PERCEPTIONS OF FEMALE NURSING STUDENTS REGARDING FOLIC ACID FOR THE PREVENTION OF NEURAL TUBE DEFECTS:
A QUALITATIVE STUDY

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ABBREVIATIONS

F.A.    Folic acid

G.P.    General practitioner

N.T.D.  Neural tube defects

RES     Interview respondent

R.N.I.  Reference nutrient intake

U.K.    United Kingdom

U.S.A.  United States of America
ABSTRACT

Background

Neural tube defects are congenital malformations caused by incomplete closure of the neural tube and represent a significant public health problem. Periconceptional folic acid (F.A.) supplementation reduces the risk of neural tube defects. International research has demonstrated low rates of periconceptional F.A. supplement use. Little data exist on rates of F.A. use and perceptions of F.A. use among Welsh women.

Objective

To explore the views of female nursing students regarding F.A. supplementation for the prevention of N.T.D. and to explore factors affecting supplement use.

Methods

Qualitative, semi-structured interviews were conducted in June 2009 with a convenience sample of six female nursing students of reproductive age in a Welsh University. Ethical approval was obtained, and data analysis was conducted using thematic qualitative analysis.
Results

All women were aware of F.A. for pregnancy, though their knowledge regarding its role and the recommendations for supplement use was limited. None of the women were using F.A., and women with a history of unplanned pregnancy often introduced F.A. too late. Knowledge regarding food sources of F.A. was also limited. Principal sources of advice and information on F.A. were healthcare professionals, media and family/friends. Barriers to supplement use included safety and efficacy concerns, low perceived pregnancy risk, and the misconception that diet provides adequate F.A.

Conclusion

This preliminary study has provided valuable insight into this issue but further qualitative research is needed to explore in more detail women’s perceptions regarding F.A. supplementation. The role of the healthcare professional in providing health education on F.A. may be underutilised.
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INTRODUCTION

The topic of folic acid (F.A.) supplementation for the prevention of neural tube defects (N.T.D.) is the focus of the following dissertation.

N.T.D. – including spina bifida, anencephaly, and encephalocoele – are congenital malformations caused by incomplete closure of the neural tube. The process of neural tube closure is completed within a month of conception (Lumley et al., 2001). N.T.D. are a major cause of infant morbidity and mortality, and termination of pregnancies. Figures for England and Wales show that in 2004 there were 969 N.T.D.-affected pregnancies (resulting in 801 terminations), with an estimated birth prevalence of N.T.D. of 0.3 per 1000 births (Morris and Wald, 2007). Thus N.T.D. are a significant public health problem in the U.K. population.

Optimal nutrition during pregnancy is crucial, with a significant body of research demonstrating the beneficial role of folate in pregnancy (Scott and McNulty, 2004). The term folate refers to the group of compounds derived from F.A. or pteroylglutamic acid (Thomas, 2007). Folate is a member of the B vitamin complex, and occurs naturally in foods such as liver, yeast extract and some fruit and vegetables. F.A. is a synthetic form of folate used in supplements and fortified products. Folate functions as a coenzyme for methylation reactions involved in D.N.A. synthesis (Thomas, 2007).

Periconceptional F.A. supplementation significantly reduces N.T.D. prevalence (relative
risk 0.28, 95% confidence interval 0.13-0.58) (Lumley et al., 2001). Yet despite continued public health and health promotion initiatives targeting this issue, most women do not take F.A. supplements appropriately during the periconceptional period (Ray et al., 2004).

Work by Smithells et al. (1980, 1981, 1983) initially demonstrated that periconceptional multivitamin supplementation reduced N.T.D. recurrence in women with a history of N.T.D.-affected pregnancy. The seminal work of the Medical Research Council (1991) was the first high quality randomised controlled trial to demonstrate a significant beneficial effect of F.A. (4mg/ day) in reducing N.T.D. recurrence. A subsequent randomised controlled trial by Czeizal and Dudas (1992) showed that F.A. supplementation (800 micrograms/ day) was also effective for primary prevention of N.T.D.

In addition, there may be further health benefits of greater mean population intakes of folate, such as prevention of folate deficiency in other groups, reduced plasma levels of homocysteine (an independent cardiovascular risk factor), and protection from certain chronic diseases (Scott and McNulty, 2004).

The adult reference nutrient intake or R.N.I. (amount considered sufficient for 97.5% of the population) for folate is 200 micrograms/ day (Department of Health, 1991). Crucially, the R.N.I. is lower than the amount of folate recommended for preventing N.T.D. Thus, even women who meet the R.N.I. for folate may not have an intake adequate to protect the health of the unborn. A recent dietary survey suggests mean daily folate intake among U.K. women is 251 micrograms (Henderson et al., 2003). Women aged 25-34 years had lower
average intakes than those aged 34-65 years. 2% of women had intakes below 100 micrograms. The same dietary survey found that 86% of women aged 19-24 years, 92% of women aged 25-34 years and 85% of women aged 35-49 years had daily intakes less than 400 micrograms, including both food sources and supplements.

To date, public health approaches adopted internationally for the prevention of N.T.D. have included the promotion of increased dietary folate intake by women of reproductive age, promotion of F.A. supplements periconceptionally, or fortification of food staples with F.A. (Scott and McNulty, 2004). Suggested reasons why the first two strategies have had limited success include: poor access by some to fortified foods; reduced bioavailability of dietary folate compared to F.A.; poor compliance with supplements; or omission of supplements where pregnancies are unplanned (Fraser and Fisk, 2003; Scott and McNulty, 2004).

In 1992, the U.S. government recommended that all women of reproductive age should take 0.4mg of F.A. daily to reduce N.T.D. risk (Department of Health and Human Services, 1992). The first U.K. recommendation for women to take F.A. preconceptionally for N.T.D. prevention emerged in the same year (Department of Health, 1992). Then, in 1996 the Health Education Authority launched an educational campaign on this topic. However, it has been suggested that the campaign failed to reduce N.T.D. rates (Abramsky et al., 1999). Indeed similar results have been reported internationally; analysis has suggested that national public health policies and recommendations for F.A. supplementation have failed to contribute to reductions in overall rates of N.T.D. across Europe (Botto et al., 2005; Busby et al., 2005).
Current national advice for the prevention of N.T.D. is as follows: “All women who could become pregnant are advised to take 400 micrograms a day of F.A. as a medicinal or food supplement prior to conception and until the twelfth week of pregnancy” (Department of Health, 2000). Unfortunately there is poor compliance with guidelines for F.A. supplementation in most populations (Ray et al., 2004). The rationale for such a recommendation is that neural tube closure is usually completed by the fourth week of pregnancy, which is a time when many women do not yet know they are pregnant. In addition, advice is directed not solely at those planning a pregnancy but at all women who are sexually active, because approximately half of all pregnancies are unplanned (Scientific Advisory Committee on Nutrition, 2006). Similar public health guidance exists in the U.S.A., Ireland, Australia and New Zealand. For women with a previous N.T.D-affected pregnancy, even higher doses of F.A. are recommended.

The nature of health behaviour is complex, as illustrated by theories of behaviour change such as the Health Belief Model (Rosenstock, 1966, 1974, cited in Tones and Green, 2004), and perhaps this helps to explain why health education alone has not lead to adequate reductions in N.T.D. rates, and why there are calls for public health measures. Indeed, several countries have already introduced mandatory fortification of grains with F.A. due to the limited success of health education on this issue (Scott and McNulty, 2004). In the U.S.A. at least, fortification has lead to a significant increase in mean plasma folate levels (Ganji and Kafai, 2006) and significant reductions in N.T.D. prevalence (Honein et al., 2001). The Department of Health (2000) advised that mandatory fortification of flour with F.A. would significantly reduce N.T.D. rate, and evidence from international research
regarding the success of F.A. fortification of flour in reducing N.T.D. arguably demonstrates a comparative health need in this country.

However, there are several perceived risks with universal F.A. fortification of flour. These include the possible masking of vitamin B12 deficiency in older adults, potential adverse effects on trade with countries where flour is unfortified, the risk of high intakes by some individuals (Scott and McNulty, 2004) and possibly consumer concerns regarding the safety of mass fortification. Also, recent research (Cole et al., 2007) suggested a possible link between high dose F.A. and increased risk of colorectal cancer, with further studies awaited. A decision on fortification is currently being considered in the U.K., and the Scientific Advisory Committee on Nutrition is due to advise the Chief Medical Officer on this topic in late 2009.

Tones and Green (2004) suggest that health promotion is viewed as a synergistic interaction between health education and healthy public policy. This suggestion is very relevant to the topic of F.A. for the prevention of N.T.D. Both strategies are crucial to national efforts to prevent N.T.D. as neither strategy is deemed sufficient on its own.

Current public health practice and theory emphasise the need to tackle health inequalities in order to improve public health (Marmot, 2006). Health inequalities apply to the problem of N.T.D. – Wasserman et al. (1998) reported that lower socioeconomic status is associated with an increased risk of N.T.D.-affected pregnancy. Hence efforts to address N.T.D. may impact more on disadvantaged groups, potentially reducing inequalities, which makes this
This dissertation begins with a review of recent literature on the topic of F.A. supplemenation. This is followed by a description of the methods of the research project. Next, the findings and discussion are addressed, and finally conclusions are presented.
LITERATURE REVIEW

I. Introduction

A literature review is conducted to establish both what is already known about a topic and what gaps in knowledge exist (Bryman, 2008). A literature search was conducted between January and August 2009. Details of the literature search, including search terms and databases used, are provided in Appendix I. The aim of the literature review was to retrieve and critically analyse recent research on the topic of F.A. use by women. In order to retrieve a manageable number of articles given the vast amount of literature on this topic, the search was limited to articles from Europe, Australia, New Zealand and North America from 2004 onwards. These countries were selected as they were deemed comparable to the U.K. in terms of development level and health policy.

Most studies retrieved were conducted in the U.S.A. The majority of studies were classified as quantitative descriptive research, of which most featured a correlation survey design. Explanatory research designs on this topic included controlled trials, systematic reviews and evaluation research studies. Only one qualitative study was located, suggesting perhaps a lack of exploratory research in these countries, or possibly a publication bias towards quantitative research. Only one original research article pertained to research conducted among the U.K. population. No research specific to Wales was located.

The following themes dominate the literature on this topic:
• awareness, knowledge and use of F.A. (among women of reproductive age, pregnant women, women post-partum, all women, students)
• knowledge and advising practices of healthcare professionals
• health promotion campaigns and interventions to increase F.A. awareness, knowledge and use
• factors affecting awareness, knowledge and use of F.A.

Studies varied according to population group and setting. Populations featured in the research include pregnant women, women who were recently pregnant, non-pregnant women of reproductive age, and health professionals. The most common setting in the research was a hospital or healthcare facility. Population-based surveys using telephone interviewing were also common. Some surveys were conducted in the context of concurrent health promotion campaigns whose focus was F.A. for N.T.D. prevention.

II. Awareness, knowledge and use of F.A.

Various theories of health behaviour feature knowledge as one of the determinants of health actions (Tones and Green, 2004). Evidence from cross-sectional surveys shows variations in rates of awareness, and knowledge of F.A. General awareness of F.A. ranged from 46% (Hilton, 2007) to 95% (de Walle and de Jong-van den Berg, 2008). Awareness was generally greater among pregnant women than women of reproductive age. Many women were aware of F.A. but far fewer women knew about its specific role in N.T.D. prevention.
Mass media, including television, were cited as a major source of information regarding F.A. (Robbins et al., 2006; Watson et al., 2006; de Walle and de Jong-van den Berg, 2008). Physicians and other health care providers were another principal source of advice about F.A. supplementation (Tam et al., 2005; Gjergja et al., 2006; Green-Raleigh et al., 2006). Watson et al. (2006) noted family and friends were also cited as a source of advice.

It is not clear from these studies though how women rate different sources of information. Also, data regarding information sources was self-reported and may be subject to bias. No studies investigating the accuracy of information provided by these sources were found, therefore it is unclear whether women are obtaining valid information. However, it appears that women can access information on F.A. from several different sources, and each of these could be a potential target for health promotion on the topic of N.T.D. prevention.

Use of F.A. at any time during pregnancy varied significantly between countries. The lowest rates observed in individual research studies ranged from 14% (Gjergja et al., 2006) to 96% (Carmichael et al., 2006). In a systematic review of international research of F.A. awareness and use, Ray et al. (2004) reported a 0.5% rate of periconceptional F.A. use among Italian women. However, among the studies which assessed this, the highest rate of appropriate supplement use over the entire recommended periconceptional period was just 52% (de Walle and de Jong-van den Berg, 2008). This suggests that a large number of women do not take F.A. supplements appropriately or at all, and are therefore at higher risk of N.T.D.-affected pregnancy, despite the presence of public health guidance in many countries and despite health promotion campaigns to improve F.A. use.
Though the low use of F.A. is concerning, it is worth remembering that some women of reproductive age may be at lower risk of pregnancy – e.g. women who use contraception appropriately, women with higher than average dietary intakes of F.A., and women who are unable to conceive.

Different studies applied different terms and definitions in their assessment of F.A. awareness, knowledge and use, making it difficult to compare findings. Some studies explored awareness of the term ‘folic acid’, while others attempted to measure knowledge of the role of F.A. in N.T.D. prevention. In addition, recommendations for F.A. supplementation might vary between countries, thus definitions of ‘compliance’ with national guidelines on supplementation could vary. In addition, the supplement dose used was rarely assessed. It is possible that some women who reported using F.A. supplements may not have been taking an adequate dose. Ray et al. (2004) also highlighted this weakness in the literature.

There are many possible reasons for the wide variations in awareness, knowledge and use of F.A. across different age groups and populations. It may be related to local differences in health policy and health education, cultural factors and norms, pregnancy as a confounding factor, local barriers to supplement use (such as access and cost), or prescribing and advising practices of healthcare professionals. However, it could also reflect the differences in characteristics of the sample groups employed, and methodological weaknesses in the studies. The international variations in health promotion and public health policy regarding
F.A. may also mean that research findings of different countries are not directly comparable.

Research findings by population group studied are discussed next.

**i. Women of reproductive age**

Seven surveys involved women of child-bearing age, all of which were based in the U.S.A. Five were large telephone surveys (Canfield et al., 2006; Green-Raleigh et al., 2006; Robbins et al., 2006; Case et al., 2007; Petrini et al., 2008), and two were conducted with convenience samples of women accessing health services (Cleves et al., 2004; Hilton, 2007). In two studies, awareness of F.A. varied from 59% (Robbins et al., 2006) to 78% (Canfield et al., 2006). However, Canfield et al. (2006) found that only 28% of women were aware of the role of F.A. specifically in N.T.D. prevention, and only 25% were aware of the need to take F.A. before pregnancy. Similarly, use of F.A. varied from 20% (Robbins et al., 2006) to 33% (Canfield et al., 2006). Both studies used non-probability sampling. Robbins et al. (2006) recruited a smaller sample (n=646) from a rural area with higher than average levels of poverty and chronic disease, which may explain the lower awareness and use in this sample. However, the response rate in this study was only 59%, and the characteristics of those who declined to respond were not described. Thus the results may not be transferable to the target population.
Green-Raleigh et al. (2006) reported on the results of nine annual random-digit dialling telephone surveys between 1995 and 2005 with nationally representative samples, following the introduction of health promotion campaigns. Awareness increased from 52% to 79% between 1995 and 2001, after which no further increase was found. Knowledge of the role of F.A. in N.T.D. prevention and of the recommending timing of supplementation also improved. This was associated with a small, non-significant increase in reported daily use of a F.A. supplement from 28% to 33% over the ten years. Unfortunately, given the very low response rates in this study (24-52%), the findings are likely to be of limited validity. Using a larger sample (n=6835) recruited in a random digit dialling survey, Case et al. (2007) found that reported use of F.A. was only 35%.

In contrast to the previous surveys, Petrini et al. (2008) did not exclude pregnant women. Women aged 18-24 years had the lowest reported awareness regarding F.A., and were less likely to know when to take F.A. compared to older women. Not surprisingly, they also had the lowest reported daily use of F.A. (30%), compared to the overall sample (40%). However, a major limitation of this study was the low response rate (32%). In each the above telephone surveys, it is possible that lower income groups are underrepresented, given that only those women with access to a telephone were included.

Both Cleves et al. (2004) and Hilton (2007) examined awareness and use of F.A. among convenience samples of women attending health services. In the former study, 62% were deemed to have accurate knowledge of the benefits of periconceptional F.A., yet their knowledge was based on a multiple choice question rather than an unprompted question.
Only 23% of all women reported daily F.A. use. Hilton (2007) recruited a younger group (aged 18-24 years), and found that 54% were unaware of the importance of F.A., and less than a quarter were taking a multivitamin containing F.A. However, the sample was non-random and very small (n=88) so findings cannot be generalised to this population group.

**ii. Pregnant women**

The proportion of pregnant women attending antenatal clinics in Ireland who had heard of F.A. increased from 54 to 94% between 1996 and 2002 (Ward *et al.*, 2004). Knowledge that F.A. can prevent N.T.D. also increased, and reported use during pregnancy also rose from 14% to 83% over the same period. Periconceptional F.A. use remained below 25%.

An earlier U.K. study involving pregnant women (n=450) found that 89% reported using F.A. during the first 18 weeks of pregnancy (Relton *et al.*, 2005). However, only 48% reported taking supplements prior to four weeks gestation. Hence, a large proportion of women sampled started supplements too late, beyond the critical window for N.T.D. prevention.

In the only other U.K. study reviewed, Brough *et al.* (2009), found that 76% of pregnant women reported using F.A. supplements during the first trimester. However, only 29% of women reported having started supplements prior to the expected time of neural tube closure. Folate deficiency was detected in 5% of the sample group. Women who reported F.A. use had significantly higher mean red cell folate levels. Folate status increased with age and social class, and was higher in Caucasian women compared to non-Caucasian
women. Sampling was not random and no details regarding questionnaire validity were provided by the authors.

In a case-control study in the U.S., de Jong-van den Berg et al. (2005) showed that F.A. awareness increased among pregnant women from 0% in 1988 to 50% in 1996, with minimal change thereafter. However, daily use of supplements periconceptionally rose to a lesser degree – from 15% to 40% – over the same period. Some of the women recruited in these surveys had given birth to a child with a malformation, thus the sample may not be representative of pregnant women generally.

Conlin et al. (2006) found 30% compliance with F.A. supplementation among pregnant women attending antenatal clinics in South Australia, while 27% reported not taking F.A. supplements. Three-quarters of the sample reported knowledge of the role of F.A. in preventing spina bifida. A strength of the study was that researchers sought enough information regarding F.A. use to accurately determine compliance with national recommendations.

A Croatian survey of 569 pregnant women attending a hospital clinic showed high rates of awareness of F.A. (Gjergja et al., 2006). However, only a quarter had received information about F.A. in advance of their first pregnancy. They may have heard about F.A. during a previous pregnancy, which may have prompted use in subsequent pregnancies. Rates of F.A. use were much lower – only 11% reported appropriate use in previous pregnancies, increasing to 14% in the current pregnancy. Such poor uptake of F.A. supplements was
concerning given that most women reported having planned their pregnancy. Interestingly, 80% of women said that they would take F.A. in future pregnancies, however 2% said they had decided not to, though it is unclear why.

Goldberg et al. (2006) assessed knowledge and use of F.A. among 327 pregnant women who called a teratogen information helpline in the U.S. 57% of women reported an unplanned pregnancy. Just over half denied using F.A. either prior to conception or at all. Worryingly, some subjects were classed as ‘high-risk’ for N.T.D. based on their history, and of these 66% reported not using F.A. appropriately. The response rate in this study was particularly low (45%).

de Walle and de Jong-van den Berg (2008) explored F.A. knowledge and use in the Netherlands, a country with a relatively low rate of unplanned pregnancy. 95% reported awareness of F.A. Reported use of F.A. was also much higher than other countries – 80% reported F.A. use at some period in the pregnancy, while 51% reported full compliance with recommendations for its use. It is possible that this could reflect a more successful approach to health promotion around F.A. in the Netherlands, or it may be related to the high rate of planned pregnancies. However, the sample involved may have been biased towards women with a higher education level.

It could be expected that pregnant women would have different levels of awareness, knowledge and use of F.A. compared to non-pregnant women, since they may have been exposed to health promotion messages about F.A. during their pregnancy or, where
applicable, during the planning of their pregnancy. It is also conceivable that self-reported
data on F.A. use from pregnant women may be more susceptible to bias than those of non-
pregnant women, in that pregnant women may feel more pressure to answer questions
about F.A. use favourably to avoid being perceived as irresponsible by medical staff.

**iii. Women post-partum**

Six articles describing cross-sectional surveys of women who had recently given birth were
located. In a convenience sample of 1000 Spanish women interviewed in hospital post-
partum, 68% reported using F.A. at some point during pregnancy (Coll *et al.*, 2004). Most
said they had not been advised to take F.A., which is concerning.

An Australian study of superior methodology involving a random sample of women who
recently gave birth found 62% awareness of F.A. for N.T.D. prevention prior to pregnancy,
with additional women finding out during pregnancy (Bower *et al.*, 2005). However, less
than a third took F.A. supplements periconceptionally. This study also assessed dietary F.A.
intake, but the validity of the food frequency questionnaire is unclear.

Two other Australian surveys also employed probability sampling (Watson *et al.*, 2006).
The first was a state-wide postal survey of all new mothers in Victoria (n=1593). The
second survey was a child health telephone survey in New South Wales (n=647). F.A. use
was 36% and 46% respectively. However, in both cases, a minority of women reported that
they had increased their dietary folate intake periconceptionally – an issue which few other
researchers have explored in detail. Unfortunately, not all who used F.A. continued this for the full time period recommended.

In a non-random sample of Canadian women recruited in hospital, 28% reported appropriate periconceptional supplement use, though rates were much lower in women aged 16-25 years (Tam et al., 2005). The women in this study appeared to be of higher socioeconomic status however.

In a population-based study, 96% of American women post-partum reported periconceptional F.A. use, though only 53% took F.A. in the first four weeks of gestation (Carmichael et al., 2006). Half of the women commenced F.A. before or during the periconceptional period, 35% during early pregnancy, and 8% even during late pregnancy. Study participants were more likely to be non-Hispanic white and have higher education than the general population.

Dobson et al. (2006) found only 39% of New Zealand women post-partum used F.A. supplements during pregnancy. However, the timing and dosage of supplements was not assessed, and the small sample was not randomly selected.

**iv. All women**

Ray et al. (2004) systematically reviewed the research evidence on F.A. use preconceptionally and periconceptionally in Eastern and Western countries between 1992
and 2001. Preconceptional F.A. use ranged from 0.9% in Israeli women to 49% in Canadian women. Similarly, periconceptional use varied from 0.5% in an Italian survey, to 52% in the Netherlands. Public health campaigns were found to have a positive impact on F.A. use, but the size of the effect was variable, and post-campaign rates of use never exceeded 50%. The authors concluded that there had been a general increase in periconceptional F.A. use over the time period covered.

**v. Students**

Potzsch *et al.* (2006) examined awareness of F.A. among 4332 male and female students aged 15-21 years in Germany. Awareness of F.A. was relatively high (61%), but only 20% had heard of F.A. in relation to pregnancy.

Overall, there were several strengths common to research articles on F.A. knowledge and use. Firstly, there was the consistent finding of low rates of F.A. supplement use among women of reproductive age. This was despite wide variations in public health policy between countries, lending weight to the validity of such findings. Another strength was the use of large sample sizes in many of the research studies on this topic. Finally, research evidence is available from a wide variety of countries and populations, offering us a global view of the issue.

However, a number of weaknesses were also noted, such as the predominance of non-probability sampling, as observed by other commentators (Chivu *et al.*, 2008). Sampling
allows the researcher to study smaller groups while still obtaining data which is representative of the target population (Sarantakos, 2005). Unlike non-random sampling, probability sampling allows inferences drawn from the sample to be generalised to the population under study (Kumar, 2005). Hence, the findings of studies on this topic which employed non-probability sampling may not be representative of the target population.

Another common weakness was inadequate provision of detail regarding the validity and reliability of data collection instruments used. Again, this weakness has been noted elsewhere (Chivu et al., 2008). Validity is an indicator of whether an instrument measures what it is supposed to measure (Sarantakos, 2005), whereas reliability refers to consistency in measurement (Punch, 2005). Only one author reported using a validated data collection tool (Hilton, 2007). Perhaps this reflects a lack of validated and reliable instruments designed specifically to assess F.A. awareness, knowledge and use, as suggested by the same author (Hilton, 2007).

In addition, the heterogeneity of populations studied means it is difficult to compare findings between studies. Women who have never been pregnant may have very different attitudes towards F.A. supplementation compared to women who are questioned during or after pregnancy, i.e. pregnancy could be a confounding factor. Women of reproductive age were usually defined by authors as being between the ages of 18 and 45 years, though this definition can vary.

Also, most of the research was of cross-sectional design, involving retrospective
assessment of F.A. supplement use. Data collected in retrospective surveys can be subject to recall error. In addition, as suggested by de Jong-van den Berg et al. (2005), it is possible that in studies involving assessment of F.A. awareness/knowledge in women post-partum, women may have learned of the nutrient after pregnancy rather than in the periconceptional period. It is advised that F.A. supplementation commences prior to conception and continues until the twelfth week of pregnancy. Prospective, longitudinal studies might offer greater insight into compliance with supplements over the whole of this critical period for N.T.D. prevention than cross-sectional studies.

Another weakness in the literature on this topic is the reliance on self-reported information from participants. There are limitations in terms of validity of self-reported data due to the risk of inaccurate reporting by subjects. Few studies reviewed used additional measures to validate self-reported data, e.g. the measurement of blood folate levels. However, given the large sample sizes involved in many of the published surveys, blood tests may not have been feasible or affordable, or acceptable to subjects.

Also, given the choice of the hospital setting in many of the above research studies, it could be argued that women who may be less likely to utilise hospital and maternity services (e.g. disadvantaged groups, those who choose home birth, or those who do not attend outpatient appointments) may be under-represented in the literature.

Sample size in quantitative research can be calculated using statistical and non-statistical methods (Sarantakos, 2005). However, few authors described having based the sample size
used on power calculations. Furthermore, many surveys reviewed featured a low response rate. Inadequate samples limit the external validity of findings (Sarantakos, 2005).

Finally, due to the time lag between completion of a research study and publication of its findings, many of the articles reviewed here relate to work conducted several years ago, which may not reflect the current reality.

**III. Knowledge and advising practices of healthcare professionals**

Healthcare professionals are directly involved in promoting health. For some this will involve delivering health education specifically on F.A. and N.T.D. prevention. Helinski et al. (2004) reported on the results of an uncontrolled educational intervention aimed at improving knowledge and advising practices of 118 staff - dietitians, nurses, general practitioners (G.P.’s), obstetricians, gynaecologists and Americorps - involved in health education. Knowledge (assessed after one month) was not significantly greater post-intervention, however pre-intervention knowledge was already high (92%) in this sample. The number of participants who reported recommending F.A. to women increased following the intervention, with the largest increase occurring among G.P.’s. This data was self-reported, and objective measures to assess changes in practice were not considered. A longer-term assessment of knowledge and advising practices would have been useful to assess whether changes in behaviour were sustained.

Morgan et al. (2004) explored whether an educational compact disc could improve F.A.
knowledge among physician assistants in the U.S. Use of the educational resource was associated with increased knowledge of F.A. after two weeks. However, the long-term impact of the education on knowledge was not assessed, characteristics of the group were not described, and the trial was uncontrolled, so findings can not be generalised.

An international survey of awareness and advising practices of doctors showed that only 58% of obstetricians, gynecologists and urologists recommend F.A. to women of reproductive age (Kondo et al., 2007). Gynecologists/obstetricians reported higher rates of awareness of the role of F.A. in preventing N.T.D., and awareness was higher among urologists from North America, Europe, Australia and New Zealand than those from Asia. A large proportion (86%) of the doctors surveyed advised women to take well-balanced meals. However, this study had a very low response rate (mean 38%), therefore results may not be generalisable. Also, knowledge and health education practices of professionals in other countries regarding F.A. supplementation may be different to those of health workers in the U.K. No studies exploring the advising practices of healthcare professionals in the U.K. were located, suggesting a dearth of research on this issue. In addition, it is possible that some women have little contact with healthcare professionals and maternity services during pregnancy, and may not benefit from health education or advice on this topic to the same degree as others.

IV. Health promotion campaigns and interventions to increase F.A. awareness, knowledge and use
Telephone surveys conducted with representative samples of women of childbearing age in Norway before and after the initiation of a national information campaign on folate and pregnancy found that awareness of the term folate increased significantly from 50% to 60% (Daltveit et al., 2004). Knowledge of its role in prevention neural tube defects also increased significantly from 9.5% to 21%. However, few women knew the recommended dose or timing for supplementation. It seems that, though awareness is greater, some of the detail of the health promotion message regarding F.A. failed to reach, or be retained by women. Half of the women surveyed in 2000 reported F.A. use, and use did not change over the two years, except during pregnancy or when close to pregnancy. However, data was self-reported and information on dose of supplements taken was not collected.

Watkins et al. (2004) conducted a non-randomised trial in the U.S. to assess the effectiveness of education materials and free F.A. supplements or fortified cereals in improving knowledge and serum folate levels among women aged 18-45 years who attended family planning clinics. Only 6% of women attending the clinic reported planning to get pregnant. Women in the intervention groups who received either free F.A. tablets or fortified cereal had greater knowledge of F.A. compared to the control group. Women who received F.A. supplements had higher reported F.A. consumption. However, the interventions were not associated with an increase in mean serum folate level over the one-year study period. Unfortunately, the authors did not explore how the educational materials were introduced by family planning clinic staff or used by women in the study. F.A. consumption was determined by asking subjects if they took a F.A. supplement or fortified
cereal within the last two days. This method may not accurately reflect daily use of F.A. or F.A. enriched cereals.

Another randomised trial was conducted with women of reproductive age attending gynaecology services in the U.S. (Robbins et al., 2005). The intervention group received brief counselling on F.A. by a gynaecologist, along with a free 30-day F.A. supply and an information leaflet. They also received a telephone counselling regarding preconceptional F.A. use for N.T.D prevention from a research nurse within two weeks. Women in the control group were advised on another health topic, and were given the same educational leaflet on F.A., and a coupon offering a month’s free F.A. supply. Weekly use of F.A. increased significantly in the intervention group. Women who were aware of F.A. were influenced more by the intervention, as were black women and those on lower incomes. Barriers to F.A. use were also explored – not planning pregnancy was the most common reason given for not taking F.A. Lack of information or forgetting to take supplements were other commonly cited barriers. The study was adequately powered, and demonstrated the feasibility of a brief intervention on F.A. use. However, physicians were not prohibited from advising women in the control group about F.A. and indeed, 85% of these women reported receiving advice about F.A. In addition, improvements in weekly F.A. use (defined by the authors as use on at least one day per week) arguably might not be sufficient to reduce N.T.D. incidence. Only some of the study limitations were cited by the authors, i.e. reliance on self-reported data about F.A. use, inadequate reporting of validity and reliability of the survey instrument, lack of long-term follow-up, and contamination of the control group.
Flores et al. (2007) described two evaluation research studies of media campaigns to increase F.A. awareness, knowledge and consumption among Hispanic women of reproductive age in the U.S.A. The first intervention was a bilingual voluntary public service announcement campaign highlighting the importance of taking F.A. before becoming pregnant, where media sources were not paid. The second comprised a paid mass media campaign on television and radio, training for healthcare professionals, and education sessions for women in the community. Details of sampling strategy are limited but it appears that non-random sampling was used. The paid campaign resulted in significant increases in F.A. awareness, knowledge and daily supplement use compared to the unpaid campaign. Perhaps paid personnel with experience in this area had greater expertise. Mass media appeared to have the advantage of reaching large numbers of women. However, the campaigns each lasted only four to six months, and long-term effects on awareness, knowledge and use were not assessed.

In a systematic review of interventions to improve awareness, knowledge and use of F.A. Chivu et al. (2008) found that all outcomes increased after intervention. On average, awareness improved from 60% to 72%, while knowledge increased from 22% to 49%. F.A. use was particularly low in this review – it increased from only 14% to 23%. Interventions to improve the knowledge of health professionals regarding F.A. were also found to be effective. There were many differences in the nature and content of interventions, and the authors noted weaknesses in methodology in many of the studies. The authors concluded that though interventions can improve F.A. use by women, overall rates of F.A.
consumption in pregnancy are inadequate, suggesting that the gaps between awareness and knowledge may relate to determinants of behavioural change.

A randomised controlled trial involving American women who were not pregnant at baseline showed that a single, 15-minute computerised counselling intervention and free F.A. supplement provision lead to increased knowledge and use of F.A. at six months (Schwarz et al., 2008). Change in knowledge was not associated with age, race, education, income, marital status or parity. Women were recruited at urgent care clinics and were deemed at risk of unplanned pregnancy. This study shows the feasibility of brief, opportunistic counselling on F.A. use in the healthcare setting. However, F.A. use was assessed by self-report and it is unclear if changes in knowledge and use were sustained long-term. In addition, free supplement provision influenced use initially but it is unclear whether women would continue to purchase these themselves in the long-term.

V. Factors affecting awareness, knowledge and use of F.A.

Factors found to have positive associations with awareness or knowledge of F.A. in women of child-bearing age include education (Cleves et al., 2004; Daltveit et al., 2004; Canfield et al., 2006; Robbins et al., 2006), being white and being sexually active (Robbins et al., 2006).

Factors positively associated with F.A. supplement use are increased age (de Jong-van den Berg et al., 2005; Relton et al., 2005; Tam et al., 2005; Petrini et al., 2008), being married
(Cleves et al., 2004), education (Bower et al., 2005; Green-Raleigh et al., 2006; Robbins et al., 2006; Case et al., 2007), being white (Cleves et al., 2004; Canfield et al., 2006; Goldberg et al., 2006; Green-Raleigh et al., 2006; Robbins et al., 2006; Petrini et al., 2008), higher income (Cleves et al., 2004; de Jong-van den Berg et al., 2005), F.A. awareness (de Jong-van den Berg et al., 2005), knowledge of the role of F.A. in N.T.D. prevention (Cleves et al., 2004; Conlin et al., 2006; Goldberg et al., 2006; Case et al., 2007), planned pregnancy and consulting a health professional prior to pregnancy (de Jong-van den Berg et al., 2005) and not being obese (Case et al., 2007). In addition, Goldberg et al. (2006) reported that predictors for F.A. use varied according to body mass index. However, in this study, body mass index was calculated using self-reported data.

Characteristics associated with low periconceptional F.A. use include unplanned pregnancy (Ray et al., 2004; Tam et al., 2005; Carmichael et al., 2006), multiparity (Carmichael et al., 2006; Watson et al., 2006), lower education, immigrant status, young maternal age and lack of a partner (Ray et al., 2004). With regard to supplement timing, lack of early F.A. use (i.e. prior to four weeks gestation) was associated with lower socioeconomic status (Relton et al., 2005) and lower education (Carmichael et al., 2006).

Van Eijsden et al. (2006) found that periconceptional F.A. use in the Netherlands varied significantly by ethnic group. Education level was a predictor of knowledge regarding F.A. in pregnancy, and knowledge was positively associated with F.A. use. One study found no relationship between pregnancy intention and F.A. use in younger non-pregnant women (Hilton, 2007). Another study demonstrated a significant positive association between use
of F.A. in a previous pregnancy and correct use of supplements in the current pregnancy (de Walle and de Jong-van den Berg, 2008). Cleves et al. (2004) found that 77% of women who reported not taking F.A. in the past month also said they had no intention to start supplements in the next six months.

These studies point to socioeconomic differences in F.A. supplement use, which may help to explain the finding by Wasserman et al. (1998) that lower socioeconomic status is associated with an increased risk of N.T.D.-affected pregnancy. However, not all correlations in these studies achieved statistical significance, and the possibility of selection bias in some studies was alluded to previously. Larger studies of superior methodology are required to validate these findings.

As part of formative research to inform the development of a educational campaign, Prue et al. (2008) conducted qualitative research into barriers to F.A. use using focus groups with 132 U.S. Latina mothers aged 26-35 years. Reported motivators for multivitamin use were perceived physical or emotional benefits, personal recommendation, routine, and placement of the product to act as a reminder for use. Vitamin use was usually referred to by women as an action carried out during pregnancy rather than prior to pregnancy. Similar barriers to multivitamin consumption were cited by both users and non-users of F.A. These included fear of weight gain, odour, tablet size, flavour, forgetfulness, lack of time, lack of routine, cost, and lack of information. F.A. awareness existed among some but misconceptions were also apparent, such as that F.A. was required only by women already pregnant. Finally, a strong theme to emerge was the belief held by some women that F.A. wasn’t required for
future pregnancies since they already had a healthy baby without taking F.A. However, findings from qualitative studies have limited generalisability (Denscombe, 2003). Such research findings could be further explored in larger samples using quantitative methodology.

The survey by Petrini et al. (2008) explored reasons why women failed to use F.A. Reasons given were “forgetting” (33%); “no need” (18%); “no reason” (14%); and “already get balanced nutrition” (12%). However, as mentioned previously, the low response rate is a limitation of the study. Also, data on reasons for use/ non-use of F.A. were self-reported which may further limit the validity of such findings.

VI. Conclusion

In conclusion, the recent research evidence relating to F.A. awareness, knowledge and use among women in Europe, North America, Australia and New Zealand has been critically analysed. Few U.K. studies were identified in the literature search. It is possible that the findings of studies conducted elsewhere may not be wholly relevant to the U.K. population, given the variations in current health policy, health promotion priorities, rates of unplanned pregnancies and rates of health inequalities that exist between countries. In addition, there is a dearth of information relating specifically to F.A. use in Wales.

Rates of awareness and knowledge among women range from low to moderate. The rate of F.A. use rarely exceeds 50% of the population. F.A. use is higher among pregnant women.
A significant proportion of women who take supplements start them too late to help prevent N.T.D. Health promotion campaigns aimed at improving compliance with F.A. supplementation have had limited success. It seems that not all healthcare professionals are routinely recommending F.A. use to women of reproductive age.

Differences in methodologies and target populations make it difficult to compare findings between studies. The main concerns regarding the research reviewed relate to the frequent use of non-probability sampling, the lack of valid and reliable data collection instruments, and the heterogeneity in definitions of awareness, knowledge and use of F.A.

Further research is required to address gaps in knowledge on this topic. For example, larger studies of superior design are required to explore awareness, knowledge and use of F.A. among women in the U.K. and specifically in Wales. In addition, we do not fully understand the barriers to F.A. use, and the factors which motivate women to take supplements appropriately. Validated data collection tools for the purpose of assessing knowledge of F.A. in different target groups should be designed. Larger and better quality randomised controlled trials investigating the effectiveness of interventions to improve compliance with F.A. supplementation are also required.

Qualitative research may help to explain why knowledge of F.A. does not necessarily lead to use, and why health promotion campaigns aimed at improving compliance with recommendations for periconceptional F.A. use appear to have had limited effectiveness. We also need to understand why rates of F.A. use vary so much between countries, as
findings could help to inform practice. Finally, the cost-effectiveness of health promotion campaigns and interventions to improve F.A. use should be assessed.

**VII. Rationale for the study**

There are several reasons for my choice of research topic. Firstly the issue of F.A. for N.T.D prevention is very topical, as the Food Standards Agency is currently reconsidering the introduction of mandatory F.A. fortification. In addition, the issue of N.T.D. constitutes an important public health problem, and which in many cases is preventable. Also, given the high incidence of N.T.D. in the U.K., it is clear that current health promotion efforts to encourage F.A. use among women remain inadequate. Furthermore, the topic of F.A. use is very relevant to the researcher’s current professional practice as a Dietitian in the health service.

This study is also indicated because there is a dearth of research on this topic in the Welsh population. In addition, to date the vast majority of published research on this topic comprises quantitative descriptive research. Thus the proposed research study aims to provide preliminary and novel data to help fill the gap in knowledge regarding beliefs of women of reproductive age in a Welsh sample on F.A. for N.T.D. prevention.
METHODS

The aim of the study was to obtain qualitative data regarding the views of women of reproductive age on the topic of F.A. and N.T.D. prevention.

I. Research questions

- How do female nursing students perceive the use of F.A. supplements for the prevention of neural tube defects?
- What factors would/do influence their use of F.A. supplements?

II. Research design

There are two main types of research strategy – quantitative and qualitative (Bryman, 2008). Research design is the framework for the collection and analysis of data (Bryman, 2008). Qualitative research takes an inductive approach, with emphasis on the generation of theory, and the ways that people interpret their society (Bryman, 2008). Proposed advantages of qualitative research design include the potential to generate in-depth descriptions and data which are considered to be ‘grounded’ in reality (Denscombe, 2003). Equally, there are potential disadvantages of this approach, such as limited generalisability of findings, and the subjectivity of the data analysis process (Denscombe, 2003).

For the current research study, the interest is in obtaining in-depth, contextual and rich
insight into the phenomenon under study. Hence qualitative methodology has been chosen as it represents the most appropriate design to achieve this and to investigate peoples’ perceptions and gain insight from the perspective of the individual.

There are several common approaches in qualitative research design, for example case study design, ethnography and grounded theory. Case studies involve collection of detailed information on a single or limited number of cases (Punch, 2005). In ethnography, the researcher observes and involves himself/herself in the social life of the study participants (Bryman, 2008). Grounded theory aims to develop theory from research data rather than to impose theory on research (Sarantakos, 2005). It involves purposive sampling to gather data until theoretical saturation is achieved, with data collection and analysis occurring together (Sarantakos, 2005). The design of the current study does not match any one of these approaches, but rather takes a broad qualitative approach.

As discussed previously, most research on F.A. supplementation is of quantitative design, and the literature review identified a dearth of qualitative research on this topic. The data derived from the quantitative research may not present the full picture and does not provide information from the individual’s perspective. Instead, factors affecting F.A. supplement use have been identified in correlation surveys. It is possible for example that there may be motivators and barriers to F.A. use beyond those identified in correlation surveys, which are more appropriately studied using a qualitative research design.

Another reason for the choice of qualitative study design is that the focus of the research
questions is broad and non-specific. Also, a qualitative design may be more in keeping with the values of feminist research (Bryman, 2008). Practical considerations, such as resources available and skills of the researcher can also influence decisions to use qualitative methodology (Silverman, 2005), as occurred in this study. A final reason is that qualitative interviewing will allow participants to be involved more in the study and to ask questions, which may allow for greater learning about F.A. for participants.

This is a cross-sectional study. Cross-sectional studies involve the collection of data on more than one case at a single point of time (Bryman, 2008). The study is considered descriptive in nature rather than exploratory, since some knowledge and theory pertaining to F.A. use does exist, but the issues affecting F.A use are not fully understood. Also, some descriptive data regarding F.A. use and knowledge will be collected in this study.

III. Sampling and access

In the literature on F.A. supplementation, the broader population of interest is women. For this study, the population targeted was female nursing students from Swansea University. This population includes women who could become pregnant and who are therefore a target group for health education regarding F.A. supplementation. At the same time, this population group includes future health professionals who may later be involved in education of women around F.A. and N.T.D. prevention. Therefore, their perceptions of F.A. supplementation will be informative on both accounts. The population under study may include women who are not of reproductive age, however their views are also relevant
to the discussion of supplement use. For example, they may have previous experience of pregnancy and supplement use, or their beliefs may influence the views of other women of reproductive age.

Sampling allows the researcher to study a smaller group of the target population (Sarantakos, 2005). Qualitative research commonly employs non-probability sampling (Sarantakos, 2005). Since the focus is often exploring meaning in depth, rather than making inferences about the target population, qualitative research rarely uses probability sampling (Punch, 2005). The sampling method chosen for the proposed study was non-probability, convenience sampling. A convenience sample is one that is chosen because it is accessible to the researcher (Bryman, 2008). The choice of sampling strategy was based on time and budget constraints of the study, and was deemed appropriate given that the research focus is to develop theory on this topic, rather than to make generalisations. In addition, qualitative samples tend to be small for practical reasons (Mason, 2002) – interviewing and subsequent transcription of interviews are time consuming, and qualitative interviewing generates large amounts of data for analysis.

Recruitment took place in June 2009. Contact was made with the programme manager for pre-registration nursing at the School of Health Science by email (Appendix II), and permission was obtained to access nursing students on campus prior to a lecture. The researcher contacted the relevant lecturer to obtain permission to visit a class. Information about the study was given to potential participants verbally by the researcher and each student was given a written information leaflet about the study (Appendix III). Time was
allocated for the students to ask questions. Students were also offered extra time to consider their involvement in the research study, and to contact the researcher by email/telephone within two weeks of receiving information about the study in order to volunteer to participate, though no students contacted the researcher to volunteer after the initial class visit. Seven students volunteered on the day to participate and were recruited. However one student later dropped out, leaving a final sample size of six. The researcher observed some difficulty in recruiting volunteers. This may have been due to time constraints by students, the inconvenience of staying on campus after completion of lectures or perhaps reluctance to discuss the subject matter. There is a lack of consensus in minimum sample sizes for qualitative research (Bryman, 2008). A sample size of six was deemed adequate to answer the research questions and to achieve meaningful comparisons on the topic – criteria which Mason (2002) suggest should inform decisions regarding sample size. No subjects withdrew from the study. If this had occurred, data from these participants would have been excluded from the study.

IV. Data collection

Data collection was conducted in June 2009. The data collection method employed was face-to-face qualitative interviewing. The interview is one of the most commonly used methods in qualitative research (Bryman, 2008), and allows the researcher to explore perceptions and meanings (Punch, 2005). Mason (2002) suggests that qualitative interviewing methodology may be chosen to achieve depth and roundedness of understanding, as is the case in the proposed study. Other advantages of interviewing
include flexibility and good response rates (Denscombe, 2003). Interviews were also suited to the time and budget resources of the study, and to the research skills of the investigator. Other qualitative data collection methods, such as observation methods or document analysis, could not generate the data required for this study, since the research questions relate to what Ayer (1956) cited in Gomm (2004) termed ‘incorrigibles’ i.e. beliefs, attitudes and opinions, which cannot be studied first hand and are investigated by asking people questions. Also, as Gomm (2004) highlights, the typical reason for relying on informant feedback is the absence of available independent sources.

Semi-structured and unstructured interviews are common interview types in qualitative research (Hopf, 2004). Both formats are appropriate for gaining insight into people’s views and experiences (Arksey and Knight, 1999). Denscombe (2003) suggests that an interview can often fluctuate between the two formats. In this case, semi-structured interviewing was used. Its main advantage over more structured interviewing is that it allows the interviewer significant freedom to digress from the interview schedule in order to probe further when necessary (Berg, 2007).

Because the researcher was interested in the views of individual women and since the research questions were broad, one-to-one interviews were chosen over focus groups to allow freedom to digress more on the topic of F.A. use. The difficulty in transcribing focus group interviews (Bryman, 2008) and the experience and skill required for successful facilitation of focus groups also informed the decision to use individual interviews in this case.
Developing rapport and gaining trust of interviewees is important and several strategies are recommended in this regard (Arksey and Knight, 1999). Some of these were applied in this study, such as providing assurance of confidentiality, offering encouragement through the interview and allowing opportunities to ask questions.

An appropriate interview schedule was developed using the method described by Mason (2002). The initial interview schedule was designed to address the research questions. The schedule was piloted with three women of reproductive age. The pilot phase was useful as it allowed the researcher to gain experience in qualitative interviewing, to become more familiar with the interview schedule, and to revise questions which were ambiguous. Based on the results, questions were reformulated and the order revised in an effort to ensure that questions were clear, comprehensible and sensitive, while still addressing the research questions. The interview schedule (Appendix IV) guided the format of the interview, and in addition prompts were used as necessary throughout the interview to obtain more detailed answers, to clarify responses and to explore emerging ideas in more depth, as recommended in the literature (Arksey and Knight, 1999). Along with tape recording of interviews, field notes on each interview were also recorded. Field notes allow the recording of details of the interview which are not amenable to audio-taping and which can be relevant in the interpretation of interviews – such as the climate, the atmosphere and aspects of non-verbal communication.

Interviews were held on campus in a quiet classroom or office with no distractions at a time convenient to the subject. Immediately prior to the interview, the researcher provided an
introduction, explained the background to the study, obtained permission to tape record interviews and explained the subject’s rights to privacy, confidentiality and to withdraw from the study or refuse to answer any questions. There is little guidance on the duration of qualitative interviews, and the required duration presumably depends on many factors, such as the depth and scope of the interview questions, and practical considerations for participants. Bryman (2008) cites examples of qualitative interviews varying in duration from 20-30 minutes to several hours. In this study, interviews lasted approximately 30 minutes.

Interviews were tape-recorded using a digital recording device, with the permission of participants in each case. Bryman (2008) cites many advantages of recording interviews and recommends prompt transcription following interviewing. Interviews were transcribed by the researcher within the two weeks following the interviews.

V. Validity and reliability

Issues of validity and reliability are pertinent to both qualitative and quantitative research (Denscombe, 2003). However, it has been argued that different criteria should be used to assess validity and reliability in qualitative research than that applied by quantitative researchers (Bryman, 2008).

There are limits to the external validity or transferability of this study due to the use of non-probability sampling and the small sample size. However, this is a common problem in
qualitative research (Bryman, 2008). Greenhalgh and Taylor (1997) argue that validity in qualitative research is improved by the use of a mixture of methods, i.e. triangulation, and by independent analysis of data by another. Triangulation was not considered feasible in this case given the small size of this research study, the time constraints involved and the limited applicability of other qualitative methods e.g. observation, in the study of perceptions and beliefs. In addition, the research was not audited by an external researcher, since this was not deemed appropriate as part of a masters degree dissertation. To support cumulative validation, as defined by Sarantakos (2005), in the following chapter the study findings are compared to results of other research literature on the topic.

Sarantakos (2005) highlights alternative criteria for reliability in qualitative research, such as auditability. The use of respondent validation is recommended as a method of establishing credibility of findings in qualitative research (Bryman, 2008). Full respondent validation – which implies the return of findings to the participants – was not considered feasible or appropriate by the researcher for several reasons. These included time constraints for the study, and also the risk of censorship of findings by participants which some acknowledge as a downside of this process (Bryman, 2008). Denscombe (2003) recommends returning transcripts to the interviewee for them to check accuracy, and Sarantakos (2005) includes this approach as a form of communicative validation. To enhance rigour, each participant was contacted by email with a copy of their interview transcript and invited to check this for accuracy, and no objections to the accuracy of the transcripts were received from participants.
Bryman (2008) advocates that researchers should be aware of and reflective about the implications of their own values and biases on how they interpret and construct knowledge in social research. The potential effect of the interviewer on the responses of the participant should be acknowledged by the researcher (Denscombe, 2003). For the purpose of reflexivity and transparency, the researcher acknowledges her background and opinions on this topic. The researcher is a dietitian and is involved in health education regarding F.A. The researcher supports F.A. supplementation and fortification of foods with F.A. as public health policies for the prevention of N.T.D. In addition, the research methodology has been clearly described in this chapter for the purposes of transparency and to allow methods to be scrutinised and replicated.

VI. Data analysis

Many critics suggest that data analysis begins with the process of transcribing interviews (Denscombe, 2003; Bryman, 2008). The researcher conducted the transcription - rather than using a transcription service - in order to improve familiarity with the data in the initial stage of analysis. It is accepted that there is a degree of subjectivity inherent in the process of transcription, since it inevitably involves decisions when converting speech into text (Arksey and Knight, 1999). Denscombe (2003) suggests that the need to edit and punctuate transcripts to allow the data to be comprehensible is inevitably associated with some risk of loss of accuracy and authenticity. After transcription, transcripts were then checked for accuracy.
Thematic content analysis was used for analysis of the data. Thematic analysis is a common approach to analysis of qualitative data (Bryman, 2008). Gomm (2004) views thematic analysis as a form of content analysis. The main disadvantage of qualitative thematic analysis is its relative subjectivity (Gomm, 2004).

Theme generation in qualitative data analysis can be a priori, i.e. generated from the existing literature on the topic, or inductive, where themes arise from the data itself (Mason, 2002; Gomm, 2004). Thematic analysis applied was based largely on the method described by Ryan and Bernard (2003). Transcripts were read several times, followed by coding. Coding features in most forms of qualitative data analysis (Bryman, 2008). Though considered best practice, Gomm (2004) acknowledges that the coding process in thematic analysis is rarely subjected to independent scrutiny, perhaps due to resource limitations. In this case, coding was conducted solely by the researcher.

Data were sorted using the cutting and sorting technique described by Ryan and Bernard (2003). Further analysis of coded data revealed prominent themes. Cues for themes included repetitions, metaphors, similarities and differences, and missing data (Ryan and Bernard, 2003). The analytical framework was then tested and revised. Computer programmes were not required for data analysis given the small size of this study. The presence of only one researcher meant it was not necessary to consider intercoder reliability during the data analysis process.
VII. Ethical issues

Researchers should anticipate and understand the ethical issues pertinent to any research study (Punch, 2006). Potential ethical issues arising from this study were considered in detail and documented by the researcher as part of the process of applying for ethical approval. Prior to commencement of the study, ethical approval was obtained in April 2009 from the Research Ethics Committee of the School of Health Science, University of Wales, Swansea following the submission of an ethics application form in March 2009 (Appendix V).

Many authors highlight the need for social researchers to consider the following ethical issues: harm to participants, deception, informed consent, and privacy, confidentiality and anonymity (Diener and Crandall, 1978, cited in Bryman, 2008; British Sociological Association, 2002; Sarantakos, 2005). The nature and focus of the study was not expected to cause harm to the participants or to others in the future. Interview questions were carefully planned and piloted informally to ensure they were both appropriate and sensitive. It was considered possible that questions regarding F.A. supplement use and the topic of neural tube defects could contribute to anxiety or concern among women participating in the research. If a participant had become anxious or upset during the interview, the interview would have been stopped and the participant removed from the study in order to limit further harm. The researcher would have stayed with the participant with their permission, and tried to calm and reassure them. Information about the option of self-referral to the University’s student counselling service was available, though this did not
become necessary at any point during the study. The researcher planned to advise subjects to speak to their G.P. or ask for a referral to a Registered Dietitian if they wanted further information regarding F.A., particularly if considering pregnancy. Harm through deception was not considered a risk since this study did not involve covert research, and subjects were provided with detailed information about the study on more than one occasion. All study participants were offered further information regarding F.A. in the form of an information leaflet produced by the Department of Health (Appendix VI).

The principle of informed consent is paramount to most discussions of ethical issues surrounding research, yet there are difficulties in ensuring informed consent (Bryman, 2008). Nevertheless, every effort was made to ensure subjects participating in the study were fully informed. The individual right to autonomy of all subjects was respected at all times. At the recruitment stage, potential participants were advised that their involvement in the study was entirely voluntary. Subjects were provided with a written information leaflet containing details of the proposed study (Appendix III) and were advised to retain this for their own records. This leaflet includes information regarding the nature and purpose of the study, and ethical issues such as informed consent, confidentiality, anonymity and the subject’s right to withdraw from the study at any time. The informed, written consent of all subjects was obtained at the time of recruitment using a standard consent pro-forma (Appendix VII). Subjects were reminded again at the point of data collection of their freedom to withdraw from the study at any stage.

Bryman (2008) warns that provision of informed consent does not remove the subject’s
right to privacy. Research participants were therefore advised prior to the interview of their right to refuse to answer any question, in an effort to minimise any intrusion to the privacy of participants. For the purposes of subject privacy, interviews were conducted in a private office or empty classroom, with little risk of being overheard.

All persons processing personal information in the U.K. are required to comply with the Data Protection Act, 1998 (Bryman, 2008). The confidentiality and anonymity of all subject data collected was preserved, and the subjects were informed of this in writing and verbally. All data collected were used only for the purpose of the proposed study. Interview tapes and subsequent transcripts were stored securely in a locked cupboard. Consent forms were kept in another locked cupboard, separate from the remaining data. Data was coded at all stages of collection to ensure anonymity. In the final research report, data has been anonymised in order to ensure that individuals are not identifiable, i.e. student names/numbers were not included, and any data provided by subjects in the interview which would allow them to be identified was omitted. Interview recordings, field notes and transcripts will be stored securely until the completion of the masters degree programme, at which point they will be destroyed.
FINDINGS AND DISCUSSION

Six female undergraduate nursing students were interviewed in June 2009. Characteristics of interview respondents (RES) one to six are shown below.

<table>
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<tr>
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<th>RES1</th>
<th>RES2</th>
<th>RES3</th>
<th>RES4</th>
<th>RES5</th>
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<td>Yes</td>
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That the sample included women with and without a history of pregnancy was an advantage as it allowed comparison of findings between these groups. The mean age of participants was 27 years. Though not all women were born in Wales, all women were living in Wales and thus may have been exposed to health promotion on the topic of F.A. and N.T.D. prevention, which may have influenced their knowledge on the topic. All women were of reproductive age. All women were in full-time third level education at the time of the study and thus may have a higher education level than the general population.

Data analysis revealed the following themes which will be discussed individually: awareness and knowledge of F.A.; F.A. supplement use; inappropriate timing of F.A. supplement use; advice and information on F.A.; and barriers to F.A. supplement use.
I. Awareness and knowledge of F.A.

All women had heard of either F.A. or folate. Thus awareness of F.A. was common and existed among women both with and without a previous history of pregnancy. There are no recent data on F.A. awareness rates in the U.K., however Irish data is available for comparison, and findings in the current study are similar to those of Ward et al. (2004) who reported that 94% of women were aware of F.A.

The high rate of awareness observed could be considered a promising finding, in that it may perhaps reflect high rates of exposure by women to health promotion messages about F.A. Previous studies have found that health promotion positively influences awareness on this topic (Daltveit et al., 2004; Flores et al., 2007). Promoting awareness of F.A. might be seen as the first step towards improving knowledge on the topic, and theories of individual health behaviour, such as the Health Action Model (Tones, 1979, 1981, cited in Tones and Green, 2004) highlight the importance of knowledge as an influence on behaviour.

However, in this study awareness was self-reported, which is clearly subject to bias. Also, awareness may have been prompted by the information leaflet provided to participants at the recruitment stage or even by the interview process itself. Another possibility is that the findings regarding women’s awareness are skewed due to sampling bias. The women sampled may have higher education levels, and as student nurses they may have greater interest and knowledge about health. This would be consistent with previous research showing that education is positively correlated with F.A. awareness and knowledge (Cleves
Though women were aware of F.A., their knowledge regarding F.A. was limited. Again, this is consistent with existing literature, which shows there is often a discrepancy between rates of awareness and rates of knowledge about F.A. in women of reproductive age (Canfield et al., 2006; Green-Raleigh et al., 2006). Differing definitions of knowledge applied mean comparing rates of knowledge with the existing literature is not meaningful.

Women knew that F.A. is important for a healthy pregnancy. Only some women knew the specific role of F.A. in pregnancy, i.e. for prevention of birth defects. Women’s knowledge of F.A. was largely related to, and in the context of pregnancy. Interestingly, there was little reference by women to a physiological role for F.A. outside of pregnancy, even though this vitamin is essential for all, not just pregnant women. It appeared that knowledge regarding the function of F.A. in general health was limited.

RES1: Only linked to pregnancy I’ve heard about it. So I know a few of my friends have had babies, and they just sort of take it every day - that’s really all I know about it… Isn’t it, it’s to do with to maintain the healthiness of the baby, I think it’s to do with supporting the growth and things like that, with the brain and the organs. I think that’s what it’s to do with.

RES2: I don’t know anything…I knew you should take it if you’re planning on getting pregnant.
RES3: Well I know that it prevents neural tube defects in the first sort of couple of months of pregnancy and it really reduces the risks of spina bifida. That’s probably about all I know…I don’t know what sort of effect it has on the woman’s health. Does it have any sort of reinforcing effect on your health aswell?

RES5: I know it’s to stop birth defects but I don’t know what ones, I don’t know.

If women’s awareness and knowledge of F.A. were viewed as functions of their exposure to health promotion, it is perhaps unsurprising that their knowledge of F.A. pertains largely to its indication in pregnancy, since this is precisely the focus of national health promotion efforts in most countries, where women of reproductive age are the main target group. Alternatively, perhaps the exclusive reference to the role of F.A. in pregnancy relates more to participants being conscious of the focus of this study i.e. F.A. supplements for the prevention of birth defects in pregnancy. It is possible that women felt any discussion regarding the more general role of F.A. in health was not pertinent to the interview.

On the other hand though, it is possible that women’s awareness of the role of F.A. outside of pregnancy is genuinely limited. Women’s knowledge of the wider role of F.A. in health generally has not been well addressed in the research literature, perhaps because in terms of health education to prevent N.T.D., women’s understanding of the wider role of F.A. outside of N.T.D. may not be crucial. However, women’s apparent lack of knowledge of the role of F.A. in health might be significant in relation to overall nutrition, since folate deficiency can have adverse health consequences independent of pregnancy (Thomas,
A lack of understanding of the importance of folate for general health could possibly represent a barrier to achieving adequate dietary folate intake.

Knowledge regarding F.A. was generally greater among participants with a history of pregnancy. This is not surprising, as it would be expected that women would receive advice and information about F.A. preconceptionally/ periconceptionally. Though it is encouraging that pregnant women may be receiving health education about F.A., the timely provision of such advice in relation to the critical window for N.T.D. prevention is essential. Perhaps women at risk of their first pregnancy/ women who have never been pregnant might be a group more in need of advice and information regarding F.A. use than women with a previous pregnancy and maybe such women should be a higher priority for health promotion around F.A.

Women seemed conscious of their lack of knowledge during the interview, and referred to it. Perhaps this reflected a perception that their knowledge should be greater on this topic given their enrolment on a nursing degree. Or it may relate to a feeling that they should be knowledgeable in order to answer interview questions.

RES5: I’m not aware of it as I should be really, doing this course.

Knowledge of food sources of folate/ F.A. was low among women who had never been pregnant. Women with a history of pregnancy were more likely to identify food sources, perhaps because they received or accessed information on this as a result of pregnancy.
Again, women seemed to lack confidence in their knowledge on this topic.

RES1: I don’t know about foods, I know that they take the pills but I’m not sure about food.

RES2: Broccoli, cereals, is it? Is it things that have fibre?

RES6: I’m not sure what contains vitamin B. So to get it from a natural source, I’m not sure how you would get that.

The lack of knowledge on food sources could suggest that health promotion messages regarding food sources of folate are scarce. This would be expected, since national recommendations regarding F.A. prioritise supplementation over food sources. Yet, though health promoters may not value the contribution of diet to F.A. status, this is contrary to the views of most women interviewed, who considered food sources as an important contributor to F.A. intake in the context of N.T.D. prevention. Though some previous studies have assessed dietary intakes of F.A. (Bower et al., 2005), knowledge of food sources of F.A. has not been well documented. Given that F.A. supplements are recommended preconceptionally regardless of dietary folate intake, it is unclear whether good knowledge among women of reproductive age regarding food sources of folate is helpful in the prevention of N.T.D. However, if many women are not using supplements, knowledge of dietary sources may be an area needing greater attention. In addition, with the possible introduction of fortified flour in the U.K., diet may play an increasingly important
role in determining the F.A. status of women of reproductive age. Knowledge regarding food sources may be important in supporting individuals to make the appropriate food choices required to achieve a diet balanced in all nutrients, including F.A.

Furthermore, women’s knowledge of national recommendations regarding F.A. supplementation was very poor. In fact, none of the women interviewed knew the guidelines for F.A. supplementation in women of reproductive age in the U.K. Some assumed that a guideline existed but this again related to use during pregnancy, rather than prophylactic use in non-pregnant women. Similarly, knowledge of the detail of guidelines regarding supplements was poor, such as timing and dosage required. Similar results have been reported by Daltveit et al. (2004). That none of the women were aware of the dose indicated tends to corroborate their reports that they were not taking F.A. supplements.

RES1: Well I know all my friends have all been – well the ones that have been pregnant – have all been told by their doctor – advised – to take it so there must be some sort of thing in place to advise to take it.

An interesting and unexpected finding regarding F.A. knowledge was an apparent confusion by some women between F.A. and iron, and that references to these two nutrients often occurred together. It seemed that women confused the two nutrients or didn’t perceive them as different and distinct nutrients.

RES4: Well, to be honest with you, I didn’t actually have a normal first pregnancy
and I developed iron deficiency anaemia, despite taking folic acid supplements.

RES6: If I was to take a guess I’d think it was mostly iron in it, but I don’t know why … I thought all folic acid was iron.

This finding has not been suggested in any previous studies reviewed. It was also interesting that this view was held by women with a history of pregnancy, who, as alluded to earlier, might be expected to have greater knowledge regarding F.A. than women without children. This tends to support the finding that in-depth knowledge regarding F.A. is generally poor. Though other nutrients and supplements were referred to during interview discussions, no other nutrient was linked to F.A. use in this way. Perhaps women associate these nutrients together because both nutrients are often provided in supplement form during pregnancy, or because both are required for normal haematological function, or since deficiencies of both nutrients can cause anaemia. Or it may reflect access to inappropriate or incorrect information by women.

The confusion is significant because routine iron supplementation is not recommended in any group, which is in contrast with advice regarding F.A. Iron use is associated with side effects and can cause toxicity in high doses. In contrast, as a water soluble vitamin which can be excreted by the body when necessary, F.A. is considered safe enough to be recommended to all women of reproductive age who could get pregnant. Routine supplementation is recommended in this population group without any requirement for medical supervision. If confused about these nutrients, perhaps women could perceive that
supplementation with just one of these nutrients is adequate. Also, it is possible that misconceptions regarding safety and side-effects of F.A. use, if seen as similar to that of iron, could represent a barrier to supplement use among women. Again, this finding is important given that the study participants are training as nurses who are likely to provide health education regarding nutrition in their professional role. However students were in the early stages of their professional training and may not yet have covered nutrition in their course. Greater emphasis on education regarding the nature and function of F.A. and nutrition in general in undergraduate training courses may be needed if such misconceptions are found to be prevalent.

Overall, the limited knowledge regarding F.A. among this sample group was surprising for several reasons. Firstly, most of the women interviewed had children and reported receiving advice about F.A. from healthcare professionals during their pregnancy. In addition, it might be expected that this sample would have greater knowledge because they are student nurses, albeit at an early stage in their training. It is arguably very important that all health professionals have adequate knowledge regarding F.A. to allow them to impart health education to women of reproductive age on this health topic. However, a more concerning suggestion from this preliminary study is that women with less education could have lower levels of awareness and knowledge about F.A. Further research with representative samples of women of reproductive age would be required to investigate this suggestion further.
II. F.A. supplement use

Supplement use outside of pregnancy was rare. None of the women reported currently using F.A. supplements. Women without children had never taken F.A. supplements, despite being sexually active. The lack of generalisability of the study findings notwithstanding, the rate of F.A. use in this sample of women of reproductive age is much lower than that reported in previous quantitative surveys, where use varied from 20-40% (Cleves et al., 2004; Canfield et al., 2006; Green-Raleigh et al., 2006; Robbins et al., 2006; Case et al., 2007; Hilton, 2007; Petrini et al., 2008). Perhaps use is genuinely lower in Wales than elsewhere, or perhaps previous surveys may have included women who were planning a pregnancy and may have thus been more likely to be taking F.A. Also, in surveys from other countries, F.A. supplementation may have been via multivitamin use. However, in the current study, multivitamin use was low also.

Use of F.A. during pregnancy was common among those women who had children. As discussed in the literature review, F.A. supplement use is more common among pregnant women compared to studies involving population samples of women of reproductive age. The high rate of use in the current study is similar to previous U.K. data, where 89% of pregnant women reported F.A use (Relton et al., 2005). F.A. use appeared to relate to receipt of advice from healthcare professionals. On the surface, the high frequency of reported use of F.A. during pregnancy might be a promising sign. However, the timing of F.A. use is critical, and in this study timing of F.A. use emerged as a distinct theme. In addition, the validity of self-reported data on F.A. use could be questioned.
RES3:...Obviously when I was pregnant, I took folic acid and the pregnancy irons as well.

Women with more than one child reported using F.A. in subsequent pregnancies. This is similar to the findings of de Walle and de Jong-van den Berg (2008), who demonstrated a significant positive effect of using F.A. in a previous pregnancy on supplement use in later pregnancies. Perhaps women are more likely to remember to initiate F.A. use when pregnant if they have done this before. In addition, perhaps a previous positive experience of taking a supplement which is well-tolerated and not associated with side-effects may help to promote future use. On the other hand, it could be that subsequent pregnancies are more likely to be planned.

RES3: So then when I was planning my second child, I made sure for the couple of months I was trying to conceive that I was taking the folic aswell…Yeah, because I’d understood more about the vitamin and the consequences of not perhaps taking it then aswell. And that was with my subsequent pregnancies aswell.

RES4: So, the first pregnancy I started taking the folic acid supplement itself, and then prior to my second pregnancy I took pregnacare, which was folic acid and a combination of three or four other vitamins aswell.

Women were not sure of the dose of F.A. used in their pregnancy. This was perhaps unsurprising given the time which may have elapsed since their pregnancy. It is also
conceivable that some women inaccurately reported using F.A. and that this is why they were unsure of the dose. Dose of F.A. supplement used by women for N.T.D. prevention has rarely been assessed in the quantitative research on this topic (Ray et al., 2004). Clearly it is crucial that women who commence supplements are taking the appropriate dose, and thus clarification of dose should be investigated more frequently in future research on this topic.

There are many possible reasons for the low rate of use in this sample. None of the women were known to be pregnant and none reported that they were planning a pregnancy, and this may help to explain the lower rate of use, since planning pregnancy is associated with greater use of F.A. (de Jong-van den Berg et al., 2005).

Awareness/ knowledge may also help to explain the rate of use, and perhaps the low reported rate of use in this study is not surprising given the limited knowledge among women of recommendations for F.A supplement use. The relationship between awareness/ knowledge of F.A. and use is clearly complex. de Jong-van den Berg et al. (2005) found that F.A. awareness is associated with supplement use, yet in the current study awareness did not predict use. As observed in previous studies, although knowledge of F.A. and N.T.D. is associated with greater F.A. use (Cleves et al., 2004; Conlin et al., 2006; Goldberg et al., 2006; Case et al., 2007), it does not necessarily lead to F.A. supplement use. Health behaviour theory may help to explain this observation, as it suggests that multiple factors influence health behaviour decisions and that knowledge is only one such factor. For example, the Health Belief Model (Rosenstock, 1966, 1974, cited in Tones and
Green, 2004) proposes that factors such as perceived susceptibility to and severity of adverse health effects (for example N.T.D.) and the perceived cost of taking action (for example taking F.A. supplements) might influence a particular health behaviour, such as that of F.A. supplement use, even if knowledge on the topic exists.

In addition, it could be that women’s attitudes towards supplement use in general influence their use of F.A. supplements. General supplement use in this sample was low. None of the women reported current use of any vitamin or nutritional supplements, though most women reported previous use. Perhaps F.A. is viewed in the same way as other supplements, and decisions regarding F.A. use are made in the same way as decisions to take multivitamins for example. Previous literature on F.A. use has not considered associations between F.A use and use of other supplements, but it is possible that taking F.A. is more acceptable to women who already take other supplements. Interestingly, F.A. use may also be more critical in non-supplements users, since users of multivitamins containing F.A. may already be at an advantage in terms of F.A. status.

Whatever the reasons for lack of F.A. use, the low rate of use in this sample of women of reproductive age is very concerning. In addition, all of the women with a history of pregnancy had at least one previous unplanned pregnancy. Given the prevalence of both N.T.D. and unplanned pregnancy in Wales, further research in a larger, representative sample is needed to gauge the true rate of preconceptional F.A. use in this population group. If the findings of low F.A. use are replicated in larger studies, this would suggest that current efforts to reduce N.T.D. rates, which consist mainly of health promotion, need
to be reviewed.

III. Inappropriate timing of F.A. supplement use

Even though most women reported taking F.A. supplements during pregnancy, their timing of initiating supplementation was often inappropriate, i.e. supplements were introduced too late. In many cases, women followed advice to take supplements but these were started after the period where neural tube closure is expected to occur. The date that supplements were started related to the timing that the woman learned of their pregnancy and when they received advice about F.A. National guidelines recommend starting supplementation prior to conception in order to ensure adequate stores of the vitamin in advance of the crucial period of neural tube development. Starting F.A. supplements after the closure of the neural tube would not provide protection against N.T.D.

RES4: I would have been, well I would have found out I was pregnant, so about five or six weeks pregnant.

RES6: I was probably about six to eight weeks pregnant. It was a bit less the second time, it was about five weeks when I found out.

Inappropriate timing of F.A. supplement use is a common finding in the literature on F.A. use. Many women in the U.K. start F.A. too late. Relton et al. (2005) found that only half of women took F.A. supplements prior to four weeks gestation, and Brough et al. (2009)
reported that only a third of pregnant women took F.A. supplements prior to neural tube
closure. This is not surprising given that many pregnancies are unplanned and women may
only learn of the pregnancy after the first month of gestation. Qualitative research by Prue
et al. (2008) also showed that vitamin use was usually referred to by women as an action
conducted during pregnancy rather than prior to pregnancy.

Late F.A. use occurred only where pregnancies were unplanned. In cases where
pregnancies were planned, women reported initiating F.A. supplements preconceptionally.
This is consistent with the findings of other research suggesting a correlation between
pregnancy planning and F.A. use (Ray et al., 2004; Tam et al., 2005; Carmichael et al.,
2006).

RES4: … But prior to my second pregnancy, obviously I didn’t want to become
anaemic again, so I made sure that over the year before we started trying for another
baby, that I was taking folic acid and other vitamin supplements…

Though women were familiar with advice to start F.A. when planning a pregnancy,
discussions of the timing of F.A. use during pregnancy suggest a lack of understanding of
the critical time period when F.A. supplementation is effective. There was little awareness
that starting supplements after the sixth week of gestation was ineffective. Other
participants did not recognise that they had initiated supplement use too late, and may thus
have incorrectly perceived that they were protected against N.T.D. They may have
perceived that they had achieved partial compliance with advice on F.A. supplementation in
that they continued to take supplements until the 12th week of pregnancy. It does raise the issue of whether the national guidelines to continue F.A. to week 12, which is well beyond the period of neural tube closure, could be creating confusion or encouraging misconceptions regarding the value of late F.A. use, and also whether such guidance is advocating unnecessary use of F.A. supplements. The message to continue supplements until week 12 seems to have been better understood than the message to start supplements before pregnancy. Maybe public health guidance on F.A. supplements should refer only to the timing when supplements should be started, since perhaps this would be an easier message for women to remember, and there may be no disadvantage in continuing supplements through pregnancy, and once pregnant, women are likely to access maternity services where advice on discontinuing supplements could then be offered.

Based on interview discussions, none of the women were told by their healthcare professional that starting supplements so late in pregnancy was not effective. It is possible that healthcare professionals are not be providing accurate advice to women regarding the appropriate timing of F.A. use.

In addition, most women stopped taking F.A. supplements after three months. They did not resume these after giving birth, as would be appropriate based on national recommendations for F.A. use. Again, this is unsurprising given the limited awareness of such recommendations.

Thus this study suggests the possibility that women do not value the importance of starting
F.A. prior to getting pregnant because of a lack of understanding regarding the critical timing at which F.A. is needed for N.T.D. In addition, reducing the rates of unplanned pregnancy might be an appropriate strategy for reducing N.T.D. rates, since women are more likely to take F.A. when a pregnancy is planned. Given the problems with timing discussed, it is critical that future studies examining F.A. use by women collect data regarding the timing of supplement use.

IV. Advice and information on F.A.

Receiving advice on F.A. use outside of pregnancy was uncommon among women of reproductive age. Women without a history of pregnancy did not recall ever receiving advice or information around F.A. use or about the national recommendations for women of reproductive age. In contrast, most women with a history of pregnancy had received advice from healthcare professionals about F.A. supplements. However, for all women their first pregnancy was unplanned and the advice to use F.A. was provided after conception. This is similar to the work of Gjergja et al. (2006), in which most women didn’t have advice on F.A. use in advance of their first pregnancy.

The main sources of advice and information on the topic of F.A. were healthcare professionals, mass media including the internet, and family and friends. This is consistent with previous literature on this topic (Tam et al., 2005; Gjergja et al., 2006; Green-Raleigh et al., 2006; de Walle and de Jong-van den Berg, 2008).
RES2: The internet, books, researching papers... Well, I wouldn't actively go and seek it out, it's just stuff you've come across.

RES4: Internet. To be honest with you, first port of call would probably be Wikipedia. Just because in a nutshell it tells you what it is and what it's for. And then, once I've got a baseline then, a basic understanding, I'd read around that then.

For women with children, the G.P. was the first health professional to have contact with the mother and often provided initial advice on F.A. and a prescription for this. Often a midwife or health visitor provided additional advice afterwards and may have covered general advice on nutrition in pregnancy. Most women seemed satisfied with the amount of advice and information received, but some referred to their desire for further information.

RES4: You go to the G.P. when you first get a positive pregnancy test at home and then the G.P. recommends that you take the folic acid supplement.

RES6: I think the midwife gives you a pack on things that you can eat, things to avoid eating; things to do and what not to do. ... It was only the doctor at the start of pregnancy to confirm it and prescribe, and then follow-on appointments were with the midwife. I don’t think I saw the doctor then.

RES3: I would probably look on the net. But my health visitor’s really proactive, she’s really good if you need any advice or support, she’ll ring round and find out
the best sort of advice for you as well. But I read a lot as well… Journals, yeah, and things like that.

Advice from healthcare professionals was valued and they were viewed as a reliable and trustworthy source of information.

RES6: Well, any health professional I suppose, providing they’re not too indifferent, I think you always seem to take their word because they always work on research-based evidence.

Women who had never been pregnant and had not recalled receiving advice from health professionals said they would go to their doctor or another healthcare professional for information on F.A. supplements and/or on nutrition in general. Their main source of knowledge regarding F.A. to date was pregnant women whom they knew. Where women access information on F.A. could be significant. For example, if they approach health professionals who have poor knowledge of F.A. supplement guidelines, they may not receive appropriate advice. Peer education is used in health promotion. However women’s access to information on F.A. from peers and persons other than healthcare professionals could be a cause for concern if the information accessed is not reliable. Also, the lack of knowledge of guidelines regarding F.A. supplements by the women in this study suggests the possibility that they themselves may not be the best source of information for new mothers or women of reproductive age in advance of pregnancy. It is clearly not possible to control how women of reproductive age receive advice on F.A., but arguably effective
health promotion and health education interventions, and timely access by women to reliable information on F.A. could help to combat misinformation.

Similar sources were mentioned by women when discussing sources of information on nutrition in general.

RES3: I’ve gone online, I’ve read journals, I’ve taken advice from professionals. Well really I think it came from my mother and my grandmother… taught me about the importance of eating healthily and I was always brought up on a good, solid diet really.

RES6: My first port of call would be my doctor and then I’d ask for a referral to a nutritionist or a dietitian or someone like that. Hopefully then they’d refer me on.

Information and explanation was highly valued by women. Some women referred to their desire for more information about F.A., i.e. this was a felt need of some women. Information was viewed by women as a factor which would motivate F.A. supplement use. Conversely, lack of information about F.A. was perceived by women as a barrier to F.A. use. The view among these women that knowledge is an important determinant of health action is supported by health behaviour theory such as the Health Belief Model, as mentioned previously. Perhaps their belief in the effectiveness of health education relates to their involvement in healthcare through their nursing training.
RES2: …Education and reasons why they should be taking them. We’re told to do things, aren’t we and not get explained why we should do them, like they never, ever explained about folic acid, why we need (it), the reason, what it does to you.

RES4: Information, yes definitely. More information, a lot more information, because a leaflet saying ‘why should I take folic acid?’ Well, to help prevent any birth defects. You think ‘oh right’. And ok, a lot of women will just look at that and say ‘oh yeah’ – as I said earlier – ‘I don’t want my child to have defects’, that’s it. But then there’s people that are more hungry for information, like myself, that want to know what defects, why and what does the body…, why does the body need this, and what will it do?

It is a positive sign that women say they would approach healthcare professionals for advice on F.A. and nutrition, since knowledge of the role of F.A. in N.T.D. prevention and consultation with a healthcare professional prior to conception have both been shown to positively influence F.A. supplement use (Cleves et al., 2004; de Jong-van den Berg et al., 2005; Conlin et al., 2006; Goldberg et al., 2006; Case et al., 2007). These studies demonstrate that healthcare professionals can have an important role in the management of this public health problem. The public health role of healthcare professionals is also clearly valued by women, and this is promising given the widespread access to alternative sources of information which may not be accurate. However, if women are relying on healthcare professionals for advice on F.A. and nutrition in general, it is imperative that they are receiving appropriate and accurate advice from these sources. Also, receiving advice at any
point in pregnancy may not be adequate. Many women received advice on F.A. supplementation too late to reduce the risk of N.T.D., which highlights the importance of preconceptional counselling. Therefore, it is imperative that opportunistic advice on prophylactic use is offered routinely to women of reproductive age. For example, this could be offered as part of counselling regarding contraception and family planning, or incorporated into the school curriculum.

In this preliminary study, it appears that opportunistic counselling on prophylactic F.A. use for women of reproductive age is not common. Findings are similar to previous research by Helinski et al. (2004) who found that although healthcare professionals were knowledgeable on the topic, many were not providing regular preconceptional counselling on F.A. supplementation. It is likely that all women interviewed had previous contact with a primary care health professional, though the amount of contact and which professionals they saw was not investigated. It is possible that some healthcare professionals are more likely to provide advice regarding F.A., as observed by Helinski et al. (2004). The lack of counselling by healthcare professionals is surprising given that many women referred to their use of contraception, and would have attended their G.P. or family planning clinic to obtain this. In addition, given the high prevalence of unplanned pregnancy and the prevalence of N.T.D., it is disappointing and concerning that advising practices by healthcare staff around F.A. use do not appear favourable. It is possible that lack of advice from healthcare professionals may be a barrier to F.A. use and compliance with national recommendations on F.A. use in women of reproductive age. Possible reasons for lack of provision of advice on F.A use by health professionals could include lack of policy/
guidelines encouraging health education, lack of knowledge, low awareness of the problem of N.T.D., or lack of time/resources. On the other hand, it is possible that women had received advice in the past but had not recalled this or had not followed the advice, or that the approach taken during any counselling offered by healthcare professionals was not effective. Further descriptive and explanatory research could help to determine current advising and prescribing practices of healthcare professionals in the U.K. around F.A., and whether this is effective in promoting F.A. use.

V. Barriers to F.A. supplement use

Several barriers to the use of F.A. supplements by women of reproductive age were suggested in this preliminary study.

i) Pregnancy risk not personally relevant

One barrier to F.A. use was that pregnancy risk was not seen as personally relevant. Women were not planning pregnancy and did not see themselves at risk of becoming pregnant. In one case, this was because of sterilisation. In most other cases, women perceived this because they were using contraception. Contraception use was generally associated with the perception that there was no need for concomitant F.A. use. This view was held even by women with a history of unplanned pregnancy.
RES1: I’m on the contraception injection so I mean… I don’t see the point of doing that then.

RES2: No, because I’m not going to get pregnant.

RES5: Any chance that I’m going to get pregnant? No, because I’ve got the rod in my arm.

These findings are similar to those of previous research studies. Petrini et al. (2008) found that many women felt there was no need for them to take F.A. Presumably this was linked to women’s perceived pregnancy risk or pregnancy intention. Robbins et al. (2005) reported that not planning pregnancy was the most common reason given by women for not using F.A. supplements. The national recommendations for F.A. use do not provide clarity regarding this issue, but presumably all women who are sexually active should take F.A., given the potential risk of pregnancy, however small. Perhaps women may not feel that the cost of using a nutritional supplement on a daily basis is justified given the perceived low risk.

Again, the findings might be explained using the Health Belief Model, which suggests that perceived susceptibility to a health risk (in this case pregnancy which could in turn be affected by N.T.D.) can influence health behaviour (i.e. F.A. supplement use). The findings are significant because they suggest that women might underestimate their chance of having an unplanned pregnancy, and that women do not realise the high incidence of
unplanned pregnancies. This could help to explain why women do not value the prophylactic use of F.A. by women of reproductive age. Greater education about the risk of unplanned pregnancy may be required.

It is not clear whether healthcare professionals who provide counselling regarding contraception also advise concomitant F.A. supplementation. Perhaps provision of such advice would be beneficial in promoting intake in sexually active women of reproductive age. In addition, perhaps manufacturers of contraception could have a role to play in providing information to women on this topic as part of their product information. Providers of emergency contraception could also offer women advice to take F.A. supplements, at least until pregnancy is ruled out.

**ii) Diet perceived as adequate folate source**

There was a common perception by women that nutritional supplements are not generally indicated if the diet is balanced. Diet alone was considered an adequate source of nutrients including F.A. A balanced diet was valued. Both women with and without children viewed diet in this way.

RES3: But I just would get mine really from my cereals. As long as I was eating something like that in the mornings and evenings I’d be fine probably.

RES4: Well, I don’t think - as long as you’ve got a healthy balanced diet and you
eat enough fruit and vegetables and drink plenty of water, and everything’s balanced – I don’t think there’s actually any requirement to take them, any sort of supplements. And I don’t think it’s needed really, because your body – we’re – built to function the way we do. And there’s been plenty of research into healthy eating and I don’t think supplements are needed really, generally.

Petrini et al. (2008) reported similar findings. It is understandable for women to perceive that diet alone would be adequate to meet nutritional needs – national nutrition guidelines do not currently recommend supplement use routinely among adults for any other nutrient apart from F.A. Perhaps nutrition health promoters are encouraging the idea that in general, nutritional supplements are not indicated if diet is balanced. Maybe the very idea that all women need to take commercially manufactured tablets on top of a healthy diet to reduce the chance of adverse effects in a process as natural as pregnancy might seem improbable to many.

However, this is a worrying finding for several reasons. Firstly, in the case of F.A., it clearly contrasts starkly with national recommendations for N.T.D. prevention, which advise preconceptional supplementation in all cases, again suggesting poor knowledge of these guidelines by women. Secondly, as discussed previously, the recommended preconceptional F.A. intake is actually greater than the R.N.I. for folate. Nutrition surveys show that mean folate intakes for women are 251 micrograms (Henderson et al., 2003), which is significantly less than the 400 micrograms required, and clearly some women will have intakes below the mean and may be at greater risk. Diet alone is not deemed sufficient
to provide 400 micrograms of F.A., hence supplements are recommended. Finally, Brough et al. (2009) has shown that folate deficiency is prevalent among pregnant women.

Similar to the findings reported by Watson et al. (2006), in some cases women made an effort to increase dietary folate intake periconceptionally. Perhaps women felt that this strategy would help to ensure adequate dietary intake of folate and that it somehow lessened their need for supplements. However, given that knowledge of food sources of folate may be poor, this strategy appears unlikely to be sufficient. In any case, F.A. supplements are still recommended even if a woman increases her dietary intake.

Women did refer to some instances when micronutrient supplementation might be necessary, such as if a deficiency existed or for certain population groups. It was seen as acceptable to take supplements in certain circumstances. Interestingly, women did not spontaneously cite pregnancy or pregnancy planning as an indication for taking supplements.

RES3: Well I think it’s obviously better to get everything you need from your diet but for some people it’s just not possible really, and perhaps some people have food intolerances that they can’t sort of take certain foods and they miss out then on their vitamins. I think they’re ok but I think they should be used in conjunction with a good diet where possible really.

RES6: Well, I think if you’re getting it from your food and things like that, you
don’t need to take it, then don’t. But I think if you’re lacking in something, like if you’re tired and things like that all the time and you need a boost of vitamins and things, then take them.

However, women’s views that supplements are unnecessary did sometimes contrast directly with their behaviour in this regard. Several women reported having initiated nutritional supplements in the past, perhaps without evidence of nutritional deficiency. Also, it appears that the perception that diet can provide enough F.A. did not actually deter any women from using F.A. supplements during pregnancy. However, it is possible that it could influence their decision to take F.A. prophylactically.

*** Safety and efficacy concerns

Another possible barrier to F.A. supplement use emerged in this study, namely the perception by women that nutrients in supplement form are somehow less effective and possibly less safe than dietary sources. Nutrients obtained from food were perceived as different and inferior to those from supplements. Obtaining nutrients from dietary sources was seen as preferable as these are natural. Nutrients derived from food were perceived as more effective. The women valued evidence of effectiveness in relation to supplement use.

RES2: …I don’t know mind, I haven’t really looked into it - but I don’t think they work in the same way with your body, in your body.
RES4: Well I think, obviously vitamins and minerals from food are much better for you because they’re natural and they’re in their own form...I mean how have they got these vitamins and minerals all packed into one little tablet? And, you never think about that I think. Where were they made and things like that?

RES6: I think that you’re better off getting it from food than a tablet... I guess it appears more pure to have it from food than in a tablet form.

Such findings have not been documented in previous research. It is very important that health promoters are aware of any such perceptions and any barriers to a particular health behaviour so that efforts can be taken to combat these in future health promotion campaigns. Unfortunately in the case of F.A., the view that supplements are less effective than the dietary form is a misconception.

Some women expressed concern over the safety of supplement use and possible harm to the health of the baby. It appeared that nutritional supplements were considered to have possible side-effects and risks in pregnancy just as any medicine, and that women wanted to be informed of these. Women valued information about risks and side-effects of treatments in general, but pregnancy was highlighted as particularly important time given that the health of the unborn could be affected.

RES4: Yes, yes, because it just says you’re advised to take this to help prevent birth defects and most mums-to-be or mothers would think ’oh my god, I don’t want my
child to have a defect’ and would automatically think ‘right, I’m going to take this’. Whereas I think well, what are the side-effects? Because with my iron tablets, there’s constipation and things like that. And that can come into it with folic acid aswell, can’t it?

RES5: If it’s good for the baby, and it’s good for the mother, I think it’s fine, as long as there’s research done that it doesn’t affect them in any other way…Well, anything with tablets, anybody can react to anything really, can’t they? … Well if you go to the doctors and they say ‘take this, take that’ – advisory – then obviously they should tell them why and what it does and … any side-effects. You need to know everything that you’re taking really, don’t you? … It’s important all the time but when you’re pregnant, you know, it’s a lot – looking after you and a little one.

This preliminary study suggests that the message that F.A. supplements are both safe and effective does not appear to be widely understood by women. It is perhaps not surprising that women would have concerns about taking any tablet during pregnancy, including F.A. which is a prescribable product (although also readily available over the counter). After all, pregnancy is a time when many medications are contraindicated due to concerns over safety of the unborn, and nursing students may even be more conscious of this as a result of their nursing training. Indeed, some nutritional supplements are also contraindicated in pregnancy, for example vitamin A, as high doses can be harmful to the foetus (Thomas, 2007). Women may have received advice to be cautious with nutritional supplements, and it is possible that this could create confusion about safety for other vitamin supplements.
Ironically, in the case of F.A., it is omission of supplements which increases the risk to the foetus. Perhaps health promotion campaigns on F.A. need to put greater emphasis on reassuring women about the safety of F.A. supplement use.

Again, though safety and efficacy concerns emerged as a potential barrier to F.A. supplement use, these fears did not appear to deter women from taking F.A. when pregnant and on the advice of a health professional. It is possible though that these concerns could deter women from prophylactic F.A. use.
STRENGTHS AND LIMITATIONS

There are several strengths to this research study. Firstly, it has addressed an important public health issue. N.T.D. remain a significant problem in the U.K., despite public health efforts to date. Also, this study is valuable as it provides preliminary data from a Welsh sample. This study is also unique in that it provides qualitative data on the issue of F.A.

This study also provided an opportunity for health education and discussion regarding F.A. for participants. Participants were given verbal and written information, which may positively influence knowledge and/or use of F.A. Discussion was generated on this topic and some women also asked questions, suggesting they were interested in further information. Given that N.T.D. represent a significant public health problem and in view of the low knowledge commonly reported on this topic, it could be argued that any efforts at education on F.A., however small, are a positive step.

However, there are inevitably limitations to this study. A principal limitation was the use of non-probability sampling. As a result, the research findings reported cannot be generalised outside the study sample. This study would need to be replicated with a larger, representative sample. However, in this case the study focus was the further development of theory on a topic which to date has many research gaps, rather than to produce generalisable findings. Also, probability sampling is rarely employed in interview-based qualitative research (Bryman, 2008).
In addition, the sample size employed was small. There were unanticipated difficulties in recruiting volunteers to participate in interviews. Focus groups may have facilitated the recruitment of a greater number of participants. However, sample sizes in qualitative research are generally smaller than in quantitative studies, as the emphasis is on detail rather than scope (Silverman, 2005). Also, Bryman (2008) suggests that there is a lack of consensus in minimum sample sizes for qualitative research.

Atkinson et al. (2003) assert that a problem inherent in qualitative research is the difficulty in evaluating whether accounts provided by respondents in a research context are truthful. Participant information may be subject to bias and inaccuracies. The data obtained from participants regarding retrospective F.A. use may be subject to recall bias, though this is a common weakness in the literature on F.A. use, and few prospective studies on this are available. It is also possible that participant responses were influenced by the presence of the interviewer. However, this is arguably a risk with all interview-based research. In this study, the researcher demonstrated knowledge in the topic area, for example by answering questions or explaining F.A. recommendations. Arksey and Knight (1999) suggest that this approach may help to deter interviewees from providing misleading accounts, because of a greater perceived risk of detection.

Triangulation is generally recommended in social research to improve validity (Bryman, 2008). Triangulation was not applied, limiting the validity of the study findings. Respondents were asked to check transcripts for accuracy however. Use of other methods e.g. observation was not appropriate for investigating opinions, as discussed earlier.
N.T.D. are a significant public health problem. Knowledge of the protective effect of periconceptional F.A. supplementation on N.T.D. risk has existed since the 1980’s, yet there is a large body of evidence to show poor compliance with current public health guidelines on periconceptional F.A. use.

A review of recent literature showed low rates of periconceptional F.A. use. Also, many women start F.A. supplements too late in their pregnancy. Use of supplements is greater in women of higher age, income and education, and in those who have some knowledge of F.A. for NT.D. prevention. Interventions to promote F.A. use have had some success and the presence of national health promotion campaigns may also influence supplement use. Much of the existing literature on the topic originates from abroad however, with an obvious dearth of research literature from the U.K., and specifically from Wales. In addition, most research on F.A. supplementation is of quantitative design, and there is a lack of qualitative research articles published on this topic.

This study explored the views of six female nursing students of reproductive age on the topic of F.A. and N.T.D. prevention using a broad qualitative approach. Awareness of F.A. was high in this sample, which is similar to international findings, and women associated F.A. with pregnancy. Yet knowledge regarding the specific role of F.A. in N.T.D prevention and health was limited, and women were not aware of government recommendations for F.A. supplementation. The lack of knowledge about F.A. in this
sample of nursing students needs to be investigated further as it could have implications for the public health role of nurses on this issue. The findings of this study also suggest that women’s lack of knowledge regarding F.A. may relate to a lack of information and advice from healthcare professionals. Yet women value the advice of healthcare professionals, and perhaps their public health role is underutilised.

F.A. use in this sample of women of reproductive age was low. Appropriate F.A. use only occurred when pregnancy was planned. There was poor insight into the critical time period in pregnancy when F.A. supplementation is required. Barriers to F.A. use include low perceived pregnancy risk, safety concerns and misconceptions regarding food as an adequate source of F.A. It is prudent that potential barriers to F.A. use are further explored and that barriers are taken into account in the planning of future health promotion campaigns.

The study provided valuable preliminary data on this important public health topic from a Welsh perspective. However, there are limitations to this study, e.g. the use of non-probability sampling, small sample size, reliance on self-reported data regarding supplement use and lack of triangulation of methods. Since this is a small qualitative study, the findings cannot be generalised to the wider population of Welsh female nursing students.

To conclude, the following recommendations are made:
1. Further qualitative research into barriers and motivators for F.A. use should be carried out using larger, representative samples of women of reproductive age to further explore this area.

2. Large, well-designed quantitative surveys are needed to assess awareness, knowledge and use of F.A. among women of reproductive age in Wales.

3. Health promotion campaigns should highlight the safety of F.A. supplements for all women.

4. The training provided to healthcare professionals and the advising practices of healthcare professionals on the topic of F.A. for N.T.D. prevention should be assessed and improved where necessary.

5. Further research should be conducted to assess the effectiveness of providing health education on F.A. supplementation in family planning services and sexual health clinics.

6. Further research is required to explore effective strategies to reduce inequalities in N.T.D. rates and to improve F.A. use among lower socioeconomic groups.

7. Efforts to reduce the rates of unplanned pregnancy should be increased as this may represent an effective strategy to reduce N.T.D.
References


**APPENDIX I**

**Summary of Literature Search on Folic Acid**

<table>
<thead>
<tr>
<th>Date of search</th>
<th>January – August 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Databases</td>
<td>Medline, Cinahl (via EBSCO host)</td>
</tr>
<tr>
<td>Population group</td>
<td>Healthy women</td>
</tr>
<tr>
<td></td>
<td>Healthcare professionals</td>
</tr>
<tr>
<td>Language</td>
<td>English</td>
</tr>
<tr>
<td>Context</td>
<td>Europe, U.S.A., Canada, America, Australia, New Zealand and systematic reviews published in these countries even if they include research from outside this geographical context</td>
</tr>
<tr>
<td>Timeframe</td>
<td>2004-2009</td>
</tr>
<tr>
<td>Search terms</td>
<td>Knowledge or attitude* or conception* or use or usage or understanding or belief*</td>
</tr>
<tr>
<td></td>
<td>AND</td>
</tr>
<tr>
<td></td>
<td>Folic acid or folate or neural tube defects or NTD or folic acid supplement* or vitamin or dietary supplement*</td>
</tr>
<tr>
<td>Exclusion criteria</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>• Studies published prior to 2004</td>
<td></td>
</tr>
<tr>
<td>• Studies conducted outside the above listed countries</td>
<td></td>
</tr>
<tr>
<td>• Studies which focused on women with epilepsy, or women affected by N.T.D., adverse pregnancy outcomes or gene variations affecting folate metabolism</td>
<td></td>
</tr>
<tr>
<td>• Studies which assess folic acid knowledge and use in older adults or post-menopausal women</td>
<td></td>
</tr>
<tr>
<td>• Studies where the main focus was on food fortification with folic acid or on use of multivitamins or vitamins other than folate/folic acid during pregnancy</td>
<td></td>
</tr>
<tr>
<td>• ‘Grey’ literature</td>
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</tbody>
</table>
Email to School of Nursing

I am writing with regard to obtaining access to a sample of nursing students for research I am conducting towards my dissertation.

I am a final year student in the Masters in Public Health and Health Promotion, University of Wales, Swansea. I am currently conducting my dissertation on the topic of folic acid and neural tube defects. The aim of the study is to explore the views and beliefs of a sample of nursing students towards the use of folic acid supplements for the prevention of neural tube defects.

I have recently received approval from the Ethics Committee of the School of Health Science for the study, and now wish to commence recruitment. Therefore, I am writing to request permission to approach undergraduate nursing students of the University of Wales, Swansea and to invite them to participate. The proposed sample size for the study is approximately 8, and participants will take part in a semi-structured qualitative interview with me on campus.

To recruit, I would propose visiting one or more classes of nursing students after a lecture, briefly discussing the study (approximately 5-10 minutes) and answering questions, offering written information (as attached), and recruiting volunteers. Interviews would then be arranged for a later date.
I would be happy to discuss any queries you may have about the study, and to discuss possible dates for me to visit university students.

Thank you in advance for your help in this matter.

Yours sincerely

Sara Rigney
APPENDIX III

Information sheet for study participants

Views of Nursing Students Regarding Folic Acid

Supplements for the Prevention of Neural Tube Defects

Participant Information

You have been invited to participate in a research study. This information sheet explains the purpose and details of the study - please take time to read this carefully.

Who is conducting the study?

My name is Sara Rigney. I am a student in the Masters in Public Health and Health Promotion, Swansea University. I am conducting this research as part of my Dissertation.

What is the purpose of the study?

It is recommended that women who could become pregnant should be taking folic acid supplements daily in order to help prevent neural tube defects in infants.
However, many women do not follow this advice. I am interested in exploring how women, specifically female nursing students, feel about the idea of taking folic acid supplements. I would like to ask you for your thoughts and opinions on this topic. This will help to provide new information on this topic from a Welsh perspective.

**What happens if I agree to take part?**

First, you will be asked to complete a consent form. Then you will be invited to a short interview on the University campus. The interview will take about 45 minutes. The interview will be arranged at a time and day that suits you, such as on a day when you are already attending the University.

Taking part is voluntary. You are free to refuse to answer any questions, or to withdraw from the study at any time without giving a reason.

**What happens to the information I provide?**

The information you provide will only be used by me. It will be kept secure in line with data protection legislation. In the final research report, you will not be identified.
Questions

If you have any questions, or if you decide after today that you would like to take part, you can contact me by email or by telephone (details supplied).

Thank you
APPENDIX IV

Interview schedule

Age:

Marital status:

Student number:

Email address (for respondent validation):

History of pregnancy: Yes/ No

Occupation:

Nationality:

Education history:

1. Have you taken a multivitamin or any nutritional supplements in the past?

2. What are your views on taking nutritional or dietary supplements in general?

3. How do you think vitamins and minerals in tablet form compare to food?

4. Are there any nutrients, vitamins or minerals which you think are particularly important for women?

5. What are your thoughts on the role of nutrition in pregnancy?

6. Where would you go to for information if you had questions about nutrition or diet?
7. Have you heard of folic acid or folate? If yes:
   - Can you tell me more about this?
   - What do you know about the role of folic acid?
   - What foods do you think might be good sources of folic acid in the diet?

8. Have you heard of neural tube defects such as spina bifida? If yes:
   - Can you tell me more about this?
   - Do you know anybody who has been affected by a neural tube defect?
   - Do you think there are any women that are more at risk of having a neural tube defect-affected pregnancy?

9. Do you take folic acid supplements or a multivitamin containing folic acid?

10. Have you ever taken folic acid supplements/ tablets in the past? If yes, can you tell me more about your reasons for taking these?

11. Have you ever had advice about taking folic acid supplements? If yes, can you tell me more about this?

12. Are you aware of any government advice or national recommendations on taking folic acid supplements? If yes, can you tell me what you have heard about this?

13. Current advice in the U.K. is for all women of reproductive age to take a folic acid
supplement if there is any chance that they could get pregnant. Would you say that you fall into this group?

14. What are your thoughts on this advice that women who could get pregnant should be taking folic acid supplements?

15. Would you see any pros or positives about taking folic acid supplements?

16. Would you see any downsides to taking folic acid supplements?

17. Would you see any barriers to taking folic acid tablets?

18. What might motivate you to take folic acid supplements?

19. Who might encourage you to take folic acid supplements?

20. Are you currently trying to get pregnant/ planning a pregnancy?

21. Do you think you would take folic acid if you were planning a pregnancy?

22. Do you know what dose you might take?
APPENDIX V

Ethics application form

Ysgol Gwyddor Iechyd

School of Health Science

RESEARCH ETHICS COMMITTEE

Application

For Research

Ethics Committee Approval
Title of Project

An exploratory qualitative study of perceptions of folic acid supplementation for the prevention of neural tube defects among female nursing students in Wales.

Name:

Sara Rigney

Email:

sararigney@hotmail.com

If a student please name your course of study:

MSc Public Health and Health Promotion

Sponsorship: (if applicable)
Aims and Objectives:

Aim

The study aims to explore the views, beliefs and perceptions of a sample of Welsh female nursing students regarding the use of folic acid supplements for the prevention of neural tube defects (N.T.D.’s).

Research Questions

- How do female nursing students perceive the use of folic acid supplements for the prevention of neural tube defects?
- What factors would/ do influence their use of folic acid supplements?
- What might improve their use of folic acid supplements?

Background/Justification for Study. Review of Literature

I have developed an interest in this topic through working as a Dietitian. I am currently responsible for delivering health education for women of reproductive age
regarding nutrition and diet, including education around folic acid supplementation. In this role, I have observed a lack of awareness and use of folic acid among this population group, despite the presence of public health guidelines which recommend folic acid supplementation.

Periconceptional folic acid supplementation protects against N.T.D.’s (Lumley et al., 2001). N.T.D.’s (including spina bifida, anencephaly, and encephalocoele) are congenital malformations caused by incomplete closure of the neural tube. N.T.D.’s are a major cause of infant morbidity and mortality, with 969 N.T.D.-affected pregnancies (resulting in 801 terminations) in England and Wales in 2004, and an estimated birth prevalence of 0.3 per 1000 births (Morris and Wald, 2007). Adequate folic acid is needed before and in the early stages of pregnancy, as neural tube closure normally occurs within the first month after conception (Lumley et al., 2001). One of the main difficulties in ensuring folic acid adequacy early in pregnancy is that around half of all pregnancies in the U.K. are unplanned (Scientific Advisory Committee on Nutrition, 2006). Hence, current U.K. government advice for the prevention of neural tube defects is as follows: “All women who could become pregnant are advised to take 400 micrograms a day of folic acid as a medicinal or food supplement prior to conception and until the twelfth week of pregnancy”.

The Health Education Authority launched a campaign in 1996 to encourage individuals to meet recommended intakes of folic acid pre-pregnancy. However, analysis of epidemiological data suggests that the education campaign failed to reduce the rate of N.T.D.-affected pregnancies (Abramsky et al., 1999). The subject of folic acid for N.T.D.
prevention is very topical, as food regulatory authorities in the U.K. are currently considering the issue of folic acid fortification of grain in an effort to reduce N.T.D. rates.

A systematic search of the literature on this topic was conducted in January 2009. A large volume of literature was identified, which tended to focus on the following themes:

- awareness/ knowledge and use of folic acid for NTD prevention
- dietary intake of folic acid
- factors affecting knowledge, awareness and use of folic acid supplements
- effectiveness of interventions aimed at promoting folic acid supplementation
- sources of information regarding folic acid

Because of differences in methodologies used in the various research studies reviewed, it is difficult to compare research findings. Overall, researchers have found that despite quite high levels of awareness of folic acid and its role in N.T.D. prevention, many women are not compliant with national recommendations for periconceptional folic acid supplement use (Bower et al., 2005; Canfield et al., 2006; Conlin et al., 2006; Dobson et al., 2006; Robbins et al., 2006; Case et al., 2007; Hilton, 2007). However, the body of literature reviewed does not provide adequate detail or information to explain why many women do not use folic acid appropriately or at all. Little qualitative research was identified, and no studies relating to nursing students in the U.K. were found. The proposed study will thus provide preliminary exploratory data to help fill the research gap regarding the beliefs of this group around folic acid supplement use.
Compared to quantitative studies, qualitative exploratory research may offer a more in-depth and contextual insight into the experiences and perceptions of women regarding folic acid use. This in turn may help in our understanding of why health promotion initiatives aimed at improving periconceptional folic acid use appear to have had limited effectiveness.

**Research Design/Methods**

**Design**

Bryman (2008) explains that research design is the framework for the collection and analysis of data. Qualitative research takes an inductive approach, with emphasis on the generation of theory, and the ways that people interpret their society (Bryman, 2008). The proposed study will use a cross-sectional qualitative research design to answer the research questions. This is deemed the most appropriate design to study peoples’ perceptions and understandings, and to gain insight from the perspective of the individual.

**Sample**

The population under study are Welsh female nursing students. This population will include women who could become pregnant and who are therefore a target group for health education regarding folic acid supplementation. This population group includes future health professionals who may later be involved in education of women around folic acid
and N.T.D. prevention. Therefore, their perceptions of folic acid supplementation will be informative on both accounts. The population under study may include women who are not of reproductive age, however the researcher believes that their views are also relevant to the discussion of supplement use. For example, they may have previous experience of pregnancy and supplement use which would be informative, or they may influence the views of female relatives of reproductive age.

Sampling allows the researcher to study a smaller group of the target population (Sarantakos, 2005). Qualitative research commonly employs non-probability sampling (Sarantakos, 2005). Since the focus is often exploring meaning in depth, rather than making inferences about the target population, qualitative research rarely uses probability sampling (Punch, 2005). The sampling method chosen for the proposed study is non-probability, convenience sampling. This is deemed appropriate given the time and budget limitations involved, and given that the research aims to explore and develop theory on this topic, rather than to make generalisations. In addition, qualitative samples tend to be small for practical reasons (Mason, 2002). The proposed sample size for this study is approximately 8 people. Recruiting and interviewing this number of participants is considered feasible within the relevant time frame, while still providing sufficient data.

**Access**

The researcher will request the permission of the programme manager for pre-registration nursing at the School of Health Science to access undergraduate nursing students on
campus but outside of teaching time, such as after a lecture. The researcher will explain the study to students. Students will be offered an information leaflet about the study, and names of volunteers will be taken. Should students want more time to consider their involvement in the research study, they can also contact the researcher within two weeks after receiving information about the study in order to volunteer to participate.

Data collection

Data collection will be conducted using questioning during face-to-face qualitative interviewing. The interview is one of the most commonly used methods in qualitative research (Bryman, 2008), and allows the researcher to explore perceptions and meanings (Punch, 2005). Mason (2002) suggests that qualitative interviewing methodology may be chosen to achieve depth and roundedness of understanding, as is the case in the proposed study. Other qualitative data collection methods, such as observation methods or document analysis, could not generate the data required for this study. Interviews are also very feasible given the time and budget resources of the study, and, as a Dietitian, the researcher already has experience in conducting interviews with members of the public.

Semi-structured and unstructured interviews are common interview types in qualitative research (Hopf, 2004). The proposed study will use semi-structured interviewing, since this type allows the interviewer significant freedom to digress from the interview schedule in order to probe further when necessary (Berg, 2007). An appropriate interview schedule will
be developed using the method described by Mason (2002). Care will be taken to ensure questions are clear, comprehensible and sensitive.

Interviews will be tape-recorded, and later transcribed by the researcher only. Interviews will be conducted in the University of Swansea, subject to permission. Interviews will be arranged at a time and location convenient to participants, with advance notice given.

The use of respondent validation is recommended as a method of establishing credibility of findings in qualitative research (Bryman, 2008). The relevant transcript will be returned to each study participant following transcription for the purpose of respondent validation.

**Data analysis**

Analysis of data will begin with the process of transcribing the taped interviews. Data analysis will be conducted using thematic content analysis. Key themes will be identified using techniques described by Ryan and Bernard (2003). Given the small sample size, qualitative data analysis software will not be required.

**Data storage and disposal**

All data collected will be stored in a locked cupboard. Consent forms containing subject names will be kept in another locked cupboard, separate from remaining data. University e-mail addresses of students (rather than names) will be used to identify transcripts so that
these can be returned to respondents for validation. The computer to be used by the researcher for transcription of interview tapes is both password protected and encrypted. All data will be destroyed upon successful completion of the Masters programme.

**Ethical Considerations**

Researchers should anticipate and understand the ethical issues pertinent to their study (Punch, 2006). While preparing the application for ethical approval from the Research Ethics Committee, the researcher has considered in detail any ethical issues which may arise in relation to the proposed study.

The researcher respects the individual right to autonomy of the students approached. At the recruitment stage, potential participants will be advised that involvement in the study is entirely voluntary. Written information about the study will be offered to all subjects invited to participate. The informed, written consent of all subjects will be sought at the time of recruitment and they will be advised that they have freedom to withdraw from the study at any stage.

The researcher considers that the focus of the proposed study is unlikely to cause harm to current participants or others in the future. The researcher will endeavour to ensure that interview questions will be appropriate and sensitive. However, it is possible that questions regarding folic acid supplement use and the topic of neural tube defects could contribute to anxiety or concern among women participating in the research. Participants will be advised in advance of their right to withdraw from the study at any time. If a participant became
anxious or upset during the interview, the interview would be stopped and the participant would be removed from the study in order to limit further harm or anxiety. The researcher would stay with the participant with their permission, and try to calm and reassure them. The participants could be referred to the University’s student counselling service with their consent. The researcher also proposes to advise subjects to speak to their GP or ask for a referral to a Registered Dietitian if they would like further information regarding folic acid, particularly if they are considering pregnancy.

Bryman (2008) advises that provision of informed consent does not remove the subject’s right to privacy. It is possible that some participants may not wish to answer certain questions which they feel address matters deemed to be private. Research participants will be advised prior to the interview that they can refuse to answer any question. In this way, the researcher hopes to minimise any intrusion to the privacy of participants. For the purposes of subject privacy, permission from the University will be sought to conduct interviewing in private in a room on campus.

All persons processing personal information in the U.K. are required to comply with the Data Protection Act, 1998 (Bryman, 2008). The confidentiality and anonymity of all subject data collected will be preserved, and the subjects will be reminded of this in the information leaflet. All data collected will be used only for the purpose of the proposed study. Interview tapes and subsequent transcripts will be stored securely as outlined above. In the final research report and any subsequent publications, the researcher will anonymise data in order to ensure that individuals are not identifiable, i.e. student names will not be
included, and any data provided by subjects in the interview which would allow them to be identified will be omitted from the research report.

Consent

Potential participants will be approached after University lectures, subject to the permission of the School of Nursing. Recruitment can take place on the same day, or at later date if students want more time to read the information leaflet and contemplate their involvement in the study, and possibly to discuss this with others.

At the recruitment stage, information about the study will be given to potential participants in verbal and written form. At this point, and again prior to the interview, study participants will be advised that they have freedom to withdraw from the study at any stage. Once a student volunteers to participate in the study, their informed, written consent will be sought, using the attached form. Participants can keep copies of both the information leaflet and the consent form for their own records.

The information supplied is to the best of my knowledge and belief, accurate.

I confirm I have obtained permission to undertake this study from my Supervisor and the appropriate Programme Manager/Director/Head of Department.

I understand that I may be invited to explain my research proposal to the Committee, either in person or by telephone.
I understand that the School of Health Science Research Ethics Committee gives Ethical Approval only and does not guarantee the quality or scientific validity of my study.

**Signature of Investigator:** Sara Rigney

**Date of Submission:** 18/3/2009
APPENDIX VI.

Department of Health information leaflet for interviewees (Email version of thesis: see attached pdf file)
APPENDIX VII.

Consent pro-forma

Views of Nursing Students Regarding Folic Acid Supplements for the Prevention of Neural Tube Defects

CONSENT FORM

I confirm that I have read and understood the information sheet for this research study, and that I have had the opportunity to ask questions which have been satisfactorily answered.

Yes ☐

I understand that my participation in this study is voluntary and that I can withdraw at any time, without giving a reason.

Yes ☐

I agree to participate in this study.

Yes ☐

_________________________  __________  ______________________
Name of participant                                    Date                 Signature

_________________________  __________  ______________________
Name of researcher                                   Date                  Signature