RYERSON UNIVERSITY

New Mathematical Model For Ebola Can Help Save Lives

Model developed at Ryerson University may significantly improve survival rates for Ebola

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Ryerson University postdoctoral fellow Xi Huo was the study's lead author. She was co-supervised by Ryerson Professor Professor Kunquan Lan and Professor Jianhong Wu at York Institute for Health Research.

TORONTO, February 22, 2016 --- Ebola is a serious, often fatal, virus. According to the Centers for Disease Control and Prevention, the West African Ebola outbreak in 2014 was responsible for over 11,000 deaths. There continues to be no effective way to produce vaccine or drug therapies for emerging diseases such as Ebola; new outbreaks are a constant concern for the world's health authorities. A new mathematical model developed at Ryerson University examining the 2014 Ebola outbreak may help to significantly improve survival rates for this and other similarly spread diseases—such as Middle East Respiratory Syndrome (MERS).

Treatment-donation-stockpile dynamics in Ebola convalescent blood transfusion therapy, led by Xi Huo, a Ryerson University postdoctoral fellow co-supervised by Ryerson Professor Kunquan Lan and Professor Jianhong Wu at York Institute for Health Research, used existing mathematical models to evaluate the blood treatment methods used during the Ebola outbreak. The resulting new model is able to quantitatively inform possible future outcomes with realistic blood service data, and help policy-makers to form strategic plans in preparation for emerging disease outbreaks.

This is the first comprehensive study of the logistics behind large-scale blood transfusion/antibody therapy during Ebola outbreaks. The paper highlights areas of improvement in order to save more lives in the case of an Ebola outbreak, including:

- Mobilizing quickly to begin collecting survivor donations
- Encouraging survivors' willingness to donate blood
- Limiting hospital palliative care resources and instead focusing on treatment
- Improving blood donation storage conditions
- Rapidly and accurately disseminating information regarding blood stockpiles
- Streamlining of blood safety screening and delivery services

"As part of this study, we used mathematical models to evaluate the blood treatment strategies employed during the 2014-2015 Ebola outbreak, and used publically available infection data and the WHO's blood transfusion therapy guideline to inform the optimal strategies for large-scale use of this treatment," said Huo. "We conclude that by optimizing treatment strategy during an Ebola outbreak, the mortality rate can be reduced to under 50 per cent, a substantial improvement over the reported rate of 70 per cent."

Dr. Huo and her collaborators examined multiple factors influencing Ebola's disease transmission dynamics and large-scale blood transfusion treatment, including distribution logistics, necessary health care resources, stockpiling of resources, record-keeping, storage, and more.

These learnings can also apply to disease outbreaks beyond Ebola. York University professor Jianhong Wu, the paper's co-author and Canada Research Chair in Industrial and Applied Mathematics, added, "We have seen, from SARS, pandemic influenza, MERS and now Zika, how difficult it is to produce effective vaccines in a timely fashion. This highlights the importance of developing the public health capacity for rapid delivery of antibody treatment. Much of this infrastructure can be developed before the outbreak takes place, and our study shows how a significant number of lives can be saved."

In order to further inform treatment strategies during disease outbreaks, the researchers' next steps involve undertaking future cost-effective studies. This will provide economical guidance on large-scale Ebola blood transfusion therapy, including blood collection, screening and matching, delivery, as well as storage.

Treatment-donation-stockpile dynamics in Ebola convalescent blood transfusion therapy will appear in the March 2016 issue of the Journal of Theoretical Biology.

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