Pre-conception Weight Loss Information on the Internet: A Website Quality Assessment

Chloé Chenoweth

The University of Adelaide

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Table of Contents

List of Figures

List of Tables

Abstract

The prevalence of maternal obesity has risen dramatically in Australia and is associated with an increased risk of adverse pregnancy and birth outcomes. Clinical recommendations indicate the pre-conception period represents an unprecedented opportunity to influence the health of overweight and obese women planning pregnancy. Research has shown that women use information sourced online to make healthcare decisions, however, there are concerns about the lack of quality information provided on health promotion websites. This research investigated the quality of websites that pre-pregnant women in Australia were likely to find when searching the Internet for weight loss information. Search terms identified from previous semi-structured interviews with 12 women were subsequently used by the author to identify websites for analysis. A previously developed website quality assessment tool was adapted and used to measure the quality of websites in relation to seven evidence-based criteria. Results demonstrate that few websites reflect current diet and exercise guidelines ascribed to by health professionals, and fail to utilise behaviour change techniques to facilitate weight loss. This study may facilitate the development of gold standard health promotion websites tailored to pre-pregnant women.

Declaration

This thesis contains no material which has been accepted for the award of any other degree of diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

Chloé Chenoweth

Signature

November 2016

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Obesity – A global Health Issue

The World Health Organisation (WHO) recognises obesity as a major worldwide health problem (World Health Organization, 2000) which has a significant impact on the overall burden of disease globally (Ezzati et al., 2002). Obesity is a major risk factor for non-communicable diseases such as cardiovascular disease, type 2 diabetes, musculoskeletal disorders, and some cancers including endometrial, breast and ovarian cancer (World Health Organization, 2000). Globally, obesity has almost tripled since 1975 (World Health Organisation, 2018). Over 1.46 billion adults (Finucane et al., 2011), and 170 million children worldwide (Lobstein, Baur, & Uauy, 2004) are overweight or obese. In Australia, over two thirds of adults, and almost one quarter of children are overweight or obese (Australian Bureau of Statistics, 2019).

Obesity in Pregnancy

Of particular concern are the rising rates of obesity in pregnancy, with approximately 35% of Australian women within prime reproductive years (between ages 25-34) being overweight or obese (The Royal Women's Hospital, 2019). Approximately 34% of pregnant women have a body mass index (BMI) over 25 kg/m2 (Callaway, Chang, McIntyre, & Prins, 2006), with some estimates indicating that this number is approaching 50% (Callaway et al., 2006; J. M. Dodd, Grivell, Nguyen, Chan, & Robinson, 2011). The most practical population-level measure of overweight and obesity is BMI as it is equivalent for all ages and both sexes of adults. For adults, WHO defines overweight as a BMI greater than or equal to 25, and obesity as a BMI greater than or equal to 30 (World Health Organisation, 2019). Overweight and obesity during pregnancy is associated with an increased risk of immediate and long-term adverse health outcomes for both the woman and her child. Maternal complications include a higher risk of gestational diabetes (Abenhaim, Kinch, Morin, Benjamin, & Usher, 2007;

Athukorala, Rumbold, Willson, & Crowther, 2010; Callaway et al., 2006; J. M. Dodd et al., 2011; LaCoursiere, Bloebaum, Duncan, & Varner, 2005), pre-eclampsia and hypertension (Abenhaim et al., 2007; Athukorala et al., 2010; Callaway et al., 2006; Cedergren, 2004; J. M. Dodd et al., 2011; Ness & Roberts, 1996; Sibai et al., 1995), infection (Crowther et al., 2005) and thromboembolic disease (Crowther et al., 2005; Wolfe, 1998). Maternal obesity is associated with higher rates of complications during labour and delivery (The Royal Women's Hospital, 2019), including perinatal death (Callaway et al., 2006; Cedergren, 2004; Kristensen, Vestergaard, Wisborg, Kesmodel, & Secher, 2005; Nohr et al., 2005; Sebire et al., 2001; Usha Kiran, Hemmadi, Bethel, & Evans, 2005). High maternal BMI and excessive gestational weight gain (GWG) are significant predictors of obesity in offspring (Godfrey, Inskip, & Hanson, 2011; Wells et al., 2011). Infants of overweight or obese mothers have an increased risk of being born preterm (Callaway et al., 2006; Cnattingius, Bergström, Lipworth, & Kramer, 1998; J. M. Dodd et al., 2011; Galtier-Dereure, Boegner, & Bringer, 2000; Wolfe, 1998), being born with a congenital anomaly (Callaway et al., 2006; Cnattingius et al., 1998; Galtier-Dereure et al., 2000), experiencing jaundice or hypoglycaemia (Callaway et al., 2006; J. M. Dodd et al., 2011; Doherty, Magann, Francis, Morrison, & Newnham, 2006), and requiring neonatal intensive care (Callaway et al., 2006; Cnattingius et al., 1998; J. M. Dodd et al., 2011; Galtier-Dereure et al., 2000; Rosenberg, Garbers, Chavkin, & Chiasson, 2003). In non-pregnant women, obesity is associated with psychological issues including depression (Luppino et al., 2010), binge eating disorder (Kessler et al., 2013), and bipolar disorder (Goldstein et al., 2011). The extent to which the association exists in pregnancy is still unclear, however a systematic review and meta-analysis conducted in 2014 indicated that women who are obese when they become pregnant are more likely to experience depression symptoms and antenatal anxiety compared to normal-weight women in both the antenatal and postpartum periods (Molyneaux, Poston, Ashurst-Williams, & Howard, 2014).

Current Recommendation – Pre-conception Intervention

As indicated above, a vast body of literature is available that defines the health risks and potential complications related with being overweight or obese during pregnancy and childbirth. However, there is limited information about interventions that may improve maternal, foetal and infant health outcomes (J. Dodd, Grivell, Crowther, & Robinson, 2010). A Systematic review and meta-analysis published by Dodd in 2010 included 9 randomised trials and 743 women and infants (J. Dodd et al., 2010). The authors found no statistically significant difference between women who underwent an antenatal intervention and those who did not for the outcome large-for-gestational-age infant (366 women) or mean gestational weight gain (416 women). The study concluded that the current literature related to antenatal dietary interventions lacks evidence of effective outcomes for limiting gestational weight gain. A 2010 systematic review detailing 10 interventions that endeavoured to reduce excessive GWG found inconsistent results across studies. Typically, GWG was reduced in just one group of participants, including: low income women (Olson, Strawderman, & Reed, 2004); normal weight women (Polley, Wing, & Sims, 2002), overweight women (Jeffries, Shub, Walker, Hiscock, & Permezel, 2009), obese women (Claesson et al., 2008; Wolff, Legarth, Vangsgaard, Toubro, & Astrup, 2008), or not at all. Furthermore, there were inconsistent results in relation to which factors were successful in reducing GWG (Skouteris et al., 2010).

Current guidelines by peak health bodies recommend that women should be counselled prior to conception and encouraged to lose weight (American College of Obstetricians & Gynecologists, 2005). Approximately 86% of women planning pregnancy initiate health behaviour changes prior to conception (Rassi, Wattimena, & Black, 2013), and

over 50% of women consult their general practitioner (GP) for pre-conception advice (Stephenson, Patel, Barrett, Howden, & Copas, 2014) including support related to healthy diet (Stephenson et al., 2014). Therefore, the pre-pregnant period represents an unprecedented opportunity to influence the health of overweight and obese women prior to conception (J. M. Dodd et al., 2011).

The Benefits of Internet-based Interventions

There is a growing body of evidence that supports the positive outcomes of Internet-based health interventions (Neuhauser & Kreps, 2003; Saperstein, Atkinson, & Gold, 2007). Internet-based programs can offer opportunities for individuals to actively participate and interact with those with similar health goals (Neuhauser & Kreps, 2003). Not only does the Internet provide anonymity and around the clock availability, such programs can be actioned in the comfort of an individual's own home, therefore providing convenience and eliminating travel barriers (Womble et al., 2004). Furthermore, they can reach vast numbers of people while still tailoring to individual needs (Cummins et al., 2004). Providing tailored information is achieved by collecting individual-level data and customising health materials based on the unique needs of an individual (Saperstein et al., 2007). A literature review of randomised control trials that examined Internet weight loss programs found that delivering tailored information via the Internet has a positive impact on health knowledge and behaviours (Saperstein et al., 2007), with participants experiencing higher levels of personal relevance, satisfaction and engagement (Brug, Oenema, & Campbell, 2003). The Internet also facilitates social support via online communities where individuals can share information and personal experiences (Eysenbach, 2003). Therefore, the Internet has a unique potential to motivate users to modify health behaviours via interactive features, tips and approaches for overcoming barriers, and opportunities to share support and inspiration with others (Rothert et al., 2006).

A sub-study of the Bettering the Evaluation and Care of Health (BEACH) program found that the internet was a highly effective source of health information for patients seeking additional information beyond a GP visit (Wong, Harrison, Britt, & Henderson, 2014). The benefits of sourcing online information include potential savings in cost and time (Pandey, Hart, & Tiwary, 2003; Wong et al., 2014), access to a free flow of information, flexible levels of interactivity with the information provider, convenience of 24 hour per day, 7 day per week access, and anonymity (Pandey et al., 2003). While the benefits of Internet-based interventions is well researched, little is known about the quality of online materials available to assist women in achieving weight loss in the pre-conception phase of pregnancy.

Where are Women Sourcing their Health Information?

Being overweight or obese is a highly stigmatised condition (Lewis et al., 2011; Murray, 1990; Puhl & Heuer, 2009), which may restrict the ways in which individuals engage in health behaviours to improve their wellbeing (Lewis et al., 2011). Results from large cross-sectional surveys indicate that individuals with highly stigmatised health conditions including obesity, herpes and mental health problems are significantly more likely than individuals with other chronic diseases to: seek health information online; consult online clinicians; and apply information sourced online to improve their health and wellbeing (Berger, Wagner, & Baker, 2005; Lewis et al., 2011). Additionally, women are higher consumers of healthcare services (Pandey et al., 2003), they are the primary decision makers on health related issues within the household (James, 2001; Nussbaum, 2000), and are more likely to consult health related websites for health support and advice, (Hern, Weitkamp, Hillard, Trigg, & Guard, 1998) with women aged 25-44 years being the most likely to obtain online health information (Wong et al., 2014). This age group of online consumers falls within women's prime reproductive years. Therefore, with over 86% of Australian women having access to home Internet

(Australian Bureau of Statistics, 2018) it is a promising medium to provide weight loss information and support to women looking to conceive.

Pandey et al., suggests the "health needs model" to explain why women turn to the Internet in search of health related information. The health needs model proposes a reactive approach towards Internet usage in which an individual is experiencing a health condition or disease that they wish to learn more about (Pandey et al., 2003). In a self-reported questionnaire exploring the internet usage of 613 pregnant women across 24 countries, nearly half the respondents felt dissatisfied with pregnancy related information provided by health professionals (48.6%), prompting them to seek information online. Other factors that influenced women's Internet usage was lack of time to ask questions at medical appointments (Lagan, Sinclair, & George Kernohan, 2010), and to supplement information provided by health care professionals (Lagan et al., 2010). Furthermore, women showed a statistically significant increase in confidence levels in relation to pregnancy related decisions upon obtaining information online (Lagan et al., 2010).

Literature Review - Quality Assessment Studies

There is an infinite choice of weight loss solutions and pregnancy related information online (Lewis et al., 2011; Saperstein et al., 2007). A Google search conducted by the author on 22nd May 2019 for the term "how to lose weight" produced 694 million websites, and the search term "preparing for pregnancy" produced 649 million results. Material aimed at overweight and obese individuals on the Internet includes websites selling commercial dieting plans and weight loss products, gyms and fitness experts offering exercise regimes, government and medical sites providing facts on health risks, and blogs and online support groups where individuals can share their personal experiences. Despite this abundance of

available information, the literature that has examined the quality of overweight and obesity-related websites has found that information tends to be inaccurate, conflicting or misleading (Berland et al., 2001; Jordan & Haywood, 2007; Miles, Petrie, & Steel, 2000). In a 2010 web based study of pregnant women's Internet usage 68.7% of respondents said they had visited a pregnancy related website that contained incorrect or misleading information. In contradiction to this, 83% considered that the information they retrieved to be of an "excellent" or "good" quality overall, and 96.2% found the information to be "useful" (Lagan et al., 2010). However, these assessments were conducted in the absence of a validated quality assessment tool designed for online health information. Most women (81%) reported that their assessments were based on their perceived credibility of the organisation providing the information. Few women (31.2%) reported checking how current the information was, or referred to quality accreditation standards of health websites (11.3%) (Lagan et al., 2010). In a similar study, the Pew Research Centre examined 500 end-users in relation to their experience in engaging with health information online. Results showed that participants had concerns in relation to the accuracy of information, and the lack of disclosure of information sources. Participants were unable to identify when information was last updated and felt that many websites focused too much of selling a product, rather than conveying quality health information (Fox & Rainie, 2002).

Eysenbach et al. conducted a 2002 systematic review of 79 articles evaluating 5,941 health websites on quality and found that only 7 studies (9%) drew positive conclusions in terms of website quality. Fifty-five studies (70%) concluded that overall, health information on the Internet was problematic. Researcher's main criticisms included information inaccuracy and incompleteness and the overall lack of high quality health websites. Levels of information inaccuracy varied across health fields, with nutrition websites varying between

45.5% to 88.9% inaccurate (Eysenbach, Powell, Kuss, & Sa, 2002). Similar concerns were identified in a 2015 systematic review examining 165 articles in which researchers assessed the quality of health information on the Internet. The study concluded that over half the articles (55.2%) reported inadequate levels of quality. Areas of concern related to content being incomplete, basic, superficial, not useful and inaccurate. In terms of website design problematic areas included inappropriate format and inaccessible content. Only ten articles (6.1%) found overall adequate levels of website quality, whereby researchers deemed content to be correct, or at least not dangerous, and website design was found to be accessible, easy to use and attractive (Zhang, Sun, & Xie, 2015).

Miles et al. conducted an evaluation of the first 50 websites found on an online search using the term “weight loss diets”. Results showed that only three websites provided satisfactory dietary advice, while 26 websites were marketing diet replacements, herbal supplements, and vitamins and minerals for weight loss. The study concluded that the quality of weight loss information provided online ranged from sound quality to misleading and potentially dangerous (Miles et al., 2000). Similarly, a sub-study of the Consumer Reports Web Watch and the Health Improvement Institute assessed the quality of the 20 most visited diet websites in terms of reliability, credibility and ease of use. Quality results were varied with the study concluding that consumers of online health information must be savvy in their searches in order to identify credible and trustworthy websites (Saperstein et al., 2007).

A quality evaluation of 41 physical activity websites using Journal of the American Medical Association (JAMA) benchmarks found that zero websites rated high in accuracy of information. Only 8% of websites met the American College of Sports Medicine (ACSM) recommendations for appropriate levels of vigorous physical activity, while 40% included

accurate recommended levels of moderate physical activity. Only 22% of websites rated high in overall level of quality, with researchers expressing concerns for consumers in terms of illness and injury (Bonnar-Kidd, Black, Mattson, & Coster, 2009).

The Research Gap

While much has been written about the quality of health related information online, what is lacking from the literature is an understanding of the quality level of material that is available online for overweight and obese women seeking pre-conception weight loss support. Does the Internet provide support to women during a period where optimal health is crucial, or are women interacting with information that is unhelpful in improving their pregnancy and birth outcomes? Understanding the scope of quality in terms of the websites that women are likely to be accessing for pre-conception weight loss support is crucial in tailoring appropriate responses such as pre-conception interventions in order to meet their needs and to potentially counter information that may be unhelpful in improving health outcomes (Lewis et al., 2011).

How is Website Quality Assessed?

The 2002 systematic review of 5,941 health websites conducted by Eysenbach et al. covered 86 different quality criteria across studies. The most frequently used quality criteria included design, accuracy, completeness, disclosures, readability, and references provided . Additionally, numerous systematic reviews have shown that various behaviour change techniques are successful in increasing health behaviours in the adult population (Eysenbach et al., 2002). Common behaviour change techniques involve theory driven methods for changing psychological determinants of behaviour such as one's attitude or self-efficacy (Michie et al., 2011). Widely studied behaviour change techniques include: barrier

identification (French, Olander, Chisholm, & Mc Sharry, 2014); action planning (Williams & French, 2011); performance feedback (Krebs, Prochaska, & Rossi, 2010); use of rewards for successfully achieving set goals (French et al., 2014; Williams & French, 2011); model demonstrations (French et al., 2014; Michie et al., 2011); information on when are where to perform a behaviour (French et al., 2014; Williams & French, 2011); prompts to perform the behaviour (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012; Neff & Fry, 2009; Webb, Joseph, Yardley, & Michie, 2010); and planning social support (Brouwer et al., 2011; Kelders et al., 2012; Olander et al., 2013). To date, quality analyses for websites offering weight loss content and behaviour change techniques have produced mixed results (Saperstein et al., 2007). A review that assessed 294 websites on their ability to produce behaviour change on a range of health behaviours including diet, exercise, smoking, alcohol use, and diabetes management found that only 15 sites (5.1%) met the minimum criteria required to facilitate behaviour change (Evers et al., 2003).

Research Aims

Professional bodies worldwide recommend pre-conception interventions whereby women are counselled about the increased pregnancy risks associated with overweight and obesity, and encouraged to lose weight prior to pregnancy (Davies et al., 2010; Hanson et al., 2015; Modder & Fitzsimons, 2010). The Internet provides an unique opportunity to facilitate pre-conception weight loss interventions. It provides an increasingly accessible platform for resource sharing and has become a major source for consumers seeking health information, including diet, weight loss, fitness, and lifestyle information. Furthermore, research has shown that health information found online can impact behaviour, and is used by consumers to make health care decisions (Eysenbach et al., 2002). Thus, whilst there is an abundance of online information related to the causes and consequence of overweight and obesity, and a

plethora of weight loss diets, tips and solutions, there remains a lack of appropriate and accessible behaviour change interventions and supports for obese individuals (Thomas, Hyde, Karunaratne, Herbert, & Komesaroff, 2008), especially in the pre-conception period. This research aims to investigate the level of quality information that exists online to support overweight and obese women to lose weight in this phase of pregnancy. Evaluating the quality of websites containing weight loss support informs researchers as to the quality level of information that pre-pregnant women are likely to be accessing, and may provide evidence for the implementation and evaluation of pre-conception public health strategies. Therefore, this research aims to:

1. Identify websites that women are likely to find when seeking weight loss support online during the pre-conception phase of pregnancy.
2. Evaluate the quality of weight management websites based on evidence based criteria.

Method

Design

A sequential mixed methods design (Tashakkori, Teddlie, & Teddlie, 1998) was used to identify the most commonly used search terms used by women seeking pre-pregnancy related weight loss information online, and to evaluate the quality of websites identified via the search terms.

Participants

Semi-structured interviews were previously conducted with 12 women to explore the search terms women would use when preparing for pregnancy, and when seeking weight loss information online. Participants were recruited using purposive sampling via two avenues of recruitment; firstly, via the Consumer and Community Engagement Team at the Women's and Children's Hospital, and secondly, via the LIMIT Randomised Trial and Grow Randomised trial, both of which investigated weight loss intervention in pregnancy. The inclusion criteria included: women of reproductive age (18-50 years); who consider their weight to be above the healthy weight range (BMI > 25 kg/m^2); and identify that they would like to lose weight. Women who are pregnant or who are adhering to a restrictive diet for the management of an illness or health problem were excluded from the study.

Materials

A website quality assessment tool developed for a previous study (Gelder, 2016) was adapted by the author for the purpose of this study. The tool was developed using the base model "The Behavior Change Model for Internet Interventions" (Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009). This model identifies criteria that have been shown

to be successful in website engagement in order to facilitate positive behaviour change. To determine the criteria to be included in the original website assessment tool research frameworks from previous website quality assessment studies (Bonnar-Kidd et al., 2009), as well as systematic reviews were used (Eysenbach et al., 2002; Zhang et al., 2015).

Procedure

Updating the tool. A literature review was undertaken to identify factors relevant to website efficacy for women seeking pregnancy related weight loss information, and these items were implemented into the adapted tool. Items from the original tool that were irrelevant to this study were either updated or discarded. The adapted tool criteria included design, credibility/accountability, usability, accuracy, participation , relevance and behaviour change techniques (Table 1). Preliminary testing of the suitability and functionality of the adapted tool was then undertaken on three websites. Issues that arose were discussed by the author and two experienced independent health researchers, and the tool underwent the final adaption.

Table 1

Assessment score range for website assessment tool.

Model Criteria	Score range
Design	0-6
Credibility & Accountability	0-17
Participation	0-4
Usability	0-8
Relevance	0-8
Accuracy	0-10
Behaviour change technique	0-16
Total	0-56

Design, credibility and usability. Items from previously developed frameworks (Devine, Broderick, Harris, Wu, & Hilfiker, 2016; Eysenbach et al., 2002) were adapted to measure facets of the design, credibility/accountability and usability of websites.

Website accuracy. The Australian Dietary Guidelines "Healthy Eating During Your Pregnancy" (National Health & Medical Research Council, 2019) and The Royal Australian and New Zealand College of Obstetricians and Gynaecologists "Exercise During Pregnancy" guidelines were used as measures of website accuracy.

Participation and Relevance. The author consulted with two experienced health professionals to develop items to measure how relevant a website was to pre-pregnant women seeking weight loss advice. This included items relating to end-user social media participation

and Internet participation. A systematic review was examined to identify perceived enablers and barriers to physical activity in pregnant women (Harrison, Taylor, Shields, & Frawley, 2018).

Behaviour change techniques. The "Taxonomy of Behaviour Change Techniques to Help People Change their Physical Activity and Health Eating Behaviours (CALO-RE taxonomy)" (Michie et al., 2011) was reviewed. Behaviour change techniques from the taxonomy which have shown to be effective at changing health behaviour using the internet were implemented into the tool (Campbell, 2012; French et al., 2014; Krebs et al., 2010; Morrison, 2015; Williams & French, 2011).

Scoring the tool. The tool was developed in Microsoft Excel and used a series of Likert scale responses to measure quality criteria. Overall there was a total of 40 individual criteria included in the tool. It was designed to provide a score for each model criteria (e.g. relevance) as well as an overall score. Responses to items relating to the particular model criteria were summed to calculate a criteria score. Model criteria scores were summed to calculate the overall score. Higher scores equated to higher website quality. Table 2 shows the scoring system for the tool. The total website quality score was then converted into a website grading of bronze, silver or gold. Websites assessed as the highest quality were graded as gold standard based on the overall scores (Table 1).

Table 2

Website quality grading.

Grading	Assessment score	Description
Gold	47-69	Website had the majority of functions/features to successfully target and engage pre-pregnant women seeking weight loss support
Silver	24-46	Website had a number of functions/features to target and engage pre-pregnant women seeking weight loss support. However, there is room for improvement
Bronze	0-23	Website had very few of the functions/features to target and engage pre-pregnant women seeking weight loss support

Conducting website searches. Search words/phrases identified from the previously conducted interviews were summarised and coded manually and formed the specific search terms to be used in the analysis (Table 3). The website searches were undertaken by the author using the following method: Chrome Internet Browser (Scardamaglia & Daly, 2016) and Google search engine (Pollard, 2007; Scardamaglia & Daly, 2016). Google search level settings were set to: any country, any time and all results set to verbatim, in order to minimise the impact of Google's local search setup. The author conducted all searches on the same computer, within the same day, and cleared the search history after each individual search.

Table 3

Search terms identified from previous semi-structured interviews.

If you were to search for information regarding preparing for pregnancy on the Internet, what words would you type in?
Search term
Preparing for pregnancy
Ideal weight (BMI) for pregnancy
Healthy weight (BMI) for conceiving
How much weight should I gain during pregnancy
Vitamins to take for pregnancy
Preparing your body for pregnancy
Optimum pregnancy diet
If you were to search for information regarding weight loss on the Internet, what words would you type in?
Search term
How to lose weight
Healthy ways to lose weight
Being overweight and pregnancy
Weight loss tips
Eating plan and exercise to lose weight

The first 10 websites of each of the 12 identified search terms were selected for assessment. The number of websites to be assessed was determined under consideration of data collection time constraints, as well as previous research that shows most people undertaking online searches only review web page links on the first page of the returned Internet search engine results (Eysenbach & Köhler, 2002). Each landing page address identified by the search terms was copied into the tool. Once the required number of webpages were in the tool, duplicate web pages were identified and excluded, and any websites not health related were

removed from the analysis. The remaining landing pages were assigned a category based on the type of website. Table 4 shows the full list of website categories.

Table 4

Website category included or excluded from analysis.

Category	Description of website	Included or excluded in final analysis
Blogs	Websites dedicated to blogs	Included
Fertility/IVF	Websites providing fertility / IVF information and/or services	Included
Government Health	.gov / or government labelled websites	Included
Magazine/TV/Radio	Media websites e.g. online fitness magazine	Included
NGO Health Service	Non-government organisation / non-profit organisation	Included
Non-health related	Website clearly not related to health	Excluded
PDF	Single PDF document	Excluded
Private companies providing a health product and/or service	Private companies offering a specific health service / product e.g. nutritionist	Included
Private companies providing health information	Websites providing health information e.g. parenting websites	Included
University/Research organisation	University or research organisation / partnerships	Included

In line with a previous website quality assessment study, three web pages within each website were assessed to ensure consistency of web page selection (Gelder, 2016). This

included the landing page (the first page the user lands on as a result of the Internet search), and the two other pages for assessment were identified by:

1) wording on the land web page suggesting ‘weight loss/diet’; or if this could not be identified
2) wording on the landing page suggesting ‘pre-pregnancy health’; or if this could not be identified
3) the words “weight loss” as typed into the website search functionality

Results

Overall, a total of 120 websites were identified using the Internet search criteria. A total of 56 websites remained for analysis after duplicate websites and websites not containing health information were excluded (Table 5). Table 5 displays the assessed websites by category.

Table 5

What women will find when searching the Internet for pre-conception weight loss support.

Websites	N	%
Total number of websites identified	120	–
Duplicate websites	60	–
Excluded websites	4	–
Remaining websites for assessment	56	–
Remaining websites by category		
Blogs	1	1.79
Fertility/IVF	4	7.14
Government Health	9	16.07
Magazine/TV/Radio	10	17.86
NGO Health Service	5	8.93
Private companies providing a health product and/or service	10	17.86
Private companies providing health information	12	21.42
University/Research organisation	5	8.93

Five websites (8.93%) received gold standard, 42 (75.00%) received silver and nine (16.07%) received bronze. The highest overall scores belonged to government health websites, universities/research organisations, and private companies providing health information. Table 6 displays the grading of websites by category.

Table 6

Number of websites per category receiving a grading of gold, silver or bronze.

Website category	# gold websites	# silver websites	# bronze websites
Blogs	0	1	0
Fertility/IVF	0	4	0
Government Health	2	7	0
Magazine/TV/Radio	0	6	4
NGO Health Service	1	3	1
Private companies providing a health product and/or service	0	8	2
Private companies providing health information	1	9	2
University/Research organisation	1	4	0
Total	5	42	9

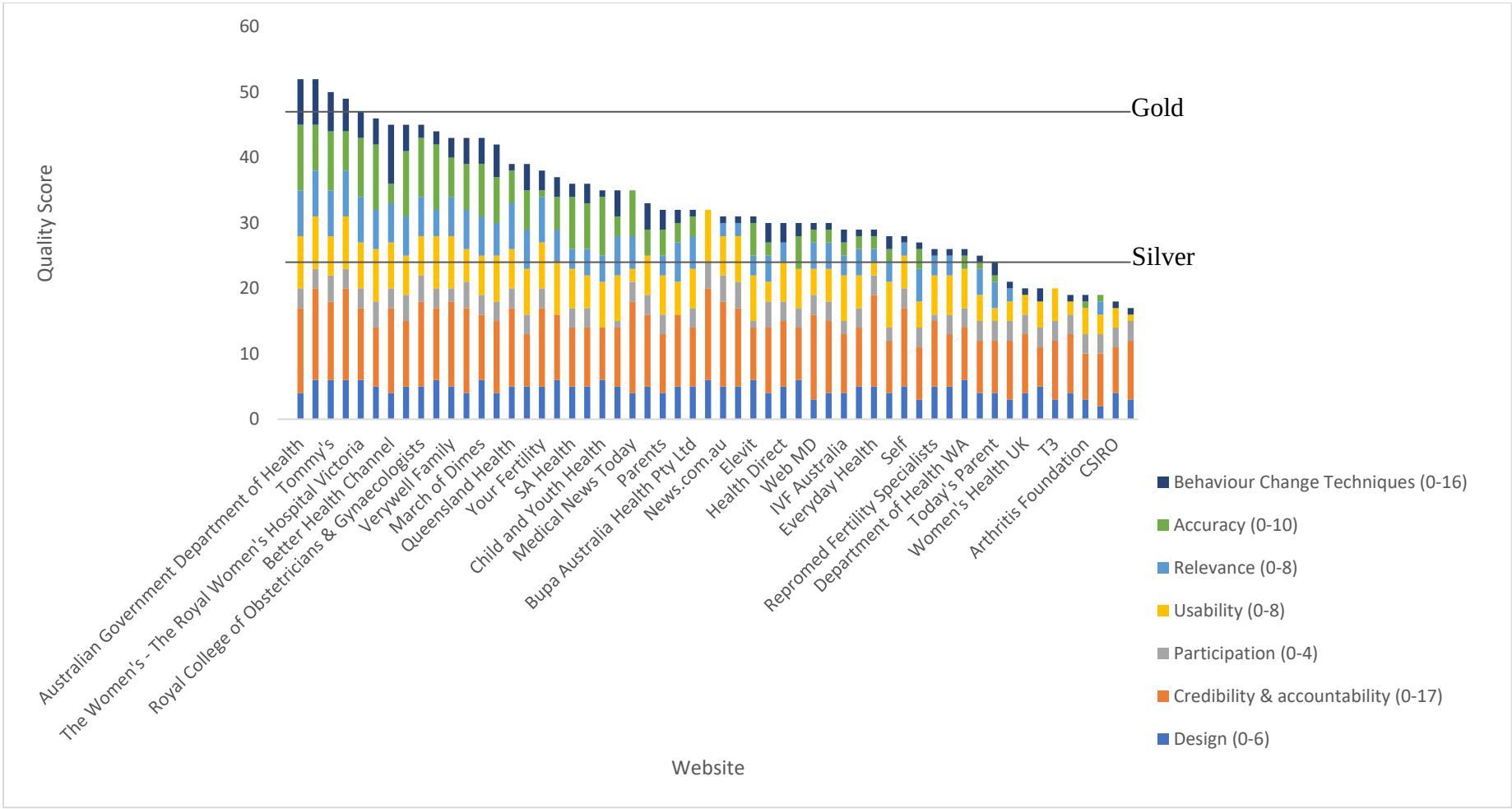
Figure 1 displays an overview of quality scores for each website. The maximum quality score available was 69. The highest overall score was 52 and this was obtained by two government health websites. Firstly, the "Australian Government Department of Health" website scored well in usability, relevance and accuracy, and scored lower on design and behaviour change techniques. Secondly, the "Office of Women's Health" website scored well in design, usability and relevance, and scored lower on accuracy and behaviour change techniques. The lowest overall score was obtained by the "Australian Women's Health" website which belonged to the magazine/TV/radio category. This website scored well in participation and scored poorly in usability, relevance, accuracy and behaviour change techniques. Standardised scores showed that overall, most websites scored high in design M=4.68 (7.80), participation M=2.77 (7.10) and usability M=5.48 (6.92) and scored low in accuracy M=3.70 (3.73) and behaviour change techniques M=2.30 (1.47). A complete copy of the website ranking and mean scores by website category can be located in Appendix A: Website Quality Assessment Scores.

Website Design

Websites were assessed on their visual appeal and the extent to which text related to heading labels. As demonstrated in Figure 1, 12 websites (21.43%) obtained a maximum score of six for design. The highest scores were obtained by private companies offering a health product and/or service *M*=5.3 (8.83) with 40.00% of websites in this category receiving full points. The search terms that produced the highest mean scores both gave reference to pregnancy, they were "vitamins to take for pregnancy" *M*=5.5 (9.17) and "being overweight and pregnancy" *M*=5.2 (8.67). The lowest scoring category was private companies providing health information *M*=4.00 (6.67), with the lowest score of two obtained by "Science Alert" website.

Figure 1

Website quality scores using the quality assessment tool (website quality score range 0-69).



Website Credibility and Accountability

Overall, websites received moderate scores for credibility and accountability *M*=10.21 (6.01). The maximum possible score was 17 and the highest score obtained was 14. This was achieved by five websites (8.93%), three of which belonged to the private companies providing health information category. The category with the highest mean was universities/research institutes *M*=11.60 (6.82), these websites tended to score high in criteria such as including highly credible authors and providing evidence supported by research articles. The lowest scoring website was "Michelle Bridges 12WBT" with an overall score of six. This website belonged to the private companies offering a health product and/or service category, and was identified using the search term "how to lose weight". This search term produced the lowest mean of all search terms *M*=8.50 (5.00). Generally, there was the lack of evidence showing the quality accreditation of websites, a lack of research articles to support website content, and a lack of advertising policies present.

Website Participation

Website participation scores were based on the level of end-user participation available on a website. Nine websites (16.07%) scored the maximum of four points for participation, with the highest scores belonging to the blog category *M*=4.00 (10.00) and university/research institution category *M*=3.80 (8.50). Three (5.35%) websites scored zero, two of these websites belonged to the private companies offering a health product and/or service category and the other was a government health website. The majority of websites (68.00%) participated in at least two social media accounts and a further 16.00% participated in three or more social media accounts. The most commonly used forms of website participation were Facebook and Twitter. Few websites enabled end-user participation in the form of a chatroom or comments section (19.64%).

Website Usability

Generally, website usability received high scores, with 34.00% of websites receiving a full score of eight, or a seven. The most user-friendly websites were government health websites *M*=7.00 (8.75) and fertility websites *M*=6.50 (8.13). The search term that yielded the most high scoring websites was "preparing for pregnancy", with 66.66% of websites scoring seven or eight. Most websites included an internal search function (78.57%). The least user-friendly websites were blogs *M*=3.00 (3.75) and the magazine/TV/radio category *M*=4 (5.00). The lowest scoring website was "Australian Women's Health" which received only one point, and was located using the search term "weight loss tips".

Website Relevance

Figure 1 shows that relevance scores were varied across all categories *M*=3.68 (4.60), with the highest mean obtained by the university/research institute category *M*=6.00 (7.50) and the lowest mean obtained by the magazine/TV/radio category *M*=1.90 (2.38). The maximum score available was eight, and the highest attributed score of seven was obtained by seven websites (12.50%) across various categories. All of the top scoring websites included either the word "pregnancy" or "conceiving" in the search term. 11 websites (19.64%) were found to be irrelevant to pre-pregnant women seeking weight loss advice, and obtained a score of zero. These websites were predominately yielded by the search terms "how to lose weight" and "weight loss tips". Only half of the websites included healthy level of BMI for entering pregnancy (50.00%), and under half included healthy levels of weight gain for pregnancy (46.43%).

Website Accuracy

Website accuracy scored low overall, with 14 websites (25.00%) scoring zero. Seven of these websites (12.50%) belonged to the magazine/TV/radio category which obtained the lowest mean *M*=0.70 (0.70). The least accurate websites were located with the following search terms: "eating plan and exercise to lose weight" *M*=0.00 (0.00); "weight loss tips" *M*=1.60 (1.60); and "how to lose weight" *M*=2.00 (2.00). Only seven websites (12.50%) included accurate guidelines that were completely in line with the Royal Australian and New Zealand College of Obstetricians and Gynaecologists recommendations for exercise during pregnancy. Four websites (7.14%) obtained the maximum score of 10, with three of the top scoring websites (5.36%) yielded from the search term "preparing for pregnancy". The highest mean was obtained by the NGO category *M*=6.20 (6.20), followed closely by the university/research institute category *M*=5.80 (5.80). Only 32.14% of websites provided accurate information on serving sizes as per the Australian Dietary Guidelines for healthy eating during pregnancy, with just under half of the dietary recommendations being incomplete (44.44%).

Website Behaviour Change Techniques

Figure 1 demonstrates that all websites scored poorly in the use of behaviour change techniques. The maximum score possible was 16, with the highest score of nine points obtained by the "Better Health Channel" website. The second highest score received was seven points and was obtained by both the "Australian Government Department of Health" website and the "Office on Women's Health" website. All three of the highest scoring websites belonged to the government health website category which had the highest mean overall *M*=4.11 (2.57). There were a total of eight different behaviour change techniques assessed. The most commonly used technique was recognising the relationship between diet

and/or physical activity and health, with 87.21% of websites using this behaviour change technique. The search terms that yielded the highest scoring websites were “preparing for pregnancy” and “ideal weight (BMI) for conceiving”. Four websites (7.14%) scored zero, three of which belonged to the private companies providing health information category. The lowest mean score belonged to the magazine/TV/radio category *M*=1.30 (0.81), followed closely by the fertility category *M*=1.50 (0.94) and the private companies providing health information category *M*=1.80 (1.13). The most under utilised behaviour change techniques included providing feedback on weight management performance and promoting the use of rewards in progress to and/or in achieving a weight management goal.

Discussion

Overview

This research sought to investigate the quality of websites that overweight and obese women in Australia were likely to find when searching the Internet for weight loss information during the pre-conception phase of pregnancy.

Findings

The majority of websites assessed in this study do not reflect the current diet and exercise guidelines ascribed to by health professionals, and lack appropriate recommendations for pre-pregnancy weight loss as well as healthy weight maintenance during pregnancy. Furthermore, commercial business websites currently dominate the online domain, and these websites were the most likely to contain inaccurate, incomplete or irrelevant information compared to other website categories. This study suggests that despite established guidelines for healthy BMI for entering pregnancy, many women may not access quality material and online resources that have the ability to aid them in their pregnancy health goals, potentially increasing their risk of adverse maternal or fetal outcomes due to excessive GWG.

The 12 search terms identified in previous semi-structured interviews produced 120 websites for review. However, after duplicate websites and websites not related to health were excluded, this number was adjusted to 56 websites. This finding alone is problematic, as it demonstrates the challenges related to sourcing information online, with only 46.7% of websites being included in the analysis. Of the 56 websites assessed only 8.9% obtained a gold standard. Mean scores for each website category demonstrated that university/research

institution websites received the highest mean score, followed by non-government websites and government websites. Two websites received the highest rating with a total score of 52 out of a possible 69 points, they were the "Australian Government Department of Health" website and the "Office on Women's Health" website. Even though these websites received the highest score, they only met 75.40% of the quality assessment criteria. These websites were located using the search terms "preparing for pregnancy" and "ideal weight (BMI) for conceiving" respectively. The website with the second highest score was "Tommy's" with a total score of 50. This website was in the university/research institution category and was located via the search term "how much weight should I gain during pregnancy". The top- rated websites all contained a reference to pregnancy or conception. The lowest scoring websites were located via more generic search terms such as "weight loss tips" and "how to lose weight", which contained no reference to pregnancy or conception. These findings suggest the more specific a search term is the more likely someone is to locate a website which is tailored to their needs. Interestingly, in the previously conducted interviews when pre-pregnant women were asked what words they would type in when searching weight loss information on the internet only one of the search terms included the word "pregnancy". The search terms identified from this question were considerably more generic than the search terms identified from asking women what words they would type in when searching online for information regarding preparing for pregnancy. This finding supports previous literature that demonstrates the vast majority of people undertake sub-optimum Internet searches when searching for health information online (Eysenbach & Köhler, 2002).

Design scores relating to the visual appeal of websites tended to be high across all categories. 60.71% of websites scored the maximum score or lost only one point for design assessment criteria. Surprisingly, commercial websites containing health related information,

media related websites and blogs scored lower than government and university/research institute websites. Lower scores related to the overuse of advertising within and around text, which not only looked unappealing but also subtracted focus from the text. Previous research evaluating weight loss websites supports this finding and concluded that websites with heavy advertising were likely to score lower on design (Modave, Shokar, Peñaranda, & Nguyen, 2014).

Similarly, participation scored high across all categories. Participation scores related to the use of social media platforms and end-user's ability to engage with a website by adding comments and/or website content. Majority of websites included both Facebook and Twitter which supports previous website quality assessment research (Gelder, 2016; Laranjo et al., 2014). Very few websites had no social media platform (5.36%). Surprisingly, the lowest mean scores belonged to commercial businesses with the fertility websites and private companies providing a health products and/or services scoring lowest and second lowest respectively.

Website credibility and accountability across all website categories scored moderately. Websites had the potential to score a maximum 17 points for this criterion, however the highest mean score belonging to the university/research institute category fell short. This finding supports previous research that indicates freely available websites contain questionable evidence of credibility and accountability (Eysenbach et al., 2002; Fox & Rainie, 2002; Gelder, 2016; Zhang et al., 2015). Government and university/research websites scored higher than media, fertility and non-government websites. This was not surprising as most articles featured on government or university/research institute websites were written by academics or health care professionals with appropriate credentials, and cited empirical research findings. In contrast, authors belonging to media, fertility and NGO related websites lacked such

credentials, and failed to support their findings with evidence-based research articles. However, government and university/research institution websites did not dominate the search engine results, and were therefore less likely to be located compared to commercial websites that were found to be less credible and accountable.

Inaccurate websites included incorrect recommendations related to BMI levels. BMI charts either differed marginally from the current Australian Dietary Guidelines BMI categories, or incorrectly defined pre-pregnancy BMI levels. Furthermore, many websites omitted guidelines relating to healthy levels of weight gain during pregnancy. These findings support previous research that assessed the accuracy of online information related to weight gain in pregnancy, and found that 12.2% of webpages contained inaccurate recommendations and 34.3% contained no specific recommendations (Chang et al., 2016). Of concern is the volume of websites that did not include any recommendations despite appearing in the top 10 results of a Google search related to pregnancy weight. This creates a substantial knowledge gap for pre-pregnant and pregnant women, which is alarming due to the high risk of obstetric complications related to excessive GWG and the potential long-term health consequences for mother and baby. Further areas of concern were related to dietary guidelines whereby information tended to be incomplete and recommendations provided generally failed to meet Australian Dietary Guidelines for healthy eating. While the majority of websites did contain accurate safety advice related to diet, for example, limiting intake of foods high in saturated fat, there was a noticeable lack of guidelines outlining recommended serving sizes and daily calorie intake limits.

While the majority of health- related websites targeting women are diligent in reporting the vast array of health risks related to maternal overweight and obesity this research showed that websites fail to specifically target pre-pregnant women who are seeking weight loss

support prior to conception. Many websites focused on pregnancy weight maintenance with the goal of reducing excessive GWG, but fail to highlight the importance of pre-pregnancy weight loss and the health benefits associated with entering pregnancy at a healthy BMI. This finding is prominent despite current guidelines from the American College of Obstetricians and Gynaecologists that recommend women be encouraged to adopt lifestyle changes and lose weight prior to conception (American College of Obstetricians & Gynecologists, 2013). There were seven top scoring websites that were found to be 87.50% relevant, they were: "Australian Government Department of Health"; "Queensland Health"; "Raising Children"; "Tommy's"; "Office on Women's Health"; "Your Fertility"; and "The Royal Women's Hospital Victoria". All of the top scoring websites were located using more specific search terms and included either the word "pregnancy" or "conceiving" in the search term.

The behaviour change criteria demonstrated the most problematic findings. Websites had the potential to score a maximum of 16 points, however only met 14.75% of the criteria on average. The most frequently used technique was the acknowledgement of the relationship between behaviour and health, which is in line with previous studies that have assessed the use of behaviour change techniques on health related websites (Gelder, 2016). This was conveyed as gain framed messaging whereby websites tended to outline the positive benefits of maintaining a healthy diet combined with regular exercise. The other behaviour change technique frequently used was acknowledging the importance of social support from family and friends, which supports a previous website quality assessment study (Gelder, 2016). There were a total of eight behaviour change techniques assessed and under half the websites contained more than two behaviour change techniques (37.5%). Websites that included behaviour change techniques lacked information on how to perform behaviour change and failed to provide resources that could facilitate behaviour change. For example, some websites

mentioned self-monitoring of progress towards set goals but did not offer practical advice on how to achieve this. This finding supports previous research that shows despite extensive evidence in the literature supporting the use of behaviour change techniques in health interventions, many health-focused organisations have failed to utilise them in their websites (Vandelanotte et al., 2014). Previous research has also demonstrated that interventions which included more behaviour change techniques have greater success in promoting health behaviour change online (Brouwer et al., 2011). Findings of this study suggest that websites targeting women wanting to lose weight are not utilising behaviour change techniques to their full potential.

In summary, the highest quality websites were those that were: visually appealing; included content that was supported by easily accessible research articles; easy to navigate; provided information tailored to overweight or obese women; and included accurate and complete recommendations related to diet and exercise in line with current practice guidelines. Overall, there is an evident lack of websites targeting women seeking weight loss support in the pre-conception phase of pregnancy. Many websites outline the risks of maternal overweight and obesity but lack practical information on how to undertake behaviour change in order to reach healthy levels of BMI for entering pregnancy. All websites lacked interactive features such as text messaging, prompts and feedback on personalised feedback on performance which have demonstrated success within web-based health interventions (Brouwer et al., 2011).

What this research adds to the literature

To the best of the author's knowledge at the time of writing, this is the only research that has endeavoured to assess the quality of websites that overweight or obese women are likely to find when seeking weight loss support during the pre-conception phase of pregnancy.

A large proportion of previous research investigating the quality of online health information has been conducted by health researchers mimicking how consumers search the Internet. This approach involves cherry-picking popular health websites which could potentially distort the generalisability of websites that are located and subsequently assessed (Eysenbach et al., 2002; Zhang et al., 2015). To locate appropriate websites for assessment, this study used search terms identified in previously conducted interviews of overweight and obese women in the pre-conception phase of pregnancy. Therefore, this research offers a unique method of identifying websites which may better represent the types of websites that women are accessing in the real world.

This study used an empirically-based Internet quality assessment tool developed for a previous study investigating the quality of websites likely to be located by men with prostate cancer (Gelder, 2016). The tool was chosen not only for its rigorous criteria which was developed using empirical research findings, but also because it was designed to be adapted to suit the target audience of interest. Furthermore, the assessment tool has the potential to add items as research in assessment criteria evolves. This study demonstrates how such an assessment tool can be adapted to suit specific website assessment studies, and may provide a strong basis for further adaption of this tool.

Practical Implications for this Research

The current research suggests there is a gap in the availability of quality weight loss websites tailored to women planning pregnancy. This presents a significant opportunity for women's health organisations, government bodies and NGO's to work towards improving the quality of their websites in order to achieve gold standard. This research could be shared with organisations whose websites were assessed as part of this research, as well as with other health promotion organisations, as a tool to aid in the identification of key website criteria, and any gaps that may exist in their websites. Perhaps an even more feasible approach to aid pre-pregnant women in their search for quality weight loss information could be for health professionals (e.g. GPs) to provide patients the website addresses for the best quality rated websites identified in this study. There is also the potential of sharing the most frequently used search terms with organisations whose websites are specifically targeting overweight and obese women planning pregnancy. This will enable organisations to improve their exposure in search results, and reach higher levels of their target audience. This may be of particular benefit to NGO's and research institutes, both of which appeared less frequently in search results, and may not be using the techniques that enable a webpage to appear in the top Google search results. Such techniques involve optimising keywords used within a website, enabling them to appear in the file name and headings throughout the webpage, in particular at the beginning of the first sentence on a page. This creates sitemaps (i.e. a list of pages that are accessible to end-users) that include related links that can be discovered to create greater website visibility (Chang et al., 2016). By using such marketing techniques, quality websites can become more accessible to users by appearing higher in Google search results, which has been shown to improve Internet traffic to websites (Chang et al., 2016). This could have exponential effects to the quality of health websites that consumers are accessing.

Finally, this study and the adapted assessment tool can be used by researchers to create a website specifically targeted at women in the pre-conception phase of pregnancy by implementing key findings and evidence- based behaviour change techniques identified in this research.

Limitations and Future Research

The search terms used in this research were identified in previous semi-structured interviews with 12 women. This is a small number of participants; future research should engage a larger sample size. A larger sample size would involve a more in-depth content analysis to gain a clearer picture of the most commonly used Internet search terms. As several of the search terms identified contained similar wording and phrasing, multiple duplicate websites were identified amongst the top search results and subsequently excluded from the study. A better understanding of popular search terms could produce a more comprehensive range of websites for evaluation. As only 56 websites were identified, this study does not cover the full scope of websites that are available to women seeking pre-conception weight loss support online. Future studies may benefit from collecting data on Internet search behaviour of women seeking weight loss support and advice. Data collection focused on the specific search terms used by participants but did not explore factors such as: Internet search behaviours; social media engagement; use of weight loss support groups, the number of websites commonly visited per individual search; the number of webpages commonly clicked on per website; and reasons for leaving a particular website. Investigating these factors in future studies may allow for more comprehensive analyses.

Although the assessment tool is comprehensive, covering seven Internet criteria based on empirical research, it should be acknowledged that the studies used to develop the tool may

have their own limitations, as quality items measured in these studies were determined by researchers and not by end-users of health websites (Eysenbach et al., 2002). A systematic review by Eysenbach et al. suggests that the research environment adopted to assess website quality may differ from real world application. For example, end-users were found to disregard the credibility of organisations, whereas researchers use credibility and accountability as key quality criteria in website assessment studies. To determine the validity of the quality assessment tool pre-pregnant women seeking weight loss support could be asked to view the websites assessed in this research to see how well the scores from the research correlate with women's perspectives of the websites. For example, future research could ask women to rate how useful they found the websites and see if the results of the research predict usefulness scores.

Interestingly, pregnancy related health interventions to date have focused entirely on behaviour change related to diet and exercise. In a review examining interventions to maintain excessive GWG, the author concluded that previous interventions had little success due to the lack of psychological factors considered (Walker, 2007). This finding is supported by the American Institute of Medicine (Rasmussen, Catalano, & Yaktine, 2009). Thus, the scope of pregnancy related health interventions over the last two decades have omitted behaviour change techniques aimed at recognising and targeting cognitive, emotional, and situational barriers that may facilitate behaviour change. Current research shows the benefits of combining behavioural and psychological interventions in addition to education to improve health outcomes (Skouteris et al., 2010). This is based upon the growing evidence that shows information alone is not adequate to produce significant changes in health behaviour (World Health Organization, 2003). When people are encouraged to form their own behavioural intention, as opposed to being led by a counsellor, the execution of new

behaviours is more likely (Boyce, Robertson, & Dixon, 2008). A general population cohort study of 12,445 pre-pregnant women showed only a small proportion of women planning a pregnancy followed dietary and health recommendations when delivered as advice alone (Inskip et al., 2009). Future health intervention studies should evaluate new strategies to aid in the reduction of weight in overweight and obese pre-pregnant women. One suggestion is targeting behaviour change in relation to diet and exercise in combination with changes in psychological factors such as mood (depression, anxiety), body image, and motivation and/or confidence to facilitate behavioural changes. Findings from such studies could be implemented into websites targeting women seeking pre-conception weight loss support.

Whilst behaviour change techniques have attracted ample research attention within the scope of Internet-based health interventions, other assessment criteria used in this analysis still have limited research findings. Areas such as aesthetics, design and usability are only starting to appear in the literature. In many cases, assessing such criteria is challenging due to the subjective nature of quality measures. Even when researchers are guided by research in these areas, one must inevitably make a subjective decision on an item. To minimise the effect of subjectivity an independent assessment of 10% of the total number of websites was undertaken by an experienced health psychology researcher, with results showing that inter-rater reliability was 84%. This result demonstrates a high level of agreeance between two independent raters, which supports the reliability and rigour of the assessments.

This study assessed three pages per website, as previous research suggests that people only review up to three webpages before moving on to another website (Gelder, 2016). However, it is possible that key information and website functionality was present on pages that were not included in the assessment. Conversely, websites may have received lower scores

if more pages per website were assessed, for example, if inaccurate information was located on subsequent pages. Although this research is indicative of website quality levels, to further validate the quality scores achieved, future research may benefit from extracting the top-quality websites identified in this study and conducting a more comprehensive analysis of the websites to ensure that the functionality of websites is assessed in entirety.

The methodology used in this research attempted to limit the impact of Google local searches by switching off local search limitations and refreshing browsing history after each search term was entered in the search engine. However, it should be acknowledged that if this research was conducted in a different location, and/or on a different day, different websites may have been located. Finally, only Google search engine results were assessed in this research, which may limit the generalisability of findings.

Conclusion

In conclusion, frequently accessed websites related to preparing for pregnancy and pre-conception weight loss do not reflect the latest guidelines ascribed to by peak health bodies, with a large proportion of websites providing inaccurate or incomplete information, or a lack of recommendations. Accurate information regarding healthy BMI for conception is vital during the pre-conception period to prevent adverse health outcomes for mother and baby. Evidence suggests that Internet searches tend to be suboptimal, making high quality websites harder to source. The few websites that achieve the gold standard as defined in this study provide ample empirical evidence regarding adverse health outcomes related to overweight and obesity during pregnancy, and provide current health guidelines. However, they lack information in the form of behaviour change techniques and instructions on how behaviour change can be applied in the real world. Health professionals have a responsibility

to acknowledge that women access the Internet for weight loss support and pregnancy related information to assist in planning and decision making, and therefore must work collaboratively with women to direct them towards high quality, evidence- based websites. The vital role that health professionals and organisations play in educating and supporting women during this critical window for maternal and infant health must be recognised. Lastly, this study provides insight that can aid in the development of websites that are tailored to pre-pregnant women seeking weight loss support and are based upon empirical research findings.

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Appendix A: Website Quality Assessment Tool

Table A1

Website quality assessment tool.

Model Criteria	Assessment element	Assessment Options	Quality score	Assessment rubric	Evidence
Design	Do heading labels relate to the text below the heading?	In no places In some places In most places In every place	0 1 2 3	0 - no headings used (one block of text) on any of the webpages assessed 1 - heading relate to subsequent text on 1 of the 3 webpages assessed 2 - heading relate to subsequent text on 2 of the 3 webpages assessed 3 - headings always relate to the subsequent text on the webpages assessed	(Devine, Broderick, Harris, Wu, & Hilfiker, 2016)
Design	Is the website visually appealing?	No visual appeal Little visual appeal Some visual appeal High level of graphics – consistent, professionally visual appeal	0 1 2 3	0 - no visual appeal, unpleasant to look at, poorly designed, clashing/mismatched colours 1 - little visual appeal – poorly designed, bad use of colour, visually boring 2 - some visual appeal – average, neither pleasant, nor unpleasant 3 - high level of visual appeal – seamless designed, very attractive, memorable	(Devine et al., 2016)

Credibility & accountability	Is there indication of website ownership?	Unable to determine Yes	0 1	Is there evidence of who owns the website, either on one of the three assessed pages or within one click away from one or the assessed pages? (e.g. name of company next to the copyright symbol)	(Eysenbach et al., 2002)
Credibility & accountability	Is the website developed by a credible source?	Source identified but legitimacy of source questionable Appears to come from legitimate source, cannot be verified Developed by specialised commercial business Developed by gov, uni, or NGO Developed in partnership across credible institutions	0 1 2 3 4	0 - source identified but credibility of source is questionable (E.g. commercial business with vested interest) 1 - appears to come from a credible source, but it cannot be verified (e.g. has no webpage) 2 - developed by specialised commercial business with expertise and no ethical concerns (E.g., not a quit smoking app by Tabaco company) 3 - developed by government, university or NGO 4 - developed in partnership across credible institutions NGO, Government, Uni, Business working together	(Devine et al., 2016; Eysenbach et al., 2002)
Credibility & accountability	Does the website have a statement of purpose?	Unable to determine Yes	0 1	Can a clear statement of what the company does be found either on one of the three assessed pages, or within one click away from one of the assessed pages? (E.g. click on About us tab to find statement of purpose)	(Devine et al., 2016; Eysenbach et al., 2002)

Credibility & accountability	Is there evidence the website has a Privacy Policy?	Unable to determine Yes	0 1	Is there evidence of a Privacy policy, either on one of the three assessed pages or within one click away from one of the assessed pages? Wording must state "Privacy Policy"	(Devine et al., 2016)
Credibility & accountability	Is there evidence the website has an Advertising Policy?	Unable to determine Yes	0 1	Is there evidence of an Advertising policy, either on one of the three assessed pages or within one click away from one or the assessed pages? Wording must state "Advertising Policy"	(Eysenbach et al., 2002)
Credibility & accountability	Does the company or website sponsors have a potential conflict of interest with positive public health outcomes	Yes No	0 1	0 – yes - the company and / or its sponsors are inappropriate in relation to promoting positive public health messages (E.g. a fast food company sponsoring a physical activity website 1 –no – the company and its sponsors are appropriate in relation to promoting positive public health messages (E.g. a government department sponsoring the Cancer Council website)	(Devine et al., 2016; Eysenbach et al., 2002)

Credibility & accountability	Is it easy to identify advertising from non-advertising content?	No No advertising present Yes	0 1 1	0 – no - not possible to distinguish between advertising and non-advertising content on any of the assessed webpages 1 – no advertising present – the website has no advertising on the assessed webpages 1 – yes – the website has advertising on the assessed webpages, it is easy to distinguish between advertisements and non-advertising content on the webpages	(Devine et al., 2016)
Credibility & accountability	Is the author of the content appropriate?	No author mentioned Author is credible Author is highly credible	0 1 2	Author's name must be next to written articles on assessed webpages 0 – no author mentioned, or no information/credentials provided on the author 1 – authors are named and are credible, but not a medical professional or academic 2 – authors are named and are medical professionals or academics (Dr, Professor)	(Devine et al., 2016; Eysenbach et al., 2002)

Credibility & accountability	Is there evidence of when the content was published / last updated?	Not evident Evident	0 1	Do the articles on the assessed pages have dates of when the articles were published 0 – not evident – no dates of publication shown 1 – evident – dates of publication shown on articles	(Devine et al., 2016; Eysenbach et al., 2002)
Credibility & accountability	Is the content supported by easily accessible research articles?	No Yes Yes, plus links included	0 1 2	0 – no - empirical references never used 1 – yes - empirical references used within articles 2 - yes - links to empirical articles provided	(Eysenbach et al., 2002)
Credibility & accountability	Can a user provide feedback to the company who owns the website?	Unable to determine Yes	0 1	Within one of the three assessed webpages, or within one click away from one of the assessed webpages is it possible to provide feedback to the website owner? (E.g. contact us tab) 0 – unable to determine 1 – yes – able to contact website owner	(Devine et al., 2016; Eysenbach et al., 2002)
Credibility & accountability	Is there evidence of the website being quality accredited by a known health accreditation body?	Unable to determine Yes	0 1	Is there evidence that the website has obtained a recognised quality accreditation standard? (E.g. HON, URAC, GOV-UK, EC quality criteria etc.)	

Participation	Does the website have a Facebook page?	Unable to determine Yes	0 1	Does the website have a link to their Facebook page?	(Laranjo et al., 2015; Moorhead et al., 2013)
Participation	Does the website have a Twitter account?	Unable to determine Yes	0 1	Does the website have a link to their Twitter account?	(Laranjo et al., 2015; Moorhead et al., 2013)
Participation	Does the website have other types of social media?	Unable to determine Yes	0 1	Does the website have a link to other social media accounts? (E.g. Instagram, Pinterest, Google+ etc.)	(Laranjo et al., 2015; Moorhead et al., 2013)
Participation	Can a participant add content to the website?	Unable to determine Yes	0 1	Does the website have its own chat room where participants can engage in conversation or a comment section where users can leave comments?	(Moorhead et al., 2013)

Usability	Does the website have a clear hierarchy structure for navigating within the website?	No visible headings at the top of the webpage to help with navigation to other pages Headings visible at the top of the webpages to help with navigation heading but title not intuitive for locating information Headings visible at the top of the webpages to help with navigation and intuitively labelled but subheading structure ill-defined Heading visible at top of webpages to help with navigation, headings are intuitive and subheading structure is intuitive	0 1 2 3	Does the website have clear headings at the top of the website, which if selected, provide clear subheadings and can be clicked on to navigate to the appropriate webpage? 0 – no visible headings at the top of the webpage to help with navigation to other pages 1 – headings visible at the top of the webpages to help with navigation heading but title not intuitive for locating information 2 – headings visible at the top of the webpages to help with navigation and intuitively labelled but subheading structure ill-defined 3 – heading visible at top of webpages to help with navigation, headings are intuitive and subheading structure is intuitive	(Devine et al., 2016)
Usability	Does the website have an internal search function?	Unable to determine Yes	0 1	Does the website have a search function within the website to help individuals locate information?	(Devine et al., 2016)

Usability	How easy is it to navigate the website?	Very difficult Difficult Neutral Easy Very easy	0 1 2 3 4	In the opinion of the researcher how easy is it to navigate the website to find desired information? 0 – hard to identify how to navigate to another webpage, requires multiple mouse clicks to read an article 1 – navigational structure between web pages in place, but headings not intuitive and requires multiple mouse clicks to read an article 2 – navigational structure between web pages headings intuitive, appropriate hyperlinks within main body of text appear, but requires multiple mouse clicks to read an article 3 – clearly visible navigational headings at the top of each web page which are intuitive to use, hyperlinks within text are clear and minimal use of mouse clicks 4 – navigation is very intuitive and consistent throughout all assessed web pages, all navigation elements are clickable links that lead directly to an article within one click, all categories and sub-categories are clearly and visually defined	(Eysenbach et al., 2002)

Relevance	Does the website provide advice for losing weight healthily prior to pregnancy for women who are overweight or obese?	Unable to determine Yes	0 1	Does the website provide weight loss information suitable for women planning a pregnancy? (E.g. recommendations related to either diet or exercise)	(The Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2019)
Relevance	Does the website provide information on the risk factors associated with being overweight/obese during pregnancy?	Unable to determine Yes	0 1	Does the website provide information on the risk factors associated with being overweight/obese during pregnancy? (E.g. Increased risk of gestational diabetes, increased risk of obesity in offspring)	(The Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2019)
Relevance	Does the website recommend healthy levels of BMI for pre-pregnancy?	Unable to determine Yes	0 1	Does the website provide a BMI graph/guide?	(The Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2019)
Relevance	Does the website indicate healthy levels of weight gain during pregnancy?	Unable to determine Yes Yes and provides pregnancy weight gain calculator function	0 1 2	Does the website provide information on maintaining weight gain during pregnancy?	(Dodd, Grivell, Crowther & Robinson, 2010)

Relevance	Does the website acknowledge at least one potential barrier to weight loss perceived by pregnant women?	Unable to determine Yes	0 1	Does the website address at least one of the below barriers for pregnant women to undertake exercise: fatigue, safety/fears, pregnancy symptoms/discomforts, lack of time, lack of motivation, lack of confidence, lack of social support, lack of access to facilities/resources	(Harrison, Taylor, Shields & Frawley, 2017)
Relevance	Does the website acknowledge at least one potential enabler to weight loss perceived by pregnant women?	Unable to determine Yes	0 1	Does the website address at least one of the below enablers for pregnant women to undertake exercise: easier labour/delivery, maternal health & wellbeing, weight control, social support, ease pregnancy symptoms/discomforts, confidence, baby's health, pregnancy specific programs	(Harrison et al., 2017)
Relevance	Does the website recommend specific exercises that are suitable for pregnant women?	Unable to determine Yes	0 1	Does the website provide information on specific exercises to aid in weight maintenance during pregnancy? (E.g. pelvic floor exercises, aerobic exercises, strengthening exercises etc.)	(The Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2019)

Accuracy / completeness	What level of safety advice does the website provide for pregnant women in relation to undertaking exercise?	No safety advice given Yes general advice is given Yes pregnancy specific advice is given Yes pregnancy specific advice is given and is relevant to overweight and/or obese women	0 1 2 3	0 – no safety advice given 1 – general advice is given (E.g., how to warm up and cool down) 2 - general pregnancy specific advice is given (E.g., recommendation to factor in baseline level of fitness and/or previous exercise experience before commencing exercise) 3 - pregnancy specific advice in relation to weight management is given and is relevant to overweight and/or obese women (E.g., recommendation for individual health evaluation/pre-screening prior to commencing exercise)	(The Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2019)

Accuracy / completeness	What level of safety advice does the website provide for pregnant women in relation to diet?	No diet safety advice given Yes general advice is given Yes pregnancy specific advice is given Yes pregnancy specific advice is given in line with the Australian Dietary Guidelines for pregnancy	0 1 2 3	0 – no diet safety advice given 1 – general advice is given (e.g., limit foods containing saturated fat, added salt, added sugars and alcohol) 2 - general pregnancy specific advice is given in relation to diet but no indication that guidelines are in line with the Australian Dietary Guidelines for pregnancy (e.g., avoid alcohol, avoid foods that may contain listeria bacteria such as soft cheese, sandwich meats, bean sprouts, pre-prepared salads and pâté) 3 - pregnancy specific advice is given in line with the Australian Dietary Guidelines for pregnancy (e.g., increase grain consumption to 8-8.5 servers per day, choosing foods high in iron, choosing calcium enriched foods)	(National Health & Medical Research Council, 2019)

Accuracy / completeness	Does the website provide correct information on the levels of weekly exercise during pregnancy recommended by The Royal Australian and New Zealand College of Obstetricians and Gynaecologists?	No mention of recommended levels of exercise Recommended levels of exercise In line with guidelines but incomplete Recommended levels of exercise completely in line with guidelines	0 1 2	Aerobic exercise: Frequency - most, preferably all days of the week Intensity - moderate Duration - at least 30min continuous exercise per session Progression - for previously inactive women and those that are overweight or obese, a shorter duration of exercise (15-20min) at commencement of program, before slowly building up to 30min Strengthening exercises: Type - resistance exercises using light weights/body weight/elasticised resistance-bands Frequency - 1–2 sessions/week Intensity – moderate rating of perceived exertion 12-14 (fairly light to somewhat hard) Duration - 1-2 sets of 12-15 repetitions for each main muscle group Progression – Exercises should not be performed lying flat on the back after the first trimester) 0 – No mention of recommended levels of exercise 1 – Recommended levels of exercise In line with guidelines but incomplete 2 – Recommended levels of exercise completely in line with guidelines	(The Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2019)

Accuracy / completeness	Does the website provide correct information on the recommended serving sizes and/or calorie/kilojoule intake as per The Australian Dietary Guidelines for healthy eating during pregnancy?	No mention of recommended serving sizes or inaccurate serving sizes mentioned Recommended serving sizes in line with guidelines but incomplete Recommended serving sizes completely in line with guidelines	0 1 2	0 – No mention of recommended serving sizes and/or calorie/kilojoule daily limits OR serving sizes and/or calorie/kilojoule daily limits mentioned but inaccurate 1 – Recommended serving sizes and/or calorie/kilojoule daily limits in line with guidelines but incomplete 2 – Recommended serving sizes and/or calorie/kilojoule limits in line with guidelines and complete	(National Health & Medical Research Council, 2019)
Behaviour change techniques	Does the website acknowledge the relationship between exercise and/or diet and health?	No Yes – relationship between exercise and/or diet and health acknowledged	0 1	Provide information on consequences of behaviour in general. Does the website provide information on benefits / consequences (gains / losses) of undertaking physical activity, or not undertaking physical activity? (E.g., gain framed, - by undertaking regular physical activity, you reduce your risk of pregnancy complications? Or loss famed – by not undertaking regular physical activity, you increase the risk of gestational diabetes mellitus)	(Jacks & Lancaster, 2015; Li, Cheng, & Fung, 2014; Rothman & Salovey, 1997)

Behaviour change techniques	Does the website promote the identification of barrier identification and/or problem solving?	No Yes - barrier identification mentioned Yes - barrier identification and problem solving mentioned	0 1 2	(Michie et al., 2011) CALO-RE taxonomy Barrier identification / problem solving. Information provided to prompt an individual to think about potential barriers and identify ways to overcome them. Barriers can be cognitive, emotional, environmental, social, physical and health related	(French, Olander, Chisolm, & McSharry, 2014)
Behaviour change techniques	Does the website promote action planning in relation to exercise?	Action planning not mentioned Only talks about action planning Recommends another website / company for online action planning Provides printable action plan Provides online function to create action plan	0 1 2 3 4	(Michie et al., 2011) CALO-RE taxonomy Action planning involves specifying when, where, what and with whom Physical Activity will be completed. E.g., I will exercise on Tuesday afternoon, at the gym, by walking for 30 mins on the treadmill with Sarah	(Williams & French, 2011)

Behaviour change techniques	Does the website promote action planning in relation to diet?	No recommendation of meal planning Recommends meal planning Recommends meal planning and gives examples of healthy meal plans for pregnancy Recommends meal planning with examples of healthy meal plans for pregnancy, plus offers an online function to create personalised meal plans	0 1 2 3	Encourages meal planning by suggesting examples of healthy eating plans/guidelines	
Behaviour change techniques	Does the website promote self-monitoring of health behaviours?	Self-monitoring not mentioned Only talks about weight management self-monitoring Recommends another website / company for online weight management self-monitoring Provides printable format to monitor weight management progress Provides online function to monitor weight management progress	0 1 2 2 3	(Michie et al., 2011) CALO-RE taxonomy Prompt self-monitoring of behavioural outcome. Website provides information on how an individual can keep a record of their weight management (E.g. keeping a diary of the type of physical activity undertaken - how long for and intensity, or keeping a food diary - daily food and portion sizes consumed)	(Morgan, Lubans, Collins. Warren, & Callister, 2011; Olander et al., 2013)

Behaviour change techniques	How does the website provide feedback on weight management performance?	No feedback on weight management performance provided Feedback on weight management progress is provided	0 1	Provide feedback on performance. Does the website provide feedback on an individual's actual progress against goals set and is this feedback generic or personalised (E.g. Dear Amy or Dear participant your goal this month was to achieve 2kgs of weight loss, you have actually lost 2.5 kgs)	(Kerbs, Prochaska, & Rossi, 2010; O'Brien et al., 2015)
Behaviour change techniques	How does the website promote the use of rewards in progress to / or achieving a weight management goal?	No promotion of rewards Only talks about using rewards on progress to / or achieving goal Provides rewards on progress to / or achieving goal (e.g. tokens, online points)	0 1 2	Provide rewards contingent on effort or progress towards behaviour. Does the website encourage use of praise / reward for attempts at achieving a weight management goal? Provide rewards contingent on successful behaviour. Does the website encourage use of praise / reward when an explicit goal is achieved?	(French et al., 2014; Williams & French, 2011)

Behaviour change techniques	How does the website promote the use of social support to undertake weight management?	Social support not mentioned Join an online community Join a specific group activity Join a gym / fitness facility Family / Friends Family / friends & group exercise activity	0 1 1 1 1 1	Plan social support / social change. Does the website provide information on encouraging an individual to seek social support to carry out weight management goals (E.g. participate in a group activity / undertake exercise with friends / family)	(French et al., 2014; Williams & French, 2011)