

The technology behind Bitcoin may improve the medications of the future

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Credit: University of Copenhagen

Researchers at the University of Copenhagen have developed a prototype of an app that may potentially prescribe the optimal dose of medicine for the individual patient, as well as prevent counterfeit products.

Big data. Machine Learning. Internet of Things. Blockchain. Futuristic

concepts from the world of technology will likely soon find their way into your medicine cabinet—and onto your mobile phone.

Using a prototype app for smartphones, researchers from the University of Copenhagen have taken the next step in the dosing, production and distribution of the [pharmaceutical products](#) of the future. And the time for innovation is more than ripe, says Professor Jukka Rantanen of the Department of Pharmacy:

"200 years ago, the first patent on making tablets was filed and the products have not changed much since. We are still having the same tablets. What we are doing now is suggesting a totally new type of product," he says.

"By rethinking the product design principles, related manufacturing solutions and distribution models for the pharmaceutical products, it is possible to dramatically reduce the overall price of medicine while also improving the safety and efficacy of the medication."

App-othecary

The core of Jukka Rantanen and his research group's wager for a future solution for pharmaceutical products is the new concept of cryptopharmaceuticals, embodying the mentioned prototype of an app for smartphones.

The app is called 'MedBlockChain' and has been developed by the group's former MSc-student Lasse Nørfeldt. It is, among other things, based on the research group's earlier work on digitalisation of pharmaceutical products, for example in the form of printing medications as edible QR codes.

With the app, patients will be able to scan a medication and receive

confirmation that it is a genuine product and not a fake item. A problem that, according to Jukka Rantanen, is particularly serious in countries with less structured medicines regulatory agencies.

At the same time, patients can choose to provide access to a range of personal data—everything from heart rate monitor watches, pedometers and internet-connected bath scales to genetic profiles, screen time and social media usage—all contributing with knowledge that can enable computer systems based on artificial intelligence to gradually pin down the optimal dose for each patient.

"This type of data already exist in our information-rich society. It would be logical to employ this [big data](#) for something useful. Not just for sharing on Facebook, your exercise app or something like that, but also for defining your optimal dose of given medicine," says Jukka Rantanen.

Builds on Blockchain

With the growing mass of personal data, data security is also gaining importance, Jukka Rantanen points out.

To guarantee [data security](#), the app uses the so-called blockchain technology, which is probably best known in connection with the cryptocurrency Bitcoin.

With blockchain, information—or data blocks—are linked in a chain that cannot be changed without simultaneously altering all other links of information in the chain. Thus, all changes will be detected and may be traced. If something looks suspicious, the system can also generate an alarm.

As an example, a patient who scans a QR code on his medication may be alerted by an alarm if the code does not match the one that the

pharmaceutical company has entered into the system, or if the medication does not match with the prescription. Conversely, the pharmaceutical company may be alerted if an otherwise unique medication code is registered more than once.

Likewise, an absence of registrations may form the basis for alarms as it may reveal that the patient is not taking his or her medication as planned. This information may for example be shared with the patient's doctor or relatives.

Cryptopharmaceuticals

The blockchain concept may still seem distant to most people, but in fact, the technology is already being used in similar ways for everything from insurance and finance to shipping and food, explains Jukka Rantanen.

As an example, Chinese consumers have already become accustomed to scanning items in the supermarket to confirm that the product they are buying is, for example, indeed bacon produced in Denmark, and not a counterfeit product.

"All of this is technologically possible. Now, the big question is how we should handle all of this data and who should get access to it. That is the discussion we hope to start with this new concept of cryptopharmaceuticals," says Jukka Rantanen.

He emphasises Denmark as an obvious candidate as a pioneer country for the technology. Among other things based on the country's existing tradition of storing citizens' health data and prominent pharmaceutical industry.

"I think it has huge potential for Denmark to be among the first movers

on this type of product. It is not limited to only one clinical condition. There could be a completely new type of product family coming out of this," says Jukka Rantanen.

For the research team at the University of Copenhagen, the next step is to test the app on a test group of patients. This could for example be diabetes, where patients are most often accustomed to taking medication and measuring their personal blood sugar on a regular basis.

The 'MedBlockChain' app may be downloaded from the App Store and Google PLAY. Note that this product is not final, but an illustrative prototype.

What is Blockchain?

A blockchain is a growing chain of data where each link—or block—is connected by means of a special, encrypted code.

Each block has its own timestamp and contains information on previous blocks. Therefore, you can always go back and trace what has happened along the way.

A network of computers, often in a huge number, shares the chain of data blocks. When new blocks are added, it will be confirmed by all the computers in the network, using a consensus mechanism.

The design makes blockchains almost impossible to manipulate. It is thus a very secure way to process and store data.

More information: Lasse Nørfeldt et al, Cryptopharmaceuticals: Increasing the Safety of Medication by a Blockchain of Pharmaceutical Products, *Journal of Pharmaceutical Sciences* (2019). [DOI: 10.1016/j.xphs.2019.04.025](https://doi.org/10.1016/j.xphs.2019.04.025)

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