The global burden of congenital toxoplasmosis: a systematic review
Paul R Torgerson* & Pierpaolo Mastroiacovo†

Objective To estimate the global burden of congenital toxoplasmosis (CT), which results from infection of pregnant women with Toxoplasma gondii. Methods The authors systematically searched 9 major databases for published and unpublished sources and established direct contact with the authors of source materials. Searches were country-specific. To be included, studies had to report on the incidence of CT, on positivity to Toxoplasma-specific IgM in infants and pregnant women (including seroconversion results) or on positivity to Toxoplasma-specific IgG in the general population. Various modelling techniques were used, depending on the country-specific data available, to estimate the CT incidence and burden in each country. These data were then synthesized into an estimate of the global incidence of CT and of the global burden of CT in disability-adjusted life years (DALYs). Findings The global annual incidence of congenital toxoplasmosis was estimated to be 190 100 cases (95% credible interval, CI: 179 300–206 300). This was equivalent to a burden of 1.20 million DALYs (95% CI: 0.76–1.90). High burdens were seen in South America and in some Middle Eastern and low-income countries. Conclusion Congenital toxoplasmosis poses a substantial burden of poor health globally. Toxoplasmosis should be included in future updates of the global burden of disease and the corresponding data should be used to support public health interventions to reduce disease burden.

Introduction

Toxoplasmosis is present in every country and seropositivity rates range from less than 10% to over 90%. The causative agent, Toxoplasma gondii, has a complex life cycle and is an important foodborne pathogen. Human infection can result from the ingestion or handling of undercooked or raw meat containing tissue cysts. Alternatively, it can result from direct contact with cats or from the consumption of water or food contaminated by oocysts excreted in the faeces of infected cats.

Congenital toxoplasmosis (CT) occurs in infants following maternal transmission. It can result in fetal death and abortion and in syndromes that include neurologic and neurocognitive deficits and chorioretinitis. We aimed to estimate the global incidence and burden of CT as part of a larger study on the global burden of foodborne toxoplasmosis arising from an initiative coordinated by the Foodborne Disease Burden Epidemiology Reference Group of the World Health Organization (WHO).

In our systematic review we searched specifically for data on CT incidence in infants (seropositivity to Toxoplasma-specific IgM or confirmed case series) or on the rate of maternal transmission, from which to estimate the incidence of CT. We also searched for country-specific data on seropositivity to Toxoplasma-specific IgM and IgG among women of reproductive age and in the general population, with and without age stratification. We used various models to estimate country-specific CT incidences from the data we obtained.

Methods

Literature and data searches

We applied a “best available evidence” approach by conducting a systematic review of the literature on the incidence of CT and on the prevalence of seropositivity to Toxoplasma-specific IgM. Box 1 shows the databases that we accessed and the search terms that we used. A PRISMA statement is provided in Appendix A (available at: www.vetepi.uzh.ch/research/Diseaseburden/Burden_CT-Appendices.pdf). We sent the authors of retrieved publications an Excel (Microsoft, Redmond, United States of America) spreadsheet with data for them to check and amend as appropriate. We cross-checked any amendments suggested and incorporated them into our database where appropriate.

We used an algorithm to select the best available evidence for each country (Fig. 1). From each source we extracted the following when available: incidence of CT, positivity to Toxoplasma-specific IgM in infants and in pregnant women, rate of seroconversion in pregnant women, and prevalence of CT in the general population, with and without age stratification; study period; study subjects; and sampling method (where and how the subjects were selected). No study was excluded on the basis of language. In countries where only one study was available, we used that study. When two or more publications with data of similar quality were available, we used the mean value given in the most recent publication and in the more valid studies and summed up the results of these, or we used the data in one publication to verify the estimates generated by the other(s). Where no data could be found, we extrapolated estimates from neighbouring countries from the same WHO region and in the same WHO mortality stratum. We entered all data extracted onto an Excel spreadsheet for further analysis.

Incidence of congenital toxoplasmosis

Because a variety of methods are used in toxoplasmosis surveillance globally, we used different methods depending on the type and quality of the data available. In a few instances we were able to directly calculate the number of incident CT cases from reports of confirmed CT cases in a given country. When the data pertained only to a sample of all possible cases, we used stochastic uncertainty analysis based on sample size as a proportion of the estimated number of births in the country.

In the absence of recorded confirmed CT cases, it is possible to estimate the incidence of CT from serological surveys of infants...
at birth. In the studies we analysed, blood was obtained by heel pricks or from the umbilical cord to measure Toxoplasma-specific IgM titres. Positive samples were usually confirmed with a second test because a single IgM test has poor positive predictive value. Data from such studies also needed to be adjusted for poor diagnostic sensitivity. We identified four studies in which a cohort of children were tested for IgM at birth and then monitored for at least 1 year (Appendix B, available at: www.vetepi.uzh.ch/research/Diseaseburden/Burden_CT-Appendices.pdf). Of these children, 385 were diagnosed with CT during infancy but only 205 were seropositive at birth, which shows that IgM testing at birth has a sensitivity of 53.3%.

The presence of Toxoplasma-specific IgM in pregnant women indicates recent infection because IgM antibodies are relatively short-lived. They can, however, remain detectable in blood for long after the pregnancy has ended. To estimate the proportion of women who were seropositive as a result of seroconversion during their current pregnancy, we constructed a simple mathematical model, using Monte-Carlo simulations, based on the kinetics of loss of Toxoplasma-specific IgM and on the length of time that the woman had been seropositive (Appendix C, available at: www.vetepi.uzh.ch/research/Diseaseburden/Burden_CT-Appendices.pdf). Since most studies failed to report the stage of pregnancy when women were tested, we assumed that each woman was midway through her pregnancy when her blood was sampled. Using this approach, we estimated the probability that a pregnant woman who was IgM-positive had seroconverted during the pregnancy as being between 15.4 and 24.3% (mean: 19.9%).

9 months and obtain in this manner the approximate risk of seroconversion in a pregnant woman at age t. Demographic and age-stratified fertility data for each country and territory are available from the United States Census Bureau. We used such data to estimate the numbers of children born to women who seroconverted during pregnancy. The base year for the data used was 2008.

For some countries only non-age-stratified seroprevalence reports were available. The incidence of seroconversion (and from this the incidence of seroconversion in pregnant women) was estimated by using reports of the age of the population surveyed (or, if not available, the median age of the countries’ population from the United States Census Bureau) and the model of Larsen and Lebech.

To estimate the proportion of seroconverting pregnant women who transmit toxoplasmosis to their offspring in utero, we identified manuscripts from the systematic review that contained data on cohorts of women who seroconverted during pregnancy. We identified 10 studies, including two systematic reviews containing collections of other studies (Appendix D, available at: www.vetepi.uzh.ch/research/Diseaseburden/Burden_CT-Appendices.pdf) that had suitable data from 6198 pregnancies during which seroconversion had occurred. This resulted in 1740 congenitally-infected infants, or a mean transmission rate of 28.1%. We used this mean transmission rate for both the IgM-positive pregnant women and for those who seroconverted during pregnancy, estimated from the formula relating increasing IgG seropositivity with increasing age.

In one study from the United Kingdom of Great Britain and Northern Ireland, the authors employed a systematic review of the published literature from the United Kingdom to estimate the national incidence of toxoplasmosis and used various data sources. From this toxoplasmosis incidence we estimated the number of incident CT cases using the transmission rate described above.

Some countries had no reported data for CT or any seroprevalence data. We had to model their data using data from neighbouring countries. Other countries had sparse data that may not have been nationally representative. This was assessed by examining the target population reported, to check for non-random or biased sampling that included only...
certain populations. In cases in which the data were sparse or of poor quality and in which alternative data were not available, we assumed a much greater uncertainty surrounding CT incidence and prevalence estimates. The quality of the data provided by each study is indicated in Appendix E (available at: www.vetepi.uzh.ch/research/Diseaseburden/Burden_CT-Appendices.pdf).

Diagnostic uncertainty

Wherever possible, we adjusted observed prevalences in accordance with the reported performance of the diagnostic test employed. We obtained the sensitivity and specificity of the diagnostic tests from either the original study, from the test manufacturer or from other reports in which the same test had been used. In many studies in which the diagnostic test had poor positive predictive value, false positives were largely eliminated by using a secondary confirmatory test and follow-up. Thus, when we used data from such studies we only had to adjust for the sensitivity of the test.

Disease model and disability weights

The disability-adjusted life year (DALY) metric was used to estimate the total disease burden comprised by CT. This followed established methods, with DALY = YLL + YLD. YLL is the number of years lost on account of death, and YLD is the number of years lived with a disability, weighted by a factor between 0 and 1 for the severity of the disability. In the main text we report the burden of CT without age weighting or discounting for either YLL or YLD calculations, as was done in the most recent global burden of disease (GBD) study. However, in Appendix F (available at: www.vetepi.uzh.ch/research/Diseaseburden/Burden_CT-Appendices.pdf) we included a table showing mean DALYs per case of CT calculated after age weighting and discounting. The duration of all sequelae of CT was considered to be lifelong, with the exception of a fraction of the cases of chorioretinitis, in which the onset of clinical signs can occur at a mean age of approximately 10 years, according to the evidence. The life table reported in the most recent GBD study with males and females having a life expectancy at birth of 86 years was used to calculate DALYs. The frequency of sequelae varies with the genotype of T. gondii. The incidence of sequelae for all regions except the Region of the Americas was calculated as suggested in a previous study. This is consistent with the CT sequelae reported when predominantly type 2 genotypes are involved, as seen in Europe. However, we used a higher incidence of eye lesions for South American cases and for 61% of North American cases (Table 1). There is considerable parasite polymorphism in South America. Non-type-2 genotypes, which are common there, appear to have more frequent and more severe sequelae. Two thirds of Brazilian children with CT had chorioretinitis by the age of 4 years, compared with 1 in 6 European children with CT. Brazilian CT patients with eye lesions showed more severe visual impairment. In other studies, 80% of CT patients in Brazil were found to have chorioretinitis, with 63% of them suffering bilateral lesions. Consequently, we assumed that chorioretinitis was present in 90% of CT cases from South America (80% in the first year of life), with bilateral involvement by 6 years of age in 70% of the affected cases. According to recent research in North America, 39% of CT cases (in a sample of 166) were exclusively of type 2 genotype, but the remaining 61% were not. Thus, for North American CT cases we assigned a 39% frequency of chorioretinitis, as in Europe, and to the remaining 61% of patients we assigned the same frequency of sequelae as observed in South American patients. We used the same disease model as reported in a previous paper. Our stochastic techniques for estimating the incidence of sequelae were similar to the techniques used to calculate disease incidence. Only the most severe disability weight was given to any one case. Thus, an infant with both chorioretinitis and severe central nervous system abnormalities was only given the weight for the latter. This adjustment was important, for example, for South American cases, since most CT patients there appear to have chorioretinitis.

In the most recent GBD study the disability weight for impaired vision ranged from 0.004 for mild distance vision impairment, to 0.195 for distance vision blindness. We assumed that cases with chorioretinitis had, on average, moderately impaired distance vision (disability weight [DW] = 0.033). However, Appendix F contains estimates of YLDs and DALYs per case, with DW ranging from 0 to 0.2. This covers the range of vision deficits reported in the GBD 2010 study. Similarly, the DWs we used for neurological disorders seem consistent
Table 1. Disease weights for the various syndromes associated with congenital toxoplasmosis, together with the estimated incidence of sequelae

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Disability weight</th>
<th>Incidence* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetal loss (&gt; 24 weeks gestation)</td>
<td>1</td>
<td>2.4 (2.3–6.3)</td>
</tr>
<tr>
<td>Neonatal death</td>
<td>1</td>
<td>0.7 (0.4–1.2)</td>
</tr>
<tr>
<td>Chorioretinitis in first year of life</td>
<td>0.033</td>
<td>13 (12–15)</td>
</tr>
<tr>
<td>Chorioretinitis later in life</td>
<td>0.033</td>
<td>16 (5–52)</td>
</tr>
<tr>
<td>Chorioretinitis in first year of life (NA and SA)</td>
<td>0.033</td>
<td>80 (70–90)b</td>
</tr>
<tr>
<td>Chorioretinitis later in life (NA and SA)</td>
<td>0.033</td>
<td>10 (5–15)b</td>
</tr>
<tr>
<td>Intracranial calcification</td>
<td>0.01</td>
<td>11 (7.9–12)b</td>
</tr>
<tr>
<td>Hydrocephalus</td>
<td>0.36</td>
<td>2.0 (1.0–3.0)</td>
</tr>
<tr>
<td>CNS abnormalities</td>
<td>0.36</td>
<td>2.9 (1.0–6.0)</td>
</tr>
</tbody>
</table>

CNS, central nervous system; CI, credible interval; NA, North America; SA, South America.

b To avoid having the incidence of sequelae being greater than the total incidence of toxoplasmosis, together with the estimated incidence of sequelae once sequelae with higher disability weights had been extracted.

Data were obtained from Kortbeek et al.14 Havelaar et al.14 and Salomon et al.21

Fig. 2. Flowchart showing study selection for the review of the evidence surrounding congenital toxoplasmosis (CT)

1648 retrieved

1235 excluded by title or review of the abstract. No data on seroprevalence or CT incidence

413 retrieved for detailed evaluation

101 excluded. Data only for children or adolescents; population not age-stratified or in highly-selected groups; study older than another study in the same country or region

312 data extracted

77 excluded. Data extracted but not used for country estimates

235 used for country estimates

with the range of values suggested in that study.26 The disability weights we used for the various syndromes associated with CT and the incidence of these syndromes are displayed in Table 1.

Spreadsheet model

We also looked for potentially biased data by examining the targeted populations reported in each study and checking for non-representative sampling (such as sampling in an unrepresentative geographic region of a given country). Bias was assessed on a scale from 1 to 4 (Appendix E). For data with a score of 1 we modelled uncertainty on the sample size of the data. We modelled point estimates of prevalences by using a $\beta$ distribution, which depended on the sample size reported (e.g. the number of pregnant women serologically investigated for IgM). Data with higher bias scores were given progressively wider uncertainty limits. As for all data, $\beta$ distributions were used for modelling adjustments based on diagnostic uncertainties. Appropriate PERT distributions were used for parameters not bound between 0 and 1. For countries without data, we used uniform distributions, with the highest and lowest estimates representing the extremes of estimates for neighbouring countries. We then drew random samples from the distributions representing each component of the model for calculating incidence, YLDs and YLLs and used the Excel add-in PopTools21 to obtain incidence and DALY estimates. The process was repeated for 10 000 iterations; the median was reported, together with 95% credible intervals (CIs). Sensitivity estimates for the potential influence of countries with missing data were also undertaken on the assumption that these countries’ incidences were similar to either the highest or the lowest incidence in their corresponding WHO subregions.

Results

Our search generated 1648 unique citations, including those found in the reference lists of papers found through the systematic review and additional materials supplied by the authors who were contacted. Of this total, we retrieved 413 publications and we used data from 235 of these publications to estimate the incidence of CT in 108 countries (Fig. 2). This included 41 publications – 30 published before 2000 and 11 after 2010 – that were identified when the search criteria were extended for specific countries with no data. All the citations we used are listed in the appendices. We were unable to retrieve data for 87 countries. These countries accounted for approximately 14 million births out of a global total of approximately 131 million in 2008 (11% of the total).

The global estimated incidence of CT is 190 100 annual cases (95% CI: 179 300–206 300). This amounted to an incidence rate of approximately 1.5 cases of CT per 1000 live births (Table 2). If we were to assume that all countries with missing data had the CT incidences per 1000 births of WHO’s European subregion A or Americas subregion C (the subregions with the lowest and highest CT incidences per 1000 births, respectively), the global estimated annual incidence would be 179 900 and 209 000 cases of CT, respectively. Table 2 shows the global distribution of CT cases by WHO epidemiological regions, which are further subdivided into subregions based on mortality strata (A to E). Appendix E gives the estimated CT incidence and burden (in DALYs) for each country, along with estimates by WHO epidemiological region, uncertainty limits, and the methods for arriving at the estimates.
From the annual incidence, the global burden of CT was calculated to be 1.20 million DALYs (95% CI: 0.76–1.90) per annum.

**Discussion**

We have used all available evidence and various techniques to generate our data. Hence, we believe that our estimates of the global burden of CT are robust. Most commonly we obtained CT incidence estimates from age-stratified seroprevalence data, which were the most widely available. Although this approach has been used before, it has at least two major disadvantages. First, infection pressure, or probability of exposure to *T. gondii*, varies with age. In particular, children and adults can have different rates of seroconversion. We minimized this potential error by modelling the age-stratified data only in adults of reproductive age and using logistic regression to discount the cumulative incidence acquired during childhood. Second, the evidence suggests that seroprevalence has decreased over the last few decades in high-income countries. This could artificially inflate the differences between younger and older women and upwardly bias the estimated rates of seroconversion during pregnancy. However, we ameliorated this potential bias, since there was substantially more data from other sources in high-income countries, such as birth surveillance data. In lower-income countries, on the other hand, there is less certain evidence of decreases in seroprevalence over time. Indeed, in Malaysia and the Russian Federation, seroprevalence appears to be increasing in the general population. In such cases, using age-stratified data to estimate incidence could lead to underestimates of the risk of CT. Furthermore, in countries undergoing rapid industrialization, such as China, demand for meat has increased enormously, and this might increase the risk of exposure to *T. gondii* over time.

We adjusted the data in accordance with the known performance of the diagnostic tests used in the studies, while taking into account any secondary or confirmatory tests used. However, diagnostic tests can perform with varying sensitivity and specificity in different populations, so this may have introduced further uncertainty in our estimates. This uncertainty is impossible to adjust for because we could only use the test performance values data that were available and extrapolated them to other populations. The incidence of CT changes much less than population seroprevalence. When infection pressure is high, a small proportion of women are susceptible to infection when they reach child-bearing age, since most have already been exposed. Therefore, although seronegative women are at greater risk, the at-risk population is low overall. When infection pressure is low, the opposite is the case; a large population is at risk but the probability of exposure is low. From a theoretical perspective, the largest number of children is born with CT when the incidence of seroconversion is about 4% per annum. At this incidence, approximately 60% of pregnant women are immune and 1% might be affected. However, if the incidence of seroconversion halves to 2% per annum, the number of affected pregnancies is reduced to approximately 0.8% – a decrease of only 20%. Consequently, very small changes in the expected number of CT cases occur even in the presence of large fluctuations in population seroprevalence. We modelled this phenomenon using Monte-Carlo methods. Therefore, the relative stability of the incidence of CT despite wider fluctuations in population seroprevalence makes our estimates more robust. This is reflected in the relatively narrow CIs of our estimates for the global incidence of CT, independent of wide variations in the quality of the data from different countries and the wide variations in population seroprevalence. Furthermore, simple sensitivity analysis suggests that countries with missing data are not likely to have a large influence on the estimated global burden of CT.

We did not utilize DisMod (World Health Organization, Geneva, Switzerland), a software tool that can be used to check the consistency of estimates of disease incidence, prevalence, duration and case-fatality rates. The latest generally available version of DisMod software (version 2) is not suitable for infectious diseases that confer immunity and the incidence of CT is strongly regulated by

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**Table 2. Global incidence and burden of congenital toxoplasmosis, by region of the World Health Organization**

<table>
<thead>
<tr>
<th>Region</th>
<th>Incident cases (95% CI)</th>
<th>Incidence* (95% CI)</th>
<th>DALYs (95% CI)</th>
<th>DALYs* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFR D</td>
<td>26 500 (24 300–30 100)</td>
<td>2.0 (1.8–2.3)</td>
<td>171 500 (92 300–294 500)</td>
<td>13 (6.9–22)</td>
</tr>
<tr>
<td>AFR E</td>
<td>37 000 (33 900–41 000)</td>
<td>2.4 (2.2–2.5)</td>
<td>235 900 (129 600–379 000)</td>
<td>15 (8.3–24)</td>
</tr>
<tr>
<td>AMR A</td>
<td>2940 (2360–3540)</td>
<td>0.6 (0.5–0.8)</td>
<td>19 700 (14 100–26 700)</td>
<td>4.2 (3.0–5.7)</td>
</tr>
<tr>
<td>AMR B</td>
<td>15 300 (13 100–17 800)</td>
<td>1.8 (1.5–2.0)</td>
<td>105 300 (82 500–127 500)</td>
<td>12 (9.4–15)</td>
</tr>
<tr>
<td>AMR C</td>
<td>5077 (4225–6792)</td>
<td>3.4 (2.5–4.1)</td>
<td>35 000 (24 400–41 200)</td>
<td>19 (13–22)</td>
</tr>
<tr>
<td>EMR B</td>
<td>8450 (6950–9530)</td>
<td>2.5 (2.1–2.9)</td>
<td>53 900 (27 800–84 800)</td>
<td>17 (8.5–26)</td>
</tr>
<tr>
<td>EMR D</td>
<td>26 300 (21 200–31 200)</td>
<td>2.2 (1.7–2.6)</td>
<td>164 900 (84 600–277 800)</td>
<td>14 (6.9–23)</td>
</tr>
<tr>
<td>EUR A</td>
<td>2170 (1900–2896)</td>
<td>0.5 (0.4–0.6)</td>
<td>13 600 (7 508–23 400)</td>
<td>2.8 (1.3–4.3)</td>
</tr>
<tr>
<td>EUR B</td>
<td>5200 (4500–6090)</td>
<td>1.5 (1.3–1.7)</td>
<td>32 200 (17 500–54 700)</td>
<td>9.2 (5.0–16)</td>
</tr>
<tr>
<td>EUR C</td>
<td>4200 (3700–4800)</td>
<td>1.6 (1.4–1.8)</td>
<td>26 400 (14 400–42 700)</td>
<td>10 (5.4–16)</td>
</tr>
<tr>
<td>SEAR B</td>
<td>6430 (4240–8600)</td>
<td>1.3 (0.9–1.7)</td>
<td>40 300 (18 700–71 800)</td>
<td>8.1 (3.8–14)</td>
</tr>
<tr>
<td>SEAR D</td>
<td>25 400 (20 700–30 700)</td>
<td>0.8 (0.7–1.0)</td>
<td>158 300 (85 900–275 400)</td>
<td>5.1 (2.8–8.9)</td>
</tr>
<tr>
<td>WPR A</td>
<td>960 (720–1200)</td>
<td>0.6 (0.5–0.8)</td>
<td>5950 (2900–10 100)</td>
<td>3.9 (1.9–6.6)</td>
</tr>
<tr>
<td>WPR B</td>
<td>24 200 (20 500–28 100)</td>
<td>1.1 (0.9–1.3)</td>
<td>154 700 (81 200–253 000)</td>
<td>7.1 (3.7–12)</td>
</tr>
</tbody>
</table>

Total: 190 100 (179 300–206 300) 1.5 (1.4–1.6) 1 200 000 (760 000–1 900 000) 9.6 (5.8–15)

AFR, African Region; AMR, Region of the Americas; CI, credible interval; DALY, disability-adjusted life year; EMR, Eastern Mediterranean Region; EUR, European Region; SEAR, South-East Asia Region; WPR, Western Pacific Region.

* Per 1000 live births.
immunity in women of child-bearing age. When possible, we checked for consistency by basing estimates on different types of data. For example, in Brazil we estimated the expected incidence of CT from age-stratified prevalence rates in women and from the incidence of IgM-positive blood tests in neonates (the latter adjusted for sensitivity and specificity). Both techniques gave estimates ranging from 6000 to 9000 cases of CT per year.

The highest burden of CT is clearly in South America and it is driven by the more pathogenic genotypes that circulate in that part of the world. The regions with the highest incidence of CT (as opposed to the greatest number of DALYs) include parts of the Middle East and some low-income countries in Africa.

Our estimates of the incidence and burden of CT point to a very large global burden of toxoplasmosis. The burden is even greater when various conditions and problems related to toxoplasmosis are considered. For example, toxoplasmosis is known to cause chorioretinitis in healthy adults and especially in elders, especially in the elderly population, which is characteristic of most high-income countries in Africa.

The results of this study are an estimate of the disease burden attributable to CT. The data and the methods used in the analysis may be used to provide a basis for future research on the subject.

**Acknowledgements**

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**Competing interests:** PT is a member of WHO's Foodborne Disease Epidemiology Reference Group, which commissioned this work.
**Resumen**

La carga global de la toxoplasmosis congénita: una revisión sistemática

**Objetivo** Calcular la carga mundial de la toxoplasmosis congénita (TC) derivada de la infección de mujeres embarazadas con el parásito *Toxoplasma gondii*.

**Métodos** Los autores buscaron sistemáticamente en nueve de las principales bases de datos de fuentes publicadas y no publicadas y establecieron contacto directo con los autores del material original. Se realizaron búsquedas específicas por país. Para ser incluidos, los estudios debían informar sobre la incidencia de la TC, la positividad de IgG específicos de Toxoplasma en niños y mujeres embarazadas (incluidos los resultados de la seroconversión) o la positividad de IgG específicos de Toxoplasma en la población general. Se utilizaron diferentes técnicas de modelización, dependiendo de los datos específicos disponibles de cada país, con el objetivo de calcular la incidencia y la carga de TC en cada país. A continuación se sintetizaron esos datos en una estimación de la incidencia mundial de la TC y la carga mundial de la TC en los años de vida con discapacidad.

**Resultados** Se calculó que la incidencia anual de la toxoplasmosis congénita a nivel mundial es de 190 100 casos (95% de intervalo de confianza: 179 300–206 300). Esto equivale a una carga de 1,2 millones de años de vida perdiendo años de vida con discapacidad (AVCI) (95%-intervalo de confianza: 0,76–1,90). Los datos para la incidencia y la carga de la TC en cada país se sintetizaron y entonces se calcularon al nivel mundial. Los datos se publicarán en una revista preimpresa incluyendo una sección de conclusión y una sección de discusión.

**Conclusion** La toxoplasmosis congénita representa una carga de morbilidad considerable a nivel mundial, y debería ser incluida en las futuras mises à jour de la carga global de morbimidad. Los datos de la incidencia y la carga de TC en cada país se sintetizaron y fueron incluidos en la estimación de la carga global de la TC.

**Referencias**
