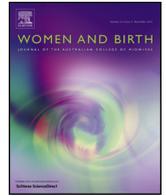




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# Differences in levels of stress, social support, health behaviours, and stress-reduction strategies for women pregnant before and during the COVID-19 pandemic, and based on phases of pandemic restrictions, in Ireland

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## ABSTRACT

**Background:** The COVID-19 pandemic and related restrictions can adversely impact antenatal maternal well-being and health behaviours.

**Aim:** To examine antenatal stress and stress-reduction strategies, social support, and health behaviours between women pregnant before and during the pandemic in Ireland.

**Methods:** 210 pregnant women were recruited online and in the antenatal department of a tertiary maternity hospital before the pandemic, and 235 women recruited online during the pandemic. Only women resident in Ireland were included in this study. Women completed measures of stress, social support, health-behaviours, and self-reported stress-reduction strategies. Differences in outcomes were examined between women pregnant before and during the pandemic, and between Phase 2 and Phase 3 of the Irish Government COVID-19 restrictions.

**Findings:** Women pregnant during the pandemic reported lower perceived social support, including support from a significant other, friends and family, than women pregnant before the pandemic. There were no significant differences in stress in health behaviours but women reported higher stress and less physical activity during the pandemic. Women reported a range of comparable stress-reduction strategies before and during the pandemic. No differences were observed between phases of pandemic-related restrictions for any outcome.

**Discussion:** Our findings highlight negative impacts of the pandemic on social support, stress, and physical activity, which can have implications for maternal and child health. Lack of differences between restriction phases suggests on-going negative effects for antenatal well-being and behaviours.

**Conclusion:** Development of supports for pregnant women during the pandemic should include social-support and stress-reduction components.

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## Statement of significance

## Problem or issue

High antenatal stress, low social support, and inappropriate health behaviours can have negative impacts on maternal and child health.

## What is already known

COVID-19 and related restrictions are linked to adverse mental health outcomes in general populations and can increase antenatal anxiety and depression.

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## What this paper adds

This is the first examination of differences in pregnancy-specific stress and stress-reduction strategies, social support and health behaviours before and during the pandemic. This is also the first examination of the impact of phased pandemic-related restrictions on antenatal outcomes.

## 1. Introduction

Antenatal stress is estimated to impact up to 30% of women during pregnancy [1] and is associated with poor postpartum mental and physical health [2,3], obstetric outcomes [4,5], and child health and neurodevelopment [6,7]. Antenatal stress is also associated with maternal perinatal health behaviours, which can also have direct impact on child health and development [8]. Positive factors, such as social support, are argued to have a protective effect however by buffering effects of stress on maternal and child outcomes [9,10]. Antenatal stress can arise from multiple psychological, physiological, social and socio-demographic factors [11,12]. It can also result from experiencing significant and/or stressful life events, such as bereavement [13], and natural disasters [14], and is a likely outcome of the COVID-19 pandemic. In Ireland, at the time of writing, the national cumulative incidence of confirmed COVID-19 cases is 974.98 per 100,000 population; the national cumulative incidence of confirmed deaths is 33.31 per 100,000 population [15].

There is already evidence that COVID-19, which was announced as a global pandemic by the World Health Organization in March 2020 [16], has led to adverse mental health consequences in general populations [17]. A recent review indicates that stress, anxiety, depression, and disrupted sleep are common mental health outcomes of COVID-19 [18]. Such outcomes may be due to multiple COVID-19 related factors, including perceived risk of infection, concerns about loved ones [19], and the implementation of full and partial lockdowns globally that have restricted movement and social interactions [20]. For pregnant women, the COVID-19 pandemic has also led to changes in maternity care access and procedures [21], which when coupled with broader COVID-19 concerns, have the potential to significantly impact pregnant women's stress and behavioural responses [20]. There is some emerging evidence supporting this, with reports that women pregnant during the pandemic experience increased concern and feelings of vulnerability [19], depression, and anxiety [22,23].

To date, there are limited data on antenatal stress, social support, and health behaviours during the pandemic in comparison to before the pandemic; this is largely due to the rapid and unexpected onset of the pandemic and associated societal changes. One study of pregnant Canadian women reported increased psychiatric symptoms, including anxiety, depression, post-traumatic stress disorder and dissociative symptoms in a sample of women pregnant during COVID-19, in comparison to a pre-COVID-19 sample [24]. Findings from a study conducted in China, also indicate increased levels of depression and anxiety in pregnant women following declaration of the COVID-19 pandemic [25].

As of yet, there is no evidence regarding the potential effects of lockdown restrictions on antenatal maternal well-being. In the Republic of Ireland (ROI), a COVID-19 'roadmap' of four phases including required and recommended public health guidelines and restrictions was established [26]. For instance, during Phase Two (June 8th to 28th) travel was permitted within one's home county or up to 20 km from home; up to 6 people from outside one's household could meet and retail could begin to re-open, with physical distancing in place for both [26]. During Phase Three (from

June 29th 2020) crèches and childcare re-opened for essential workers in a phased manner, playgrounds were re-opened, and small social gatherings were allowed [26]. Full information on the roadmap phases can be found at <https://www.gov.ie/>. Each phase was implemented simultaneously across the country on the same date, allowing for an examination of the impact of varying levels of restrictions on antenatal well-being.

This study had two main aims. The first was to examine differences between antenatal stress, social support, health behaviours, and stress-reduction strategies of Irish women pregnant before the pandemic and during the pandemic. The second aim was to examine differences in these outcomes at different stages of pandemic-related restrictions.

## 2. Material and methods

### 2.1. Study design

A cross-sectional survey design, including closed and open-ended questions, was used with data collected before and during the COVID-19 pandemic. This study is a secondary data analysis from a larger program of research on maternal stress, social support and health behaviours [27].

### 2.2. Participants

Participants were pregnant women over the age of 18 years. There were no exclusions based on gestational age or nationality during recruitment for the larger study. Only participants self-reporting living in the ROI were included in the current study, to facilitate comparison of antenatal well-being between two groups situated in similar cultural, societal and antenatal care contexts before and during the pandemic.

### 2.3. Procedure

Recruitment of women before the pandemic was conducted online and in the antenatal department of a tertiary maternity hospital in the South of ROI from May 2019 to February 2020. Recruitment of women during the pandemic was conducted online from June 16th to July 17th 2020. Online recruitment in both time periods was conducted via pregnancy forums and social media (e.g., Twitter, Facebook, Reddit, Instagram). All women recruited online were provided with a link to the online survey, which they completed upon providing electronic informed consent. Women recruited in-person prior to the pandemic completed a hard-copy survey following provision of informed consent.

### 2.4. Survey

Both surveys included questions on socio-demographic factors, stress, social support, health behaviours and stress-reduction strategies. The survey used prior to the pandemic included an assessment of women's knowledge about stress and health behaviours; the survey used during the pandemic also assessed mental and physical well-being, perceived quality of antenatal care, and COVID-19 related stress, beliefs and behaviours. As this study is interested in differences between outcomes before and during the pandemic, only those measures included in both surveys are outlined here. More details of the additional measures can be found in our complimentary papers [27].

#### 2.4.1. Sociodemographic data

Participants provided information on age, nationality, relationship status, gestation, parity and the number of other children.

#### 2.4.2. Antenatal stress

This was measured using the Revised Prenatal Distress Questionnaire (NuPDQ [8,28]). The NuPDQ is a 17-item scale with items measured on a 3-point scale ranging from “not at all” to “very much”. Items assess the degree to which women experience worries and concerns related to their pregnancy including, for example: “about whether you might have an unhealthy baby”. The reliability coefficient of the NuPDQ in the overall sample was  $\alpha = 0.79$ .

#### 2.4.3. Social support

Perceived support was measured using the Multidimensional Scale of Perceived Social Support (MSPSS [29]). This is a 12-item scale of perceived support from family, friends and loved ones, with items measured on a 7-point scale from “very strongly disagree” to “very strongly agree”. The reliability coefficient of the MSPSS in the overall sample was  $\alpha = 0.96$ ; reliability of the significant other subscale was  $\alpha = 0.98$ , the friends subscale was  $\alpha = 0.96$ , and the family subscale was  $\alpha = 0.95$ .

#### 2.4.4. Health behaviours

Behaviours were measured using the Prenatal Health Behaviours Scale (PHBS [8]), which assesses the frequency of women’s engagement in behaviours related to nutrition, physical activity, sleep, vitamins, smoking and alcohol in the last two weeks. Items are measured on a 5-point scale ranging from “never” to “very often”. A composite ‘healthy eating’ outcome was created by combining data on frequency of consumption of dairy, fluids, fibre, balanced meals and eating to satiety. The reliability coefficient of this outcome was  $\alpha = 0.73$ . A composite ‘unhealthy eating’ outcome was created by combining data on frequency of consumption of fatty or oily foods, snack foods, and eating beyond the point of satiety. The reliability coefficient of this outcome was  $\alpha = 0.36$  in the overall sample, which was too low for inclusion in further analyses. Single items were used to examine frequency of smoking, alcohol consumption, physical activity, taking vitamins, and sleep.

#### 2.4.5. Stress-reduction strategies

Women responded to a single open-ended question that asked “When you feel stressed what do you like to do to reduce your stress levels?”

#### 2.5. Analysis

Statistical analyses were conducted using IBM SPSS Version 26. Participant demographic factors, levels of stress and social support, and frequency of health behaviours were descriptively summarised. Independent samples t-tests and Chi square tests of independence were used to examine differences between women who completed the survey before and during the pandemic on continuous and categorical socio-demographic variables respectively. Assumption testing indicated that the data were not suited to multivariate analysis of variance. Independent samples t-tests were used to examine differences in stress, perceived social support and frequency of healthy eating between women who were pregnant before the pandemic and those pregnant during the pandemic, and between women who completed the survey in Phase Two and Phase Three of pandemic restrictions in the ROI. Chi-square tests of independence were used to examine differences in frequency of exercise, taking vitamins, and sleep. Due to the number of analyses conducted a Bonferroni correction was applied with a more stringent significance value of  $p < 0.01$ . Analysis of the strategies for coping with stress was conducted using a quantitative content analysis to provide a structured way of analysing participants open-ended response. A list of individual strategies was initially identified for each time period, from which

a list of categories was then derived, with individual strategies grouped in accordance to comparability. Differences in stress-reduction strategies were not examined by lockdown phases due to low numbers of some reported strategies. Differences in strategies before and during the pandemic are presented narratively and in table form.

#### 2.6. Ethical approval

All procedures were approved by the University College Cork School of Public Health Research Ethics Committee and the Clinical Research Ethics Committee of the Cork Teaching Hospitals.

### 3. Results

The study included 445 pregnant women between 19 and 46 years ( $M = 33.78$ ,  $SD = 4.27$ ) and between 4 and 41 weeks pregnant ( $M = 26.99$ ,  $SD = 9.34$ ). A total of 210 women living in the ROI completed the survey before the pandemic; 235 women living in the ROI completed the survey during the pandemic. Details of the two groups are presented in Table 1. There were no significant differences for age, gestational weeks, relationship status or number of children women had, between women pregnant before or during COVID-19. Due to the low number of women reporting any smoking or alcohol consumption these variables were not included in further analyses.

#### 3.1. Differences between women pregnant before and during the pandemic

Results of independent-samples t-tests demonstrated no difference for levels of antenatal stress ( $t(425) = -2.19$ ,  $p = 0.028$ ) though women pregnant during the pandemic had higher levels than those pregnant before the pandemic (mean difference =  $-1.19$  (95% CI:  $-2.27$  to  $-1.3$ ),  $\eta^2 = 0.01$ ). A difference was observed for total perceived social support ( $t(420.49) = 3.86$ ,  $p < 0.005$ ) with lower social support reported by women during the pandemic; though the mean difference of 5.88 (95% CI: 2.89–8.88) was small ( $\eta^2 = 0.03$ ). A difference was observed for perceived social support from a significant other, with lower support reported during the pandemic  $t(420.67) = 2.77$ ,  $p = 0.006$ ; the mean difference, 1.44 (95% CI: 0.42–2.47), was small ( $\eta^2 = 0.02$ ). Social support from friends demonstrated a significant difference, with lower support reported during the pandemic ( $t(433.65) = 4.44$ ,  $p < 0.005$ ), with a moderate mean difference of 2.71 (95% CI 1.51–3.91;  $\eta^2 = 0.05$ ). A difference was also observed for social support from family, with lower support also reported during the pandemic ( $t(429.39) = 3.01$ ,  $p = 0.003$ ); the mean difference, 1.74 (95% CI 0.61–2.88), was small ( $\eta^2 = 0.02$ ). There was no difference for healthy eating before or during the pandemic ( $t(433) = 0.81$ ,  $p = 0.42$ ). Chi-square tests for independence indicated no differences between women’s frequency of exercise, taking vitamins or sleep before or during the pandemic (see Table 1).

In terms of pregnant women’s stress reduction, 82.5% ( $n = 208$ ) of women reported 49 individual stress-reduction strategies before the pandemic; 89.8% ( $n = 211$ ) reported 47 individual stress-reduction strategies during the pandemic. As outlined in Table 2 the most commonly reported strategies were connecting with others and exercise. The proportion of women connecting with others remained similar in both time periods. Women were less likely to report using exercise (40.8%;  $n = 86$  vs 56.3%;  $n = 117$ ), particularly walking, and engaging with a form of entertainment (11.8%;  $n = 25$  vs 22.6%;  $n = 47$ ) during the pandemic (see Table 2).

**Table 1**  
Characteristics before and during the pandemic.

	Pre-pandemic (n = 210) M(SD)	During-pandemic (n = 235) M(SD)	Between-group differences
Age	33.91 (4.05)	33.67 (4.47)	t(438) = 0.57, p = 0.57
Gestational weeks	26.43 (10.09)	27.49 (8.60)	t(410.63) = -1.19, p = 0.23
Number of children	1.15 (1.2)	0.87 (1.02)	t(391) = 2.44, p = 0.015
Pregnancy-specific stress	12.80 (5.88)	14.00 (5.39)	t (425) = -2.19, p = 0.028
Social support (total)	72.45 (13.61)	66.56 (17.94)	t (420.49) = 3.86, p < 0.005
Social support (significant other)	25.89 (4.56)	24.44 (6.28)	t (420.67) = 2.77, p = 0.006
Social support (friends)	22.81 (5.75)	20.10 (7.01)	t (433.65) = 4.44, p < 0.005
Social support (family)	23.79 (5.38)	22.05 (6.68)	t (429.39) = 3.01, p = 0.003
Healthy eating	3.31 (0.58)	3.27 (0.58)	t (433) = 0.81, p = 0.42
	N(%)	N(%)	
Relationship status			$\chi^2(4) = 4.71, p = 0.32$
Married	144 (68.6)	178 (75.7)	
Cohabiting	41 (19.5)	38 (16.2)	
In a relationship	15 (7.1)	13 (5.5)	
Not cohabiting	1 (0.2)	0	
Single	9 (4.3)	5 (2.1)	
First pregnancy			$\chi^2(1) = 1.37, p = 0.24$
Yes	92 (44)	89 (38.5)	
No	117 (56)	142 (61.5)	
Exercise			$\chi^2(4) = 8.83, p = 0.06$
Never	4 (2)	17 (7.2)	
Almost never	30 (14.7)	29 (12.3)	
Sometimes	55 (27)	71 (30.2)	
Fairly often	64 (31.4)	65 (27.7)	
Very often	51 (25)	53 (22.6)	
Vitamins			$\chi^2(4) = 4.87, p = 0.30$
Never	15 (7.4)	13 (5.5)	
Almost never	12 (5.9)	13 (5.5)	
Sometimes	17 (8.3)	30 (12.8)	
Fairly often	32 (15.7)	25 (10.6)	
Very often	128 (62.7)	154 (65.5)	
Sleep well			$\chi^2(4) = 6.45, p = 0.17$
Never	8 (3.9)	7 (3)	
Almost never	24 (11.8)	36 (15.4)	
Sometimes	58 (28.4)	86 (36.8)	
Fairly often	77 (37.7)	68 (29.1)	
Very often	37 (18.1)	37 (15.8)	
Alcohol <sup>a</sup>			
Never	176 (86.7)	206 (87.7)	
Almost never	21 (10.3)	20 (8.5)	
Sometimes	6 (3.0)	8 (3.4)	
Fairly often	-	1 (0.4)	
Very often	-	-	
Smoking <sup>a</sup>			
Never	189 (92.6)	221 (94)	
Almost never	4 (2.0)	4 (1.7)	
Sometimes	7 (3.4)	6 (2.6)	
Fairly often	3 (1.5)	1 (0.4)	
Very often	1 (0.5)	3 (1.3)	

Note. Pregnancy-specific stress scores can range from 0 to 34; all social support scores can range from 12 to 84; frequency of healthy eating ranges from 0 to 4.

<sup>a</sup> Alcohol and smoking were not included in further analyses due to the low number of participants reporting engaging in these behaviours.

### 3.2. Differences based on phase of pandemic-related restrictions

During Phase Two (which included phased re-opening of retail and eased restrictions on travel), 138 women completed the survey; 97 women completed the survey during Phase Three of pandemic-related restrictions (which included opening of crèches and childcare, and easing of restrictions on small social gatherings). Independent samples t-tests used to examine differences in continuous variables by phase of lockdown restrictions indicated no differences between pregnant women who completed the survey during Phase Two and Phase Three for antenatal stress, total perceived social support, perceived support from a significant other, friends or family, or frequency of healthy eating. Chi square tests for independence, used to examine differences in categorical variables, also indicated no differences in frequency of exercise, taking vitamins, or sleep. See Table 3.

### 4. Discussion

This study examined differences between women pregnant before and during the COVID-19 pandemic for levels of stress, social support, frequency of health behaviours and stress-reduction strategies. To our knowledge this is the first examination of potential differences in these variables during the pandemic; it is also the first examination of the potential role of pandemic-related restrictions on outcomes during pregnancy. Our findings indicate significant decreases in pregnant women's perceived social support from all sources during the COVID-19 pandemic. No significant differences were observed for antenatal stress or health behaviours, though women pregnant during the pandemic did report higher levels of stress than women pregnant before the pandemic. There were also no differences in outcomes based on the phase of pandemic-related restrictions.

**Table 2**  
Activities, including individual strategies, reported by participants to relieve stress.

Activity	Strategies	Before pandemic N(%)	During pandemic N(%)
Connecting with others		101 (48.6)	102 (48.3)
	Talking to husband/partner	35 (16.8)	44 (20.9)
	Talk to family	36 (17.3)	38 (18.0)
	Talk to friends	41 (19.7)	29 (13.7)
	Talk to someone (unspecified)	17 (8.2)	22 (10.4)
	Time with children	6 (2.9)	1 (0.5)
	Time with pets	7 (3.4)	2 (0.9)
Exercise		117 (56.3)	86 (40.8)
	Walking	91 (43.8)	71 (33.6)
	Yoga	16 (7.7)	15 (7.1)
	Exercise (unspecified)	10 (4.8)	5 (2.4)
	Swimming	10 (4.8)	2 (0.9)
	Running	4 (1.9)	1 (0.4)
	Cycling	1 (0.5)	–
	Dance	–	1 (0.5)
	Pilates	–	2 (0.9)
	Hiking	1 (0.5)	–
	Kayaking	1 (0.5)	–
Entertainment	Stretching	1 (0.5)	–
		47 (22.6)	25 (11.8)
	Music	16 (7.7)	7 (3.3)
	Television	16 (7.7)	9 (4.3)
	Reading	24 (11.5)	12 (5.7)
	Podcast	1 (0.5)	2 (0.9)
Rest and relaxation	Social media	–	3 (1.4)
		43 (20.7)	40 (19.0)
	Relax	11 (5.3)	18 (8.5)
	Time out	6 (2.9)	2 (0.9)
	Isolate	–	2 (0.9)
	Sleep	9 (4.3)	11 (5.2)
	Nap	7 (3.4)	9 (4.3)
	Bathing	12 (5.8%)	8 (3.8)
Complementary and alternative therapies		42 (20.2)	31 (14.7)
	Breathing techniques	13 (6.3)	7 (3.3)
	Meditation	19 (9.1)	19 (9.0)
	Mindfulness	9 (4.3)	2 (0.9)
	Hypnobirthing	–	5 (2.4)
	Therapy	–	2 (0.9)
	Acupuncture	2 (1.0)	–
	Reflexology	1 (0.5)	1 (0.5)
	Massage	3 (1.4)	–
Connecting with nature		8 (3.8)	4 (1.9)
	Gardening	2 (1.0)	–
Home activities	Outdoors	6 (2.9)	4 (1.9)
		6 (2.9)	2 (0.9)
Hobbies	Baking	2 (1.0)	–
	Cleaning	4 (1.9)	2 (0.9)
Organisation		4 (1.9)	1 (0.5)
	Journaling	–	1 (0.5)
	Knitting	1 (0.5)	–
	Draw	1 (0.5)	–
	Paint	1 (0.5)	–
	Puzzles and word searches	2 (1.0)	–
		4 (1.9)	5 (2.4)
Emotional expression	Plan	4 (1.9)	2 (0.9)
	Learn/research	–	2 (0.9)
	Prepare for baby's arrival	–	1 (0.5)
Food and drinks		2 (1.0)	9 (4.3)
	Cry	1 (0.5)	9 (4.3)
	Laugh	1 (0.5)	–
Other		3 (1.5)	8 (3.8)
	Drink tea	1 (0.5)	3 (1.4)
	Drink water	2 (1.0)	–
	Eat	–	5 (2.1)
Other		7 (3.4)	6 (2.8)
	Shop	1 (0.5)	–
	Keep busy	1 (0.5)	1 (0.5)
	Distracting activity	–	1 (0.9)
	Drive	3 (1.4)	3 (1.4)
	Pray	1 (0.5)	–
	Smoke	1 (0.5)	–
	Work	–	1 (0.5)
	Face mask	–	1 (0.5)
	Help with childcare	–	1 (0.5)

Note: Strategies are not mutually exclusive and therefore percentages are greater than those reported within the activity category.

**Table 3**  
Participant characteristics during phases of lockdown restrictions.

	Phase 2 (N = 138) M (SD)	Phase 3 (N = 97) M (SD)	Between-group differences
Age	33.38 (4.50)	34.11 (4.40)	t(231) = -1.23, p = 0.22
Gestational weeks	25.87 (8.68)	29.82 (7.95)	t(229) = -3.54, p = 0.001
Number of children	0.93 (1.12)	0.89 (0.85)	t(230) = 1.05, p = 0.29
Pregnancy-specific stress	13.90 (5.57)	14.14 (5.15)	t(224) = -0.32, p = 0.75
Social support (total)	65.99 (17.52)	67.39 (18.58)	t(228) = -0.57, p = 0.57
Social support (significant other)	24.46 (6.35)	24.41 (6.21)	t(231) = 0.06, p = 0.95
Social support (friends)	19.459 (7.04)	20.81 (6.93)	t(232) = -1.32, p = 0.19
Social support (family)	21.94 (6.42)	22.20 (7.08)	t(230) = -0.29, p = 0.77
Healthy eating <sup>a</sup>	3.20 (0.60)	3.35 (0.55)	t(229) = -1.92, p = 0.056
	N(%)	N(%)	
Relationship status			$\chi^2(3) = 7.98, p = 0.047$
Married	99 (72.3)	79 (81.4)	
Cohabiting	27 (19.7)	11 (11.3)	
In a relationship	10 (7.3)	3 (3.1)	
Single	1 (0.7)	4 (4.1)	
First pregnancy			$\chi^2(1) = 0.0001, p = 0.55$
Yes	52 (38.5)	37 (38.5)	
No	83 (61.5)	59 (61.5)	
Exercise			$\chi^2(4) = 2.96, p = 0.57$
Never	11 (8.0)	6 (6.2)	
Almost never	19 (13.8)	10 (10.3)	
Sometimes	36 (26.1)	35 (36.1)	
Fairly often	40 (29)	25 (25.8)	
Very often	32 (23.2)	21 (21.6)	
Vitamins			$\chi^2(4) = 2.96, p = 0.57$
Never	11 (8.0)	6 (6.2)	
Almost never	19 (13.8)	10 (10.3)	
Sometimes	36 (26.1)	35 (36.1)	
Fairly often	40 (29)	25 (25.8)	
Very often	32 (23.2)	21 (21.6)	
Sleep			$\chi^2(4) = 1.87, p = 0.76$
Never	5 (3.6)	2 (2.1)	
Almost never	18 (13.1)	18 (18.6)	
Sometimes	50 (36.5)	36 (37.1)	
Fairly often	42 (30.7)	26 (26.8)	
Very often	22 (16.1)	15 (15.5)	
Alcohol <sup>a</sup>			
Never	122 (88.4)	84 (86.6)	
Almost never	14 (10.1)	6 (6.2)	
Sometimes	1 (0.7)	7 (7.2)	
Fairly often	1 (0.7)	-	
Very often	-	-	
Smoking <sup>a</sup>			
Never	129 (93.5)	92 (94.5)	
Almost never	3 (2.2)	1 (1.0)	
Sometimes	3 (2.2)	3 (3.5)	
Fairly often	-	-	
Very often	3 (2.2)	1 (1.0)	

Note. Pregnancy-specific stress scores can range from 0 to 34; all social support scores can range from 12 to 84; frequency of healthy eating ranges from 0 to 4.

<sup>a</sup> Alcohol and smoking were not included in further analyses due to the low number of participants reporting engaging in these behaviours.

Though perceived antenatal social support has not been widely reported to date, one study did find that nearly all participants in a Canadian survey reported feeling more alone during the pandemic than usual [23]. Our finding that women reported reduced perceived social support from all sources is in line with this previous finding and may relate to pandemic-related social and physical restrictions. Similarly, the finding that women experienced reduced social support from a significant other is similar to a report that some women experience a strain on their relationship with a significant other during the pandemic [23]. Social support overall, and from specific sources including family, friends and significant others, is recognised as an important protective and resiliency factor in pregnancy and has important implications for perinatal mental health and obstetric outcomes [30]. Our finding

that women were as likely to report connecting with others as a stress-reduction strategy during the pandemic further supports the importance of social interactions during this period. As such, reductions in perceived social support during the pandemic may have adverse maternal and child health outcomes.

The absence of a significant reduction in antenatal stress in the current study differs from previous findings of high levels of antenatal distress during the pandemic [19,22,24,31,32]. Previous examinations have tended to focus on depression and anxiety as indicators of distress [22,24,31,32], which may explain the difference with our finding. Further, examinations have mostly examined general anxiety [22,24] or anxiety related to COVID-19 [19,31]. Pregnancy-specific stress differs in that it is specifically focused on the pregnancy, the baby, and antenatal care. However,

one study reporting high levels of health anxiety among women pregnant during the pandemic did include worries about the self and the baby. The period of the pandemic examined may also explain differences in findings. Data collection during the pandemic in our study began in June 2020, at a point when some restrictions (e.g., related to travel) were being eased. Earlier stages of lockdown, as were examined in previous studies [19,22,24,31,32], may have resulted in higher levels of distress due to higher perceived threat and uncertainty of COVID-19. Similarly, differences between the first and subsequent phases may have resulted in larger differences in outcomes than were observed in this study.

Our finding that phase of lockdown did not influence any outcomes in the current study suggests that phase of pandemic-related restrictions may not impact antenatal psychological well-being or health behaviours however. This should be considered in relation to development and implementation of mental health strategies and support for pregnant women because it cannot be assumed that easing of restrictions will result in improved well-being. Furthermore, as with other large-scale stressors such as natural disasters [33], the effects of the pandemic on maternal mental health and associated effects on infant health and development [34] are likely to be long-lasting; highlighting the need for future support. It should also be noted that restrictions applied to maternity services remained during both Phase Two and Three, with limitations on access to antenatal care and restrictions around partner access. Thus, this may also explain a lack of differences observed in our study.

This is the first study to examine potential changes in pregnant women's engagement in health promoting and protective behaviours resulting from the pandemic. We found no significant differences in the frequency with which women engaged in health behaviours during the pandemic. However participants opened responses in relation to their stress-reduction activities did indicate a reduction in exercise, and in particular walking. This is similar to a recent finding that 64% of survey women reported reduced physical activity with the onset of pandemic-related isolation measures [35]. Overall we found that the health behaviours reported by Irish women during the pandemic are good, with most women reporting frequent healthy eating, engaging in some exercise and taking vitamins. In addition, very few women report alcohol consumption or smoking cigarettes. As health behaviours including diet, exercise, smoking and alcohol consumption are associated with obstetric and child health outcomes [8,36–38], this is a promising finding that suggests women did not alter their behaviours in the context of the pandemic.

Examination of differences between women before and during the pandemic was limited to those variables that were examined in the pre-pandemic group. As such, additional variables such as satisfaction with maternity care and perceived health could not be examined. A further limitation of the study is that we did not ask women in the current study if they had or suspected they had COVID-19. The two groups examined in the current study also represent distinct groups of women, rather than being part of a longitudinal cohort. However, our approach to examining only women living in the ROI who are exposed to similar social contexts and maternity care services served to enhance comparability of the two groups. The majority of participants in the study were multiparous women who were either married or in a relationship and so our findings may not be generalisable beyond this group. This is of particular relevance in relation to COVID-19 related inequalities, whereby certain groups such as obese pregnant women and minority groups, who are more likely to experience higher antenatal stress [11], also represent a higher proportion of

COVID-19 cases [39]; this represents increased risk for certain groups, which could not be examined in the current study.

## 5. Conclusion

The findings of this study demonstrate that pregnant women experienced significantly lower perceived social support from all sources during the pandemic, and a non-significant increase in stress. Taken together these findings highlight negative impacts of the pandemic on two important psychological constructs related to maternal and child health [30]. Development of supports and intervention strategies for pregnant women during the on-going pandemic, and future similar large-scale stressors, should include a focus on both stress-reduction and promotion of social support. Further, many of the stress-reduction strategies women engaged during the pandemic are similar to those engaged in prior to the pandemic, suggesting that women are already familiar with and engage in potentially useful strategies to protect their mental health. The finding that the health behaviours of pregnant women, which are linked to improved maternal and child outcomes [8], were not impaired during the pandemic is a further positive finding of the current study.

## Conflict of interest

None declared.

## Ethical statement

All procedures were approved by the University College Cork School of Public Health Research Ethics Committee and the Clinical Research Ethics Committee of the Cork University Teaching Hospitals.

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## Author contributions

KMS conceptualised and designed the study, collected and analysed the data, wrote and revised the final manuscript.

JP contributed to study design, collected data and assisted with data analysis, critically reviewed and revised the manuscript.

AC contributed to study design, collected data, and critically reviewed and revised the manuscript.

HC contributed to study design, collected data, and critically reviewed and revised the manuscript.

SL conceptualised and designed the study and critically reviewed and revised the manuscript.

EKO designed the study, contributed to analyses and critically reviewed and revised the manuscript.

SM conceptualised and designed the study, contributed to analyses and critically reviewed and revised the manuscript.

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