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What the health?
Information sources and maternal lifestyle behaviours

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Abstract

Background: Regular physical activity (PA), adequate gestational weight gain (GWG) and healthy eating are important for the long-term health of both mother and baby. Hence, it is important that women receive current and updated advice on these topics, and are encouraged to adopt a healthy lifestyle during pregnancy.

Objectives: The aim of this study was to investigate the main information sources among pregnant women regarding PA, GWG and nutrition, as well as evaluate how these information sources may affect their health behaviours.

Methods: A cross-sectional study design, comprising an electronic questionnaire, was distributed to two antenatal clinics, as well as pregnancy-related online chat forums and social media. Inclusion criteria were ≥ 18 years, ≥ 20 weeks gestation and able to read/write Norwegian. In total, 150 pregnant women answered the questionnaire, which was a mix of 11-point Likert scales, close-ended questions and semi close-ended questions. The relationship between information sources and selected variables, including health behaviours and descriptive variables, were assessed by logistic regression, linear regression or X² as appropriate (p < 0.05).

Results: Mean age (years), gestation week and pre-pregnancy BMI (kg/ m²) were 31.1 (± 4.3), 30.6 (± 5.9) and 24.2 (± 4.2), respectively. More than eight out of ten had received or retrieved information about nutrition (89%) and PA (80%), whereas 54% reported information on GWG. When combining all three lifestyle factors, 38.5% had retrieved information from blogs and Internet forums, and 26.6% from their midwife or family physician. Reporting Internet and media as primary source increased the odds of gaining below the IOM guidelines
(P = 0.02), but was also associated with higher compliance with nutritional guidelines (P = 0.03). Family and friends’ advice was significantly associated with gaining above the IOM guidelines (P = 0.03). Otherwise, no other associations were found between information sources and health behaviours.

**Conclusions:** The small number of health professionals giving information, and that about 40% use blogs and Internet forums, highlight the need to address the quality of advice and guide women towards trustworthy sources of information during pregnancy. The association between information sources and PA, GWG and nutrition requires further research.

**Key words:** Information sources, pregnancy, physical activity, gestational weight gain, nutrition
**Introduction**

Regular physical activity (PA), adequate gestational weight gain (GWG) and healthy eating may lower the incidence and severity of serious conditions associated with pregnancy, including, gestational diabetes mellitus [1-3], pregnancy-induced hypertension [2], macrosomia [1] and small for gestational age infants [4]. In addition, daily exercise for the pelvic floor muscles may prevent and treat urinary incontinence [5]. Hence, it is important that women receive current and updated advice on these topics, and are encouraged to adopt a healthy lifestyle during pregnancy [6].

Research show that pregnant women retrieve health information from a variety of sources, including the Internet, books, family and friends, parenting magazines, blogs, Internet forums and health professionals [7-9]. Of these, the Internet and media sources and health professionals are often cited as the most helpful and informative sources of information [7, 9]. On the other hand, studies have shown that low quality is a problem on the Internet [10] and others have found that pregnant women may perceive advice from family physicians and midwives confusing, vague, contradictory and frequently changing [8, 11-13]. Also, research show that most health care providers, regardless of medical training, lack knowledge and awareness of the ACOG [6] PA guidelines [12, 14], and the majority of pregnant women being counselled about weight gain report that the advice is generally discordant with the Institute of Medicine (IOM) [15] GWG guidelines [7, 12, 16, 17].

A search on PubMed in December 2017 revealed 13 studies investigating pregnant women’s information sources on PA, GWG and/or nutrition [7-9, 12, 13, 16, 18-23]. However, the population sizes were generally small (n = 17-60) [8, 12, 13, 18, 20, 23], and information sources were rarely the main outcome [8, 12, 16, 19-23]. Three studies had moderate methodological quality and sufficient population sizes (n = 350-368) [7, 9, 24]. Still, two of
the studies recruited women in the postpartum period; limiting the results to the women’s memory [9, 24], and information on diet, PA and weight control was captured in one question only [24]. In a cross-sectional study, Willcox et al. [7] investigated women who were only half way through pregnancy (mean 20.8 weeks). Hence, there is limited evidence investigating pregnant women’s information sources regarding PA, GWG and nutrition at late gestation. To our knowledge, the present study is also the first to evaluate how different information sources may impact PA, GWG and nutritional habits among pregnant women. Hence, the aim of this study was to investigate the main information sources among pregnant women in Scandinavia regarding PA, GWG and nutrition and evaluate how these information sources may affect their health behaviours.
Methods

Study design

The present project was a cross-sectional study conducted in Oslo, Norway, from February to August 2016. Pregnant women were asked to fill in an electronic questionnaire investigating their health behaviours, as well as information sources regarding PA, GWG and nutrition. The study was reviewed by the Regional Committee for Medical and Health Research Ethics (REK 2015/1941 A), who concluded that, according to the Act on medical and health research (the Health Research Act 2008), the study did not require full review by REK. The study was approved by the Norwegian Social Science Data Service (NSD 45111).

Participants

Enrolment was limited to women living in Oslo, ≥ 18 years, ≥ 20 weeks gestation and being able to read and write Norwegian. To ensure a representative sample with respect to different ethnicities, age groups and socioeconomic backgrounds, all antenatal clinics in Oslo (n=18), both urban and rural, were invited to participate. However, only two agreed to distribute questionnaires to their pregnant patients. In total, 31 women were recruited through these clinics. Hence, we needed to recruit participants from other arenas, such as pregnancy-related online chat forums and social media. The internet-based questionnaire was active between June 1st and August 15th 2016, and was accessed 1078 times. Of the 244 women responding, 125 were excluded due to insufficient answers, while 119 completed the questionnaire. Hence, the total number of included women, recruited from antenatal clinics and social media, was 150, comprising women from both urban and rural parts of Oslo.

Outcome measures

The standardized electronic questionnaire contained 101 questions, required 15-20 minutes to
complete and addressed pregnant women's information sources, PA level, nutritional habits and GWG. We also investigated social support, motives and barriers for being physically active, as well as pregnancy complaints and quality of life. The questionnaire was based on current literature and included a number of validated questions used in previous studies [25-27]. Questions were a mix of 11-point Likert scales, close-ended questions and semi close-ended questions. The questionnaire was piloted for comprehensibility of questions and answer options among 23 pregnant women and was revised accordingly. Below is the questions used to answer the present research questions.

1. The health authorities recommend all pregnant women to perform moderate-intensity aerobic physical activity (activities that take moderate physical effort and make you breathe somewhat harder than normal, such as brisk walking, housework etc.) for a minimum of 30 minutes five days a week. With this in mind, would you characterize yourself as physically active a) pre-pregnancy and b) in your current gestation week? Response options: “Yes”, “No” or “I don’t know”.

2. The Norwegian directorate of health recommend a balanced and varied diet, comprised of whole grain products, vegetables, fruits and berries, lean dairy products, fish, legumes and nuts, while also limiting the amount of processed meats, red meat and foods high in saturated fat, sugar and salt [28]. With this in mind, how would you characterize your diet in your current gestation week? The participants rated their diet on a scale from 0-10, where 0 represented "Very poor" and 10 represented "Very good".

“I have not received/retrieved information/advice” and “Other”. Selection of more than one response was allowed.

4. Which of the information sources had the greatest impact on your PA/GWG/nutrition?
Response options: “Midwife”, “Family physician”, “Blogs and Internet forums”, “Parenting magazines”, “Books and information pamphlets”, “Family and friends”, “I have not received/retrieved information/advice” and “Other”. Selection of two responses was allowed.

5. Have you received any of the following advice on PA?
Response options: “Maintain the same level of PA as pre-pregnancy”, “Increase PA/exercise”, “Reduce PA/exercise”, “Avoid PA/exercise” and “Other”.

6. How much (in kg) have the information sources indicated that your total GWG should be?

7. Anthropometry and knowledge of the GWG guidelines:
Participants were asked to state their height, pre-pregnancy weight and current gestational weight gain. Pre-pregnancy height and weight were used to calculate pre-pregnancy BMI. BMI categories and GWG ranges were consistent with the World Health Organization’s (WHO) guidelines [29] and the guidelines from the IOM [15]. Knowledge of the GWG guidelines was explored using the IOM GWG table.

8. Demographics:
Questions regarding the participant’s demographics addressed age, gestation week, parity, marital status, place of residence, country of birth, educational level, occupation, number of antenatal consultations and whether they currently were on sick leave.
**Statistical analyses**

All statistical analyses were performed using SPSS Statistical Software version 21.0 for Windows. Background variables are presented as frequencies, percentages and means with standard deviation (SD). To address the association between information sources and self-reported compliance to PA, GWG and nutritional guidelines, we divided the participants into three groups based on the most frequently reported source and the source perceived to mostly impact maternal health behaviour:

1) Internet and media (including blogs and Internet forums, parenting magazines and books and information pamphlets)

2) Health professionals (including midwife and family physician)

3) Friends and family

Whether a woman had gained weight below, within or above the GWG guidelines was calculated using mean recommended weight gain in first trimester (1.5kg) [15], adding the mean recommended number of grams per week multiplied by the number of weeks the woman was pregnant above the first trimester. Good nutritional habits and compliance with nutritional guidelines was defined as a score $\geq 7$ on an 11-point scale. The relationship between information sources and selected variables, including health behaviours and descriptive variables, were assessed by logistic regression, linear regression or $X^2$ as appropriate. Level of statistical significance was set at $P < 0.05$. 
Findings

Participant characteristics are shown in Table 1. Age ranged from 19 to 45 with a mean of 31.1 (± 4.3) years. Mean gestation week was 30.6 (± 5.9) and mean pre-pregnancy BMI was 24.2 (± 4.2) kg/m². Thirty-seven (24.7%) reported that they were sick listed due to pregnancy complaints, with the highest prevalence in pelvic girdle pain (12%), fatigue (8.7%) and nausea (6.7%). The mean number of antenatal consultations was 5.2 (± 2.7) (range: 1-15).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primiparous</td>
<td>91</td>
<td>60.7</td>
</tr>
<tr>
<td>Multiparous</td>
<td>59</td>
<td>39.3</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/living together</td>
<td>147</td>
<td>98.0</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Country of birth</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>130</td>
<td>86.7</td>
</tr>
<tr>
<td>Other</td>
<td>20</td>
<td>13.3</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 4 years</td>
<td>54</td>
<td>36.0</td>
</tr>
<tr>
<td>≥ 4 years</td>
<td>96</td>
<td>64.0</td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed/student</td>
<td>144</td>
<td>96.0</td>
</tr>
<tr>
<td>Not employed</td>
<td>6</td>
<td>4.0</td>
</tr>
<tr>
<td><strong>Physically active</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-pregnancy</td>
<td>132</td>
<td>88.0</td>
</tr>
<tr>
<td>During pregnancy</td>
<td>73</td>
<td>48.7</td>
</tr>
<tr>
<td><strong>Pre-pregnancy BMI category</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Normal weight</td>
<td>102</td>
<td>68.4</td>
</tr>
<tr>
<td>Overweight</td>
<td>28</td>
<td>18.7</td>
</tr>
<tr>
<td>Obese</td>
<td>17</td>
<td>11.4</td>
</tr>
<tr>
<td><strong>Prenatal care provider</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family physician</td>
<td>25</td>
<td>16.7</td>
</tr>
<tr>
<td>Midwife</td>
<td>43</td>
<td>28.7</td>
</tr>
<tr>
<td>Shared care*</td>
<td>75</td>
<td>50.0</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>4.7</td>
</tr>
</tbody>
</table>

*Antenatal care shared between midwife and family physician.

Table 1: Participant characteristics (n=150). Data are presented in frequency (n) and percentage (%).
Almost 90% of women reported that they were physically active for a minimum of 150 minutes of moderate intensity each week prior to pregnancy. This number decreased to less than 50% in current gestation week (Table 1).

As shown in Table 2, nearly 65% of the women had gained weight outside the GWG guidelines. About half the participants (50.7%) had knowledge of the IOM table for recommended weight gain. Knowledge of GWG guidelines was not associated with compliance with the guidelines and proportions gaining within ($P = 0.82$), below ($P = 0.10$) or above ($P = 0.82$) the guidelines.

### Table 2: Women gaining within, below or above the IOM recommendations ($n=139$). Data are presented in frequency ($n$), percentage (%), mean kg (SD) below and above recommendations and knowledge of IOM guidelines.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
<th>Mean (SD)</th>
<th>Knowledge of IOM guidelines (n)</th>
<th>Knowledge of IOM guidelines (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below recommendations</td>
<td>37</td>
<td>26.7</td>
<td>-2.6 (± 2.2)</td>
<td>14</td>
<td>10.0</td>
</tr>
<tr>
<td>Within recommendations</td>
<td>51</td>
<td>36.7</td>
<td></td>
<td>27</td>
<td>19.4</td>
</tr>
<tr>
<td>Above recommendations</td>
<td>51</td>
<td>36.7</td>
<td>+3.0 (± 2.4)</td>
<td>27</td>
<td>19.4</td>
</tr>
</tbody>
</table>

Good nutritional habits and compliance with the nutritional guidelines was reported by 65.3%.

### Information sources

Most women reported multiple information sources on PA, GWG and nutrition (Table 3). More than eight out of ten had received or retrieved information about nutrition (89%) and PA (80%), whereas 54% reported information on GWG. When combining all three lifestyle factors, 38.5% had retrieved information from blogs and Internet forums and 26.6% from their midwife or family physician. Books and information pamphlets were the most frequent information source on nutrition, reported by 48%. Significantly more women reported Internet
and media sources than health professionals as the source with the most impact on their health behaviour (Table 4). This association was statistically significant across all three lifestyle factors ($P < 0.001$ for PA, $P < 0.001$ for GWG and $P < 0.001$ for nutrition).

Table 3: Pregnant women’s information sources on PA, GWG and nutrition. Data are presented in percentage (%).

<table>
<thead>
<tr>
<th>Source</th>
<th>Physical activity</th>
<th>Gestational weight gain</th>
<th>Nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blogs and Internet forums</td>
<td>42.7</td>
<td>32.0</td>
<td>40.7</td>
</tr>
<tr>
<td>Books and information pamphlets</td>
<td>32.0</td>
<td>22.0</td>
<td>48.0</td>
</tr>
<tr>
<td>Parenting magazines</td>
<td>20.7</td>
<td>10.0</td>
<td>20.7</td>
</tr>
<tr>
<td>Friends and family</td>
<td>27.3</td>
<td>7.3</td>
<td>22.7</td>
</tr>
<tr>
<td>Midwife</td>
<td>30.7</td>
<td>18.0</td>
<td>35.3</td>
</tr>
<tr>
<td>Family physician</td>
<td>28.7</td>
<td>14.0</td>
<td>34.0</td>
</tr>
<tr>
<td>Other</td>
<td>10.0</td>
<td>2.7</td>
<td>7.3</td>
</tr>
<tr>
<td>I have not received/retrieved information</td>
<td>19.3</td>
<td>46.0</td>
<td>11.3</td>
</tr>
</tbody>
</table>

When examining sources of information across sociodemographic groups, including age, education level, employment status, parity, number of children, marital status and country of birth, the only significant association was between high education and not stating friends and family as the main information source on nutrition ($P = 0.04$).

**Advice consistent with guidelines**

Irrespective of information source, 32.8% and 27.3% had retrieved information inconsistent with the GWG guidelines and the PA guidelines, respectively. Less than $\frac{1}{3}$ of women (29.7%) had received advice on PA from a midwife or family physician. Of these, 25% had received advice inconsistent with the present PA guidelines. With respect to GWG, 13.3% ($n=20$) reported receiving advice from a health professional, and half of these had received advice inconsistent with the GWG guidelines.
**Impact of advice on women’s health behaviours**

No significant associations were observed between the three groups of information sources and the odds of meeting the PA guidelines.

The odds of gaining below the GWG guidelines was increased in women choosing Internet and Media ($P = 0.02$) and health professionals ($P = 0.08$) as the most important source on GWG information. GWG above the guidelines was increased in women receiving advice from friends and family ($P = 0.03$)

Otherwise, no significant relationships or interaction effects were observed.

Good nutritional habits and compliance with nutritional guidelines was significantly associated with Internet and media as primary information source ($P = 0.03$). This association remained significant after controlling for self-reported diet before pregnancy ($P = 0.03$). No significant associations were found between the categories family and friends or health professionals and compliance with nutritional guidelines.
Discussion

To our knowledge, this was the first study investigating the relationship between pregnant women’s information sources and their health behaviours. Consistent with previous research [7, 30], the most common sources of information were Internet and media. About ¼ of women reported receiving information on PA, GWG and nutrition from their midwife or family physician. Reporting Internet and media as the most important source increased the odds of gaining weight below the GWG guidelines, but was also associated with higher compliance with nutritional guidelines. The category friends and family was significantly associated with gaining above the GWG guidelines.

Compared to most other studies investigating pregnant women’s information sources on PA, GWG and/or nutrition, a sample size of 150 women is large [8, 12, 13, 20, 23]. Due to challenges gaining access to antenatal clinic, the majority of women were recruited through social media and parenting chat forums. While electronic questionnaires do not always give the best response rates [31], it enabled us to reach a large number of potential participants. Although women from both urban and rural parts of Oslo participated in the study, most participants were Nordic Caucasians, had stable partners, were non-smokers, college/university educated (≥ 4 years) and employed. Also, a much higher percentage reported meeting the PA guidelines compared to previous reports [27, 32]. Pregnant women answering such a questionnaire may be more interested and more attentive to PA than non-participants, thus introducing the problem of selection bias and possibly impacting the generalizability of the results. Hence, it would be interesting to replicate this study in a more diverse sample, with respect to ethnicity, residency, education and physical activity level.

Our recruitment method may also be an important reason for the large proportion of women choosing Internet and media as preferred information sources. On the other hand, our results
correspond with other studies, recruiting women on the first hospital antenatal visit [7, 24]. A qualitative study have found that women turn to the Internet to gather information prior to meeting with a health professional and afterwards to obtain more information [20]. Social media was also considered an arena for socializing and sharing experiences with other pregnant women and mothers [20]. In the present study, we have not thoroughly investigated the quality of the Internet advice, but a meta-analysis of health website evaluations concluded that low quality was a problem on the Internet [10]. Hence, it is important that women are guided towards trustworthy online resources during pregnancy.

According to the Norwegian guidelines for antenatal care, all prenatal patients should receive lifestyle counselling, including advice on PA, GWG and nutrition on the first prenatal visit [33]. Consistent with other studies [7, 8, 12, 13, 16, 17], only ¼ of women in the present study reported receiving advice from their midwife or family physician on these topics. Further, only ten participants received advice consistent with the GWG guidelines. Others have also reported low numbers (5.2% - 12.0%) with respect to information on GWG from health professionals [7, 17]. Low levels of information are in contrast to research showing that receiving advice from a health professional increases the likelihood of gaining weight within the guidelines [24, 34]. Hence, it is important that health professionals are knowledgeable about current guidelines and the health benefits of regular PA, adequate GWG and healthy eating. Interventions are needed to increase the percentage of health professionals who accurately advise women on PA, GWG and nutrition during pregnancy.

**Impact on women’s health behaviours**

Choosing Internet and media as the most important source on GWG information significantly increased the odds of gaining below the GWG guidelines. Hicks and Brown [35] found that time spent on social media was associated with body dissatisfaction among pregnant women.
In the present study no association between negative body image and choosing Internet and media as the most important source of information was found (data not shown). Still, the way Internet and media focuses on the "yummy mummy", a slender woman with a neat bump [35], may have impacted the women’s GWG.

Reporting friends and family as the main information source on GWG was associated with gaining above the GWG guidelines. Public health guidelines for GWG have been revised several times over the past decades, and friends and family might be less knowledgeable and aware of the risks associated with excessive weight gain in pregnancy. Nevertheless, only ten women considered friends and family to have the most impact on GWG.

The most frequently reported information source on maternal nutrition was books and information pamphlets, highlighting this channel for dietary information. The Norwegian Directorate of Health [28] distributes an information pamphlet with updated nutritional guidelines, available at antenatal clinics, as well as on the Internet. In the present study, we observed that compliance with nutritional guidelines was significantly associated with reporting Internet and media as primary information source \((P = 0.03)\). This association remained significant after controlling for self-reported diet before pregnancy \((P = 0.03)\).

**Strengths and limitations**

This is one of the largest studies investigating pregnant women’s information sources, and the first to explore how different information sources may impact three distinct, but importantly related health topics: PA, GWG and nutrition. Also, the questionnaire used covered a broad range of factors that could possibly explain women’s health behaviours and was based on previously validated questions and questions used in similar studies [25-27, 36]. Further, the use of an electronic questionnaire is time efficient and cost effective [31].
On the other hand, participants were mainly recruited through social media and may therefore represent a somewhat selected sample. Also, all information was self-reported and therefore subjective to social desirability bias.

Conclusion

The small number of health professionals giving information, and the extensive use of Internet and media based sources, highlight the need to address the quality of advice and guide women towards trustworthy sources of information during pregnancy. Even though Internet and media sources seemed to have a positive impact on nutritional behaviour, it was also associated with gaining below the GWG guidelines. Further research investigating how different information sources influences PA, GWG and nutritional behaviours are needed.

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Conflict of Interest

The authors declare that they have no conflict of interest.
References:


