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The effectiveness of a prenatal education programme for the prevention of congenital toxoplasmosis

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SUMMARY

A 10 min education programme was developed which, if effective in changing the behaviour of pregnant women, would eliminate or greatly reduce the risk of congenital toxoplasmosis. It was taught in 26 randomly selected (case) prenatal classes offered to women early in their pregnancy. The remaining 26 (control) classes received routine class material which did not mention toxoplasmosis. A questionnaire was administered to all women prior to this early class (pre-test) and again after the last prenatal class, held just prior to delivery (post-test). Changes in pet, food and personal hygiene behaviour between the pre- and post-test were determined and a score calculated by adding points for change towards those behaviours recommended in the programme and subtracting points for change in the opposite direction. Cat owners in case classes had a significantly higher score in pet hygiene behaviour than those in control classes ($P < 0{\cdot}05$). No significant difference was found between the food or personal hygiene scores of women in case and control classes, possibly because of low power. However, although behaviours did not differ on the pre-test, women in case classes had significantly better cooking methods for roast beef and hamburger on the post-test ($P < 0{\cdot}05$ and $P < 0{\cdot}01$ respectively). It is concluded that this programme is effective and should be offered to all women in order to reduce congenital toxoplasmosis incidence.

INTRODUCTION

Toxoplasma gondii is a protozoan parasite with worldwide distribution. It completes its sexual reproductive cycle only in the intestinal tract of the domestic cat and other felines which excrete the resultant oocyst. Both oocysts and tissue cysts, found in the flesh of infected vertebrates, are infectious to humans. The infection, called toxoplasmosis, is usually mild or inapparent. However, a woman

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who experiences her first infection during pregnancy may transmit it to her foetus which can be seriously harmed (1, 2). It is estimated that severe damage affects between 70 and 280 newborn infants every year in Canada (2). Estimated rates of maternal infection in the U.S. and Great Britain range from less than one to three infections per 1000 pregnancies (3–7). Detection of infection in the asymptomatic mother and treatment before the foetus is damaged is unlikely if not impossible without a complex and expensive screening programme (2, 8, 9).

Teaching women to avoid infection during pregnancy offers the most practical preventive approach (2, 8, 10). There is little doubt that, if pregnant women followed a few simple guidelines in their pet (cat), food and personal hygiene behaviours, the risk of congenital toxoplasmosis could be greatly reduced or eliminated (11, 12). Ideally, women would be taught these guidelines prior to their first pregnancy. The behaviour change must, however, occur from the time of conception until delivery.

In order to evaluate the potential effectiveness of the educational approach, it was decided to teach appropriate behaviour to women in early pregnancy and evaluate their behaviour change later in the same pregnancy. Publicly funded prenatal classes presented an ideal opportunity to accomplish this, since many local health agencies in Ontario provide a class as early in pregnancy as possible, as well as a series of six weekly classes late in pregnancy.

Very little analytic research has been reported in the literature on the effectiveness of prenatal education classes. Most reports available are not adequately controlled. Using self-selected non-attendees as controls leads to severe bias as these women differ significantly from those choosing to attend prenatal classes (13–15). The design which reduces bias to a minimum is the randomized, controlled trial comparing attendees to non-attendees. This is now impossible in Ontario where provision of prenatal classes to all women who wish to attend is required of all health agencies (16). It is still possible, however, to compare various methods of delivery of prenatal education to randomly selected classes. It is also possible to study the effectiveness of a particular educational programme which may be offered to one randomly selected group of class attendees and not to another, provided the content of the programme is not part of the legally mandated curriculum. Review of the literature identified four adequately controlled trials of this nature (17–20). This was the method chosen for this study.

METHODS

A prenatal educational programme in toxoplasmosis prevention, consisting of a three page handout understandable to a person with 8 years of education (21), a display poster, and resource materials for teachers, was prepared. It was presented in a 1 h workshop to the prenatal class instructors of a mixed urban–rural public health agency in Ontario. This agency offered, at no cost, an early pre-natal class as well as six later classes, and provided almost all of the prenatal education available within its jurisdiction. The toxoplasmosis prevention programme stressed basic knowledge about toxoplasmosis infection, its effect on the foetus and prevention of exposure during pregnancy. The particular preventive behaviours taught centred around three areas: cat hygiene, including litterbox

maintenance and limiting the cat's diet to cooked food; food hygiene, particularly washing garden vegetables and cooking meat well; and personal hygiene, particularly hand washing after exposure to cat faeces, garden soil and raw meats.

During the study period, each first prenatal class offered by the health agency was randomly assigned to either receive a 10 min teaching session based on this educational programme as well as the routine class material (case class) or to receive only the routine class material (control class). Routine class material contained no mention of toxoplasmosis and control class teachers were instructed to mention the disease only if specifically questioned by a pupil. Randomization was stratified so that an equal number of case and control classes were taught in each of the six centres in which the agency offered classes. Most teachers taught both case and control classes. This process was continued until 26 case and 26 control early prenatal classes had been taught (approximately 6 months).

A questionnaire eliciting information on the pet (cat) hygiene, food hygiene and personal hygiene preventive behaviours taught in case classes was administered to all case and control class attendees prior to the first class (pre-test) and following the last class of the pre-natal series (post-test). Women attended this last class between the seventh and ninth month of their pregnancy. The post-test was identical to the pre-test except that a question concerning the source of the woman's information on toxoplasmosis was added. In the questionnaire, the questions of interest were scattered amongst other questions concerning demographic characteristics, knowledge of nutrition and communicable disease, and other factors such as breastfeeding plans, smoking habits and alcohol consumption. Information on five demographic variables were collected: age, education, occupation, country of origin and religious affiliation. Before administering the questionnaires, teachers explained that their purpose was to determine the effectiveness of the prenatal classes, that answers were confidential and that no one was under any obligation to participate. Husbands were encouraged to help their wives but class teachers were permitted to assist only by reading questions and translating if the woman's command of English was poor. Women were not told the specific purpose of the study nor their case or control status.

Questionnaires completed at the first and last class by the same women were matched and changes in behaviour between the first and last classes were examined. In addition, the demographic characteristics and the case/control status of women making various behaviour changes were determined.

A behaviour change scoring system was developed for cat, food and personal hygiene behaviour. For each behaviour, a number of items representing various aspects of that behaviour were selected on face validity. The variance of each item and relationships among the items were evaluated. Based on that evaluation the best items were selected and scored. A woman received one point for a change in behaviour towards that which was taught as useful in preventing toxoplasmosis in the teaching package. She lost one point for a change in behaviour in the opposite direction. The Student's *t*-test was used to investigate the effect of case/control status on cat hygiene, food hygiene and personal hygiene behaviour change scores. Two-way analysis of variance was used to examine the effect of case/control status on these scores taking into consideration the demographic

variables: age, education, occupation, religion and cat ownership. Reliability between questionnaires was tested by the Kappa statistic. Differences in proportions were evaluated by the χ^2 test when expected cell sizes were sufficiently large. Otherwise Fisher's exact test was used. A probability of less than 0·05 was considered significant.

RESULTS

Prior to the 52 first prenatal classes, 432 women completed the pre-test questionnaire (201 in case classes and 231 in control classes). Of these, 285 eventually completed the post-test questionnaire at the end of the last pre-natal class (122 in case classes and 163 in control classes), 91 of whom owned pet cats and could therefore be tested on behaviours involving their pet (32 in case classes and 59 in control classes). No one attending a class refused to complete a questionnaire. Toxoplasmosis was mentioned in 6 of the 26 control classes, reaching 27 of the 163 women in control classes who completed both a pre- and post-test questionnaire. The length of time between the first and last class ranged from 5 weeks to 5 months with a mean of 4 months. The reliability between the two questionnaires on a question concerning country of origin was nearly perfect with a Kappa of one.

Women who completed a pre-test questionnaire but not a post-test questionnaire were considered to be dropouts for analysis purposes. Dropouts were compared to non-dropouts, cases were compared to controls and dropout and non-dropout cases were compared to dropout and non-dropout controls respectively. The variables compared were: the five demographic variables; class location; pet (for cat owners only) hygiene, food hygiene and personal hygiene behaviour on the pre-test; and cat ownership. The only significant associations were the following: dropouts were significantly younger ($P < 0·005$), and had less education ($P < 0·001$) than non-dropouts, and one particular class location had a significantly higher dropout rate ($P < 0·0001$). The dropout rate was higher for cases than for controls ($P < 0·05$). When asked on the post-test about the source of their knowledge about toxoplasmosis, only 5% of women in case classes recalled the teaching session. Most of these women were in the professional occupational category.

Pet hygiene behaviour of cat owners

Women in case classes had a significantly higher cat hygiene behaviour change score than women in control classes ($P < 0·05$). Differences in this score between the cases and controls did not depend on the age, education, occupation or religion of respondents, as indicated by the non-significant interaction between the case control status and each of these demographic factors.

Food hygiene behaviours

No significant difference in the food hygiene behaviour change score was found between cases and controls. No interaction was found between case control status and any of the demographic variables. Except for the cooking of roast beef and hamburger, food hygiene behaviour on the pre-test was close to that taught in the programme, leaving little room for improvement. This reduced the power of the

study to find a significant difference between the score of cases and controls to only 10%.

When specific behaviours were examined individually, no differences between cases and controls were found on the pre-test. A significant difference was found on the post-test for the cooking of roast beef and hamburger, with cases cooking these meats more thoroughly, as was taught in the teaching package ($P < 0{\cdot}05$ and $< 0{\cdot}01$ respectively).

Personal hygiene behaviours

The personal hygiene behaviour change score did not differ significantly between cases/controls. There was no significant interaction between the case control status and each of the demographic variables. However, in the two-way analysis of variance taking occupation into consideration, the score for the cases was significantly higher than for controls ($P < 0{\cdot}05$) mainly because of the markedly improved behaviour of professional women. Personal hygiene behaviour on the pre-test was close enough to that taught in the programme that the power of the study to find a significant difference between the score of cases and controls was reduced to only 20%.

DISCUSSION

In all aspects tested, random selection created two groups of women attending case and control classes who did not differ from each other to any significant degree. Since dropouts in case classes did not differ from those in control classes and dropouts did not differ from non-dropouts in any of the behavioural variables studied, the high dropout rate should have no effect on the findings of the study. It is unlikely that a 10 min lesson on toxoplasmosis would influence women to drop out. It is assumed that the differential dropout rate in case women was due to chance alone. The increased dropout rate in younger women and women with less education was to be expected and can be explained by the increased rates of miscarriage, pregnancy complications and premature delivery reported in these groups of women as well as accessibility problems encountered by them (22, 23). This finding should not affect the study since these women dropped out of the case and control groups at equal rates.

No attempt was made to measure a decrease in the number of infected babies. This measure of effectiveness would be impossible to evaluate in such a small population. The literature on toxoplasmosis indicates that the behaviours taught would be effective in preventing toxoplasmosis if they were followed (11, 12). Thus, documenting a change in behaviour in the desired direction implies that the number of infected babies would decrease.

Behaviour was not actually observed. Self-reported behaviour was accepted without validation. The results are thus open to reporting bias in case women who knew the 'right' answer if they recalled what they were taught. The 5% of women who did recall what they taught tended to be professional women who had the most notable improvement in personal hygiene. However, 95% of case women at post-test did not specifically recall being taught about toxoplasmosis. In addition, subjects were in effect 'blinded' because they did not know the purpose

of the study or their case or control status. Thus, reporting bias should not invalidate the findings of this study.

Clearly the teaching package had a significant positive effect on self-reported cat hygiene behaviour of cat owners. Although it was not reflected in the food hygiene behaviour change score, the cooking of beef and hamburger which was similar in cases and controls on the pre-test was significantly better in cases than controls on the post-test. The cooking of these two meats was the behaviour most in need of improvement. The remainder of the food hygiene behaviours studied were close to ideal before intervention. Thus, it can be concluded that the teaching package was effective in altering food hygiene behaviour. The teaching package appears to have had significant positive effect on personal hygiene behaviour of professional women. The failure to find a significant effect for all women may have been due to the low power of the analysis.

A very difficult task was chosen: to measure a change in behaviour 4 months after receipt of a 10 min teaching session directed towards this behaviour. Achievement of a measurable effect is very encouraging. Additional research is required to determine the most efficacious time and methodology for encouraging women to practice toxoplasmosis prevention during each pregnancy. Perhaps the most ideal time to introduce this topic will be found to be in high school in conjuction with family planning lessions. In the meantime, since the burden of illness almost certainly warrants the low costs and risks, this proven effective intervention should be offered to all women either before or very early in their first pregnancy.

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