ACMSF risk profile in relation to toxoplasma in the food chain – Table of consultation responses and additional information on toxoplasma

This table summarises responses to the consultation on the draft toxoplasma risk profile (8 responses were received) and also summarises additional information relevant to the report that was published following the start of the consultation.

Respondant	Report reference	Comment	Suggested response
Dr G A McConkey Senior Lecturer, Faculty of Biological Sciences, University of Leeds.	General	1. This is a well-documented report of the data and gaps thereof in toxoplasma contamination of food. The clear limit of this report is the amount of data available for the UK. The extensive study on the cost is a good prototype for examining the importance of this parasite in the UK.	Noted. No action required for risk profile.
	Section 9	2. The importance of evaluating the relative contribution of vegetables/fruits vs animal sources is important in work to assess the importance of the foodborne route of infection. There is interesting data finding similar prevalence levels in countries/regions of vegetarians.	Noted. No action required for risk profile as the report already covers these issues.
	Section 7 and 9	3. There is no mention of the need to consider changes in farming in the UK to free range and organic. It is unclear whether this will be a factor and which animals would be most affected.	This issue is already addressed by the report. Extensive/outdoor vs intensive/indoor farming is referred to in 7.5, 7.19, 7.20, 9.9. Para 7.55 concludes that "consumer demand for outdoor reared meat… is likely to result in increased animal exposure to the parasite". Para 7.58 makes recommendations to address this data gap.
	Section 4	4. There is no discussion of neurological effects of infection. There are numerous studies with very significant associations of toxoplasma with neurological disorders.	Report amended to include reference to toxoplasmosis and neurological conditions in para 4.1.
	Section 7 and 9	5. Strategies to reduce or disrupt oocyst infection should be considered. Modelling of cat vaccination, for example, is important. The contribution of oocyst infection in both	Report amended at para 7.47 to note that modelling studies may help inform development of a cat vaccine and this may have a significant

		livestock and humans is needed.	effect on the burden of human disease.
	General	6. Regarding at risk groups, cost analysis should be performed to assess whether routine screening for toxoplasmosis in immunocompromised individuals and pregnant women is warranted.	This comment relates to risk management and is therefore outside the remit of ACMSF and this report. For FSA/DH to consider.
British Maternal Fetal Medicine Society	General	1. In general terms, the document is interesting and we found nothing contentious in it indeed it was rather informative and is sensibly written.	Noted. No action required for risk profile.
	Para 10.4	2. As a general comment we felt that the recommendations relevant to pregnancy were rather weak: For example: Recommendations 10.4: "*The current UK advice to pregnant women should be reviewed in the light of current knowledge, and the advice given by other countries*". However the document does not go on to suggest what those recommendations should be?	This comment relates to risk management and is therefore outside the remit of ACMSF and this report. For FSA/DH to consider.
	General	3. We congratulate them on a thorough appraisal of current evidence and support the initiative. We would offer to be part of the process that finalises the recommendations to pregnant women if it was felt appropriate?	Noted. As this relates to risk management it is outside the scope of ACMSF but the offer to participate in further work will be passed to the FSA.
Dr. Doloris Hill, USDA	Para 3.7	1. "Bradyzoites are more resistant to digestive enzymes . . . whereas tissue cysts are normally killed by freezing at minus 12°C." Do you really mean tissue cysts here?	Para 3.7 clarified to refer to bradyzoites rather than tissue cysts.
	Para 7.57	2. Retail meat surveys are required due to the observed difference seen between on-farm seroprevalence and meat case prevalence of viable organisms, likely due to post harvest meat storage/treatment. Unfortunately, bioassays in mice or cats are the only reliable method for assaying meat for viable organisms.	Noted. No action required for risk profile. Retail meat and livestock seroprevalence surveys are already recommended.

	Para 9.16 Para 7.59	3. Para 9.16 states that lab test cannot distinguish infection from oocysts and tissue cysts. A distinguishing assay has been developed; J. Parasitol 97(2) 328-37; K. Boyer et al., CID, on line 10/21/11. Data from the US suggests that >70% of infections are related to unrecognized oocyst exposure. 4. Para 7.59 recommends that methods are developed to assess the number of viable tissue cysts in edible tissues. This will vary depending upon species, tissue, and level/duration of exposure to infectious stages, and may not be important, since experimental infection in pigs suggests that they can become infected with a single tissue cyst, which can contain thousands of infective bradyzoites.	Report amended at para 9.1, 9.2, 9.16 and 9.20 to refer to laboratory test developed by Boyer et al and potential applications of this novel test. N.B. The paper describing this method was published after the report was finalised for consultation. It is accepted that variation in the number of viable tissue cysts in edible tissue will exist but it is important to assess the number and distribution of viable cysts in a range of edible tissues to assess the risks to consumers.
Institute of Food Research	Section 6	<u>1. Symptomatic toxoplasmosis should be made notifiable</u> A primary consideration is the burden of disease caused by *Toxoplasma* in the UK. The report concludes that there are not sufficient data to assess the burden of disease due to toxoplasmosis in the UK, but that it will probably not be significantly different from the assessments made in the USA and the Netherlands. The paper (cited in the report) by Kemmeren *et al*. (2007) for the Netherlands concluded that toxoplasmosis causes the highest disease burden among seven evaluated foodborne pathogens (the other pathogens were *Campylobacter* spp. *Salmonella* spp. *Listeria monocytogenes*, *Escherichia coli* O157, norovirus and rotavirus). In the United States, Scallan *et al.* (2011) estimated that *Toxoplasma gondii* was the second major cause of deaths due to foodborne illness, causing 24% of deaths compared with 28% due to nontyphoidal *Salmonella* spp. These assessments indicate that toxoplasmosis is one of the most costly gastrointestinal infections and a major cause of deaths due to foodborne	

	Section 6	pathogens. **Symptomatic toxoplasmosis is not notifiable in the UK and is probably underreported; in order to assess the burden of disease it would assist greatly if symptomatic toxoplasmosis was made notifiable.** In addition to symptomatic toxoplasmosis, many people are affected by latent infection. In immunocompetent persons symptoms of infection may be mild/moderate and self-limiting (para 6.36) and may not be identified by the healthcare system, but the infection persists as a latent infection. Latent infection (whether congenital or not) in these in asymptomatic people poses a risk of reactivation of the infection if the person becomes immunocompromised as a result of illness or medication. Although latent infection in immunocompetent people is commonly viewed as asymptomatic, there are a number of reports (not cited in the ACMSF report) of possible behavioural disorders, ranging from subtle personality changes to severe disorders such as schizophrenia, associated with latent infection with *Toxoplasma* (e.g. Torrey and Yolken, 2003; da Silva and Langoni, 2009; Fekadu et al. 2010; Webster and McConkey, 2010; Thomas *et al*. 2012). The incidence of such behavioural effects needs further consideration, as these effects may contribute significantly to the burden of disease.	Para 6.36 amended to clarify that Toxoplasmosis is notifiable in Scotland but not in the rest of the UK. Notification could be considered as a risk management strategy but is beyond the remit of the ACMSF and this report. For FSA/DH/HPA to consider.
	Section 6	The report concludes (para 6.33) that an estimated 350,000 people become infected with *Toxoplasma* each year in the UK, of which 10-20% (35,000-70,000) are symptomatic, a very high burden of disease. Seroprevalence increases with age, indicating that a high incidence of latent infection is not congenital. The prevalence shown in Fig 6 of the report ranging from 0.10% to 0.50% is difficult to understand in view of the seroprevalences of 11% -40% shown in Fig. 5. The	Figure 6 amended to correct y axis scale.

		change in seroprevalence with age indicates a high incidence of infection that is not congenital. **In order to assess the burden of disease due to *Toxoplasma* there is a need to consider further the prevalence of latent infection, its possible effects on human behaviour, and the risk of reactivation that it poses to people who subsequently become immunocompromised.**	Links between toxoplasmosis infection and behavioural changes in mammalian hosts are mentioned and referenced in paragraph 4.1. Report amended at paras 6.17 and 6.31 to clarify that the incidence and burden of disease from toxoplasmosis associated behavioural change is unknown. Report also amended at para 6.43 and 10.5 to highlight that consideration should be given to infected immunocompetent individuals who may become immunocompromised in later life.
	Section 5 and 6	<u>2. Further information is needed on seroprevalence</u> Persons with latent infection with *Toxoplasma* are at risk of activation of the parasite if their immune system is weakened by immunosuppressive drugs, irradiation, viral infection, malnutrition, and/or ageing. This latent infection may be congenital or may result from infection at any stage of life. The report recognises (para 11.22) that the largest burden of disease is likely to be associated with immune-compromised individuals. It has been estimated, from seroprevalence studies, that between 5 and 10 million of the UK population show latent infection with *Toxoplasma,* the incidence of infection increasing with age (ACM/828). Persons with HIV/AIDS are at high risk of reactivation and primary infection, but this has been reduced by treatment with highly active antiretroviral drugs. Persons undergoing organ transplants are at risk of primary infection and of reactivation of infection; cases usually occur when prophylactic treatment with trimethoprin-sulphamethoxazole (primarily for prevention of *Pneumocystis carinii* infection) is discontinued because of ill-effects. Cancer patients are also at risk of	

		toxoplasmosis (Edvinsson et al. 2009; Herold et al. 2009). In the UK, 298,000 cases of cancer were diagnosed in 2007, if 20% of these had latent *Toxoplasma* infection then 59,600 people could be at risk of activation of the parasite during treatment with immunosuppressive drugs and/or irradiation, and prophylaxis against *Toxoplasma* may be important. Rare cases of toxoplasmosis have also been reported in persons receiving treatment with antitumour necrosis factor –alpha (TNF-alpha) and other medication for rheumatoid arthritis (Lassoued et al. 2007; Young and McGwire, 2005), and during treatment of multiple sclerosis with natalizumab (Zecca et al. 2009); these cases were due, probably, to reactivation of latent infection. The majority of *Toxoplasma* infections in immunocompromised hosts are reactivation of previous infection or reactivation of tissue cysts in transplanted organs and in bone marrow transplants (Mele et al. 2002, cited in EFSA 2007). **An ageing population with an increased risk of illness needing treatment with immunosuppressive medication indicates a need for continued prevention of both congenital infection and primary infection resulting in latent infection.**	Report amended at para 6.43 and 10.5 to highlight that consideration should also be given to infected individuals who may become immunocompromised in later life.
	Section 10	<u>3. Advice on avoidance of *Toxoplasma* infection should be publicised immediately</u> The recommendations call for further work to assess the importance of food as an important source of infection with *Toxoplasma* in the UK. EFSA (2007) concluded that *Toxoplasma* is mainly acquired postnatally • by ingestion of tissue cysts in infected meat, meat-derived products or offal (viscera) *or* • by ingestion of soil, water or food contaminated	

	Para 8.21	with sporulated oocysts derived from the environment or (less frequently) directly from feline faeces. However, the relative importance and frequency of horizontal transmissions via tissue cysts versus oocysts in a given population is unknown. Consumption of raw or undercooked meat has been identified consistently as a risk factor for toxoplasmosis, but the importance of this risk factor and the major type of meat associated with it differs in different countries (EFSA, 2007). **There is sufficient evidence of the importance of raw or undercooked meat in transmission of tissue cysts of *Toxoplasma*, that advice on cooking meat sufficiently to inactivate tissue cysts in meat should be publicised immediately, rather being delayed for more detailed information. The need for this advice is supported by the facts that (a) a change to more outdoor farming of pigs may lead to increased seroprevalence (para 7.20) and (b) a proportion of meat in the UK is imported.** Studies of the effect of heat on *Toxoplasma* tissue cysts in meat showed that a temperature of 58°C for 9.5 min or temperatures ≥ 67°C cause loss of viability. Thus, ensuring that during cooking meat is maintained at a temperature of 70°C for at least 2 min, as advised in general for meat products, would be expected to destroy *Toxoplasma*. *Toxoplasma* tissue cysts appear to be less heat-resistant than bacterial foodborne pathogens such as *Salmonella*, *E. coli* O157 and *Listeria*. Nevertheless, the very serious potential consequences of infection mean that there is a need to stress the temperature to which meat should be cooked.	Current advice in relation to toxoplasma and food preparation is outlined in 10.1. The content, publication and prioritisation of advice is outside the remit of ACMSF and this report as it relates to risk management. For FSA to consider.

		The recommendation that the effect of meat curing processes on survival of *Toxoplasma* should be investigated is important, particularly in view of the development of processes by small businesses. **The campaign launched by the Food Standards Agency in November 2011, reminding people to wash raw vegetables, should help to reduce the risk of transmission of oocysts on vegetables.**	Noted. No action required for risk profile. Noted. No action required for risk profile.
	Section 6 and 10	<u>4. Advice should be aimed at the whole population</u> The report recommends (para 6.43) that risk management strategies should be focused on relevant subpopulations, described as immune-compromised individuals including the unborn child. These groups do need advice to prevent primary infection, but symptomatic toxoplasmosis in immunocompromised people is due mainly to reactivation of latent infection (EFSA, 2007) contracted before their immune system was compromised. Risk management therefore needs to focus also on prevention of primary, latent infection in immunocompetent people. **Renewed advice on avoidance of *Toxoplasma* infection needs to be publicised to the general population. In view of the disease burden due to this pathogen, advice needs to be publicised without delay. The advice given under NHS Choices is reasonable, but the temperature in the meat and the required time (70°C for at least 2 min, required to inactivate vegetative bacterial pathogens as well as T*oxoplasma*) should be specified.** A report from Ireland concluded that most women were unaware about risks posed by exposure to *Toxoplasma* during pregnancy (Ferguson *et al.* 2011). Pregnant	Current advice in relation to toxoplasma and food preparation is outlined in 10.1. The content, publication and prioritisation of advice is outside the remit of ACMSF and this report as it relates to risk management. For FSA to consider.

		women probably receive more health advice than most other groups of the population; if they are uninformed about *Toxoplasma* other groups are liable to be even less informed. **There is a need to ensure that advice on avoidance of *Toxoplasma* reaches the general population effectively.**	The publication and prioritisation of advice is outside the remit of ACMSF and this report as it relates to risk management. For FSA to consider.
Hybu Cig Cymru Meat Promotion Wales	Section7	1. The draft report suggests that toxoplasmosis is one of the most costly gastro-intestinal infections however there is limited robust evidence on its incidence both in farmed livestock and humans. HCC would like to see detailed studies undertaken to establish the seroprevalence in livestock which will enable the industry to develop guidelines on risk management to prevent further infection.	Noted. No action required for risk profile. A recommendation to establish seroprevalence in livestock is made in para 7.58
	Section 6 and 9	2. According to the draft report the risk of infection to humans from food sources is also not clearly understood and further studies are recommended in this area to ensure consumer confidence in red meat. It is highlighted that 80-90 percent of cases are asymptomatic and therefore HCC suggests improving surveillance methods to improve our understanding of these cases will be important for developing risk management strategies. Also of concern are the possible routes of infection from non-food sources and the limited information on what these routes are and how they can be prevented.	Noted. No action required for risk profile. A recommendation to consider existing data gaps in relation to prevalence and burden of disease is made in 6.42. A recommendation to consider studies that may help distinguish environmental from food borne infections is made in 9.19 and 9.20.
	General	3. HCC welcomes this report as the first step to highlighting the importance of this disease. The recommendations made throughout the report need to be followed up to reduce the knowledge gaps and to ensure information is available throughout the supply chain on preventing, controlling and managing the disease.	Noted. No action required for risk profile.

Public Health and Health Policy, NHS Lothian	General Section 11	1. In NHS Lothian, cases of toxoplasma are rarely seen and patients are often found to have had their exposure outside the United Kingdom. Advice on risks associated with pet handling during pregnancy is already provided by General Practitioners and midwives. 2. We agree with the proposals in this report which suggest further work to establish the disease's prevalence and occurrence in United Kingdom livestock and food. We also agree with the proposal that risk assessment should be focused on relevant sub-populations. Consideration of the European approach is valuable, given the interlinked nature of food distribution in Europe.	Noted. No action required for risk profile. Noted. No action required for risk profile.
Health Protection Scotland	General Section 6	1. We welcome the timely report of the ACMSF's report, and endorse all of its recommendations. 2. Toxoplasma is notifiable in Scotland. All laboratory confirmed cases are reported to HPS. National figures are therefore available, although we recognise that there is under-ascertainment of cases. The increasing recognition of the importance of toxoplasmosis, and its potential for foodborne transmission re-inforces the need to review sources of infection, routes of transmission, and the surveillance of human cases. Ascertainment in Scotland can be improved by effective collaboration between HPS, the Scottish Toxoplasma Reference Laboratory, first-line diagnostic laboratories and clinicians.	Noted. No action required for risk profile. Report amended at para 6.36 to clarify toxoplasmosis is notifiable in Scotland.
	Para 8 of consultation letter	***3. Recommendation:*** *Further work to assess the importance of the foodborne route of infection, to identify the most important risks and appropriate risk management measures, and to refine the burden of disease assessment is justified.* **Response: HPS endorses this recommendation and**	Noted, the offer to participate in further work will

		will be happy to contribute to and collaborate with those involved	be passed to the FSA.
	Para 8 of consultation letter	***4. Recommendation:*** *Risk management strategies could be focused on relevant sub-populations.* *Susceptibility of intermediate hosts to toxoplasma infection varies according to species with seroprevalence data indicating that infection is most common in sheep, pigs and wild game. Cattle appear to be relatively resistant to infection. There is a very small amount of data on meat contamination in the UK but (other than a recent serological survey in sheep) virtually no data on the presence of the parasite in farm animals reared in the UK. Further data on seroprevalence in farm animals would be useful in monitoring the effectiveness of control measures in animal husbandry and testing of a larger range of meat samples would be useful in identifying the main sources of risk.* **Response: HPS endorses this recommendation.**	Noted. No action required for risk profile.
	Para 8 of consultation letter	***5. Recommendation:*** *Further studies are recommended to establish seroprevalence in UK livestock species and to enable the outcome of these studies to be related to prevalence and levels of viable tissue cysts in edible tissues. 4* *Toxoplasma has been found in a wide variety of meats. However based on the available, limited evidence, beef and housed chicken appear less commonly infected, than other meat. Tachyzoites and bradyzoites are relatively fragile whereas oocysts and tissues cysts are relatively resistant to food preparation and processing. Washing of salads and vegetables may remove some surface contamination of oocysts, whereas inactivation of the more resistant tissue cyst requires adequate cooking. Curing of meats may inactivate tissue cysts, depending on the process used.* **Response: HPS endorses this recommendation.**	Noted. No action required for risk profile.

	Para 8 of consultation letter	***6. Recommendation:*** *It would significantly assist risk assessment if further studies were undertaken to determine the prevalence and concentration of toxoplasma contamination in foods in the UK and to assess the effect of a number of microbiological reduction/destruction processes e.g. salad washing, milk fermentation and various meat curing methods on toxoplasma.* **Response: HPS endorses this recommendation.**	Noted. No action required for risk profile.
	Para 8 of consultation letter	***7. Recommendation:*** *It is also recommended that methods are developed to assess the number of viable tissue cysts in edible tissue.* *Oocyst contamination of the environment is an important risk factor in infection and consumption of undercooked meat is also likely to be an important risk factor for pregnant women and immune-compromised groups. However the relative contribution of food associated toxoplasma infection is not well-defined and not known in the UK. None of the case control studies has involved cases in the UK.* **Response: HPS endorses this recommendation and would be happy to collaborate with colleagues in establishing the relative contribution of food associated toxoplasma infection.**	Noted, the offer to participate in further work will be passed to the FSA.
	Para 8 of consultation letter	8.***- Recommendation:*** *Given the variability in seroprevalence across Europe, differences in food handling and consumption, and in climate, a case control study in the UK should be considered.* **Response: HPS endorses this recommendation, and would be happy to be involved in the design and implementation of a UK case-control study.**	Noted, the offer to participate in further work will be passed to the FSA.
	Para 8 of consultation letter	***9. Recommendation:*** *If food is confirmed as an important source of infection better data are required on*	

		the incidence of human infection and its complications in the UK as a baseline for subsequent comparison. *There is a variation in the consumer advice given by different countries in relation to toxoplasmosis.* **Response: HPS endorses this recommendation, and (whether or not food is identified as an important source of infection) is happy to discuss strategies for developing improved surveillance with interested stakeholders, in particular the Toxoplasma Reference Laboratory.**	Noted, the offer to participate in further work will be passed to the FSA.
	Para 8 of consultation letter	***10. Recommendation:*** *The current UK advice to pregnant women should be reviewed in the light of current knowledge, and the advice given by other countries.* **Response: HPS endorses this recommendation and would be happy to collaborate with colleagues to formulate and communicate effective and appropriate advice.**	Noted, the offer to participate in further work will be passed to the FSA.
	Para 8 of consultation letter	***11. Recommendation:*** *The need for similar advice for other immune-compromised groups should also be considered.***Response: HPS endorses this recommendation and would be happy to collaborate with colleagues to formulate and communicate effective and appropriate advice.**	Noted, the offer to participate in further work will be passed to the FSA.
Scottish Toxoplasma Reference Laboratory	Para 8 of consultation letter	1. We agree with the key recommendations and conclusions from the report stated on Page 3, Section 8. These are as follows: *1.1 Further work to assess the importance of the food borne route of infection, to identify the most important risks and appropriate risk management measures, and to refine the burden of disease assessment is justified.* We endorse this recommendation and would be willing and able to collaborate with other working groups. We also	Noted. No action required for risk profile.

		believe that seroprevalence and incidence studies of sub-groups within the UK population would provide important information that would target risk management strategies and public health advice, we believe we would be well placed to conduct those studies if so commissioned by the FSA	
	Para 8 of consultation letter	*1.2 Risk management strategies could be focussed on relevant sub-populations.* We agree with this recommendation and would be willing to collaborate with appropriate working groups to conduct the studies	Noted, the offer to participate in further work will be passed to the FSA.
	Para 8 of consultation letter	*1.3 Further studies are recommended to establish seroprevalence in UK livestock species and to enable the outcome of these studies to be related to prevalence and levels of viable tissue cysts in edible tissues.* We agree with this recommendation.	Noted. No action required for risk profile.
	Para 8 of consultation letter	*1.4 It would significantly assist risk assessment if further studies were undertaken to determine the prevalence and concentration of toxoplasma contamination in foods in the UK and to assess the effect of a number of microbiological reduction/destruction processes e.g. salad washing, milk fermentation and various meat curing methods on toxoplasma.* We agree with these recommendations.	Noted. No action required for risk profile.
	Para 8 of consultation letter	*1.5 It is also recommended that methods are developed to assess the number of viable tissue cysts in edible tissue.* We agree with this recommendation and would be willing to collaborate with other working groups.	Noted, the offer to participate in further work will be passed to the FSA.
	Para 8 of consultation letter	*1.6 Given the variability in seroprevalence across Europe, differences in food handling and consumption, and in climate, a case control study in the UK should be considered.* We agree with this recommendation and would be willing to cooperate with other working groups. We believe that the this document should recommend	Noted, the offer to participate in further work will be passed to the FSA. Report also amended at para 9.20 to recommend use of recently developed methods that report to distinguish sporocysts from oocysts as the source of

		further studies into the role oocysts have in transmission of toxoplasma using newly devised serological methods (see Specific comments point 11 below).	infection.
	Para 8 of consultation letter	*1.7 If food is confirmed as an important source of infection better data are required on the incidence of human infection and its complications in the UK as a baseline for subsequent comparison.* We agree with this recommendation and would be willing to collaborate with other working groups.	Noted, the offer to participate in further work will be passed to the FSA.
	Para 8 of consultation letter	*1.8 The current UK advice to pregnant women should be reviewed in the light of current knowledge, and the advice given by other countries.* We agree with this recommendation and that the current knowledge in the UK should include the studies recommended in 1.1 above.	Noted. No action required for risk profile.
	Para 8 of consultation letter	*1.9 The need for similar advice for other immune-compromised groups should also be considered.* We agree with this recommendation.	Noted. No action required for risk profile.
		2. The report does not present all information known about toxoplasma in the UK. Although most of this data is historic, it is peer-reviewed and relevant to the aims of the report and so we feel that it should be included in the document the papers are described further on in this response.	Noted, -see response to points 4 & 6 below.
		3. Thirdly there is a danger in making the assumption that the incidence of toxoplasma in the UK will not be significantly different from that in the USA and the Netherlands (page 4, Section 4, lines 9-16) and has not changed significantly over the last ten to thirty years. The epidemiology of the UK population has changed over this period. We have observed an increase in the number of patients from particular sub-groups with toxoplasma infection. Studies to identify the seroprevalence and	The Group notes the comments and publications that provide some evidence of a change in toxoplasmosis incidence in the UK. However we do not feel this changes the position of the report which uses comparisons with estimates of the burden of disease in the USA and the Netherlands as a basis for recommending further studies.

		incidence of infection in these sub-groups will allow for a targeted approach for risk management strategies. We do not believe that the report addresses the issues appropriately.	
	Page 15, Section 5.7	4. Data from two studies in Scotland have published variation in seropositivity with age from women of child-bearing age (Williams *et al* 1981, Congenital toxoplasmosis: a prospective survey in the West of Scotland. *Journal of Infection* 3; 219-229 and Joss et al 1988, Simultaneous serological screening for congenital cytomegalovirus and toxoplasma infection. *Public Health* 102; 409-417). The seroprevalence for these women range from 347/2618 (13.25%) and 237/2092 (11.3%) in the <20 years old age group to 76/226 (33.6%) and 57/181 (31.5%) in the >40 years old age group for Scotland as a whole and the West of Scotland respectively (Williams et al 1981). These are similar to data for women of child-bearing age in the Highlands (<20 years 122/865b (14%), >40 years 23/64 (35.9%), overall prevalence 998/5909 (16.9%)) from a study published in 1988 (Joss *et al* 1988). These are two published peer-reviewed studies that provide good evidence for the prevalence of toxoplasmosis in part of the UK. We believe that they should be included in the study as they provide evidence of a gap in the data presented and reinforce the evidence of the data already stated in the report.	Reported amended to include reference to studies of toxoplasma seroprevalence in women in Scotland by Williams et al 1981 and Joss et al 1988.
	Pages 17-18, Section 5.13	5. Table 1 on page 18 is misleading as it appears that only 8 cases of congenital toxoplasmosis were identified in the UK for the period January – December 2009. It would be important to emphasise that the 38 cases in pregnant women and 55 cases of ocular disease (total of 101 cases) may also be involved in the health burden of congenital toxoplasmosis and certainly contribute to the	Noted, the Group do not feel the table is misleading.

		financial costs of the disease.	
	Page 23, Section 6.20	6. Data is available for the cost of congenital toxoplasmosis in Scotland from 1990. For the estimate of 73 cases of congenital toxoplasmosis occurring in Scotland at this time the costs of preventable outcomes were considered to range from £64 000 to £2 511 000 (Joss et al 1990 Congenital toxoplasmosis: to screen or not to screen? *Public Health* 104; 9-20). Again this data is historical and the epidemiology of toxoplasmosis is likely to have changed over the last two decades. We have published data indicating a significant increase in the number of women of all ages and those in childbearing age with toxoplasma infection over a ten year period (1999/2000 – 2009/2010) (Chatterton et al 2011, Changes in toxoplasma diagnosis. *Journal of Medical Microbiology* 60; 1762-1766). It should be recognised that there is a need for better studies to assess the current prevalence and incidence of toxoplasmosis in the UK, particularly in child bearing age women.	The Group note the study referenced but consider the larger and more recent study quoted at 6.20 is sufficient. Report amended at 6.42 to recommend that consideration is given to how existing data gaps regarding both prevalence and burden of disease can be addressed.
	Page 24, Section 6.36	7. Toxoplasmosis is a notifiable disease in Scotland.	Para 6.36 amended to clarify that Toxoplasmosis is notifiable in Scotland but not in the rest of the UK.
	Page 25, Section 6.42	8. The recommendations stated here are appropriate. However, we think it is incorrect to assume that the prevalence and incidence of toxoplasmosis in the UK is similar to that of the Netherlands and the USA. As stated in comment 3 above we have recognised a significant increase in the number of current toxoplasma infections in child-bearing age women diagnosed at the Scottish Toxoplasma over the last ten years. It is possible that this increase may be driven by sub-groups within the UK population and this merits detailed and appropriate	The Group notes the comments and publications that provide some evidence of a change in toxoplasmosis incidence in the UK. However we do not feel this changes the position of the report which uses comparisons with estimates of the burden of disease in the USA and the Netherlands as a basis for recommending further studies.

		investigation. The data provided would give a more accurate figure of the burden of disease in the UK and allow for targeted public health intervention to reduce this burden.	
	Page 34, Section 7.55	9.The increase in outdoor and organic farming methods (Page 28, section 7.20) may result in an increased amount of toxoplasma infected meat on the market. As the susceptible human population has increased there is a potential for rising rates of infection.	This issue is already addressed by the report. Extensive/outdoor vs intensive/indoor farming is referred to in 7.5, 7.19, 7.20, 9.9. Para 7.55 concludes that "consumer demand for outdoor reared meat… is likely to result in increased animal exposure to the parasite". Para 7.58 makes recommendations to address this data gap.
	Page 34, Section 7.58	10. We would suggest that the FSA states that it will commission further studies to establish the seroprevalence of toxoplasmosis and the presence of viable tissue cysts in UK livestock.	This is outside the remit of an ACMSF report. For FSA to consider.
	Pages 40-43, Section 9	11. It is stated on page 42, section 9.16 that 'Laboratory tests cannot distinguish an infection due to oocysts from due to tissue cysts'. This is not entirely true. A recent paper published by a group in Chicago have developed a serological test to detect antibodies to sporozoites demonstrating that oocysts were the major source of toxoplasma infection in four North American epidemics and in mothers of children in the National Collaborative Chicago-based Congenital Toxoplasmosis study (NCCCTS) (Boyer et al 2011, Unrecognized ingestion of *Toxoplasma gondii* oocysts leads to congenital toxoplasmosis and causes epidemics in North America. Clinical Infectious Diseases 53; 1081-1089). This is an important article to include in the report and indicates an area of research that would be vital to assessing the burden of food-borne toxoplasmosis in the UK. However, it should be remembered that transmission of toxoplasma infection by oocysts can be food-borne. We are in the	Report amended at para 9.1, 9.2, 9.16 and 9.20 to refer to laboratory test developed by Boyer et al and potential applications of this novel test. N.B. The paper describing this method was published after the report was finalised for consultation.

		process of developing a collaborative work to investigate the use of this type of test for Scotland. Once again we would like to thank you for the opportunity to participate in the review of this document. We believe that there have been significant changes in the epidemiology of toxoplasma infection in the UK and that the FSA should commission specific studies to determine the burden of this disease in the UK.	
The following information was drawn to the attention of the secretariat after the group had completed their draft report.			
Rick Holliman	Section 9	A paper published in 2011 **(**Hill D, Coss C, Dubey JP et al. Identification of sporozoite-specific antigen from Toxoplasma gondii) describes a method that may assist in determining whether human infection is as a result of sporocyst infection (likely to be from soil or water) or tissue cysts infection (likely to be from meat). This could be a useful tool to provide information on the relative importance of different sources of infection.	Report amended at para 9.1, 9.2, 9.16 and 9.20 to refer to laboratory test developed by Boyer et al and potential applications of this novel test. N.B. The paper describing this method was published after the report was finalised for consultation.
FSA	Section 7	An EFSA opinion published in October 2011 identified *Toxoplasma gondii* as one of the priority targets for official controls on pig meat due to its prevalence and impact on human health. In the light of this the FSA is commissioning a research project to apply the principles described in the Opinion to the UK pig production system with a view to developing a more risk based model of official controls for the pig sector. The research will include establishing the epidemiological situation in the UK for the key hazards (including T gondii) and establishing epidemiological indicators for the hazards to enable to categorisation of farms, herds and slaughterhouses according to risk as well as the setting of targets for final chilled carcasses.	Report amended at para 7.47 to refer to EFSA report.