

*The Natural*  
**Health Network**

*A decentralized, user-centric  
marketplace, uniting all participants  
in the health data exchange ecosystem.*

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# Abstract

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**The advent and recent rise of blockchain technology has introduced society to the potential benefits of decentralization in technology. The decentralized world knows no borders; both geographical and socioeconomic.**

This technology has the potential to transform data exchange by giving people everywhere back their rights in controlling who sees and has access to their personal data, while making it immutable and resistant to tampering, adding an extra layer of security many of us currently do not know.

The Natural Health Network is a decentralized network for health, fitness, lifestyle, and medical data exchange, where users have full and complete access to their personal health and medical records anywhere in the world, and control all access to who sees and licenses this data for treatment and research & development purposes.

The current Electronic Health Records (EHRs) system is wrought with proprietary, legacy systems, resulting in data silos of personal records, and leaving healthcare users personal records incomplete and fragmented at best. These fragmented, incomplete personal health and medical records make research and development by those who purchase those records more costly and leaves those researchers with incomplete data. Furthermore, when being treated, patients are at a greater risk of injury and even death as a result of medical error due to incomplete medical records information.

This whitepaper outlines the plethora of problems facing the current healthcare system, namely the problems caused by the current methodology for electronically tracking personal health and medical information and records. We will discuss how The Natural Health Network aims to create a solution to this problem by building a user-centric platform that is inclusive of all practitioners and forms of personal health and medical information. On this platform, healthcare practitioners of all types will work within a single user profile, to contribute to a lone “living record” for the user that will grow more robust, detailed, and prolific with every submission from every network practitioner over time.

# Motivation

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We strongly believe that patient and healthcare user access and rights to their own records is a major problem that both increases administrative costs and is highly inefficient for data exchange for all participants in the health data exchange ecosystem (e.g. patients, practitioners, researchers).

**This has also become a legitimate public health issue due to the injury and even deaths that result from medical error due to incomplete and inconsistent patient health and medical records.**

The current Electronic Health Records (EHRs) system is made up of proprietary, legacy systems that lack interoperability with other networks, resulting in patient data and information silos that create inconsistent and incomplete records. These “silos” mean that a healthcare user who travels, lives abroad, or even sees multiple practitioners using different EHR systems, will not have full access to their complete health and medical records. This is also an issue for those who collect data such as researchers, doctors running clinical studies, and developers as they have to gather data in an inefficient, costly manner, that is often times incomplete as well.

Furthermore, it is our belief that personal health and medical records data should be robust in nature, and should include as much information as possible on fitness, lifestyle, and personal wellness so that those viewing this information are able to draw more informed, concise conclusions when consulting with and/or treating a patient.

This means an EHR system that has a more holistic approach and allows practitioners of all types to work with the same patient and user records in a highly accessible manner. As consumers become more informed and their preferences shift more and more towards natural and alternative forms of medicine and treatment, their personal health records should be inclusive of this shift.

Not only should this information be as complete and comprehensive as possible, so that it paints the full picture of the patient and user's health, but it should be accessible by the user and all practitioners at all times. The way the current EHRs system is set up, information is fragmented, locked away in various silos, only accessible by practitioners who have access to that specific proprietary EHR system. And patient access is generally quite inefficient, often times forcing the patient to physically be at the hospital or practitioner's office where they have to fill out a request, and even pay an administrative cost to receive a physical copy of their records.

Giving users full access to more complete medical records should become the standard in healthcare as it is in the banking and financial sectors, and we also believe that full and complete rights to who sees and uses this data should become the standard as well. By sticking with dated, proprietary legacy systems that create data silos, those with access to those silos maintain control over who sees and uses that data, and most importantly to them, how they monetize it. Users should have full rights to their own data, with complete control over who sees it, and how they want to monetize it if they should choose to do so.

In our eyes, the only solution to these problems is the Blockchain. Utilizing blockchain technology will allow for user health and medical data to be stored in a decentralized database, with greater security, and will allow for users to finally gain full access and complete rights to their own personal health and medical data.

# Current Issues In Healthcare

## 3.1 Lack of Interoperability

The current Electronic Health Records (EHRs) systems are fragmented, disparate, and siloed. Proprietary, legacy systems create records that are incomplete, full of inconsistencies, and can vary in important and critical details from hospital to hospital.

These silos of patient information from hospital to hospital created by these proprietary legacy systems can make proper patient care difficult, which can lead to mistreatment, further injury, and even death while being cared for.

[1] A paper published in 2016 by two researchers from Johns Hopkins estimates that “Medical Error” is the third leading cause of death in the US behind Heart Disease and Cancer. When all causes of death related to “Medical Error” are taken into account, this paper estimates that 251,453 deaths in US hospitals a year are attributed to “Medical Error”.

At minimum, this classifies medical error as a legitimate public concern, and if the estimate in the 2016 paper is accurate, death from medical error is an all out public health problem.

The serious effects of a lack of interoperability are also felt by those in research and development as well. As a result of the lack of interoperability, consistent, large scale data collection becomes very difficult, if not nearly impossible. This means that much of the medical research and clinical studies performed, are being performed with incomplete data, leaving the findings open to inconsistencies. Furthermore, having to gather data going from siloed legacy system to siloed legacy system is a cumbersome, inefficient, and costly method of data collection.

[1] *Medical Error—The Third Leading Cause of Death in the U.S. (2016)* Cite as: *BMJ* 2016,353:i2139 <https://www.bmj.com/content/353/bmj.i2139.full>

## 3.2 Security & Fraud

### Security protocols for EHRs lag in safety and security behind banking and financial sectors, leaving your personal information more vulnerable to theft.

Medical records are often times the most valuable source of identity theft on the black markets because not only do they contain your health insurance info making insurance and prescription fraud more easy, but they usually contain your driver's license, social security number, and other highly relevant information for identity theft.

As a result of the lack of quality security protocols, due to legacy, proprietary EHR systems in place, and the fact that medical records are a highly sought after source for personal identity theft, it is estimated that by 2024, every person in the US will have had their health care data compromised.

[2] These breaches are costly too, and these costs impact and drive up healthcare costs which are then passed onto healthcare users. Each year, healthcare IT breaches cost the industry \$6B, and these numbers continue to grow.

[3] Once private, personal health insurance information has been stolen due to a security breach, the costs and ramifications of these breaches are then felt in even greater numbers in the form of insurance fraud. Statistics released by *The National Healthcare Anti-Fraud Association* conservatively estimates that health care fraud costs the US \$68B annually, which is about 3% of the \$2.26 trillion spent annually on healthcare. It also cites that other estimates can be as high as 10% of the annual healthcare costs, or \$230 billion annually.

[2] *The Frightening New Frontier for Hackers: Medical Records* (April 10, 2017)  
<https://www.modernhealthcare.com/article/20170410/NEWS/170419987>

[3] *Source: Fraud Statistics-Blue Cross Blue Shield of Michigan.*  
<https://www.bcbsm.com/health-care-fraud/fraud-statistics.html>

### 3.3 Evolving Consumer Behaviors and Preferences

Consumers in today's modern and fast changing environment demand more access to their personal information, and in an instantaneous manner. Furthermore, healthcare users behaviors and personal views towards healthcare are changing and evolving quickly.

[4] The number of citizens and students moving abroad continues to grow, people travel internationally more than ever, and international travel for medical services is increasing dramatically. In a study performed by consulting firm Deloitte, they estimated that 750,000 US citizens travelled abroad for medical services in 2007, and estimated at that time, that the number would grow to 1,600,000 by 2012.

[5] Consumers, faced with more flexibility and options, are seeking natural and alternative methods for treatment and prevention in growing numbers. A 2017 report by Grand View Research, Inc estimates that the 'complementary and alternative medicine' market will grow to \$196.87B by 2025 citing an increase in adoption of alternative medicine and government initiatives as the main reasons.

[6] Also a result of increased flexibility, options, and a more educated healthcare user, consumers are increasingly seeking second opinions at an annual CAGR of 18.2%.

[4] Source: *The movement of patients across borders: challenges and opportunities for public health.* <http://www.who.int/bulletin/volumes/89/1/10-076612/en/>

[5] Source: *Alternative & Complementary Medicine Market Worth \$196.87B by 2025: Grand View Research, Inc:*  
<https://www.prnewswire.com/news-releases/alternative--complementary-medicine-market-worth-19687-billion-by-2025-grand-view-research-inc-619591673.html>

[6] Source: *Medical Second Opinion Market Set to Grow \$3.4B by 2020.*  
<https://www.prnewswire.com/news-releases/alternative--complementary-medicine-market-worth-19687-billion-by-2025-grand-view-research-inc-619591673.html>



# *Welcome to the* **Natural Health Network**

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The Natural Health Network is a platform that utilizes blockchain technology to enable all participants in the network to access, exchange, and use health, fitness, lifestyle, and patient data in a fully transparent manner, and to the benefit of the network itself.

User and patient data on The Natural Health Network will be stored in a secure, decentralized blockchain, that will allow for standardization of all records, creating a single user-centric profile that serves as a “living record” for the user, accessible anywhere in the world.

## **4.1 The Data Marketplace**

The Data Marketplace acts as the broker within the network that connects third parties seeking specific user information with the users willing to provide this information in an anonymous fashion.

### **4.1.1 Giving users full access and rights to their data**

The Natural Health Network will give users complete ownership over their data, giving them the ability to grant conditional access to anyone seeking it. This can include insurance agents, practitioners, pharmacists and anyone needing a certain level of access to help treat and/or care for the patient. This can also include those seeking user information for third party research and development purposes such as medical researchers, marketers, pharmaceutical companies, app and software developers, those running third party clinical studies, and any other party or entity interested in accessing this data.

### 4.1.2 Data is the biggest asset class

When all segments of the health data market combine, the current total addressable market for The Natural Health Network is over \$50 billion and is expected to grow to over \$100 billion by 2021. On top of this is also the unforeseen potential growth and new revenue streams for companies that can broker health data as the Big Data industry is currently seeing unprecedented growth.

The proliferation of wearable devices, sensor based apps, and mobile apps tracking everything from exercise to meditation data will create new revenue opportunities and strategic partnerships, and establish a new data market that will also give our users the opportunity to create and build truly holistic, prolific, and robust user profiles. This will not only better serve third parties seeking to purchase that data, but will also ensure better care and treatment when needing healthcare for that user.

### 4.1.3 How it works

Third parties seeking data from The Natural Health Network's users put in a query to The Data Marketplace requesting specific user information. Users then have the ability to provide information in one of two ways should they so choose:

1. A user receives a request for information and decides to either grant access in an anonymized fashion or to deny access.
2. Users can also create settings that automatically allows any access to their information by third parties in an anonymized fashion.

In both instances, the third party requesting user information, such as a medical researcher or software developer, pays for all information via NHN tokens. The Natural Health Network *Data Marketplace* receives payment for the comprehensive user data it provides, acting as the broker for the user and third party, and then pays out each individual user in NHN tokens with respect to the amount of information provided to the third party. For each individual transaction *The Data Marketplace* brokers between the user and the third party, The Natural Health Network collects a broker fee in the form of a percentage of each token paid out by the third party.

## 4.2 The Practitioner Network

In an effort to best serve our users, one solution to easing the perils of the ‘*interoperability problem*’ is to bring practitioners and health & wellness specialists of all types together via our *Practitioner Network*.

This will allow users to better seek out the best practitioner or specialist for their needs and desires based on a multitude of factors. By networking practitioners and specialists of all types, and allowing them to work within a single user profile, rather than dealing with incomplete, fragmented records, they can then better consult, treat, and overall serve users.

### 4.2.1 Artificial Intelligence (AI) And Machine Learning (ML)

The *Practitioner Network* will make use of AI and ML that over time, (especially as the total network grows more robust with individual user data, habits, and tendencies, and machine learning can take place) will drive much of this network.

Think of this like a combination of Amazon’s “user’s who bought this, also bought this” algorithm for recommending similar products and items to its users for purchase, with the algorithms social media giants like Facebook and Instagram use to better curate a user’s feed and improve the user experience. However, in this instance, we aim to better match users with practitioners, specialists, and other services they may not have otherwise been aware of at the time.

As Machine Learning takes place over time, and with the combination of a user’s individual profile on the network growing more robust and prolific with health, fitness, and other lifestyle data, and with continued inputs from the practitioners and specialists on the network, the AI will grow more effective in not only making further recommendations, but our hope and aim is that it will be able to pick up on potentially critical warning signs of current and future conditions to be diagnosed, or not yet picked up on by a practitioner.

### 4.2.2 Reputation

The implementation of blockchain technology that underlies the network, allows for patient/client reviews of network practitioners that can be verified by a decentralized consensus and are immutable.

This creates a level of trust when user's are reading their fellow peers' reviews that is otherwise not possible on a Web 2.0 application or website.

Furthermore, these verified, immutable practitioner and service provider reviews provide further fuel to the network's AI/ML element.

### 4.2.3 Telemedicine

Healthcare costs around the globe are continuing to rise, and as consumer behaviors, preferences, and overall lifestyles shift, the demand for digital health services as a whole are increasing exponentially, including *Telemedicine*.

Telemedicine is becoming a more critical component to serve the changing demands of modern consumers, and to help offset some of the rising costs of healthcare that can be handled through a digital consultation in a more convenient, efficient, and cost effective manner.

Telemedicine can be made available across a wide range of medical and health & wellness categories, and can cover services such as: second opinions, initial consultations, follow-ups, general education, and even treatment when the necessary treatment doesn't have to be done or obtained in person.

[7] This is already a large market that is growing rapidly. According to *Statista*, the global telemedicine market was \$23B in 2017 (this was the most recent year reported) and was expected to reach \$41.2B by 2021, at a CAGR of 15%.

The main issue facing TeleHealthcare is the same facing the healthcare industry as a whole: Lack of Interoperability. Most telemedicine applications are separate companies, working in their own silo, and not part of a larger provider network with interoperability. This means user and patient data obtained using a telemedicine app generally stays with that company and doesn't complement the patient's overall robustness in medical and health records.

We aim to offer a telemedicine application within the *Practitioner Network* that will reduce healthcare costs to our users, generate new revenues and patients/clients for practitioners and specialists within the network, and further add to the robustness of the user's individual "living record" on our network, while increasing the robustness in total data available on the network.

[7] Source: *Global telemedicine market size from 2015 to 2021*.

<https://www.statista.com/statistics/671374/global-telemedicine-market-size/>  
(Further sources for data found within link)

#### 4.2.4 How it works

Users on the Natural Health Network seeking care, consultation, education, and/or treatment, can access practitioners and specialists of all types to meet their specific needs.

A user can search out practitioners and specialists based on their needs that can be filtered through a search query. The user can then personally select their ideal match. As the network's AI develops over time, ideal matches, along with other complementary recommendations, will also be made for the user by the network's AI.

**Once a user selects a network practitioner or specialist the following takes place:**

1. The selected practitioner or specialist will receive an alert informing them of the request for consultation via the *Telemedicine* app.
2. If the practitioner or specialist confirms, they will then put in a request to the user seeking access to view any necessary records in the user's profile that will be required for a proper consultation.
3. The user then grants access to the records request if they choose to do so, and if both parties confirm both requests, the consultation can take place via the *Telemedicine* app.

Practitioners and specialists receive payment directly from the user in the form of NHN tokens. The Natural Health Network, acting as the broker that connected the user and practitioner or specialist, receives a commission from the practitioner or specialist for every completed transaction. Transactions are governed entirely by smart contracts on the network.

### 4.3 Delegated proof of stake (DPOS)

A *Delegated Proof of Stake* (also known as DPOS) is defined as a consensus algorithm maintaining irrefutable agreement on the truth across the network, validating transactions, and acting as a form of digital democracy.

However, before we dive into the reasons DPOS is our protocol of choice, let's first take a moment to discuss the issues facing Bitcoin and other blockchains utilizing Proof of Work (PoW) protocols.

### 4.3.1 Bitcoin and the issues facing PoW

The idea and spirit behind Bitcoin's consensus algorithm known as Proof of Work (PoW) was to create a decentralized consensus method for recording transactions on the Blockchain and thus, keeping the power out of centralized authorities.

PoW uses miners to verify the next block. To choose which computer is paid for the work, a highly complex algorithm is passed out to every computer on the network, and the first computer to solve the algorithm and send it back to the blockchain will then be tasked with verifying the next block. In essence, this "proves" they've done the necessary "work" and will receive that block.

The idea was to make the algorithm so complex that even a group of miners could not possibly solve as little as even two blocks in a row. However, the decentralization of the network had now diminished greatly as tens of thousands of miners have pooled together and now, anywhere from 50-70% the entire network is controlled by a mere few mining pools.

### 4.3.2 DPoS: Faster and More Decentralized

**\*Algorithm: SHA512 / Scrypt: Hybrid**

Think of a DPOS consensus protocol like a company with a board of executives. However, with DPoS, the stakeholders in the company have the power to both hire or fire the executives every single day based on their previous performance and the amount of trust they've built and relayed within the network. Essentially, if an "executive" is not trusted or carrying their weight, you can fire them every day.

DPoS uses *Witnesses*, not *Miners*. Under DPoS, the stakeholders can elect any number of witnesses to generate the next block. A block is a group of transactions which update the state of the database on the NHN Blockchain. Each account is allowed one vote per share, per witness, a process known as approval voting. Approval voting is a single winner electoral system where each node may select ("approve") any number of candidates. The winner is the most approved candidate and will receive 1% on the funds she/he staked yearly. The NHN Blockchain will only release 1 Million additional NHN per year divided by the number of elected witnesses / weight at stake.

Each time witnesses produce a block, they are paid for their services. Their pay rate is 1% yearly by stake, paid after coinbase maturity. If a witness fails to produce a

block, then they are not paid, and may be voted out in the future and may lead to losing their entire stake and listed as a bad node in the peers.dat file which registers stable / reliable nodes.

### **4.3.3 DPoS: Transactions**

Each transaction on the blockchain may include the hash of a recent block. If this is done, the transaction signer can be confident that their transaction won't end up on any other blockchain that does not include that block. This helps prevent spending funds from cross-chains / hard-fork.

Maximally decentralized under the NHN DPoS coin, every stakeholder has an influence that is directly proportionate to their stake, and no stakeholders are excluded from validating transactions and earning a reward. DPoS ensures that block generation is evenly distributed among the most people and that everyone has an economically viable way to influence who those people are.

### **4.3.4 DPoS: Energy Efficient**

Another major issue facing Bitcoin and the PoW consensus protocol is that as mining difficulty increases, the amount of energy required to drive the Blockchain increases. This creates an incredible demand for energy that is not efficient, is costly, and not environmentally conscious.

As a company looking to move the proverbial needle forward through technology, we felt it imperative to create a better solution to PoW due to its demand on energy and subsequent negative impact it could have on the environment.

Energy efficiency was very important to us.

We've developed a coin and built a Blockchain that can run on as little as a few masternodes, which can be a basic laptop running at its normal speed, using as little as 10MB of data daily, thus creating a coin that is extremely energy efficient.

### **4.3.5 The NHN Token**

We have minted 100,000,000 tokens that will change hands via "closed loop" mechanisms within the network. As more users license and sell their data, more practitioners and specialists onboard and book and complete consultations, and developers contribute to the network, the token will increase in value due to its scarcity and create a true "network effect", whereby the value of the token will be

based on the contributions made to the network from the various participating parties.

The NHN token is the means with which these “closed loop” mechanisms and subsequent transactions take place within the network, thus contributing to the overall network effect the token will fuel.

There are also staking rewards, whereby anyone that has a wallet can stake some coins to benefit the network if they so choose. There is no minimum staking amount, stakers only need to leave their wallets open and they will be rewarded on a random basis every 1500 blocks, after which, their reward becomes spendable. Thus, all stakers have an equal chance, based on time staking, of sharing in the 1% annual staking reward of 1 million NHN DPoS.