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Leprosy and elephantiasis: New cases could be prevented in ten years

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The life chances of over one billion people could be improved through examining the transmission of nine neglected tropical diseases (NTDs), an international consortium of researchers has argued. Leprosy, Elephantiasis and Sleeping Sickness are among nine tropical diseases targeted. Neglected tropical diseases affect over one billion people worldwide.

In the first findings by the NTD Modelling Consortium into Leprosy, Elephantiasis (Lymphatic filariasis), Sleeping Sickness (Human African trypanosomiasis) and Visceral Leishmaniasis the researchers say that many urgent policy issues concerning the control and elimination of NTDs can only be answered through high-quality modelling.

Commenting on the findings the NTD Modelling Consortium's principal investigator, Dr Deirdre Hollingsworth of the University of Warwick, said:

"The life chances of over one billion people could be improved through targeted research into how these diseases are being transmitted, by high quality data analysis and modelling- the NTD Modelling Consortium has been established to meet these needs".

The findings, published in four separate papers by researchers from the University of Warwick on each disease in Parasites and Vectors, address the challenges facing health authorities throughout Africa and India.

Leprosy

215,000 new cases of leprosy were detected in 2013, even though the number of new cases has been dropping for decades.

Researchers at the University of Warwick and London School of Hygiene and Tropical Medicine, led by Dr Ron Crump, have adapted a statistical model first developed for the HIV-AIDS epidemic. This predicts, for the first time, the number of people with clinical and sub-clinical infections, and how they will develop over time. Such information is critical for the planning and assessment of elimination programmes. Dr Crump explains:

"Leprosy is caused by infection with a bacterium. Because the times between infection, onset of disease and diagnosis are long and variable, the numbers of cases in 2013 is a mixture of people who were mostly infected from 1995-2010. This means that there are a large number of people who are already infected, and will develop leprosy in the future - a hidden iceberg of disease."

Elephantiasis (Lymphatic filariasis)

It has been estimated that 1.24 billion people are at risk of lymphatic filariasis in tropical and sub-tropical countries in Africa, Asia, the Western Pacific, the Caribbean and South America. Recent campaigns of annual mass drug treatments have dramatically reduced incidence of disease in many countries; however there are still many open questions related to the ambitious 2020 elimination goals.

Led by Dr Deirdre Hollingsworth of the University of Warwick's School of Life Sciences and Institute of Mathematics, mathematical modellers have highlighted that one of the important factors in reaching the targets

is whether there are people who are at high risk of being infected and also are less able to access the mass treatment campaigns.

Dr Mike Irvine, a co-researcher also from the University of Warwick says, "In areas where transmission rates are very high, a combination of approaches will be needed to achieve the elimination targets. Control of the mosquitoes is a very effective tool to improve the impact of the treatment campaigns."

Sleeping Sickness (Human African trypanosomiasis)

Led by Professor Matthew Keeling of the University of Warwick's School of Life Sciences and Institute of Mathematics, researchers have been analysing data on incidence of African sleeping sickness. African sleeping sickness is a deadly vector-borne disease, endemic in many countries across Central and West Africa with around 3,700 cases reported annually and a further 70 million living in at-risk areas.

Dr Kat Rock, co-researcher also from the University Warwick, says:

"Mathematical modelling of sleeping sickness in the Democratic Republic of Congo has shown that screening and treatment programmes have more than halved the number of new infections of this disease over a 15-year period for high-endemicity regions, which is a large achievement. However, the analysis shows that this current intervention is unlikely to achieve the World Health Organization's goal of elimination as a public health problem by 2020.

"The results indicate that as much as 77% of cases which are not detected in mass screening may go unreported. Variation in risk of exposure and participation in screening are key drivers of disease dynamics, suggesting that improved screening or alternate strategies such as vector control are needed to meet the 2020 target".

Visceral Leishmaniasis

Visceral Leishmaniasis is a parasitic disease that disproportionately affects the poorest of the poor in the Indian sub-continent, and kills an estimated 20,000-40,000 people a year globally. Led by Dr Deirdre Hollingsworth, the Warwick researchers have been analysing data on the incidence of cases to understand the course of disease. Dr Hollingsworth says:

"Visceral leishmaniasis is an NTD for which we have a limited understanding of even the basic course of an infection. Using mathematical models we can try to understand these basic dynamics to inform control strategies."

In the Indian sub-continent there is a pool of people who may be contributing to transmission but are not diagnosed. Dr Lloyd Chapman, of the University of Warwick's School of Life Sciences, says that his research has shown that "actively screening for individuals who are likely to develop the disease, and rapidly treating those that do, could prevent many deaths".

The NTD Modelling Consortium, comprising researchers from twelve universities on three continents, was established to assist the global community in meeting the World Health Organisation's 2020 goals for eliminating NTDs.

In addition to the four diseases addressed in initial papers, the consortium also seeks to significantly reduce the transmission rates of Trachoma, Schistosomiasis, Soil-transmitted Helminthiasis, Onchocerciasis and Chagas disease.

A large international effort, the consortium comprises groups from the UK (Imperial College London, Liverpool School of Tropical Medicine,

London School of Tropical Medicine and University of Warwick), Europe (Erasmus Medical Centre), the USA (Case Western Reserve University, Johns Hopkins University, Notre Dame University, Princeton University, University of California San Francisco and Yale University) and Australia (Monash University).

"NTDs are neglected not only in terms of control, but also in terms of the epidemiological research needed to control them. Mathematical modelling is a powerful tool in other areas of infectious disease control and is now being applied more broadly to NTDs. The gathering of this global team is a unique effort, brought together by the goal of improving the health of the poorest populations in the world", says Dr Hollingsworth.

Provided by University of Warwick