**An assessment of pregnant women’s knowledge and use of the Internet for medication safety information and purchase**

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**ABSTRACT**

**Aim:** To assess pregnant women’s internet searching activity regarding medication safety, knowledge and perceptions of medication risk and willingness to take prescribed and non-prescribed medication or make online medication purchases.

**Background:** Online medication advice for pregnant women is complex. The quality and veracity of this data is increasingly important as more midwives report women are bringing retrieved online information to clinical appointments. Pregnant women’s use of the internet for seeking medication advice and purchasing medications has not yet been fully investigated.

**Design**: Online survey conducted from January - March 2013.

**Findings:** Of the284 respondents, 39% were taking a medication when they became pregnant and 76% had searched the internet for medication safety information. Analgesics were the most commonly searched category (41%). Health service sites were the most common online source and regarded as the most helpful and trusted. Regardless of age and education level, 90% of women agreed that if trying to become pregnant they would reconsider taking any medications because of the potential risk to their unborn baby. Forty six percent of women with higher levels of education consider buying medication online as safe, a greater proportion than those of lower education. Five percent of women reported buying medication online.

**Conclusion**: The lack of specific recommendations for medication use during pregnancy is challenging for healthcare staff and pregnant women who need robust evidence to make informed treatment decisions. The internet is a recognized, commonly accessed, source of medication information for pregnant women.

**Key Words:** Pregnancy, nursing, midwifery, medication use, medication information, medication safety, internet, online survey

**SUMMARY STATEMENT**

**Why is this research needed?**

* Some women are taking prescribed medication before becoming pregnant and many women need to take medications during pregnancy
* Pregnant women are using the internet to seek information about medications
* Un-validated information sources on use of medications in pregnancy exist

**What are the key findings?**

* Over a third of women were taking a medication at time of conception
* Three quarters of the women had used the internet to search for information about the safety of a medication in pregnancy with analgesics being the most commonly searched drug category
* Health service sites were the most common online source and regarded as the most helpful and trusted
* Few women currently purchase medications from e-pharmacies

**How should the findings be used to influence practice/education?**

* The types and safety of medications being used by pregnant women require investigation
* Pregnant women require help and guidance to access accurate and reliable medication information sources
* Midwives and maternity care providers need to be alert to online searching by pregnant women, both for information and purchase and keep themselves apprised of the safety aspects

**INTRODUCTION**

Previous research shows pregnant women use the internet for information about all aspects of their pregnancy (Larsson 20019, Lagan *et al*. 2011, Bjelke *et al*. 2016) and early postnatal period, including medication usage (Bakhireva *et al.* 2010, De Santis *et al*. 2010, Sinclair *et al.* 2014). As part of EUROmediCAT, a daughter project of EUROCAT (European Surveillance of Congenital Anomalies), dedicated to investigating and improving medication safety during pregnancy and funded by the European Union (EU) Seventh Framework Programme in 2010, Lagan and colleagues (2014) conducted a descriptive cross-sectional survey of 50 e-pharmacies. They demonstrated how easy it was to purchase isotretinoin (a known teratogenic drug that has a strict Pregnancy Prevention Programme (PPP) protocol) from 42 of the sites without a valid prescription (Lagan *et al*. 2014). The study also reported on the lack of safety information for the protection of pregnant women on the sites accessed. The study demonstrated the power of the internet to provide the public with access to e-pharmacies and freedom to purchase prescription-only medications using the internet as the *portal of opportunity (*Lagan *et al.* 2014*)*. In the study reported here, we expand the focus to understanding more generally pregnant women’s use of the internet in the context of their knowledge and perceptions of safe medication usage in pregnancy.

**Background**

The lack of evidence to inform specific recommendations for medication use by pregnant women has been identified as a critical issue for women’s healthcare (de Jong *et al*. 2015, Thorpe *et al.* 2013, Thomas and Yates 2012, Sundseth and Semancik 2016) and this is challenging for healthcare staff and pregnant women who need robust evidence to make informed treatment decisions (Hansen et. al. 2016). Due to the risk of potential harm to the fetus in a vulnerable state of development, pregnant women are usually excluded from premarketing trials and scientific evidence depends on post-marketing observational studies (Thomas and Yates 2012). Up to now, these have not provided sufficient scientific evidence to inform decision making (Thorpe *et al*. 2013).

Women have been found to be more conservative about use of medication in pregnancy than when not pregnant (De Santis *et al*. 2010, Nordeng *et al*. 2010a, Zaki and Albarraq 2014, Twigg *et al*. 2016) and this is borne out by drug use studies specific to pregnancy (Bakker *et al*. 2006). Yet usage of medication by women, both prescription (Bakker *et al*. 2006, Stephansson *et al*. 2011) and over the counter (Thorpe *et al*. 2013) is high due to treatment needs for chronic and acute health conditions, risk of untreated conditions for both pregnant woman and unborn baby and inadvertent use before pregnancy is recognised. Older maternal age at childbirth has moreover led to an increase in women with chronic conditions who need medication.

A growing literature explores women’s knowledge and perceptions of medication safety in pregnancy. Surveys have found that women rate the risk of OTC medications such as analgesics to be relatively low but may rate the risks of certain prescribed medications to be higher than the evidence base suggests (Petersen *et al*. 2015). Women’s beliefs and fear surrounding the safety of medications has an impact on their likely adherence to drug therapy (Bonari *et al*. 2005, Nordeng *et al.* 2010a, Nordeng *et al.* 2010b, Lupattelli *et al*. 2014a, Twigg *et al*. 2016). Specific problems concerning medication use have been reported for pregnant women suffering from migraine (Amundsen *et al*. 2016), epilepsy (Widnes *et al*. 2010) and back pain (Sinclair *et al*. 2014) among others.

Few studies have specifically explored pregnant women’s use of the internet for medication safety information and none for online medication purchase. De Santis *et al*. (2010) described how 57% of a sample of 203 women in 2008-9 who contacted an Italian Teratology Information Service helpline and thus were a sample of particularly concerned women, had accessed the internet for drug exposure information, particularly in the first trimester. However, 22% had received incorrect information (over or underestimating the risks) and only 60% had found evidence based answers. A survey of Latina women in New Mexico also found the internet to be commonly consulted for information and information seeking was associated with higher education and primiparity (Bakhireva *et al*. 2010). Health professionals, including midwives, have been urged to engage more actively with women’s use of the internet for medication safety information (Larsson 2009, Weston and Anderson 2014, Bakhireva *et al*. 2010). No previous studies have been found regarding online purchase of medication by pregnant women.

There is little evidence regarding the internet sources of information that women are accessing. Some internet safe lists of medications use during pregnancy have been found to be inaccurate (Peters *et al*. 2013). Norby *et al*. (2015) reported that women found great value in the Swedish internet database *Medications and Birth Defects* and reported it was easy to understand, however, only 11% (n=29) had knowledge of it prior to the study. Van Calsteren *et al*. (2016) stated that: “many people still appear to prefer a search by ‘Dr Google’ and do not contact the specialised organisations” for information regarding pharmaceuticals. Therefore, there is a clear need to actively engage with pregnant women to establish where on the internet they search for medication safety information and how they use that information to inform their medication taking and purchasing activity.

**THE STUDY**

**Aim**

The aim of this study was to assess pregnant women’s use of the internet to search for information on medication safety during pregnancy; their knowledge and perceptions of medication risk; and willingness to take prescribed and non-prescribed medication or make online medication purchases.

**Methodology**

***Design***

**An exploratory and descriptive approach was adopted using a specifically developed online questionnaire.**

***Data collection tool***

Online questionnaires have been used to collect data from pregnant women for the past 10 years and examples can be found in research by Lagan *et al*. (2011), Lupattelli *et al.* (2014a and 2014b), Palosse-Cantaloube *et al*. (2014), Sinclair *et al.* (2014), Hameen-Anttila *et al.* (2015), Petersen *et al*. (2015) and Twigg *et al*. (2016). For this study, a 72-item web-based questionnaire was designed for data collection based on pragmatism as online surveys conserve time and offer an economy of efficiency that is very attractive to both researcher and participant. The construction of the instrument was theoretically underpinned by Rogers (1983) Protection Motivation Theory and items from previously validated instruments were borrowed and adapted with permission from the authors (Närhi *et al*. 2008, Peterson-Clarke *et al*. 2010, Lagan *et* *al*. 2011).

The questionnaire consisted of mainly of closed questions (e.g. Have you ever purchased a medication from an internet pharmacy while pregnant?) or seven point Likert type scales from strongly agree to strongly disagree. The survey also asked someopen questions, e.g. ‘Please name the medications would you be happy to take during pregnancy?’ Questions were arranged in four sections: demographic information; attitudes to taking medications during pregnancy; use of the internet for medication safety information during pregnancy and use of the internet for medication purchase.

***Pilot study***

A two-phase pilot study was conducted. First, a paper copy of the questionnaire was tested for content validity and reliability with ten female members of the EUROmediCAT project team. Following this pilot phase minor amendments were made and then an online version of the questionnaire was designed using ‘Qualtrics’ ([www.qualtrics.com](http://www.qualtrics.com/)) a software which provides a platform for online survey data collection and preliminary analysis. Next, a further pilot was conducted to check for potential logistic and technical problems with members of the team. Following minor calibration work the survey was uploaded onto the EUROmediCAT website (http://euromedicat.eu/) where it had a unique URL address.

***Sampling and recruitment***

Only female volunteers who satisfied the following inclusion criteria were invited to participate in the study from January 2013 to March 2013: 18 years of age or over, currently pregnant or had a baby in the last year, living in the UK and able to read and understand English. Pregnant minors were excluded from the study due to difficultly obtaining parental consent in a timely and cost-effective manner.

This sample was drawn from the four UK countries. In the first instance, a **search was undertaken to identify ‘women health and pregnancy’ social media sites as possible platforms for advertising the study. However, the researchers were unable to get information about the study or a link to the survey posted on the ‘main’ web pages of such relevant sites which potentially resulted in a poor response. To increase the response rate** the survey was then administered to a panel of participants compiled by Qualtrics that fulfilled all the inclusion criteria**. Willing participants were given the hyperlink to the participant information and consent page that provided details about the survey and what participating would involve and then a link** to the questionnaire.

**Validity and reliability**

The survey was piloted with a small sample of doctoral students and parents after a content validity check by an expert group of multi-professional researchers with expertise in online instrument development, epidemiological research and medications in pregnancy. Cronbach alpha measures were also taken post-test to provide evidence of good reliability.Cronbach’s alpha was calculated, to assess whether the scores on the 11 items that were summed to create the Attitudes to taking medication scale, the 12 items in the Evaluating the quality of medication information online scale and the 16 items in the purchasing medicines from an Internet pharmacy scale were internally consistent. All three scales had reliability coefficients above 0.60 (Attitudes to taking medications α = 0.63; Evaluating the quality of medication information online α = 0.87; purchasing medicines from an internet pharmacy scale α = 0.74).

**Ethical consideration**

The study received ethical approval from the Ulster University Institute of Nursing and Health Research Ethics Filter Committee.

**Data analyses**

Data were transferred directly from the Qualtrics survey tool into SPSS version 21 for analysis. The majority of the items in the survey had categorical response options. Frequencies are provided for the responses in the tables. For analysis purposes, the original seven point Likert response scales were collapsed into three point scales: ‘Disagree’ (strongly disagree, disagree, somewhat disagree – Scored 1), ‘Unsure’ (Scored 2) and ‘Agree’ (strongly agree, agree, somewhat agree – Scored 3). The *Pearson’s* χ2 tests (or Fisher’s exact tests for cells less than 5) were used to test significance between categorical variables. A two-sample t-test was used to examine whether the sample mean of a single continuous variable was different between groups e.g. young adults and older adults; or those that had obtained a university degree and those that had not. A *p*-value of ≤0.05 was considered significant.

**RESULTS**

In total 443 volunteers accessed the survey and 284 women completed the questionnaire. The demographic profile of the 284 participants is presented in Table 1. Women used the internet to access information as it was easy to search and readily available. The main reason for searching for medications information was to ensure the safety of their unborn child.

***Use of the internet for medication safety information in pregnancy***

Over three quarters (76%, n=217) of the women who participated in the study had personally used the internet to search for information about the safety of a medication in pregnancy*.* This group were given a list of various online sources and asked if they had used them and if so, had they found the source helpful (Table 2) and trustworthy (Table 3).

For those women who had accessed online sources for information about the safe use of a medication in pregnancy (76%, n=217) health service sites were the most used online source (93%, n=201) and also the source the participants found helpful and most trusted (84%, n=239). Although social media sites for pregnant women were the second most used source (85%, n=185) they were also the second most cited source that was found by the participants as being unhelpful (18%), but also the second most cited source to be helpful (68%), they were trusted by 42% of respondents (n=120). Although just over half (n=115/217) of the women had accessed sites hosted by pharmacy/drug companies, almost a fifth of them found the sites unhelpful and there was no clear consensus on their trustworthiness. Of the women who used the internet to search for drug safety information 53% (n=115) of women shared this information with their midwife.

***Knowledge and perceptions of medication risk***

The most common medication that women searched the internet for information about were vitamins and minerals (45%) and analgesics (pain killers) (41%) (Table 4). Older women (80% vs 68%) and those with a university degree (82% vs 67%) were more likely to read the information leaflet accompanying medications before becoming pregnant (p=0.033 and p=0.002 respectively). Women with a university degree (78% vs 64%) were also more likely to report that they would always weigh up the benefits of taking a medication against the possible side effects (p=0.016) even before pregnancy.

For those who answered yes (46%, n=100) to the question which asked if the information they sourced online influenced their decision about whether to take the medication during their pregnancy, they were asked to explain how. The majority said the information either verified or reassured them it was ‘ok’ to take the medication or influenced their decision to not take the medication. On average women rated their ability to evaluate the validity and safety of information they sourced as high (Figure 1), however, they were less sure of their ability to recognise a regulated internet pharmacy (Figure 2). Regardless of age and level of education, 90% (n=256) of women ‘agreed’ that if they were trying to become pregnant they would reconsider taking any medications because of the potential risk to the unborn baby and would consider the potential risks to their baby before taking any medications.

***Medication use during pregnancy***

Of the women who participated in the survey 40% (n=82) had a history of a chronic health condition and overall, 111 (39%) of the study participants were taking at least one medication that was not a mineral or vitamin when they became pregnant (Table 5). Of those taking medication, 55% (n=156) altered their behaviour when planning a pregnancy or when they became pregnant; 22% (n=43) made no pregnancy related changes to their medication.

Most of women were not happy to take medication during pregnancy (n= 169, 60%). The vast majority of women would only take a medication during pregnancy if more harm could come to their unborn baby by not taking it (87%), only if it was absolutely necessary for their health (95%) and only if prescribed by a health professional (93%). However, 53% of women would be happier taking a medication in the third trimester than the first and 41% of women said that there were some medications that they would take during pregnancy. Of the 115 participants who named medications they would be happy to take in pregnancy, 54/284 (19%) named paracetamol, with a further four (4%) women stating they would be happy to take ‘mild pain killers’. Ten (4%) women stated they would be happy to take antibiotics.

***Purchasing medications from online pharmacies***

Regardless of age or education women would not buy medications over the internet whether they were pregnant (85%) or not (78%). This was mainly due to fear surrounding legitimacy, safety, quality, dosage and likelihood of receipt. Women with a university degree felt that websites should provide referenced, balanced evidence with details of the author and/or editor’s identity available (81% vs 64% p=0.003). 67% of all respondents were unsure or agreed that internet pharmacies were not required to display their address and phone number.

Women with higher levels of education felt that buying medications from online pharmacies was safe (42% vs 26% p<0.001) and also would purchase a medication from an internet pharmacy while pregnant if she could not obtain/buy the medication from a local pharmacy or doctor (54% vs 46% p=0.008) or if it was cheaper (41% vs 23% p=0.004) compared with women with lower levels of education, however, only 5% (n=14) of respondents had done so during pregnancy. Of these respondents, 10 women (71%) had been asked ‘sometimes’ or never by the online pharmacy for a prescription and eight women (57%) had ‘sometimes’ been asked if they were pregnant with the remainder never being asked (29%) or they could not remember being asked (14%). Six (43%) women were asked to complete a medical questionnaire. Of those women who purchased medications on the internet 50% always received their order, while the rest received them occasionally or never. 200 (70%) women had never seen the symbol indicating that “This medication may harm your unborn baby if taken in pregnancy. Do not take while pregnant”. However, only 14% (n=40) of women did not know what the symbol meant.Regardless of age and education level 75% of women stated that they would be unable to determine the difference between legitimate and illegitimate e-pharmacies.

**DISCUSSION**

Participants in this study reported using the internet as it was easy to search for information, readily available to them and convenient, which were also the main reasons for use reported by De Santis *et al*. (2010). Seventy six percent of participants, who were all resident in the UK, accessed the internet for information about the safety of medication during pregnancy. This is considerably higher than that reported by Twigg *et al*. (2016) who found only 49.6% (n=257) of UK women used the internet to research medicine use during pregnancy from November 2011 to January 2012. However, the participants in this current study had a higher educational attainment compared with Twigg *et al*. (2016) (79.2% versus 52.1% had progressed beyond high school) and this is a predictor for accessing the internet for health activities (Bansil *et* *al*. 2006, Kontos *et al*. 2014). Both our study and that of Twigg *et al*. (2016) conducted an online survey, which would bias participation towards women who use the internet more readily.

Health service sites were the most commonly used online source and deemed to be the most ‘helpful’ (93%) with most women trusting these sites (84%). This is echoed by Lemire *et al*. (2008) who reported the perceived usefulness of the site itself and trust in the information retrieved were two of the most important factors in visiting a website. The least used sites were funded teratology information sites (63%) and *safefetus.com* (65%) an online database of worldwide medications updated and run by experts. The *safefetus* mobile phone app is due for release soon which may increase usage and access of this valuable resource. In total 85% of women used social media sites, such as *Netmums* to search for information. Such sites were reported as the second most helpful (68%) and also the second most unhelpful (18%). However, 58% of women were unsure or did not trust social media sites. Discussion forums were also viewed negatively by pregnant and postnatal women and midwives during a focus group study, the main reasons given being that they reported the personal experiences and opinions of other users instead of providing facts (Weston and Anderson 2014). Other studies have reported that women have felt worried and concerned particularly after accessing information from online forums (De Santis *et al.* 2010, Bjelke *et al*. 2016). A French study by Palosse-Cantaloube *et al*. (2014) conducted an investigation of the first 10 pregnancy-related forum websites accessed by pregnant women searching for information regarding drugs and pregnancy and examined 115 of the posted questions. They reported the main drugs that women were concerned about included those used for the nervous system (such as AEDs), antibiotics and those used for the respiratory system. They concluded that nearly half of the drugs identified in online chats had not been evaluated properly for safe and effective use in pregnancy and when they explored the answers provided, only 7% of the 214 answers came from health professionals. The Position Statement from the European Board and College of Obstetrics and Gynaecology (EBCOG) (Van Calsteren *et al.* 2016) have called for a centralised, high quality, robust website to improve drug information provided to pregnant and lactating women.

McArdle *et al*. (2015) reported that most women (87%) preferred to use the internet to supplement information given by their healthcare provider; however, midwives remain the preferred source of advice for pregnant women (Weston and Anderson 2014). Importantly, over half (53%) of the women surveyed in our study had shared and discussed the information retrieved with their midwife which contrast with previous studies reporting only 24.9%-29% of women sharing their findings (Gao *et al.* 2013, Larsson 2009). However, midwives reportedly lack awareness and knowledge of popular pregnancy websites and their use by and importance to, pregnant women (Weston and Anderson 2014). It is recommended that antenatal HCP should be able to guide pregnant women to high quality reliable sources of information online and assist them with interpreting and applying it (Larsson 2009, Lagan *et al*. 2011, McArdle *et al.* 2015).

Older women and those with a university degree were more likely to make a more considered decision regarding the advantages or disadvantages of taking medications. Higher educational attainment and maternal age have previously been found to be associated with internet usage and with a higher perception of risk of medications use during pregnancy (Bakhireva *et al*. 2010, De Santis *et al*. 2010, Nordeng *et al.* 2010a, Van Deursen *et al*. 2011, Grimes *et al.* 2014). Education and age, however, had no bearing on women’s desire to protect their baby from drug side-effects by deciding to only take medications in pregnancy if absolutely required.

In this current study, the online drug information sourced was used as confirmation or reassurance that it was ‘ok’ or not ‘ok’ to take medications by 46% of respondents. Lagan *et al*. (2011) reported that assisting decision making was one of the main reasons why pregnant women accessed the internet. Overall, the results from this survey demonstrated that women exercise extra caution regarding taking medications before and during pregnancy and 55% altered or reduced their intake. This corresponds with Twigg *et al*. (2016) and Nordeng *et al*. (2010b) where women cited concerns for the safety of their baby as the primary reason for not taking medication. Peters *et al*. (2013) has reported that many internet lists of medications safe for use during pregnancy provide inaccurate information, however, of the women surveyed here, 48% felt that they had above average skills in their ability to evaluate the quality and validity of safety information found on the internet.

Nordeng *et al*. (2010a) reported that 79% of women had used medications during pregnancy with paracetamol being the most commonly used (59%), however, 43.4% believed all medicines were potentially harmful. Thorpe *et al*. (2013) reported that, in the USA, paracetamol and ibuprofen were the most common OTC medications taken in the first trimester. In comparison in our survey, only 19% of women reported that paracetamol was one of the medications that they would be happy to take during pregnancy, when asked an open question and 41% reported looking for information about analgesics suggesting some need for reassurance or information about safety. A multinational survey suggested that perception of risk of OTC medicines, such as paracetamol, was much lower than perceptions related to some other prescribed medications (Petersen *et al.* 2015). A recent online survey conducted in the UK also reported that women with back pain took analgesics including ibuprofen throughout their pregnancy (Sinclair *et al*. 2014), buying them over-the-counter despite official advice to take them in pregnancy only if prescribed by a doctor and to take paracetamol rather than ibuprofen in pregnancy where possible (NHS Choices 2014). The risks associated with paracetamol are currently controversial (Brandlistuen *et al*. 2013, Thiele *et* *al*. 2013, Bauer and Kriebel 2013, Liew *et al*. 2014) but official sites advise it as a safe medication in pregnancy (NHS Choices). These findings point towards the need for greater education and awareness of OTC drug use during pregnancy.

In our survey 53% of women stated that they would be happier to take medicines during the third trimester of pregnancy than the first trimester and women are more likely to search for information in the first trimester (Larsson 2009, De Santis *et al.* 2010). This is comparable with Zaki and Albarraq (2014) who reported that almost 100% of women stated that the first trimester was the critical time for foetal drug exposure. This suggests women correctly identify the first trimester as the critical time for structural birth defects, although the risks of foetal exposure also extend to other trimesters (Thomas and Yates 2012).

Clemow *et al*. (2014) stated that health care professionals (HCP) and pregnant women routinely overestimate the teratogenic risks of medicines. This may be one reason why women in our survey felt that doctors are reluctant or unwilling to prescribe medications during pregnancy, the other reason being the lack of evidence and readily available information regarding safety (Thorpe *et al.* 2013). This fact has been highlighted by the FDA and Health Canada and the FDA has revised its drug labelling policy to include the *Pregnancy and Lactation Labelling Rule* in June 2015 to ensure drug manufacturers provide information on product labels regarding safety for pregnant and lactating women (Mosley *et al.* 2015). The European Board and College of Obstetrics and Gynaecology (EBCOG) (Van Calsteren *et al*. 2016) and the European Institute of Women’s Health have strongly urged the European Commission to follow suit regarding this.

Of the women who participated in the survey 40% had a chronic health condition and overall 111 (39%) were taking at least one medication when they became pregnant. Swedish researches suggests that, while women collect prescriptions and have them filled, other than those with a chronic condition such as diabetes or epilepsy, they are not compliant in taking medication (Stephansson *et al*. 2011). Indeed women with epilepsy have been found to be reluctant to take any medicine other than their antiepileptic medications during pregnancy (Widnes *et al.* 2012). This suggests a change of heart by women regarding medications prescribed, possibly due to their own research of these medications to make an informed decision.

Perceived product and retailer risk play a major role in purchasing medications online. Perceived trustworthiness in an online pharmacy has a negative impact on customer purchasing (Buttner *et al*. 2006). 46% of women with higher levels of education considered buying medications from e-pharmacies to be safe and acceptable, although only 5% (n=14) of all respondents had done so during pregnancy. Most women would not buy medications over the internet and were even more unlikely to do so if they were pregnant, citing concerns around whether the e-pharmacy was legitimate and safe, the quality and dosage of the product and whether it would actually be delivered. Also, of university educated women significantly more believed that websites should have credible identification of authors made available. In July 2015, the compulsory EU internet pharmacy logo and registration verification process was launched (MHRA 2016). However, there was a degree of uncertainty surrounding the genuine internet pharmacy logo regardless of age and education. There was also no firm response regarding whether internet pharmacies were required to display their address and phone number which, in fact, should be clearly displayed on websites (GPC 2015).

Most women (79%) agreed that internet pharmacies should ask if the purchaser is pregnant, however, Orizio *et al.* (2009) found that this was the case with only 70.2% (n=40) of suppliers and a previous study of isotretinoin found that even for this highly teratogenic drug online pharmacies did not routinely ask this question (Lagan *et al*. 2014). Of the women who had purchased medications on the internet, 12 women (86%) had never or only sometimes been asked if they were pregnant and half had never been asked for a prescription. Illegal, counterfeit and recalled medications are widely available on the internet often from seemingly legitimate sources (Mackey and Liang 2011, .Alwon *et al*. 2015). The lack of knowledge reported by women in this study surrounding the requirements of genuine e-pharmacies poses serious concerns for pregnant women and their babies; greater consumer awareness is required (Alwon *et al*. 2015). Indeed, analyses of a sample of 120 online pharmacies highlighted that low-quality sellers display fewer of the high-cost signs, that allow customers to easily verify their legitimacy, than high-quality sellers do (Mavlanova *et al*. 2012), therefore, increasing the potential for uncertainty among consumers. In an attempt to optimise maternal and fetal health professionals need to educate pregnant women about the health risks associated with taking non-prescribed medications during pregnancy and the dangers of purchasing medications online. Ideally this education should be provided in the preconception period.

**Study Limitations**

Although the survey sample were designed to constitute a representative cross-sections of women living in the UK, the majority of participants resided in England therefore the samples were not representative of the women living in the United Kingdom as a whole. It also needs to be accounted for that in Scotland, Wales and Northern Ireland prescriptions are free to all citizens, whereas in England this is not the case. To achieve the sample size for the survey an online panel sample was used. Online panel samples are by definition, convenience samples. Even when their composition may resemble the general population, they are populated with individuals who want to participate in surveys in exchange for incentives. Although to complete the survey there was a stipulated inclusion and exclusion criteria it has to be highlighted that not all women who fulfilled these criteria would have had the same chance to participate in the survey as not all belong to an online panel. Participants who had given birth up to a year previously were included in this study and difficulties recollecting details regarding medication searching may have led to recall bias.

**CONCLUSIONS**

This survey demonstrates that pregnant women routinely use the internet to access drug information and the primary reason for doing so is to ensure the safety of their baby. Pregnant womenare actively seeking information online and the internet offers convenience, accessibility and affordability. However, they lack a single well known, authoritative online reference source regarding medication safety in pregnancy, but would use it if provided. The development of such a database would be invaluable for pregnant women and maternity healthcare providers alike.

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**REFERENCES**

Alwon B.M., Solomon G., Hussain F. & Wright D.J. (2015) A detailed analysis of online pharmacy characteristics to inform safe usage by patients. *International Journal of Clinical Pharmacy* 37(1), 148-158.

Amundsen S., Øvrebø T.G., Amble N.M.S., Poole A.C. & Nordeng H. (2016) Use of antimigraine medications and information needs during pregnancy and breastfeeding: a cross-sectional study among 401 Norwegian women. *European Journal of Clinical Pharmacology* 72(12), 1525-1535.

Bakhireva L.N., Young B.N., Dalen J., Phelan S.T. & Rayburn W.F. (2010) Patient utilization of information sources about safety of medications during pregnancy. *The Journal of Reproductive Medicine* 56(7-8), 339-3343.

Bakker, M.K., Jentink, J., Vroom, F., Van Den Berg, P.B., De Walle, H.E. & Jong‐Van Den Berg, D. (2006) Maternal medicine: Drug prescription patterns before, during and after pregnancy for chronic, occasional and pregnancy‐related drugs in the Netherlands. *BJOG: An International Journal of Obstetrics & Gynaecology*, *113*(5), 559-568.

Bansil, P., Keenan, N. L., Zlot, A. I., & Gilliland, J. C. (2006) Health-related information on the Web: results from the HealthStyles Survey, 2002-2003. *Preventing Chronic Disease* 3(2), A36.

Bauer A.Z. & Kriebel D. (2013) Prenatal and perinatal analgesic exposure and autism: an ecological link. *Environmental Health* 12(1), 1.

Bjelke M., Martinsson A.K., Lendahls L. & Oscarsson M. (2016) Using the Internet as a source of information during pregnancy-a descriptive cross-sectional study in Sweden. *Midwifery* 40, 187-191.

Bonari L., Koren G., Einarson T.R., Jasper J.D., Taddio A. & Einarson A. (2005) Use of antidepressants by pregnant women: evaluation of perception of risk, efficacy of evidence based counseling and determinants of decision making. *Archives of Women's Mental Health* 8(4), 214-220.

Brandlistuen R.E., Ystrom E., Nulman I., Koren G. & Nordeng H. (2013) Prenatal paracetamol exposure and child neurodevelopment: a sibling-controlled cohort study. *International Journal of Epidemiology* 42(6), 1702-1713.

Buttner, O. B., Schulz, S., & Silberer, G. (2006) Perceived risk and deliberation in retailer choice: Consumer behavior towards online pharmacies. Advances in Consumer Research, 33, 197.

Can I take ibuprofen when I’m pregnant? NHS Choices. Retrieved from <http://www.nhs.uk/chq/Pages/2398.aspx?CategoryID=54> on 4 December 2016.

Clemow D.B., Dewulf L., Michaels D.L., Nolan M.R., Cantrell S.A., Kogelnik A.M., Koren G. & Mikita J.S. (2014) A proposed framework to address needs of clinical data for informed medication use in pregnancy. *Therapeutic Innovation & Regulatory Science* 48(2), 145-154.

de Jonge, L., Garne, E., Gini, R., Jordan, S.E., Klungsoyr, K., Loane, M., Neville, A.J., Pierini, A., Puccini, A., Thayer, D.S. and Tucker, D. (2015) Improving information on maternal medication use by linking prescription data to congenital anomaly registers: a EUROmediCAT study. *Drug Safety* 38(11), 1083-1093.

De Santis M., De Luca C., Quattrocchi T., Visconti D., Cesari E., Mappa I., Nobili E., Spagnuolo T. & Caruso A. (2010) Use of the Internet by women seeking information about potentially teratogenic agents. European *Journal of Obstetrics & Gynecology and Reproductive Biology* 151(2), 154-157.

Gao L.L., Larsson M. & Luo S.Y. (2013) Internet use by Chinese women seeking pregnancy-related information. *Midwifery* 29(7), 730-735.

General Pharmaceutical Council (2015) Guidance for registered pharmacies providing pharmacy services at a distance, including on the internet. Retrieved from [www.pharmacyregulation.org/standards/guidance on 22 October 2016](http://www.pharmacyregulation.org/standards/guidance%20on%2022%20October%202016).

Grimes H.A., Forster D.A. & Newton M.S. (2014) Sources of information used by women during pregnancy to meet their information needs. *Midwifery* 30(1), e26-33.

Hämeen-Anttila K., Kokki E., Lupattelli A., Nordeng H., Jyrkkä J., Vainio K. & Enlund H. (2015) Factors associated with the need for information about medicines among pregnant women–A multinational internet-based survey. *Research in Social and Administrative Pharmacy* 11(2), 297-302.

Hansen C. andrade,S.E., Freiman H., Dublin S., Haffenreffer K., Cooper, W.O., Cheetham T.C., Toh S., Li, D.K., Raebel M.A. & Kuntz J. L. (2016) Trimethoprim–sulfonamide use during the first trimester of pregnancy and the risk of congenital anomalies*. Pharmacoepidemiology and Drug Safety* 25(2), 170-178.

Kontos, E., Blake, K.D., Chou, W.Y.S. & Prestin, A., (2014) Predictors of eHealth usage: insights on the digital divide from the Health Information National Trends Survey 2012. Journal of Medical Internet Research 16(7), e172.

Lagan B. M., Dolk H., White B., Uges D. R. & Sinclair M. (2014) Assessing the availability of the teratogenic drug isotretinoin outside the pregnancy prevention programme: a survey of e‐pharmacies. *Pharmacoepidemiology and Drug Safety* 23(4), 411-418.

Lagan B.M., Sinclair M. & Kernohan W.G. (2011) A web-based survey of midwives’ perceptions of women using the Internet in pregnancy: a global phenomenon. *Midwifery* 27(2), 273-281.

Larsson M. (2009) A descriptive study of the use of the internet by women seeking pregnancy-related information. *Midwifery* 25(1), 14-20.

Lemire M., Paré G., Sicotte C.& Harvey C. (2008) Determinants of Internet use as a preferred source of information on personal health. *International Journal of Medical Informatics* 77(11), 723-734.

Liew Z., Ritz B., Rebordosa C., Lee P.C. & Olsen J. (2014) Acetaminophen use during pregnancy, behavioral problems and hyperkinetic disorders. *JAMA Pediatrics* 168(4), 313-320.

Lupattelli A., Picinardi M., Einarson A. & Nordeng H. (2014a) Health literacy and its association with perception of teratogenic risks and health behavior during pregnancy. *Patient Education and Counselling* 96(2), 171-178.

Lupattelli A., Spigset O. & Nordeng H. (2014b) Adherence to medication for chronic disorders during pregnancy: results from a multinational study. *International Journal of Clinical Pharmacy* 36(1), 145-153.

Mackey T.K. & Liang B.A. (2011) The global counterfeit drug trade: patient safety and public health risks. *Journal of Pharmaceutical Sciences* 100(11), 4571-4579.

Mavlanova T., Benbunan-Fich R. & Koufaris M. (2012) Signaling theory and information asymmetry in online commerce. *Information & Management* 49(5), 240-247.

McArdle A., Flenady V., Toohill J., Gamble J. & Creedy D. (2015) How pregnant women learn about foetal movements: sources and preferences for information. *Women and Birth* 28(1), 54-59.

Medicines and Healthcare products Regulatory Agency (MHRA) 2016. Retrieved from [www.gov.uk/government/organisations/medicines-and-healthcare-products-regulatory-agency](http://www.gov.uk/government/organisations/medicines-and-healthcare-products-regulatory-agency) on 22 October 2016.

Mosley 2nd J.F., Smith L.L. & Dezan M.D. (2015) An overview of upcoming changes in pregnancy and lactation labelling information. *Pharmacy Practice* (Granada) 13(2), 605.

Nörby U., Källén K., Shemeikka T., Korkmaz S. & Winbladh B. (2015) Pregnant women's view on the Swedish internet resource Drugs and Birth Defects intended for health care professionals. *Acta Obstetricia et Gynecologica Scandinavica* 94(9), 960-968.

Nordeng H., Koren G. & Einarson A. (2010a) Pregnant women's beliefs about medications—a study among 866 Norwegian women. *Annals of Pharmacotherapy* 44(9), 1478-1484.

Nordeng H., Ystrøm E. & Einarson A. (2010b) Perception of risk regarding the use of medications and other exposures during pregnancy. *European Journal of Clinical Pharmacology* 66(2), 207-214.

Orizio G., Schulz P., Domenighini S., Bressanelli M., Rubinelli S., Caimi L. & Gelatti U. (2009) Online consultations in cyberpharmacies: completeness and patient safety. *Telemedicine and e-Health* 15(10), 1022-1025.

Palosse-Cantaloube L., Lacroix I., Rousseau V., Bagheri H., Montastruc J.L. & Damase-Michel C. (2014) Analysis of chats on French internet forums about drugs and pregnancy. *Pharmacoepidemiology and Drug Safety* 23(12),1330-1333.

Peters S.L., Lind J.N., Humphrey J.R., Friedman J.M., Honein M.A., Tassinari M.S., Moore C.A., Mathis L.L. & Broussard C.S. (2013) Safe lists for medications in pregnancy: inadequate evidence base and inconsistent guidance from Web‐based information, 2011. *Pharmacoepidemiology and Drug Safety* 22(3), 324-328.

Petersen I., McCrea R.L., Lupattelli A. & Nordeng H. (2015) Women's perception of risks of adverse fetal pregnancy outcomes: a large-scale multinational survey. *BMJ Open* 5(6), e007390( doi:10.1136/bmjopen-2014-007390 accessed 15 May 2017).

Peterson-Clark G., Aslani P. & Williams K.A. (2010) Pharmacists’ online information literacy: an assessment of their use of Internet-based medicines. *Information Health Libraries Group Health Information and Libraries Journal*, 27(3) 208–216.

Rogers R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In Cacioppo J. & Petty R. (Eds.), Social psychophysiology (pp. 153–176). New York: Guilford Press.

Sinclair M., Close C., McCullough J. E.M., Hughes C. & Liddle S.D. (2014) How do women manage pregnancy-related low back and/or pelvic pain? Descriptive findings from an online survey. *Evidence Based Midwifery* 12(3), 76-82.

Stephansson O., Granath F., Svensson T., Haglund B., Ekbom A. & Kieler H. (2011) Drug use during pregnancy in Sweden–assessed by the Prescribed Drug Register and the Medical Birth Register. *Clinical Epidemiology* 3, 43.

Sundseth H. & Semancik K. (2016) Safe Use of Medicines During Pregnancy & Lactation: Tackling the Information Gap. *European Institute of Women’s Health*.

Thiele K., Kessler T., Arck P., Erhardt A. & Tiegs G. (2013) Acetaminophen and pregnancy: short-and long-term consequences for mother and child. *Journal of Reproductive Immunology* 97(1), 128-139.

Thomas S.H. & Yates L.M. (2012) Prescribing without evidence–pregnancy. *British Journal of Clinical Pharmacology* 74(4), 691-697.

Thorpe P.G., Gilboa S.M., Hernandez‐Diaz S., Lind J., Cragan J.D., Briggs G., Kweder S., Friedman J.M., Mitchell A.A. & Honein M.A. (2013) Medications in the first trimester of pregnancy: most common exposures and critical gaps in understanding fetal risk. *Pharmacoepidemiology and Drug Safety* 22(9), 1013-1018.

Twigg M.J., Lupattelli A. & Nordeng H. (2016) Women’s beliefs about medication use during their pregnancy: a UK perspective. *International Journal of Clinical Pharmacy* 38(4), 968-976.

Van Calsteren K., Gersak K., Sundseth H., Klingmann I., Dewulf L., Van Assche A. & Mahmood T. (2016) Position Statement from the European Board and College of Obstetrics & Gynaecology (EBCOG): The use of medicines during pregnancy: call for action. European *Journal of Obstetrics & Gynecology and Reproductive Biology* 201, 211-214.

Van Deursen, A. J., van Dijk, J. A., & Peters, O. (2011). Rethinking Internet skills: The contribution of gender, age, education, Internet experience and hours online to medium-and content-related Internet skills. *Poetics*, 39(2), 125-144.

Weston C. & Anderson J.L. (2014) Internet use in pregnancy. *British Journal of Midwifery* 22(7), 488-493.

Widnes S.F., Schjøtt J. & Granas A.G. (2012) Risk perception and medicines information needs in pregnant women with epilepsy–A qualitative study. *Seizure* 21(8), 597-602.

Zaki N.M. & Albarraq A.A. (2014) Use, attitudes and knowledge of medications among pregnant women: A Saudi study. *Saudi Pharmaceutical Journal* 22(5), 419-428.

**Figure 1 Women’s self-rated skills, using a 0-10 scale, for evaluating the quality and validity of medication safety information found on the internet.**

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**Figure 2. Women’s self-rated ability, using a 0-10 scale, to recognise a professional regulated internet pharmacy**



**Table 1. Demographic profile of sample (n=284)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristic** | **Mean** | **Standard deviation** | **Range** |
| Age (years) | 30.01 | 5.75 | 18-45 |
|  | **n**. | **%** |
| UK Country of Residence |  |  |
| England | 244 | 85.9 |
| Wales | 21 | 7.4 |
| Scotland | 10 | 3.5 |
| Northern Ireland | 9 | 3.2 |
|  |  |  |
| Highest level of Education Achieved |  |  |
| Left school with no qualifications | 17 | 6.0 |
| Left school when compulsory education completed with basic qualifications | 42 | 14.8 |
| Higher secondary school/technical college qualifications | 100 | 35.2 |
| University degree | 125 | 44.0 |
|  |  |  |
| Pregnancy Status  |  |  |
| Were currently pregnant | 92 | 32.4 |
| Pregnant in previous 12 months | 192 | 67.6 |
|  |  |  |
| History of pre-pregnancy chronic condition |  |
| No chronic condition | 171 | 60.2 |
| Asthma | 45 | 15.8 |
| Depression | 43 | 15.1 |
| Raised blood pressure | 11 | 3.9 |
| Severe acne | 10 | 3.5 |
| Diabetes | 7 | 2.5 |
| Cardiac  | 6 | 2.1 |
| Thyroid | 5 | 1.8 |
| Crohns or coeliac disease | 4 | 1.4 |
| Epilepsy | 3 | 1.1 |
| Other | 18 | 6.3 |

**Table 2. Online sources women used to search for drug safety information and how they rated their helpfulness (n=217)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Online source** | **Used & Helpful** | **Used & Unhelpful** | **Not used / N/A** |
| No. | (%) | No. | (%) | No. | (%) |
| Health service sites | 187 | (86.2) | 14 | (6.5) | 16 | (7.4) |
| Health professional sites with credentials shown | 128 | (59.0) | 26 | (12.0) | 63 | (29.0) |
| Government organisations such as regulated medicine agency sites e.g. MHRA, EMA, FDA | 102 | (47.0) | 28 | (12.9) | 87 | (40.1) |
| Sites hosted by pharmacy/drug companies | 74 | (34.1) | 41 | (18.9) | 102 | (47.0) |
| Links to Medical/Pharmacy Journals e.g. Pub Med/Med-line | 86 | (39.6) | 35 | (16.1) | 96 | (44.2) |
| Teratology Information Services e.g. Organisation of Teratology Information Specialists, Toxbase | 49 | (22.6) | 32 | (14.7) | 136 | (62.7) |
| Safefetus.com: On-line database of worldwide medications | 59 | (27.2) | 17 | (7.8) | 141 | (65.0) |
| On-line drug reference guides e.g.; British National Formulary (bnf.org); Physicians' Desk Reference | 80 | (36.9) | 24 | (11.1) | 113 | (52.1) |
| Social media sites for pregnant women such as NET MUMS | 147 | (67.7) | 38 | (17.5) | 32 | (14.7) |

**Table 3. Internet sites used by respondents and how they rated their trustworthiness (n= 284)**

|  |  |  |  |
| --- | --- | --- | --- |
| Online source: | Trust | Do not trust | Not sure |
| No. | (%) | No. | (%) | No. | (%) |
| Health service sites |  239 | (84.2) | 12 | (4.2) | 33 | (11.6) |
| Health professional sites with credentials shown | 204 | (71.8) | 20 | (7.0) | 60 | (21.1) |
| Government organisations such as regulated medicine agency sites e.g. MHRA, EMA, FDA. | 182 | (64.1) | 30 | (10.6) | 72 | (25.4) |
| Sites hosted by pharmacy/drug companies | 88 | (31.0) | 78 | (27.5) | 11 | (41.5) |
| Links to Medical/Pharmacy Journals e.g. Pub Med/Med-line | 11 | (39.1) | 40 | (14.1) | 133 | (46.8) |
| Teratology Information Services e.g. Organisation of Teratology Information Specialists, Toxbase | 71 | (25) | 52 | (18.3) | 161 | (56.7) |
| Safefetus.com: On-line database of worldwide medications | 82 | (28.9) | 46 | (16.2) | 156 | (54.9) |
| On-line drug reference guides e.g.; British National Formulary (bnf.org); Physicians' Desk Reference | 119 | (41.9) | 50 | (17.6) | 115 | (40.5) |
| Social media sites for pregnant women such as NET MUMS | 120 | (42.3) | 67 | (23.6) | 97 | (34.2) |

**Table 4. Types of medications participants used the internet to search for regarding safety (n=217)**

|  |  |  |
| --- | --- | --- |
| **Type of medication searched information about:** | **n.** | **%** |
| Minerals and vitamins | 97 | 44.7 |
| Analgesics | 89 | 41.0 |
| Antibiotics | 75 | 34.6 |
| Anti-histamines | 33 | 15.2 |
| Anti-Depressants | 32 | 14.7 |
| Inhalers for asthma | 23 | 10.6 |
| Anti-acne medications | 19 | 8.8 |
| Anti-coagulants | 12 | 5.5 |
| Anti-hypertensive | 11 | 5.1 |
| Diabetic Medications | 11 | 5.1 |
| Anti-emetics | 7 | 3.2 |
| Thyroid and anti-thyroid medications | 7 | 3.2 |
| Cold/Flu remedies | 6 | 2.8 |
| Anti-convulsants | 5 | 2.3 |
| Other type of medications  | 10 | 4.6 |

**Table 5. Medications taken by respondents when they became pregnancy**

|  |  |  |
| --- | --- | --- |
|  **Medication** | **n.** | **%** |
| No medications | 105 | 37.0 |
| Minerals and vitamins | 100 | 35.2 |
| Antibiotics | 35 | 12.3 |
| Asthma inhaler | 29 | 10.2 |
| Antidepressant | 22 | 7.7 |
| Anti-acne medications | 11 | 3.9 |
| Medication for diabetes | 10 | 3.5 |
| Anticoagulant | 6 | 2.1 |
| Anticonvulsant | 7 | 2.5 |
| Antihypertensive | 4 | 1.4 |
| Thyroid medication | 4 | 1.4 |
| Taking other medications¹ | 8 | 2.8 |

¹ e.g. contraceptives, ant-acids, aspirin, zoledax