In the matter of the Leveson Inquiry into the Culture, Practices and Ethics of the Press

Exhibit "TG1"

This is exhibit "TG1" referred to in the Witness Statement of Tony Gallagher dated 12 July 2012

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### Cat parasite blamed for women's suicide risk

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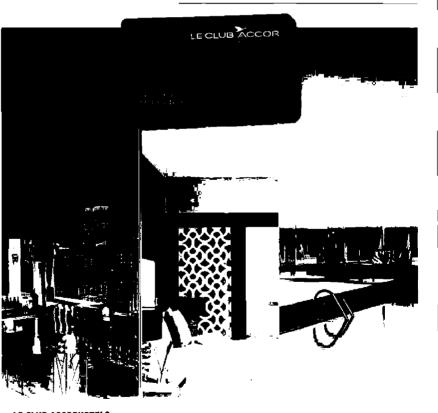


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# Cat parasite blamed for women's suicide risk

CAT owners may be more likely to attempt suicide if they are infected by a common parasite found in cat faeces, new research has suggested.

The study of 45,000 women in Denmark found those infected with the Toxoplasma gondii (T. gondii) parasite, which is spread through contact with cat faeces or eating undercooked meat or unwashed vegetables, were one and a half times more likely to try to kill themselves.

The risk seemed to rise with increasing levels of T. gondii antibodies, said the study's senior author, Doctor Teodor Postolache, at the University of Maryland School of Medicine.

The infection was also linked to mental illness among women. In the matter of the Leveson Inquiry into the Culture, Practices and Ethics of the Press

Exhibit "TG2"

This is exhibit "TG2" referred to in the Witness Statement of Tony Gallagher dated 12 July 2012

\* Print Article - IBTIMES.com: International Business News, Financial News, Market ... Page 1 of 2

### Print

Monday, July 2. 2012 5:22 PM EDT

### 'Cat Lady' Parasite Linked To Higher Suicide Attempt Risk In Some Women

By Roxanne Palmer

A new study based on data of women screened for infection of Toxoplasma gondii -- the parasite primarily spread by cats -- by measuring the parasite's presence in their offspring revealed an additional danger posed by the freeloader, which is known to affect human behavior: The mothers infected with T. gondii were found to have a higher risk of attempting suicide than uninfected mothers, researchers said Monday.

Estimates for the rate of infection range from a little less than a quarter to a third of the U.S. population. Most people will feel no ill effects from the parasite, which lurks in brain and muscle cells, but pregnant women and people with weak immune systems do face risks.

In a paper published in the journal Archives of General Psychiatry, the researchers looked at medical records for nearly 46,000 women in Denmark who gave birth between May 1992 and January 1995 and had volunteered their children to be screened for T. gondii. Since babies don't produce antibodies to the parasite until they're three, the researchers could count a positive screen on the infant as evidence of T. gondii infection in the mother.

The team followed the women's medical progress up until 2006. They found that women infected with *T. gondii* were one and a half times more likely to attempt suicide compared to uninfected women, irrespective of a previous mental illness diagnosis.

"We can't say with certainty that *T. gondii* caused the women to try to kill themselves, but we did find a predictive association between the infection and suicide attempts later in life that warrants additional studies," senior author and University of Maryland associate professor of psychiatry Teodor T. Postolache said in a statement on Monday.

Still, the small number of fatalities from suicide -- 10 in uninfected women and 8 in T. gondii-positive mothers -- is too small to pass statistical rigor, and merits further study, the researchers said.

One of the strengths of the study is that, thanks to the extensive medical records maintained in Denmark, the researchers could adjust the data for prior history of mental illness in the subjects and also their parents.

However, the study isn't perfect: what's missing are childless women, and men, and any suicide attempts that went unrecorded.

*"T. gondii* infection is likely not a random event and it is conceivable that the results could be alternatively explained by people with psychiatric disturbances having a higher risk of becoming *T. gondii* infected prior to contact with the health system," Postolache said.

Previous studies have shown a link between T. gondii and behavioral changes in humans, including schizophrenia.

A 2007 study from a Czech researcher published in the Schizophrenia Bulletin examined how adults infected with the parasite performed on personality questionnaires or on behavioral tests as compared to uninfected people.

http://www.ibtimes.com/art/services/print.php?articleid=358787

12/07/2012

Men infected with the parasite scored lower on 'superego strength' - rule consciousness and behaviors that oppose the self-gratification of the id - and higher on vigilance. In short, they were more jealous and more likely to disregard rules, study author Jaroslav Flegr wrote.

Infected women, on the other hand, were warmer and scored higher on superego strength than uninfected women. Both infected men and infected women also scored higher on apprehension metrics.

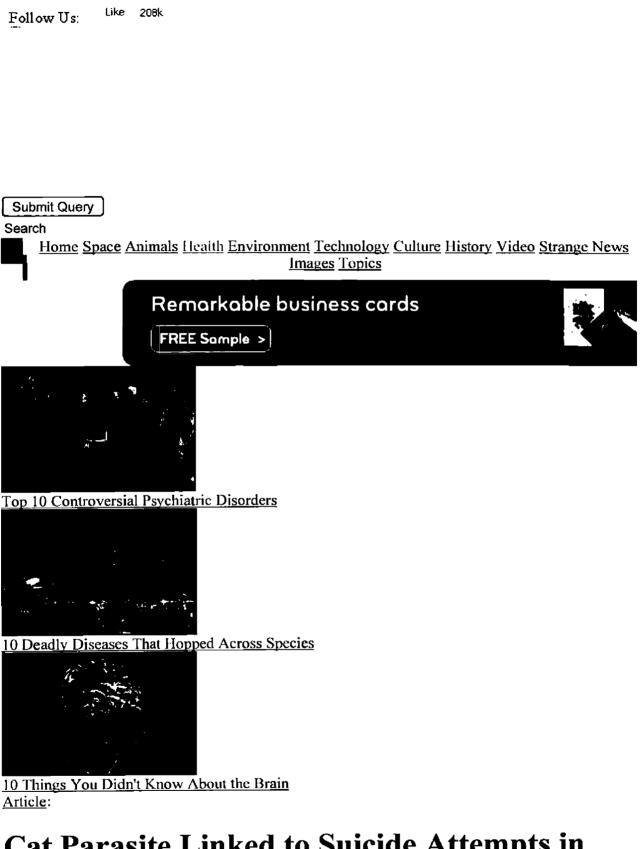
In 2009, researchers from the University of Leeds described a possible method by which T. gondii could trigger schizophrenia and other mental disorders by affecting how the brain produces dopamine. When the parasite infects the brain, it forms a cyst and produces an enzyme called tyrosine hydroxylase, a building block of dopamine, the authors said in the journal PLoS ONE.

"It's highly unlikely that we will find one definitive trigger for schizophrenia as there are many factors involved, but our studies will provide a clue to how toxoplasmosis infection - which is more common than you might think - can impact on the development of the condition in some individuals," lead researcher Glenn McConkey said in 2009.

SOURCE: Pedersen et al. "Toxoplasma gondii Infection and Self-directed Violence in Mothers." Arch Gen Psych, published online 2 July 2012.

12/07/2012

Cat Parasite Linked to Suicide Attempts in Humans | Toxoplasma Gondii | LiveScience Page 1 of 9



## **Cat Parasite Linked to Suicide Attempts in Humans**

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Cat Parasite Linked to Suicide Attempts in Humans | Toxoplasma Gondii | LiveScience Page 2 of 9



The mind-altering parasite called Toxoplasma gondii has a unique apparatus that is likely used to invade host cells and for its own replication. Shown here, the parasite is building daughter scaffolds within the mother cell. CREDIT: Ke Hu and John Murray. PLoS View full size image *T. gondii* is a protozoa that prefers to infect cats, but can make its home in any warm-blooded animal. Humans can pick up the parasite from contact with cat feces, or by eating undercooked meat or unwashed vegetables. Once ingested, *T. gondii* can make a home for itself inside the brain and muscle tissues, protected inside cysts that are resistant to attacks b the host's immune system.

Some studies have linked infection by this parasite with a variety of mental health and brain problems, including schizophrenia, neurosis and <u>brain cancer</u> But scientists aren't clear on whether the parasite contributes to these problems or is a mere side effect. Someone with schizophrenia, for example, might struggle to keep up good hygiene, meaning the mental disorder could increase the risk for infection. [Top 10]

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The new study linking suicide and T. gondii has the same limitation. Researchers can't say for sure whether the parasite somehow drives people to suicide. But in women with infections, they found, the risk of an attempt is 1.5 times greater than in women without.

"We can't say with certainty that *T. gondii* caused the women to try to kill themselves, but we did find a predictive association between the infection and suicide attempts later in life that warrants additional studies," lead researcher Teodor Postolache, a psychiatrist at the University of Maryland School of Medicine, said in a statement. "We plan to continue our research into this possible connection."

### A common infection

One-third of the world's population is <u>infected with *T. gondii*</u>, which is often asymptomatic. The parasite is the reason that pregnant women are advised not to <u>change cat litter boxes</u> — they can inadvertently pass an infection directly to their fetuses.

In its usual animal hosts, *T. gondii* plays a literal cat-and-mouse game. Mice infected with the parasite lose their fear of the smell of cat urine. The parasite actually changes the brain so that the ca

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Cat Parasite Linked to Suicide Attempts in Humans | Toxoplasma Gondii | LiveScience Page 3 of 9

-pee smell becomes <u>sexy to mice</u>, prompting them to get close to their adversaries. This works out well for the parasite, which needs to get to a cat intestine to reproduce.

It's unclear whether the parasite's mind-control techniques have any effect on infected humans. Spurred by a couple of small studies of mentally ill patients that found links between suicide and *T. gondii*, Postolache and his colleagues put together a massive research project on 45,788 Danish women whose newborns had been screened for *T. gondii* antibodies between 1992 and 1995 (a positive result was a sure sign that mom was infected). About a quarter of the women had been infected at the time of delivery, the results revealed.

The researchers then combed through all of the women's later medical records for suicide attempts. They found a relatively small number, 517, had tried to kill themselves, with 78 of these women attempting violent methods such as guns, sharp instruments or jumping. Eighteen women in the sample succeeded at <u>killing themselves</u>, eight of whom had *T. gondii* infections.

A statistical analysis turned up a link between suicide attempts and parasite infection, such that an increasing number of *T. gondii* antibodies were linked with an increasing risk of attempts, especially violent attempts. When looking at just attempted suicides, researchers found women who were infected were 1.8 times more likely to attempt suicide by violent means than uninfected women.

The researchers were able to control for diagnoses of mental illness, meaning that infection was independently linked to suicide attempts, not just to mental health problems in general.

### Suicide and parasites

More study will be needed to determine if the parasite somehow causes <u>suicide attempts</u> or selfharm, Postolache said.

"T. gondii infection is likely not a random event, and it is conceivable that the results could be alternatively explained by people with psychiatric disturbances having a higher risk of becoming T. gondii infected prior to contact with the health system," he said.

If the parasite is found to be a cause, the next mystery to unravel will be how, Postolache said. It could be that the parasite acts directly on the brain in a way that promotes mental illness. Or perhaps it triggers the immune system to attack the brain somehow. Either way, he said, infection by *T. gondii* isn't necessarily a mark of doom. For one thing, even with a 26 percent infection rate, the number of women in the study who attempted suicide was very small. For those who may be at risk, there may be treatments.

"If we can identify a causal relationship, we may be able to predict those at increased risk for attempting suicide and find ways to intervene," Postolache said.

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A common parasitic infection frequently associated with cat litter boxes has been linked to an increased risk of attempting <u>suicide</u> (<u>http://www.examiner.com/topic/suicide</u>) according to a newly published study.

Researchers from Denmark and the University of Maryland conclude that women with a <u>Toxoplasma gondii (http://www.examiner.com/topic/toxoplasma-gondii/articles)</u> infection have an increased risk of self-directed violence although the reason for this connection is not clear.

The study was published online Monday in the <u>Archives of General Psychiatry</u> (<u>http://archpsyc.jamanetwork.com/article.aspx?articleid=1206779)</u>.

According to the prospective cohort study, the risk of self-directed violent behavior was increased 1.53-fold for women who tested positive for the *T. gondii* IgG antibody compared with those testing negative.

Researchers also show that with an increased IgG level, violent suicide attempts (1.8 times) and suicide (2 times) also increased.

In this study, researchers analyzed data from more than 45,000 women in Denmark, who gave birth between 1992 and 1995 and whose babies were screened for T. gondii immunoglobulin G (IgG) antibodies. Since babies don't produce antibodies to T. gondii for several months after they are born, the presence of antibodies in their blood represented infection in the mothers.

The scientists then combed through medical records to determine if there were any suicide attempts, including violent suicide attempts.

They found that a relatively small number (517) women attempted suicide with 78 of these women attempting violent methods such as guns, sharp instruments or jumping. Eighteen women committed suicide of which eight had the parasitic infection.

Lead researcher Teodor Postolache, a psychiatrist at the University of Maryland School of Medicine, said in a statement:

"We can't say with certainty that T. gondii caused the women to try to kill themselves, but we did find a predictive association between the infection and suicide attempts later in life that warrants additional studies. We plan to continue our research into this possible connection."

As reported in <u>CNN Health, Dr. Charles Raison (http://thechart.blogs.cnn.com/2012/07/02/weird-science-kitty-litter-increases-risk-of-suicide/)</u>, associate professor of psychiatry at the University of Arizona in Tucson notes, "There's a strong association between certain types of infection at certain times in life and various psychiatric problems."

Raison goes on to say:

"We have these simple ideas about infection and illness like you get the influenza virus and then get the flu. One bug equals one illness. What we now know is it's much more complicated than that. Infections can produce a lot of secondary effects," he added.

In the context of the current study, that means T. gondii may not be causally linked to increased suicide risk, but a more global and complex process may begin with infection.

"It appears that toxoplasmosis does things that unbalance emotional mental functioning," said Raison, CNNHealth.com's mental health expert. "Depending on other risk factors, maybe it makes you depressed, maybe it makes you impulsive."

http://www.examiner.com/article/parasite-found-kitty-litter-linked-to-suicides-accordi... 12/07/2012

**Toxoplasma gondii** (http://www.examlner.com/article/toxoplasmosis-the-immunocompromised) is a protozoan parasite that's found worldwide. According to the Centers of Disease Control and Prevention (CDC), there are approximately 23% of adults and adolescents infected with the parasite. They also mention that in certain populations around the world the prevalence may be as high as 95%. It is believed that the infection is acquired throughout life.

Human infection with *Toxoplasma* typically occur by one of the following routes; eating undercooked or raw meat, changing cat litter boxes and getting exposed to cat feces while gardening or other activities.

This parasite infects almost all warm-blooded animals, but the domestic cat is the final host. Cats may excrete millions of these parasites in their feces on a daily basis. Cats usually pick up this organism through eating mice, rats, birds and by grooming themselves.

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### Robert Herriman, Infectious Disease Examiner

With over 20 years of experience and education in microbiology and infectious diseases, Robert Herriman, MPH, M (ASCP) will educate and inform about infectious diseases rare and common, those publicized in the media and those found in your own backyard. Leads, story ideas, questions and comments...

### 'Cat ladies' likelier to commit suicide - Times Of India

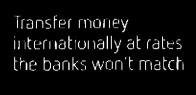
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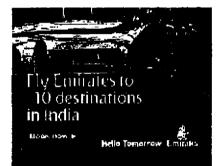
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### 'Cat ladies' likelier to commit suicide

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The Times of Indi-

Tags: Women | violent | University of Maryland | Suicide | spread | parasite | Mental health | health | Cat | behaviour | Antibodies

A common parasite that is found in the cat litter box may cause undetected brain changes in women that make them more prone to suicide, a new study has revealed.

The study involving more than 45,000 women in Denmark reported that women infected with the Toxoplasma gondii (T. gondii) parasite, which is spread through contact with cat faeces or eating undercooked meat or unwashed vegetables, are at increased risk of attempting suicide.



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The infection called toxoplasmosis, has been linked to various mental illness, such as schizophrenia, and changes in behaviour.

"We can't say with certainty that T. gondii caused the women to try to kill themselves, but we did find a predictive association between the infection and suicide attempts later in life that warrants additional studies," the Telegraph quoted study's senior author Doctor Teodor Postolache as saying.

Doctor Albert Reece, vice president of medical affairs at the University of Maryland, said that T. gondii infection is a major public health problem around the world, and many people don't realize they're infected.

"Dr Postolache is a leading expert on suicide neuroimmunology. Suicide is a critically important mental health issue. About one million people commit suicide and another 10 million-attempt suicide worldwide each year. We hope that this type of research will one day help us find ways to save many lives that now end prematurely in suicide," Reece said.

The study is the largest ever of T. gondii and attempted suicide and the first prospective study to document suicide attempts that occurred after the infection was discovered.

The T. gondii parasite flourishes in the intestines of cats, and it is spread through oocysts passed in their facces.

All warm-blooded animals can get infected through ingestion of these occysts.

The organism spreads to their brain and muscles, hiding from the immune system within "evsts" inside the cells.

Humans can get infected by changing their infected cats' litter boxes, cating unwashed vegetables, drinking water from a contaminated source, or more commonly, by cating undercooked or raw meat that is infested with cysts.

Not washing kitchen knives after preparing raw meat before handling another food item also can lead to infection. Pregnant women can pass the parasite directly to their unborn babies and are advised not to change cat litter boxes to avoid possible infection.

http://articles.timesofindia.indiatimes.com/2012-07-03/health/32522697\_1\_suicide-att... 12/07/2012

### 'Cat ladies' likelier to commit suicide - Times Of India

Babies don't produce antibodies to T. gondii for three months after they are born, so the antibodies present in their blood represented infection in the mothers

The researchers checked Danish health registries to determine if any of these women later attempted suicide, including cases of violent suicide attempts which might have involved guns, sharp instruments and jumping from high places.

They found that women infected with T. gondii were one and a half times more likely to attempt suicide compared to those who were not infected, and the risk seemed to rise with increasing levels of the T. gondii antibodies.

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Dr Postolache, an associate professor of psychiatry at the University of Maryland School of Medicine in the United States, noted limitations to the study, such as the inability to determine the cause of the suicidal behaviour.

"T. gondii infection is likely not a random event and it is conceivable that the results could be alternatively explained by people with psychiatric disturbances having a higher risk of becoming T. gondii infected prior to contact with the health system," he added.

The findings were published online in the Archives of General Psychiatry.

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## Common parasite found in cat litter may increase suicide risk

Вy

Published July 03, 2012

| MyHealthNewsDaily

300x250

Women infected with a common parasite called *toxoplasma gondii* may be more likely to attempt suicide, a new study suggests.

Researchers looked at the health records of more than 45,000 Danish women and concluded that over a 14-year period, women with toxoplasmosis, as infections with the parasite are called, were 53 percent more likely to attempt suicide than their uninfected counterparts. The likelihood of making a suicide attempt increased with the levels of parasite-fighting antibodies, suggesting that the stronger the infection, the larger the risk, the researchers said.

The link between the parasite and suicide attempts held when the researchers took into account other factors that may have affected the results, such as the women's mental health and socioeconomic class.

The study showed an association, but does not prove that toxoplasmosis infections might cause women to attempt suicide, the researchers said.

But if a causal relationship was found, researchers might be able to predict who is at an increased risk for attempting suicide, and find ways to intervene, study author Dr. Teodor Postolache, an associate professor of psychiatry at the University of Maryland School of Medicine.

Further research on the topic could lead to a new vaccination against the parasite, avenues for treating people with toxoplasmosis, or increased efforts to teach people how to reduce transmission, Postolache told MyHealthNewsDaily.

### A common infection

Toxoplasma parasites affect a third of people worldwide, and healthy people may develop no symptoms. The parasite is spread through undercooked meat, unwashed vegetables or contact with fecal matter from cats, as the feline family is the only animal host that allows the parasite to reproduce.

The parasite attacks the brain and muscles, but a strong immune system keeps it in check. Infections are more concerning when they happen to people with weakened immune systems, such as pregnant women, people undergoing cancer treatments, and people with HIV.

In the new study, the researchers looked at the records of the Danish women, all of whom gave birth between 1992 and 1995. The infants' blood was sampled for antibodies against toxoplasma, which indicates an infection in the mother, because babies can't develop their own antibodies until they are 3 months old.

The researchers found that not only was toxoplasmosis infection linked with an increased risk of attempting suicide, but also that womenwith toxoplasmosis were more 81 percent likely to attempt to commit suicide violently, with a gun, sharp object or by jumping. In total, 488 women in the study attempted suicide, 78 violently.

One possible explanation for the link to the increased violence could be an increased level of aggression that comes with infection, Postolache said. In order to attempt suicide, one must "be ready to die and have a capability to kill," he said.

Additionally, the researchers found that women with toxoplasmosis were 25 percent more likely to attempt suicide than women who had previously experienced mental health problems.

### A parasite that affects the brain

The new findings are in line with past research suggesting links between toxoplasmosis and schizophrenia and brain cancer, the researchers said.

While the idea of screening people for the parasite may have been "scoffed at 10 years ago," today, the parasite has been shown to be associated with such a wide array of health conditions, and screening is so inexpensive that this may become a viable option, said Kevin Lafferty, a parasite researcher with the U.S. Geological Survey who was not involved in the study.

Lafferty said the link between the parasite and suicide may stem from the parasite's effect on the brain. The infection may make the brain more vulnerable to mental illness and predispose people to suicide. (It's less likely that people with existing mental illnesses are more likely than others to contract the infection, he said.)

"The chemistry of the brain is the underlying common thread here," Lafferty said.

The research was published today (July 2) in the journal Archives of General Psychiatry.

**Pass it on:** Women carrying the parasite toxoplasma may be more likely to attempt suicide.

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### (Thinstock) ±

### 'Cat ladies' may be more likely to attempt suicide, scientists say

Madeleine White

The Globe and Mail

Published Tuesday, Jul. 03 2012, 10:16 AM EDT

Last updated Tuesday, Jul. 03 2012, 10:16 AM EDT

### 116 comments



Report on Business



So you love cats. No big deal, right? Having a few of them has no effect on your mental health. Well, actually, it might.

According to <u>new research</u> from the University of Maryland, owning cats may be a risk factor in why some people attempt suicide. The study looked at the effects of the common cat parasite *Toxoplasma gondii*, which has been attributed to mental health issues in humans in the past. The nasty bug is found in cat feees, making cat litter boxes a cesspool of disease that is repulsive not only for its choking smell but for its health effect.

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Specifically this research, which looked at over 45,000 Danish cat owners, found that infected women (yes, they were all women) were one-and-ahalf times more likely to try to kill themselves than women who didn't have the parasite.

"We can't say with certainty that T, gondii caused the women to try to kill themselves, but we did find a predictive association between the infection and suicide attempts later in life that warrants additional studies. We plan to continue our research into this possible connection," says Dr. Teodor T. Postolache, the senior author of the paper.

Despite the link presented in his paper, Dr. Postolache does concede there are other factors that may be contributing to these suicide attempts. Readers on the Telegraph web site were quick to jump on that point and really claw into the stereotype of the <u>"crazy cat lady."</u>

"Could it just be that lonely single people are in fact more prone to depression and hence suicide attempts?" asked one Telegraph reader.

"In my experience, many women own cats because they are mentally and emotionally immature," harped another know-it-all. "The cat is used as an ideal for the partner she will never find... compliant, doting, easily manipulated and (of course) unable to challenge the woman's motives."

http://www.theglobeandmail.com/life/the-hot-button/cat-ladies-may-be-more-likely-to... 12/07/2012

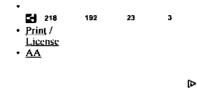
### For Distribution to CPs

'Cat ladies' may be more likely to attempt suicide, scientists say - The Globe and Mail Page 3 of 9

There is, however, one upshot to this study for cat owners. The study found the parasite was especially dangerous for pregnant women, who unknowingly often passed it along to their fetuses. The bright side? Moms-to-be now have a "get out of jail free" card when it comes to cleaning the cat litter.

Cat lovers, do these findings make you nervous?

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## Scientists link cats to female suicides

• From: AFP

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## Women infected with a parasite spread by cat faeces run a higher risk of attempting suicide, suggests a study of more than 45,000 women in Denmark.

"We can't say with certainty that T. gondii caused the women to try to kill themselves," said Teodor Postolache of the University of Maryland medical school, senior author of the study in the Archives of General Psychiatry.

"But we did find a predictive association between the infection and suicide attempts later in life that warrants additional studies. We plan to continue our research into this possible connection."

About one in three people in the world are believed to be infected with T. gondii, which has been linked to schizophrenia and behaviour changes, but often produces no symptoms as it lurks in brain and muscle cells.

http://www.dailytelegraph.com.au/news/weird/scientists-link-cats-to-female-suicides/... 12/07/2012

Humans run the risk of infection when they clean out their cats' litter boxes, as well as by consuming unwashed vegetables, undercooked or raw meat, or water from a contaminated source.

"The study found that women infected with T. gondii were one-and-a-half times more likely to attempt suicide compared to those who were not infected, and the risk seemed to rise with increasing levels of the T. gondii antibodies," a summary of the findings said.

"Previous mental illness did not appear to significantly alter these findings. The relative risk was even higher for violent suicide attempts."

The suspected perils of T. gondii featured in The Atlantic magazine in March this year when it ran a widely-read profile of Czech biologist Jaroslav Flegr, who suspects the parasite of literally changing people's minds.

It headlined the article: "How Your Cat is Making You Crazy."

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### Study Links Cat Litter Box to Increased Suicide Risk

By SUSAN DONALDSON JAMES July 2, 2012—

abcnews.go.com

Toxoplasma Parasite May Cause Changes in the Brain

A common parasite that can lurk in the cat litter box may cause undetected brain changes in women that make them more prone to suicide, according to an international study.

Scientists have long known that pregnant women infected with the toxoplasma gondii parasite -- spread through cat feces, undercooked meat or unwashed vegetables -- could risk still birth or brain damage if transmitted to an unborn infant.

But a new study of more than 45,000 women in Denmark shows changes in their own brains after being infected by the common parasite.

The study, authored by University of Maryland School of Medicine psychiatrist and suicide neuroimmunology expert Dr. Teodor T. Postolache, was published online today in the Archives of General Psychiatry.

The study found that women infected with T. gondii were one and a half times more likely to attempt suicide than those who were not infected. As the level of antibodies in the blood rose, so did the suicide risk. The relative risk was even higher for violent suicide attempts.

"We can't say with certainty that T. gondii caused the women to try to kill themselves, but we did find a predictive association between the infection and suicide attempts later in life that warrants additional studies," said Postolache, who is director of the university's Mood and Anxiety Program and is a senior consultant on suicide prevention.

"There is still a lot we don't know," he told ABCNews.com. "We need a larger cohort and need a better understanding of the vulnerabilities that certain people have to the parasite."

Suicide is a global public health problem. An estimated 10 million attempt suicide and 1 million are successful, according to Postlache's work.

More than 60 million men, women, and children in the United States carry the toxoplasma parasite, according to the Centers for Disease Control and Prevention, but very few have symptoms.

Toxoplasmosis is considered one of the "neglected parasitic infections," a group of five parasitic diseases that have been targeted by CDC for public health action.

About one-third of the world is exposed to T. gondii, and most never experience symptoms and therefore don't know they have been infected. When humans ingest the parasite, the organism spreads from the intestine to the muscles and the brain.

Previous research on rodents shows that the parasite can reside in multiple brain structures, including the amygdala and the prefrontal cortex, which are responsible for emotional and behavioral regulation.

Rat Study Showed Parasite Changes the Brain

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A 2011 study on rats infected by the parasite showed that their fear of cats disappeared. Instead, the parts of their brains associated with sexual arousal were activated. Researchers theorized that the mind-manipulating T. gondii ensures that the parasite will reach and reproduce in the gut of a cat, which it depends upon for its survival.

"The parasite does actually alter the brain of its host," Stanford University study co-author Patrick House told ABCNews.com last year. "The fact that a parasite can get into an organism, target its brain, stay there without killing the host and alter the circuitry of the brain -- we've seen this is insects and fungi, but it's the first time we've seen it in a mammalian host."

It was this and other research that led Postolache to investigate the relationship between the parasite and biological changes in the brain that might lead to suicide. He was also intrigued by studies on allergies and research that showed a connection between toxoplasmosis and schizophrenia.

"I was interested in the neuron aspects of suicide and intrigued by low-grade activation in patients who attempted suicide, as well as victims," he said. "Other studies had looked at the brain and suicide risk and impulsivity. The next question was, what could be the triggers that perpetuate this level of heightened activation in the brain?"

Postolache collaborated with Danish, German and Swedish researchers, using the Danish Cause of Death Register, which logs the causes of all deaths, including suicide. The Danish National Hospital Register was also a source of medical histories on those subjects.

They analyzed data from women who gave birth between 1992 and 1995 and whose babies were screened for T. gondii antibodies. It takes three months for antibodies to develop in babies, so when they were present, it meant their mothers had been infected.

The scientists then cross-checked the death registry to see if these women later killed themselves. They used psychiatric records to rule out women with histories of mental illness.

Postolache said there were limitations to the study and further research is needed, particularly with a larger subject group.

Dr. J. John Mann, a psychiatrist from Columbia University, said Postolache's research mirrors his work in the field of suicidal behavior.

"The relationship of the brain to the immune system is more complex than it may appear," said Mann. "The brain regulates the stress response system, which impacts the immune response."

Scientists already know that steroids like cortisone can affect the immune response. Some antibodies whose goal is to kill off cancer can also affect the brain. Oftentimes the first symptom of pancreatic cancer is depression, he said.

Research also shows that streptococcus bacteria can trigger obsessive-compulsive disorder (OCD) in some children. Sydenham's chorea, the loss of motor control that can occur after acute rheumatic fever, may also be an immune response affecting the brain, according to Mann.

Maryland researcher Postolache suspects that some individuals have a predisposition to these neurological changes.

http://abcnews.go.com/Health/litter-box-parasite-toxoplasma-linked-higher-suicide-ris... 12/07/2012

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He speculates that the parasite may disrupt neurological pathways in those who are vulnerable, so that projections of fear and depression from the amygdala are not tempered or controlled by the "braking" function of the prefrontal cortex.

But, Postolache warns that even if a direct cause were found, no antibiotics for T. gondii yet exist and it could be a decade before effective vaccines or other agents that might stop the neurological damage are developed.

Right now, the most effective weapon against T. gondii is education about handwashing, the proper cooking of food, and not using a knife exposed to raw meat on cooked meat.

He also cautions against trendy food production techniques that let animals roam free. "The risk of infection could go up," he said, "and increase the rate of toxoplasmosis."



By ALEXANDRA SIFFERLIN | @acsifferlin | July 3, 2012 | 7

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Women who are infected with the common cat parasite Toxoplasma gondii may be more vulnerable to suicide, a new study finds, adding to the evidence that T. gondii or Toxo, as the bug is known, may cause subtle changes in the human brain that lead to personality changes and even mental illness.

The parasite is excreted in cat feces — which is why pregnant women are advised not to change the litter box — but it also spreads through undercooked meat and unwashed vegetables. Pregnant women who become infected with T. gondii can pass it onto their fetus, possibly causing brain damage or stillbirth. Now the new study finds that expectant mothers who have the infection, called toxoplasmosis, may themselves be at higher risk of suicide.

The finding comes from a study of 45,788 Danish women who gave birth between May 15, 1992, and January 15, 1995. University of Maryland School of Medicine researchers tested the women's babies for T. gondii antibodies, which the infants could only have acquired from their mothers, and compared infection rates to the women's suicide rates logged in the Danish health registry. The team also cross-checked the mental health registry to find out if any of the women had been previously diagnosed with mental illness.

### (MORE: Crazy Cat Love: Caused By Parasitic Infection?)

They found that women who were infected with T. gondii were one-and-a-half times more likely to attempt suicide than uninfected women. The higher the levels of T. gondii antibodies found, the higher the suicide risk. They were also more likely to try to commit suicide violently, with a gun, sharp object or by jumping. When the researchers took into account women's previous mental illness, they found that those who had toxoplasmosis were more likely to attempt suicide than those who had been mentally ill.

"We can't say with certainty that T. gondii caused the women to try to kill themselves, but we did find a predictive association between the infection and suicide attempts later in life that warrants additional studies," lead study author Dr. Teodor T. Postolache, an associate professor of psychiatry and director of the Mood and Anxiety Program at the University of Maryland School of Medicine, said in a statement.

The findings fall in line with previous studies on T. gondii infection in humans. (In animals also, the parasite has been shown to subvert brain chemistry and manipulate behavior, sometimes dangerously.) A Czech scientist, Jaroslav Flegr, has studied T. gondii's effect on human personality and mental illness for decades, as detailed in a lengthy article in The Atlantic in March. The bug resides in about one-third of the world's population (in the U.S., 10% to 20% are infected), but it usually doesn't cause any noticeable effects - healthy people fight off the flu-like symptoms of an initial infection, after which the parasite lies dormant in the brain. "[O]r at least that's the standard medical wisdom," wrote Kathleen McAuliffe in The Atlantic:

http://healthland.time.com/2012/07/03/are-cat-ladies-more-likely-to-attempt-suicide/

12/07/2012

If Flegr is right, the "latent" parasite may be quietly tweaking the connections between our neurons, changing our response to frightening situations, our trust in others, how outgoing we are, and even our preference for certain scents. And that's not all. He also believes that the organism contributes to car crashes, suicides, and mental disorders such as schizophrenia. When you add up all the different ways it can harm us, says Flegr, *"Toxoplasma* might even kill as many people as malaria, or at least a million people a year."

(MORE: The Science of Women and Cats: The Bond Is Real)

Still, Flegr acknowledged that the effects of the parasite on personality were "very subtle" and that the "vast majority" of people wouldn't even know they were infected. As for whether *T. gondii* infection could be used to predict self-harm or the odds of a car crash, Stanford neuroscientist Robert Sapolsky told McAuliffe: "[1]'m not too worried, in that the effects on humans are not gigantic. If you want to reduce serious car accidents, and you had to choose between curing people of *Toxo* infections versus getting people not to drive drunk or while texting, go for the latter in terms of impact."

In the new study, researchers couldn't establish that T. gondii infection caused increased risk of suicide, only that it was associated. And they're not sure exactly why the link exists. "Is the suicide attempt a direct effect of the parasite on the function of the brain or an exaggerated immune response induced by the parasite affecting the brain? We do not know. In fact, we have not excluded reverse causality as there might be risk factors for suicidal behavior that also make people more susceptible to infection with *T. gondii*," said Postolache in the statement.

The authors call for further studies focusing on the biological mechanisms of the parasite and how it may affect people's suicide risk and other personality factors. If the findings hold up, perhaps *T. gondii* infection could be used to help prevent some of the 10 million suicide attempts that occur each year. "If we can identify a causal relationship, we may be able to predict those at increased risk for attempting suicide and find ways to intervene and offer treatment," Postolache said.

In the meantime, people should cook their meat through, wash their vegetables and give their kitchen knives a good scrubbing to avoid spreading or contracting the parasite.

The study was published online in the Archives of General Psychiatry.

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## **Hail**Online

## Women cat owners are 'more likely to kill themselves' due to higher chance of infection with parasite found in feline faeces

- Women infected with Toxoplasma gondii are one-and-a-half times more likely to attempt suicide
- Third of world's population is infected with parasite, which hides in cells in the brain and muscles, often without producing symptoms

### By Graham Smith

PUBLISHED: 09:52, 3 July 2012 | UPDATED: 09:52, 3 July 2012

Female cat owners are more likely to suffer mental health problems and commit suicide because they can be infected with a common parasite that can be caught from cat litter, according to a study.

Women infected with the Toxoplasma gondii - or T. gondii - parasite, which is spread through contact with cat faeces or eating undercooked meat or unwashed vegetables, are at increased risk of suicidal thoughts.

About a third of the world's population is infected with the parasite, which hides in cells in the brain and muscles, often without producing symptoms.

Women cat owners are 'more likely to kill themselves' due to higher chance of infectio... Page 2 of 7



Risk? Female cat owners are more likely to commit suicide because they can be infected with a common parasite that can be caught from cat litter

The infection, which is called toxoplasmosis, has been linked to mental illness, such as schizophrenia, and changes in behaviour.

Scientists from the U.S., Denmark, Germany and Sweden looked at more than 45,000 Danish women who gave birth between 1992 and 1995.

Babies don't produce antibodies to T. gondii until three months after they are born, so the antibodies present in their blood represented infection in the mothers.

The scientists scoured Danish health registries to determine if any of women diagnosed as infected later attempted suicide, including cases of violent suicide attempts which may have involved guns, sharp instruments and jumping from high places.

They found that women infected with T. gondii were one-and-a-half times more likely to attempt suicide compared to those who were not infected, and the risk seemed to rise with increasing levels of the T. gondii antibodies.

Lead researcher Dr Teodor Postolache, from the University of Maryland, said: 'We can't say with certainty that T. gondii caused the women to try to kill themselves, but we did find a predictive association between the infection and suicide attempts later in life that warrants additional studies.'

http://www.dailymail.co.uk/health/article-2168089/Women-cat-owners-likely-kill-hig... 12/07/2012

Women cat owners are 'more likely to kill themselves' due to higher chance of infectio... Page 3 of 7

### Toxoplasma gondii thrives in the intestines of cats and is spread through oocysts passed in their faeces

The study is the largest ever to try and ascertain a link between T. gondii and attempted suicide and the first prospective study to document suicide attempts that occurred after the infection was discovered.

Dr Postolache's research team at the University of Maryland was the first to report a connection between T. gondii and suicidal behaviour in 2009.

The parasite thrives in the intestines of cats and is spread through oocysts passed in their faeces.

All warm-blooded animals can become infected through ingestion of these oocysts. The organism spreads to their brain and muscles, hiding from the immune system within 'cysts' inside cells.

Humans can become infected by changing their infected cats' litter boxes, eating unwashed vegetables, drinking water from a contaminated source or, more commonly, by eating undercooked or raw meat that is infested with cysts.

Not washing kitchen knives after preparing raw meat before handling another food item also can lead to infection.

Pregnant women can pass the parasite directly to their unborn babies and are advised not to change cat litter boxes to avoid possible infection.

Dr Postolache noted the study's limitations, such as the inability to determine the cause of suicidal behaviour.

He added: 'T. gondii infection is likely not a random event and it is conceivable that the results could be alternatively explained by people with psychiatric disturbances having a higher risk of becoming T. gondii infected prior to contact with the health system.'

The findings are published online in the Archives of General Psychiatry.

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