as general health and physical, mental, social, and
89 occupational functioning during their periods.^{1 4-7} Furthermore, these symptoms may
90 create considerable financial burdens on patients and their families as well as on
91 society.^{5 6 8-12} Such financial burdens are related to the costs of visits to the doctor,
92 over-the-counter drugs, and medical or surgical treatment. However, costs related to
93 productivity loss could be the largest cost driver. Productivity costs are defined as
94 costs associated with paid and unpaid production loss and the replacement of
95 productive people due to illness or disability.¹³ Productivity costs can be divided into
96 costs related to absenteeism and costs related to presenteeism. Absenteeism
97 represents the total amount of time off work or away from school, and presenteeism
98 represents the loss of productivity while present at a job or school.

99 Although the literature is scarce and the results are variable, studies on specific
100 patient groups generally show that MRSs can cause absenteeism.¹⁴⁻¹⁶ Research on
101 the association between MRSs and presenteeism is even more limited. It has been
102 suggested that research into possible impairments in quality of life caused by
103 menstrual symptoms should not focus on single symptoms but rather on a complex of
104 symptoms that vary widely but that are all related to the menstrual cycle. This
105 complex includes both standard symptoms, like heavy menstrual bleeding and
106 abdominal cramps, and also less common symptoms, like nausea and cold sweats.

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3 108 Taking all symptoms into account, it seems likely that the real impact of MRSs is
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5 109 underestimated in the general population. Despite being almost two decades into the
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7 110 21st century, discussions about MRSs may still be rather taboo. This survey-based
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9 111 exploratory study aimed to quantify the burden of MRSs in the general female
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11 112 population, with burden defined as the number of lost days at work or school due to
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13 113 absenteeism and presenteeism. Furthermore, it was aimed to study the impact of
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15 114 specific symptoms on absenteeism and presenteeism.
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23 116 **Methods**

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26 117 This cross-sectional study consisted of an online survey that was distributed from
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28 118 July 12 to October 11, 2017. Approval for this study was obtained from the local
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30 119 medical ethics committee “Commissie Mensgebonden Onderzoek (CMO)” under
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32 120 number file number 2017-3387 on July 12th 2017. All data were anonymously
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34 121 collected and stored under the privacy rules of the Radboud University Medical
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36 122 Center. Patients gave informed consent when they initiated the questionnaire.
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44 124 *Patient and Public Involvement*

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47 125 A group of women, among which were several members of the Dutch Patient
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49 126 Endometriosis Foundation, women with a linguistic education and women with a
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51 127 medical origin, was involved in the conduct of this study at several stages; i.e. in the
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53 128 development and dissemination of the questionnaire and in the analysis and
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55 129 interpretation of the results. One of the authors of this manuscript, BD, is the chair of
56
57 130 the Dutch Patient Endometriosis Foundation. Additional contributions are noted in the
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59 131 Acknowledgements section.
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133 *Questionnaire development*

134 The questionnaire had several parts, and Appendix 1 provides details about the
135 questions. Part 1 consisted of questions about each woman's basic characteristics.
136 Part 2 had questions about menstrual symptoms, and part 3 had questions related to
137 absenteeism and presenteeism. Adaptive questioning was used with a maximum of 6
138 questions per page. Participants were asked in a lay manner how long their
139 menstrual cycle was and what the exact meaning of a menstrual cycle was. The
140 duration of the cycle was divided in 5 categories (25 days or less, 26-30 days, 31-35
141 days, 36-40 days and 41 days or more). Furthermore participants could indicate if
142 they had an irregular cycle, meaning more than 10 days difference per cycle, if they
143 were amenorrhic due to the use of an Intra-Uterine Device (IUD) or the continuous
144 use of oral contraceptives, or the option "I do not know". Additional questions about
145 absenteeism and presenteeism were included that were based on the Productivity
146 Cost Questionnaire from the Institute for Medical Technology Assessment (iMTA-
147 PCQ).¹⁹ We modified the iMTA-PCQ-recommended recall period of four weeks to
148 three months so that it was in line with the relevant time period for this study and so
149 we could include multiple menstrual periods. We assumed the amount of
150 presenteeism to be larger than the amount of absenteeism. Therefore, the recall
151 period for absenteeism was extended to six months to maintain accuracy. Visual
152 analogue scales (VAS) were used to quantify the amount of pain, or the intensity of
153 the symptom, and the impairment due to pain or the other symptom. Presenteeism
154 was measured by asking women to what extent they were able to be as productive
155 as possible compared to a day without MRSs. This was scored on a scale from 0 to
156 10, with 0 being totally unproductive and 10 fully productive. In separate questions,

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3 157 participants were asked to quantify their absenteeism that was related to MRSs and
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5 158 absenteeism for any other reason than MRSs. For the latter, we did not specifically
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7 159 ask the underlying reason.
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14 161 *Target population and recruitment*

17 162 The study population comprised of women between 15 and 45 years old. The upper
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19 163 age limit was chosen to avoid interference from menopausal symptoms; the lower to
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21 164 have a time margin after the average menarche age, since it is known that the first
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23 165 periods are irregular and often accompanied with discomfort and uncertainty. A large
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25 166 number of women were approached with the aim of obtaining a cohort that was
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27 167 representative of the general female population in terms of level of education,
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29 168 medical history, and/or gynaecological diagnosis. Women were invited to complete a
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31 169 survey using an online questionnaire tool²⁰ through a campaign on social media
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33 170 platforms Facebook and Twitter. Patient organisations, colleagues, and visitors of the
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35 171 Facebook page of one of the authors (TN) were asked to share the link to the
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37 172 questionnaire in order to reach the widest possible audience.
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43 173 On July 12, 2017, a link to the questionnaire was posted on Facebook and Twitter
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45 174 through the account of one of the authors (TN). In the post both women with and
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47 175 without MRSs were encouraged to fill in the questionnaire. Within 24 hours of the first
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49 176 posting on social media, over 6,000 respondents had filled in the questionnaire, and
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51 177 by July 18, there were 15,000 respondents, which was announced by a re-post of the
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53 178 link to the questionnaire. A third post was made on Facebook and Twitter on
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55 179 September 16, 2017, to reach women who may have been on holiday when the first
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57 180 posts were created.
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182 *Data analysis*

183 The outcome measures were presented in a descriptive way; we used valid
184 percentages in case of missing values where necessary. We distinguished between
185 women who were mainly working or mainly studying. Therefore, we present these
186 data for two groups i.e. for women who worked more than 5 hours per week
187 (“working group”) and for women who studied more than 5 hours per week (“studying
188 group”).

189 We used binary logistic regression to calculate odds ratios. Absenteeism and
190 presenteeism were used as dependant variables. As independent variables we used
191 the following parameters: women younger than 21 versus women aged 21 and older,
192 smoking yes or no, reports of absenteeism not related to MRSs, educational level,
193 the use of oral contraception and the use of an levonorgestrel-releasing intra uterine
194 device. All independent variables were used in an univariate as well as a multivariate
195 analysis. We also studied the association between pain scores and both
196 absenteeism and presenteeism, given that the literature shows that pain scores of 0
197 to 4, 5 to 6, and 7 or higher have a different impact on activity, mood, and sleep.^{21 22}
198 Analyses were performed using IBM SPSS Statistics version 22.00.

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200 *Assumptions and transformation of the original data*

201 To present data on level of education in an international format we had to transform
202 the original data, which was based on the Dutch school system.²³ The categorical
203 data of participants’ length of menstrual cycle were transformed into averages.

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3 204 With regard to the evaluation of absenteeism and presenteeism, “the guideline for
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5 205 economic evaluations in healthcare in the Netherlands” was used.²⁴ A work-day
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7 206 accounts for 8 hours. For most sectors in the Netherlands, a full-time work-week is 36
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9 207 hours. The maximum amount of working hours per year was set at 1558 when they
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11 208 were working full time. We asked women to report their absenteeism due to MRSs
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13 209 per cycle and used a recall period of six months.
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18 210 To calculate the percentages for absenteeism, one day of absenteeism accounted for
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20 211 8 hours of lost productivity. When a woman reported to study or work more than 40
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22 212 hours per week, we transformed these hours to 40 for reasons of clarity in the
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24 213 calculations and comparability with the data of the Dutch Central Bureau of Statistics,
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26 214 CBS. We made a few other transformations for categorical data. For absenteeism
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28 215 related to MRSs, the category “more than three days per cycle” was considered to be
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30 216 4 days per cycle. For absenteeism that was not related to MRSs, the category “more
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32 217 than ten days in the past six months” was considered to be 11 days in the past six
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34 218 months.
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39 219 To present yearly data, we multiplied some of these data based on the original recall
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41 220 period. The number of days for absenteeism related to MRSs was based on days per
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43 221 cycle, which were therefore multiplied by 12.7 based on the reported average
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45 222 menstrual cycle of 28.8 days, see table 1. These values were then multiplied by one
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47 223 if the woman reported that she called in sick “every period”, 0.75 if she reported
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49 224 “almost every period”, 0.5 if she reported “half of all periods”, and 0.25 if she reported
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51 225 calling in sick “only once in a while”. Values for absenteeism that was not related to
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53 226 MRS were based on a recall period of 6 months and were therefore multiplied by two
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55 227 in order to obtain the number of days per year. The values for presenteeism were
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57 228 based on a recall period of three months and were therefore multiplied by four.
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230 **Results**

231 A total of 44,173 women initiated the questionnaire. We excluded participants who
 232 did not report a date of birth or whose age did not fulfil the inclusion criteria (figure 1).
 233 There were no duplicates of IP addresses. Women who did not answer questions
 234 related to absenteeism and presenteeism were excluded. Furthermore, cases with
 235 impossible results (e.g. 10,000,000 days of presenteeism in three months or 140
 236 changes of sanitary pads a day) were excluded. This resulted in a total of 32,748
 237 women in the final analysis.

238 Table 1 summarizes the basic characteristics of the participants. We found that
 239 45.4% (n=14,839) had visited a doctor for menstrual complaints in the past, with a
 240 total of 3017 (9.2%) women reporting a diagnosis of a menstrual disorder, such as
 241 endometriosis or fibroids.

242 The mean age of women in the working group was higher than the mean age of
 243 women in the studying group. The mean number of working hours per week in the
 244 working group was 27.0 (SD 11.4), and the mean number of study hours in the
 245 studying group was 27.4 (SD 12.1). A total of 7,335 women (22.4%) reported both
 246 working and studying more than five hours per week. In this group, 3,001 women
 247 were working more than 16 hours a week, and 5,284 women in the study group were
 248 studying more than 16 hours a week.

	Number (percentage)	Mean \pm SD	Median
Age, years		28.6 \pm 8.6	28
15-19	6,141 (18.8%)		
20-24	6,118 (18.7%)		

25-29	5,825 (17.8%)		
30-34	5,483 (16.7%)		
35-40	4,687 (14.3%)		
41-45	4,494 (13.7%)		
Level of education			
Low	4,020 (12.3%)		
Medium	12,335 (37.9%)		
High	16,229 (49.8%)		
Hours/week			
Paid work		21.7±14.7	24
Study		7.4±13.6	0
Voluntary work		0.8±3.1	0
Menstrual cycle			
Regular cycle	25,717 (78.5%)		
Duration		28.8±3.0	28
Amenorrhoea due to LG-IUD/OC	3,675 (11.2%)		
Irregular, variation >10 days per cycle	2,495 (7.6%)		
Do not know	861 (2.6%)		
Days with blood loss per cycle		5.4±1.6	5
Visited a doctor for MRSs			
No	17,873 (54.6%)		
Yes, general practitioner	10,141 (31.0%)		
Yes, gynaecologist	4,698 (14.4%)		
Diagnosis for MRSs*			
No	29,731 (90.8%)		
Yes	3,017 (9.2%)		
Endometriosis	1,120 (3.4%)		
PCOS	588 (1.8%)		
Adenomyosis	103 (0.3%)		

Fibroids	275 (0.8%)		
Other	1,901 (5.8%)		
Contraception*			
Hormonal contraception	11,993 (36.6%)		
OC	8,650 (26.4%)		
LG-IUD	2,752 (8.4%)		
Other hormonal: injection, transdermal etc.	882 (2.7%)		
No hormonal contraception	20,755 (63.4%)		
Cu-IUD	771 (2.4%)		
Female sterilisation	423 (1.3%)		
No female contraception	19,639 (60.0%)		
Nulliparous	21,585 (66.0%)		
Paid work >5 hr a week	26,104 (79.7%)		
Age		29.7±8.3	29
Hours of paid work/week		27.0±11.4	28
Hours spent on study/week		7.5±13.4	0
>40 hours of paid work/week	1,047 (3.2%)		
Study >5 hr a week	8,764 (26.8%)		
Age		22.0±6.2	20
Hours spent on study/week		27.4±12.1	30
Hours of paid work/week		15.5±11.3	12
>40 hours spent on study/week	322 (1.0%)		

249

250 Table 1 | Basic characteristics of study participants (n=32,748) Mean duration of
 251 cycle based on women with a regular cycle. SD = standard deviation, MRSs =
 252 menstruation-related symptoms, PCOS = polycystic ovary syndrome, OC = oral
 253 contraceptive, LG-IUD = levonorgestrel-releasing intrauterine device, Cu-IUD =
 254 copper intrauterine device. *More than one answer possible.

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256 *Absenteeism*

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3 257 Table 2 shows the results on absenteeism due to MRSs. Although 13.8% of the
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5 258 women (n=4,514) reported absenteeism due to MRSs, only 1,108 women (3.4%)
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7 259 reported absenteeism every cycle or almost every cycle. The percentage of
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9 260 absenteeism in every cycle or almost every cycle was 2.4% in the working group and
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11 261 4.5% in the studying group. The mean absenteeism due to MRSs was 0.9 days per
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13 262 year for the working group and 1.6 day per year for the study group.
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18 263 We also calculated the mean total absenteeism that was not related to MRSs. For the
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20 264 entire group, this was 3.3 days per year; for the working group, it was 3.5 days, and
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22 265 for the studying group, it was 4.3 days. The mean percentage of absenteeism that
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24 266 was not related to MRSs was 3.5% in the working group and 3.7% in the studying
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26 267 group. Consequently, absenteeism due to MRSs in our cohort accounted for, on
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28 268 average, 22% of the total absenteeism in the working group and 24% in the studying
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	Number (percentage)	Mean \pm SD
All (n=32,748)		
Absenteeism	4,514 (13.8)	
≤ 0.5 day	538 (1.6%)	
1 day	2,259 (6.9%)	
2 days	1,171 (3.6%)	
3 days	349 (1.1%)	
>3 days	184 (0.6%)	
Total days of absenteeism per year		1.3 \pm 5.9
Work (n=26,104)		
Absenteeism	2,926 (11.2%)	
≤ 0.5 day	374 (1.4%)	
1 day	1,476 (5.7%)	
2 days	757 (2.9%)	
3 days	211 (0.8%)	
>3 days	98 (0.4%)	
Total days of absenteeism per year		0.9 \pm 3.9
Study (n=8,764)		
Absenteeism	1,715 (19.6%)	
≤ 0.5 day	234 (2.7%)	
1 day	921 (10.5%)	
2 days	423 (4.8%)	
3 days	92 (1.0%)	
>3 days	41 (0.5%)	
Total days of absenteeism per year		1.6 \pm 5.0

271

272 Table 2 | Reported absenteeism caused by menstruation-related symptoms. Women
 273 were asked to report the average amount of days on which they were absent due to
 274 menstruation-related symptoms per cycle. The total days of absenteeism per year

275 was calculated. The added numbers of women in the work and study group exceed
 276 the total amount of participants, since 2,120 women reported to both study and work
 277 more than 5 hours/week. SD = standard deviation

278

279 *Presenteeism*

280 Table 3 shows the numbers reported for presenteeism. Over 80% of all women
 281 reported presenteeism during their periods. The differences between the working
 282 group and the study group were not large in terms of prevalence and lost productivity.
 283 The mean number of lost productive days per year due to presenteeism was more
 284 than seven-fold greater than the mean number of lost productive days due to
 285 absenteeism.

	Number (percentage)	Mean \pm SD	Median
All (n=32,748)			
Presenteeism	26,438 (80.7%)		
Number of days in the past 3 months		5.8 \pm 5.3	5.0
Percentage of productivity loss per day		33.0 \pm 24.8	30.0
Days/year of lost productivity		8.9 \pm 11.0	5.6
Work (n=26,104)			
Presenteeism	21,252 (81.4%)		
Number of days in the past 3 months		5.7 \pm 5.2	5.0
Percentage of productivity loss per day		31.7 \pm 24.7	30.0
Days/year of lost productivity		8.4 \pm 10.6	4.8
Study (n=8,764)			
Presenteeism	7,385 (84.3%)		
Number of days in the past 3 months		6.3 \pm 5.3	5.0
Percentage of productivity loss per day		36.8 \pm 24.2	40.0

Days/year of lost productivity		10.5±11.8	7.2
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287 Table 3 | Reported presenteeism caused by menstruation-related symptoms. Women
 288 were asked to report the amount of days on which they were less productive and to
 289 what extent. The total days of lost productivity per year was calculated. The added
 290 numbers of women in the work and study group exceed the total amount of
 291 participants, since 2,120 women reported to both study and work more than 5
 292 hours/week. SD = standard deviation

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294 *Factors associated with absenteeism and presenteeism*

295 Figure 2 shows the association between reported pain or discomfort scores and both
 296 absenteeism and presenteeism. As seen in detail in table 4, high VAS scores were
 297 significantly associated with higher levels of absenteeism and presenteeism. The
 298 strongest relationship was found for abdominal pain scores that were 7 or higher on a
 299 scale from 0 to ten. Odds ratios were 5.6 for absenteeism (95% confidence interval:
 300 5.0 to 6.2) and 8.8 for presenteeism (95% confidence interval: 8.1 to 9.5). Figure 3
 301 shows the association between age and both presenteeism and absenteeism. As
 302 shown in both figure 3 and table 4, we found that younger women showed
 303 significantly higher rates of absenteeism and presenteeism. A levonorgestrel–
 304 releasing intrauterine device is associated with especially less presenteeism.

	Absenteeism		Presenteeism	
	OR (95% CI)	OR after correction (95% CI)	OR (95% CI)	OR after correction (95% CI)
Age<21 years^a	3.7 (3.4-3.9)	3.3 (3.1-3.6)	1.4 (1.3-1.5)	1.3 (1.2-1.4)
Smoking^b	1.3 (1.2-1.5)	1.3 (1.2-1.4)	1.5 (1.3-1.6)	1.4 (1.3-1.6)
Absenteeism not related to MRSs in the past six months^c	2.2 (2.1-2.4)	1.7 (1.6-1.9)	1.4 (1.3-1.5)	1.3 (1.2-1.4)
Level of education^d				

	Low	4.5 (4.1-4.9)	2.7 (2.4-3.0)	1.3 (1.2-1.4)	1.1 (1.0-1.2)*
	Medium	2.2 (2.1-2.4)	1.7 (1.5-1.8)	1.3 (1.2-1.4)	1.2 (1.1-1.2)
	High	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
Oral contraception^e					
	No	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	Yes	1.2 (1.1-1.3)	1.0 (0.9-1.1)**	0.9 (0.9-1.0)	0.9 (0.8-0.9)
LG-IUD^e					
	No	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	Yes	0.7 (0.6-0.8)	0.9 (0.8-1.0)	0.5 (0.5-0.6)	0.5 (0.5-0.6)
Abdominal pain score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	2.6 (2.3-2.9)	2.2 (1.9-2.4)	5.2 (4.8-5.7)	5.3 (4.9-5.7)
	>7	7.0 (6.4-7.8)	5.6 (5.0-6.2)	8.7 (8.0-9.4)	8.8 (8.1-9.5)
Headache pain score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.5 (1.3-1.6)	1.5 (1.4-1.6)	3.0 (2.7-3.3)	3.1 (2.8-3.4)
	>7	2.0 (1.8-2.1)	2.3 (2.1-2.5)	3.5 (3.2-3.9)	3.7 (3.4-4.1)
Backache pain score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.6 (1.5-1.7)	1.4 (1.3-1.5)	3.5 (3.2-3.9)	3.5 (3.2-3.8)
	>7	2.7 (2.5-2.9)	2.2 (2.1-2.4)	4.7 (4.2-5.2)	4.5 (4.0-5.0)
Tiredness intensity score^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.8 (1.7-2.0)	1.8 (1.6-2.0)	3.3 (3.1-3.6)	3.3 (3.1-3.6)
	>7	3.0 (2.8-3.2)	2.8 (2.6-3.1)	5.1 (4.7-5.6)	5.2 (4.7-5.7)
Psychological complaints intensity					

score ^e					
	0-4	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)	1.0 (n/a)
	5-6	1.6 (1.5-1.7)	1.5 (1.4-1.7)	2.7 (2.5-2.9)	2.6 (2,5-2.9)
	>7	2.2 (2.0-2.4)	2.1 (2.0-2.3)	4.4 (4.0-4.7)	4.3 (4.0-4.7)

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306 Table 4 | Odd ratios (ORs) and 95% confidence intervals (95% CIs) for factors
 307 related to absenteeism and presenteeism. ORs >1 correlate with a higher prevalence
 308 of absenteeism or presenteeism. ORs <1 correlate with a lower prevalence of
 309 absenteeism or presenteeism.

310 LG-IUD = Levonorgestrel-releasing intra uterine device

311 ^aCorrection for smoking and absenteeism that was not related to menstruation-

312 related symptoms (MRSs); ^bCorrection for age, absenteeism that was not related to

313 MRSs, and level of education; ^cCorrection for age, smoking, and level of education;

314 ^dCorrection for age, smoking, and absenteeism that was not related to MRSs;

315 ^eCorrection for age, smoking, absenteeism that was not related to MRSs, and level of

316 education. *p=0.26, **p=0,73 For all other ORs, p<0.05

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318 *Menstruation and suggested implications for schools and workplaces*

319 From the respondent who had been calling in sick due to MRSs, 20.1% (n=908) told
 320 their employer or school menstrual symptoms were the reason, 46.4% (n=2092) only
 321 mentioned the presenting symptom. No reason was given by 27.7% (n=1250), while
 322 5.8% (n=260) made up another reason. Comparing women aged below 21 with
 323 women aged 21 and above, we found that younger women were less open about
 324 their MRSs being the reason for calling in sick (12.0%) versus women older than 21
 325 (27.0%). Women were asked to report suggestions on how work places and
 326 conditions could be changed in order for them to function better during their
 327 menstrual periods. There were 32,708 responses to this multiple-choice question, to
 328 which each woman could give more than one answer. The majority of women

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3 329 (67.7%, n=22,154) preferred more flexibility during their periods, such as the
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5 330 possibility of doing less physical work (32.1%, n=10,499), the ability to work from
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7 331 home (39.5%, n=12,917), more time for personal care (28.3%, n=9,241), or the ability
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9 332 to take a day off and make up for it later (11.5%, n=3,756). In addition, 32.9% wished
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11 333 they could take a complete day off without any consequences. 27.2% (n=8,890) did
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13 334 not wish for any changes in policy. Many women (79.7%, n=26,072) were open to
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15 335 discussing MRSs with their company doctor, and 56.7% (n=18,579) thought that
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17 336 doing so would draw more attention to MRS-related matters.
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337 **Discussion**

338 This survey-based study showed that menstruation-related absenteeism and, to a
339 greater extent, presenteeism are widespread in the general female population. In our
340 cohort, MRSs accounted for up to 24% of total absenteeism for women who were
341 working and studying. The annual productivity loss due to presenteeism was seven-
342 fold times more than the annual productivity loss due to absenteeism and women
343 younger than 21 years experience the largest burden. Symptom severity scores
344 showed significant and strong associations with both absenteeism and presenteeism.
345 When women called in sick due to MRSs, only one in five stated openly that
346 menstrual symptoms were the main reason. A majority of women prefers more
347 flexibility during their periods when it comes to work or school.

348 There have been few studies on absenteeism and presenteeism related to MRSs in
349 the general female population. To our knowledge, Tanaka's study²⁵ is the only other
350 published study on absenteeism and presenteeism due to MRSs in the general
351 female population. In a cohort of 19,254 Japanese women, a total of 3,311 (17.2%)
352 reported work productivity lost in the prior 3 months, mostly in the form of decreased
353 efficiency (62.0%, n=2,052). Of these 2,052 subjects, the mean number of workdays
354 lost due to decreased efficiency was 5.7 days in 3 months. After recalculation, this
355 accounts for 2.4 days per year for the entire population. This is fewer days than the
356 8.9 days per year in our cohort. On the other hand, the numbers for absenteeism
357 were more similar, with a mean of 1.0 day of absenteeism per year in the entire
358 Japanese cohort compared to 1.2 days in our cohort. Differences in regulations of
359 social services, a difference in attitude towards sick leave and a different method of
360 data collection might explain these differences. It has been suggested in research on
361 musculoskeletal symptoms that rates of absenteeism might be lower in Japan

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3 362 compared to European countries and the United States. Consequently, presenteeism
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5 363 might therefore be a more representative variable.^{26 27}
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8 364 More data are available regarding the impact of dysmenorrhoea on quality of life and
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10 365 absenteeism. De Sanctis et al. reviewed studies on dysmenorrhea in multiple
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12 366 countries, some of which included menstruation-related absenteeism data. They
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14 367 found that the prevalence of school absences in adolescents that was due to
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16 368 dysmenorrhea varied between 7.7% and 57.8%. Since the review included 41,140
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18 369 women in 27 countries, and there was a high degree of heterogeneity in the outcome
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20 370 measures, no firm conclusions could be drawn. Hailemeskel et al. evaluated 440
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22 371 female university students in Ethiopia.²⁸ Among students with dysmenorrhea, 66.8%
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24 372 reported a loss of concentration in class, and 56.3% reported class absences during
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26 373 the last month. In a questionnaire-based study of 706 Hispanic female adolescents,
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28 374 38% reported missing school due to dysmenorrhea during the 3 months prior to the
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30 375 survey, and 59% reported a decrease in concentration in class due to dysmenorrhea.
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39 377 Absenteeism and presenteeism due to endometriosis in other studies was greater
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41 378 than in our study, which was not surprising.^{9 14 30} However, some interesting parallels
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43 379 can be drawn to findings from a recent study by Soliman et al.¹⁴ They found that the
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45 380 average number of hours of presenteeism, 5.3 hours per week, was far greater than
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47 381 the number of hours of absenteeism, which was 1.1 hours per week. Furthermore,
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49 382 younger women had significantly higher levels of lost productivity than their older
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51 383 counterparts, and more severe symptoms were associated with more absenteeism
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53 384 and presenteeism. This was in line with our findings, since we also found higher rates
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55 385 of both absenteeism and presenteeism in younger women. A taboo on talking openly
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57 386 about MRS, under-treatment and less flexibility at school might be possible
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3 387 explanations for these differences. Comparing our outcomes with studies on other
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5 388 non-gynaecological conditions is hard due to differences in methods and
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7 389 presentation of findings and the cyclic character of MRSs. However, the incidence of
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10 390 presenteeism seems to be as high as it is in patients with inflammatory bowel
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12 391 disease.³¹ Moreover, the amount of impairment is comparable with severe
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14 392 gastroesophageal reflux (31.9%) , moderate irritable bowel syndrome (36.6%) and
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16 393 allergic rhinitis (33.4%-39.8%).³²

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20 394 Our finding that only 20.1% of women were open about their menstrual symptoms as
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22 395 a reason for calling in sick may confirm the general idea that women tend not to
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24 396 speak openly about MRSs. Wong et al. found that in a cohort of schoolgirls in
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26 397 Malaysia, 76.1% considered dysmenorrhoea a normal part of the menstrual cycle.¹⁵
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28 398 In the context of the findings noted above, our study also suggests there is a taboo
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30 399 for women in terms of discussing menstrual problems with their employers. The latter
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32 400 may therefore conclude that the impact of MRSs on their employees is negligible.
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34 401 Considering the fact that we also found that 68% of women wish that they had
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36 402 greater flexibility during their periods, either at school or at work, more openness
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38 403 about MRSs in the employment setting seems desirable. The reasons underlying this
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40 404 taboo are likely to have a historical basis; indeed, since ancient times, menstruation
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42 405 has been surrounded with mythical stories and has not been well understood.
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44 406 However, in recent years, the lay literature in developed countries has focused more
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46 407 attention on MRSs. ³³⁻³⁵ The prevalence and the impact of MRSs on the general
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48 408 population and the number of women who are asking for a different approach all
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50 409 reflect the need to change the view of menstrual symptoms and the way they are
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52 410 addressed in society.
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3 411 This study consisted of a large cohort, and it reached a large number of women
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5 412 within the age range that was aimed for. The questionnaire was developed in
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7 413 collaboration with patient representatives to make it understandable by and relevant
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9 414 to most women. The cohort appeared to be a representative sample of the general
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11 415 female population based on the number of working hours.³³ When we compare our
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13 416 data with the national registries the total amount of absenteeism is found to be
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15 417 comparable, regardless of whether it was related to MRSs.^{36 37} It is difficult to
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17 418 compare our numbers on women with a diagnosis explaining their MRSs with
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19 419 numbers found in other studies. We found that only 9% of the participants had such a
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21 420 diagnosis, which seems about as expected or even somewhat low.^{3 38-40} In contrast,
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23 421 45% of the women in the study reported consulting a physician for their MRSs. This
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25 422 number was relatively high compared to other studies in which, for example, the
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27 423 percentage of women with dysmenorrhoea who sought medical advice was
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29 424 approximately 15%.^{15 16} An important factor might be the Dutch health system in
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31 425 which general practitioners are available free of charge. Women with a low level of
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33 426 education were relatively underrepresented.⁴¹ As our results show, especially
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35 427 absenteeism related to MRSs is associated with a low level of education, and this
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37 428 might have biased our results. We expect women with lower educational levels to do
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39 429 more physical jobs or jobs with less flexibility. Therefore, our findings on work
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41 430 productivity loss might be underestimated. On the other hand, our finding could be
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43 431 overestimated due to the possibility that women with more MRSs might be more
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45 432 likely to respond to a questionnaire, as it may seem more relevant to them. Moreover,
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47 433 we were not able to provide data on presenteeism not related to MRSs nor were we
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49 434 able to correct for comorbid health conditions. Thus, these results must be
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51 435 interpreted with caution. Due to the way that the questionnaire was distributed
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53 436 through social media, there may have been some selection bias. However, a recent

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3 437 review stated that Facebook is a useful recruitment tool for healthcare research.⁴²
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5 438 Although we did not use a validated questionnaire, our most important outcomes
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7 439 were based on questions derived from the PCQ, which itself is based on validated
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9 440 questions and which is recommended by guidelines for cost research.²⁴ Self-reported
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11 441 absenteeism generally shows a good correlation with official records, although
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13 442 accuracy decreases with increasing recall period.⁴³ This might have initiated a recall
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15 443 bias in our cohort. It is unknown to what extent recall bias affects reports on
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17 444 presenteeism.⁴⁴ In general, although results vary among studies on premenstrual
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19 445 complaints, a prospective collection of data on symptoms is advisable.^{45 46}
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21 446 Furthermore, an extrapolation of a three and six months timeframe to a yearly basis
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23 447 may intrinsically imply some degree of uncertainty, for example when the influenza
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25 448 season is not included in the original analysis. Finally, these results may not be
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27 449 generalized internationally due to variability in the regulation of social services in
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29 450 different countries, and this is also a limitation of our study. In The Netherlands,
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31 451 wages are paid during sick leave that has duration of less than 1 year, but women in
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33 452 other countries may not have this benefit. Since we know that many factors influence
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35 453 menstrual symptoms, including biological, cultural, and environmental factors, these
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37 454 differences might well influence both absenteeism and presenteeism.^{6 14 47}
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45 455 In conclusion, we have found that the impact of MRSs on work and school
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47 456 productivity is considerable and that presenteeism contributes significantly more to
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49 457 the matter than absenteeism. Future research should identify how women affected by
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51 458 MRSs could be helped best and how their productivity can be improved in order to
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53 459 reduce the societal impact regarding absenteeism and presenteeism.
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7
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17
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22 621 the submitted work; no financial relationships with any organisations that might have
23
24 622 an interest in the submitted work in the previous three years; no other relationships or
25
26 623 activities that could appear to have influenced the submitted work.
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33 625 **Contributorship statement**
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35
36 626 TN, BD and JA conceived the study. MS wrote the first and successive drafts of the
37
38 627 manuscript. MS, TN and EA modelled and analysed the data. TN, EA, JM, BD and
39
40 628 JA contributed to study conception and design. MS and TN collected the data. All
41
42 629 authors revised the manuscript for important intellectual content. MS and TN had full
43
44 630 access to the data and take responsibility for the integrity of the data and the
45
46 631 accuracy of the data analysis. TN is the guarantor.
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54 633 **Data sharing statement**
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56
57 634 No additional data from this study are available from a repository. Data are available
58
59 635 on request from the corresponding author.
60

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5

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3 641 **Legends to figures**
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9 643 *Figure 1*
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12 644 Flow chart for the respondents.
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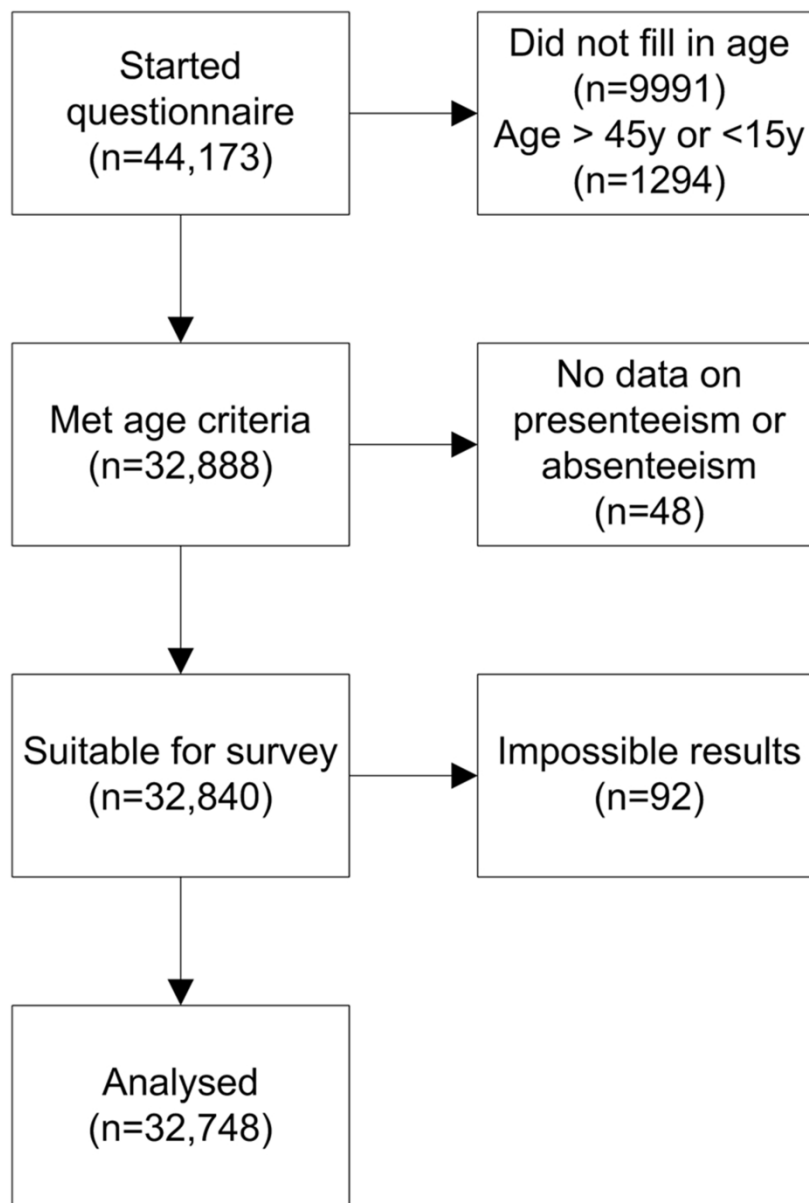
18 646 *Figure 2*
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21 647 The relationship between pain and intensity scores, related to absenteeism and
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23 648 presenteeism, in lost days per year.
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29 650 *Figure 3*
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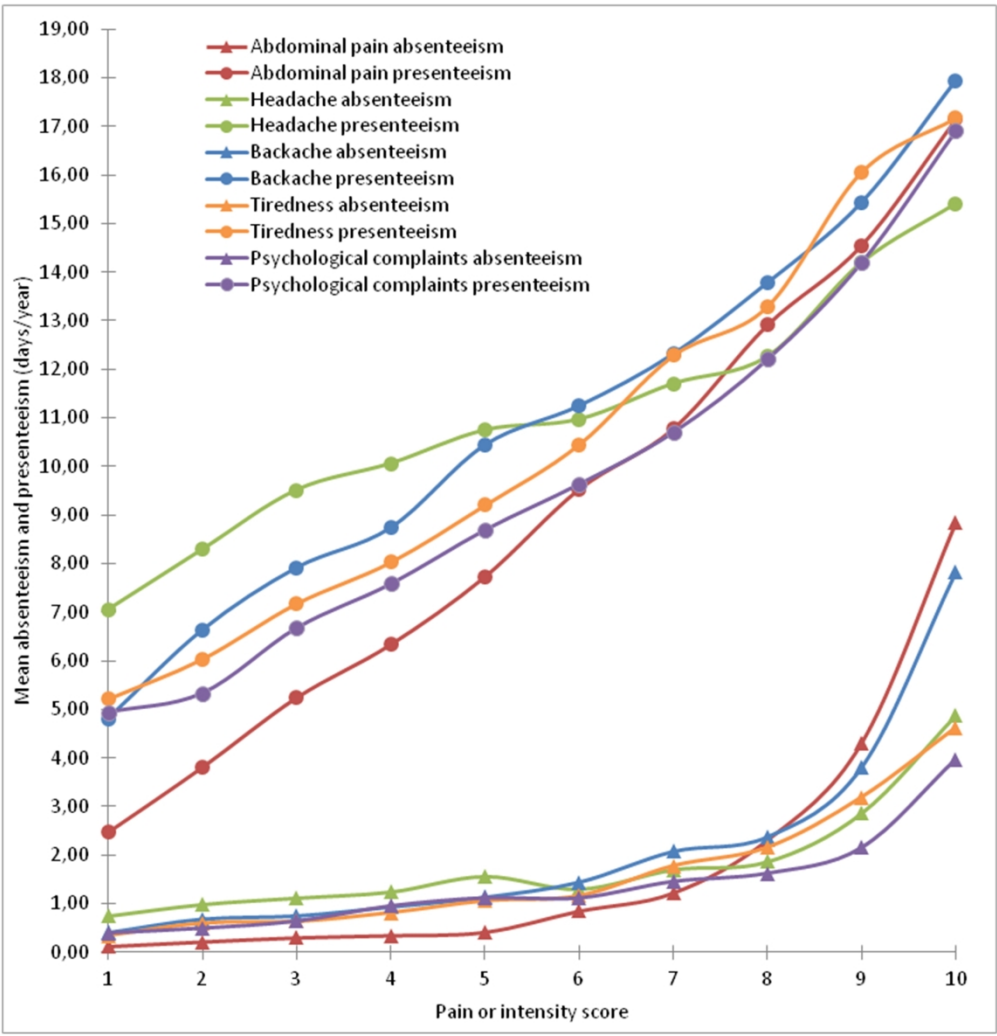
32 651 The relationship between age and average absenteeism and presenteeism.
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Flow chart for the respondents.

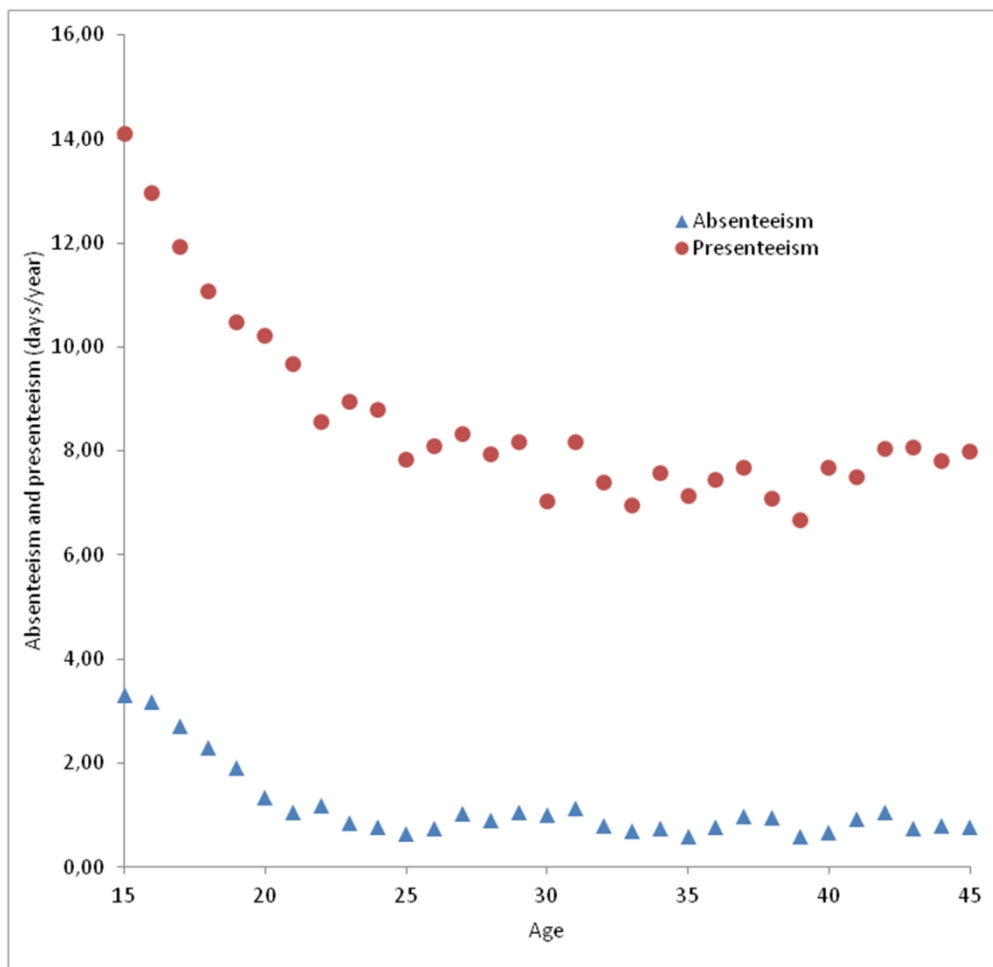
287x423mm (300 x 300 DPI)

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The relationship between pain and intensity scores, related to absenteeism and presenteeism, in lost days per year.

202x209mm (300 x 300 DPI)



The relationship between age and average absenteeism and presenteeism.

206x199mm (300 x 300 DPI)

Appendix

Summary of the questionnaire

Part 1: Questions about basic characteristics

- Age, marital status, nationality, level of education
- Work, voluntary work and study: hours per week, sector, experienced stress
- Smoking
- Menstrual cycle: total length, number of days with blood loss, number of times needing to change pad or tampon
- Medical and obstetric history
- Contraception use

Part 2: General questions about menstruation-related symptoms

- Symptoms: abdominal pain, heavy menstrual blood loss, headache, fatigue, backache, nausea and vomiting, tender breasts, problems with stool, psychological complaints
- Per symptom: number of days the symptom was present; number of days that the symptom influenced daily functioning; the magnitude of the symptom's influence on daily functioning; pain or intensity score (not for heavy menstrual bleeding, nausea and vomiting); continuation of daily activities despite symptoms; and the extent to which women forced themselves to continue their daily activities
- Usage of over-the-counter drugs, narcotics, painkillers, alternative medicine

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3 *Part 3: Questions related to absenteeism and presenteeism (full text)*
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- 6
7 - How often did you call in sick due to menstrual complaints in the past six months?
8
9 ○ Every menstrual cycle
10
11 ○ Almost every menstrual cycle
12
13 ○ Half of all menstrual cycles
14
15 ○ Sometimes
16
17 ○ Never
18
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22
23 - What is the mean number of days you called in sick due to menstruation-related
24 symptoms per cycle in the past six months?
25
26 ○ More than three days
27
28 ○ Three days
29
30 ○ Two days
31
32 ○ One day
33
34 ○ Half a day or a few hours
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43 - What is the number of days you were present at work while being hindered by
44 menstrual complaints?
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50 - How was your performance during these days?
51
52 ○ A Visual Analog Scale by means of sliding a bar was used to score the amount
53 of productivity loss, where the left end said “I could not do anything” and the
54 right end said “I could do just as much as I normally do”.
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- What was the number of days you called in sick because of non-menstruation-related symptoms in the past six months?

 - What reason do you give when you call in sick due to menstruation-related symptoms?
 - Menstrual complaints
 - Only the presenting symptom, for example abdominal pain or headache
 - You do not give a reason
 - You think up another reason

 - What measures would be desirable for women on the workplace or at school during their menstrual period? It is possible to give more than one answer.
 - A day off without any consequences
 - A day off to catch up later
 - Flexibility to perform less physical work
 - More time for personal care
 - The possibility to work from home
 - None
 - Not applicable

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8, appendix
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	7-9
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7-8
		(b) Describe any methods used to examine subgroups and interactions	7-8
		(c) Explain how missing data were addressed	7,9
		(d) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(e) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	9/Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9/Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Not reported, can be reported if desirable.
Outcome data	15*	Report numbers of outcome events or summary measures	9-11/Table 2,3
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 4
		(b) Report category boundaries when continuous variables were categorized	Table 1,4
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14-15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	n/a

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.