# CASE STUDY

# A CASE STUDY IN BLOCKCHAIN HEALTH CARE INNOVATION

## *Thomas F Heston

Elson S Floyd College of Medicine, Washington State University, PO Box1495,Spokane,WA99210USA

| ARTICLE INFO | ABSTRACT |
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| | Healthcare complexity and costs can be decreased through the application of blockchain technology to medical records and insurance companies. Estonia has taken a leadership role in blockchain based services both in the commercial sector and in government. The Estonian government's innovation strategy was to create GovTech partnerships to implement blockchain based technologies throughout the country, and become a global leader in the technology. Starting in 2011, just 3 years after Satoshi Nakamoto published the first description of distributed ledgers and blockchain technology, the Estonian Government started partnering with the private technology startup company Guardtime to use blockchains to secure public and internal records. Then in 2016, Estonia once again reinforced its global leadership in blockchain technology when it announced it would use blockchain technology to secure the health records of over a million citizens. Estonia's systematic method of applying blockchain technologies through GovTech partnerships demnostrates how innovation is a process. Estonia also identified early the value of the blockchain as a disruptive platform innovation. The application of blockchain technology to healthcare is a radical innovation given that nearly all previous applications have been in the financial and legal sectors. |

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## INTRODUCTION

Healthcare is at a crisis globally, with global demand for medical services outpacing the ability to pay for it. As the world population ages, the ratio of elderly people to working age people is rapidly growing. The result is a greater need for healthcare services by the elderly, with fewer working age people to provide financial support for medical insurance. In addition, the cost of providing medical care continues to outpace inflation, with the average global rise in medical care projected to be 7.8% in 2017, up from 7.3% in 2016 and 7.5% in 2015 (1). These two factors, an aging population with fewer working age people to pay for their medical costs, along with steadily increasing costs of medical care, are creating an enormous pressure on governments and businesses to find innovative ways to make the delivery of health care more efficient and less costly. Advances in technology to tame the bureaucratic burden of medical care will provide aprimary means to accomplish these goals. A major technological breakthrough occurred in 2008 with the publication of Satoshi Nakamoto's white paper on bitcoin (2). Nakamoto proposed a way to create a safe and secure system of money built upon a distributed ledger known as the blockchain. This innovation was a revolutionary, disruptive breakthrough. Through the use of a blockchain, control of financial transactions could be

*Corresponding author:* **Thomas F Heston**<br>Elson S Floyd College of Medicine, Washington State University, PO Box1495,Spokane,WA99210USA.

taken away from a central, trusted authority and instead be controlled by a decentralized, widely distributed, and secure ledger. Estonia was one of the first countries to recognize the vast potential of blockchain technology beyond money, and became an early adapterincreating block chain based governmental systems.

### Estonia's Innovative Approach

Estonia's government saw vast opportunities in blockchain applications as early as 2011, shortly after introduction of the technology. Even before that, however, Estonia laid a strong technology foundation in 1992 when Mart Laar, Estonia's prime minister at the time, committed the country to high technology. By 1998, all Estonian schools were online, and in 2000, Estonia declared Internet access to be a human right (3). With this foundation, Estonia has implemented innovation as a system through the promotion of GovTech partnerships (4). In healthcare, Estonia has collaborated with Guardtime, a private data security company, to secure the health records of over one million citizens. The blockchain based proprietary Keyless Signature Infrastructure will be utilized to insure record security and at the same time wide availability to authorized parties (5).

### Benefits of Introduction

Using the blockchain to store medical records has the potential to make private healthcare data more tamper-proof, secure, and

scalable. The distributed nature of the blockchain can ease the sharing of data among authorized parties and bridge traditional data silos, dramatically increasing efficiencies and improve coordination of care (6). Costs of medical care can be decreased through better insurance claim coordination with treatment rendered. Data auditing is improved through the immutable records maintained by the blockchain. The costs associated with blockchain mining can even be offset by offering anonymized metadata rewards for medical researchers (7).

**Critical Success Factors**

The success of the Estonian medical record blockchain project will depend upon its ability to keep medical records private while at the same time widely available to medical providers and insurance companies. Estonia has already successfully setup a process of routinely searching for new blockchain applications, and selected a strategic partner in the private sector (Guardtime). Implementation of their e-health initiative has been supported by Estonia's Health Information System Act of 2007 and the Government Regulatory Act of Health Information Exchange in 2008 (8). They have demostrated value capture by applying lessons learned to their larger eEstonia range of services, which include eTaxes, eElections, and eSchools. While they have become arguably the most successful country to implement a blockchain based health record system, life expectancy ranks only 40th out of 194 member states of the World Health Organization (9). The ultimate success or failure of their eHealth initiative will be reflected in theirabilitytoimprovetheaveragecitizen'slife expectancyfromit'scurrent77.6years.

**Challenges and Risks**

The blockchain platform for the development of secure, immutable, and easily accessible medical records has great potential but also great challenges. As the world becomes more digitally and socially connected, there is a growing need for global solutions to health. Scaling a national blockain based electronic medical record to the global community will require broad acceptance of protocols for the coding of medical information. Incentizising individuals, healthcare providers, medical systems, and insurance companies to adopt a single system will likely be prohibitively expensive. It is possible that the development of blockchain based electronic medical records will proceed along similar lines as cryptocurrency, starting with a single coin (Bitcoin in 2009) then rapidly expanding to 4331+ coins by 2017 (10). While such a large diversity in cryptocurrency may be desireable, a single blockchain for medical records would provide tremendous benefits in terms of medical research, the financing of medical services,andtheadvancementofglobalhealth.

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