

RESEARCH FOR THE WORLD

Can we use AI to predict mental health crises?

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The rising demand for mental healthcare is prompting hospitals to work on and identify novel methods of anticipating demand and better deploying their limited resources. Research led by **Aleksandar Matic** explores how machine learning could help.

Nearly one billion people worldwide are living with a mental health disorder. With demand for mental health care rising, there is a strong need to pro-actively anticipate patient demand, improve patient outcomes and decrease long-term costs.

Research led by Visiting Fellow Dr Aleksandar Matic from the Department of Psychological and Behavioural Science at LSE aims to tackle these concerns by using machine learning to help predict mental health crises in patients so they can be prevented and caseloads can be better managed.

Conducted using the records of patients who had suffered at least one previous mental health crisis event, the research works on the assumption that historical patterns can predict future crises. A crisis is described as a situation where a patient can neither care for themselves nor function effectively in the community, and where they may hurt themselves or others.



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Finding patterns in patient journeys

To carry out the study, the researchers explored how to develop machine learning algorithms by leveraging the anonymous health record data of over 17,000 patients spanning seven years to accurately predict the risk of a crisis in a 28-day period.

“The model works by finding patterns in patient journeys which suggest an upcoming crisis and are too complex for humans to infer,” explains Dr Matic, who also works as R&D Director at **Koa Health**, a digital mental healthcare provider. “Much like predictive text on your phone which detects a pattern and gives you a recommendation for the word you are trying to type, machine learning in this case examines patterns in patient journeys to predict what will come next.”

Three different variables of data were fed into the algorithm. Firstly, the researchers inputted static data about patients such as their age, gender and diagnosis. Secondly, they included information from the patient’s latest assessment and interaction with the hospital, including the severity and number of previous crisis events. Finally, they inputted variables representing time elapsed since registered events such as the patient’s last crisis, their last contact with the hospital and the time elapsed since their last referral. Using this information, the algorithm was able to continuously monitor patients for risk of a mental health crisis over a period of 28 days.

The researchers found that, in 64 per cent of cases, the machine learning predictions were deemed “clinically valuable” in terms of either managing caseloads or mitigating risk. More specifically, clinicians reported the predictions were useful for preventing crises in 19 per cent of cases, identifying the deterioration of a patient’s condition in 17 per cent of cases and managing caseload priorities in 28 per cent of cases.

Although there is further work to do to improve accuracy, these results show that machine learning can play a major role in predicting preventing and mitigating mental health crises.


The problem with electronic records

However, one of the main limitations in this area currently stems from the quality of electronic records and structure of our healthcare system. “I’m surprised we achieved the accuracy we did in this study due to the problems with electronic health records as a data source – they can be sparse, there are biases and there are errors,” explains Dr Matic.

“The reactive episodic nature of healthcare means patients come to hospital when they’re already sick so there are gaps in the data. You don’t know what’s happened in between their hospital visits. We show in the paper that the accuracy of predictions changes depending on the gaps in the data. If you don’t have any information on patients for two years, you can’t really predict anything.”

The researchers found lack of records for more than three months resulted in a seven per cent drop in accuracy and missing records for more than six months to a year contributed to a 13 per cent to 20 per cent drop



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We need to shift from episodic to proactive healthcare

Dr Matic believes part of the solution is building technology that can shift the paradigm from episodic reactive healthcare to continuous proactive healthcare that is digitally supported.

For example, he argues we can start by making patients aware of mental health risk factors and empowering them to address some of these risks. "I'm not talking about the most serious cases here," he clarifies. "The area where the most unmet need lies is where people have mild or moderate symptoms. In these cases, technology and digital therapies could help. I don't think technology will, or should, replace psychologists or psychiatrists but it could help scale their support better and reduce the face time needed with therapists."

He suggests healthcare data collected via smartphones, for instance, could also help support a continuous care model with these devices providing psychological data and information on day-to-day behaviours such as sleep, mobility patterns, and physical activity levels.

With an **estimated 1.2 million people** currently on waiting lists for NHS mental health services in England, anything that helps manage caseloads sounds promising but are there any concerns around using technology for this purpose?

Dr Matic believes there are some challenges but transparency is key. "Unknown biases are very important and every sample will be biased until we have a critical mass of data," he says. With this in mind, the same scientific team is working on replicating this research and testing the algorithm in various healthcare systems in different countries to ensure the results are consistent. A recent replication study in the US has produced consistent findings.

As we face an ever-growing mental health emergency, one thing is abundantly clear: anything that can help patients, mitigate risks and manage caseloads is certainly worth exploring. ■

Dr Aleksandar Matic was speaking to Charlotte Kelloway, Media Relations Manager at LSE.

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