

Blockchain for Healthcare: Applications and Usecases

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<https://www.blockchain-healthcare.org/>



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Presentation Content



1. Mapping Exercise Process and Methodology

What is going on in the Blockchain for Healthcare space?

Where are we in practice?

Applications and Usecases

- In this study, *blockchain for healthcare applications* refer to real-world instances in which blockchain technology has been deployed, in whole or in part, in the creation of commercially viable products and services within the healthcare sector.
- *Blockchain for healthcare usecases* refer to proposals of specific instances, scenarios or situations in which blockchain technology can potentially be used in a healthcare context.
- Seeking to distinguish between applications and use-cases to differentiate between real-world, applications of blockchain for healthcare, and academic papers concerned with theoretically conceptualising the *potential* use of blockchain in healthcare settings.

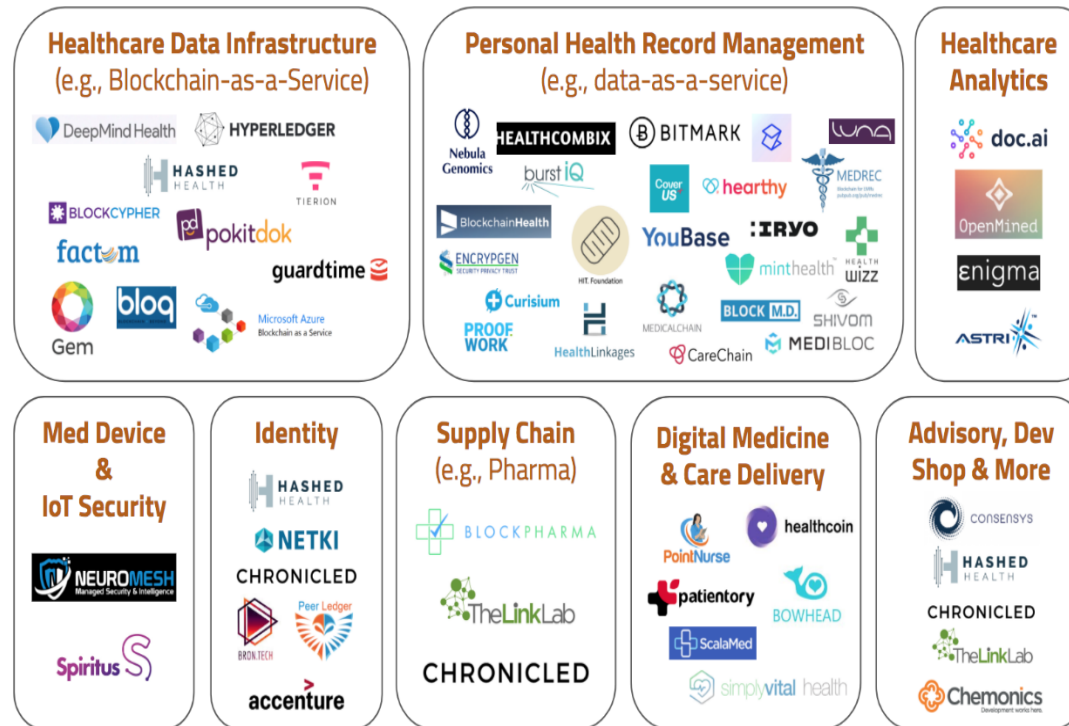
Research Methodology

- **Applications** - The data from this study was sourced from existing blockchain for healthcare databases which were cross-checked, updated, triangulated and consolidated with results from a google search
- **Use cases** – Identified in academic literature including journal articles, book chapters, conference and proceedings. Present the basic architecture and protocols to be deployed and include details such as scenarios and security analyses.
- **Variables**
- **Summary:**
 - 129 Applications
 - 55 Academic Use Cases (up to June '19)

Name of Company/Project
Name of Company
Name of Platform/ Application
Location
Category of Application/Use case
Sub-Category of Application/Use case
Description
Website

Databases

Healthcare-related blockchain projects



Have an update for the map? DM @andreacoravos or submit a pull request via our GitHub repo.

135 BLOCKCHAIN STARTUPS WITH ICOs

Closed initial coin offerings greater than or equal to \$500K. 2014 - YTD (9/8/2017)



Note: ICO data sourced from TokenData.io. Map is illustrative, not exhaustive.

Challenges, Limitations and Exclusions

- Possible exclusion are new, privately funded projects still in development
- Lack of clarity and ambiguity in about what the project wants to do or what they want to build e.g. Elcoin
- Some have pivoted e.g. 'Dr Smart' a telemedicine company; nanovision (medical research) to 'mynano' wellness platform
- Rebranding and mergers e.g. The [PeerAtlas-IScientia partnership](#) announced in May of 2018, recently took another step forward with a web page reveal and rebranding to [NEO Health](#), a collaboration between the two teams.

Challenges, Limitations and Exclusions

- Name changes e.g Docademic, doc.com; BitMed is now Rejuvenan
- Discrepancy and inconsistency between ICO information, press announcements, commentary and the website; differences across social media platforms e.g. telemedicine on twitter, big data on LinkedIn, patient control on ICO listing in an unintegrated and inconsistent way
- No mention of blockchain on their website at all e.g. 4Medica; they mention only cloud technology although they've been said to be using blockchain in an industry report, if I can't verify myself through data they publicly provide then I exclude. Might be that they want to be tech-agnostic or showcase a different lead technology. Or blockchain at the backend

Challenges, Limitations and Exclusions

- Inactive, just on ICO bench but no website or sign of life beyond that e.g. NWP solution, Healtherium etc.
- Exclusions – if your website is flagged as a security risk and I cannot access it or your domain name is for sale!
- Exclusion - no website, no news mention, no public domain existence no 'proof of life' e.g. nursecoin

Challenges, Limitations and Exclusions

- Exclusion – an ICO on (icorating.com; icobench, icomarks, icosbull, coins-marketcap, Latoken etc) without a website, or a website (usually .io that doesn't exist) a white paper or any other subsequent media – e.g. lumenus
- Exclusion – using blockchain only to raise funds – e.g. cryogen
- Exclusion – blockchain for healthcare consultancies with no specific application or platform e.g. 23 Consulting, Burst IQ
- Location - e.g. Neonano is a merger between a Belgian and US company incorporated in Malta

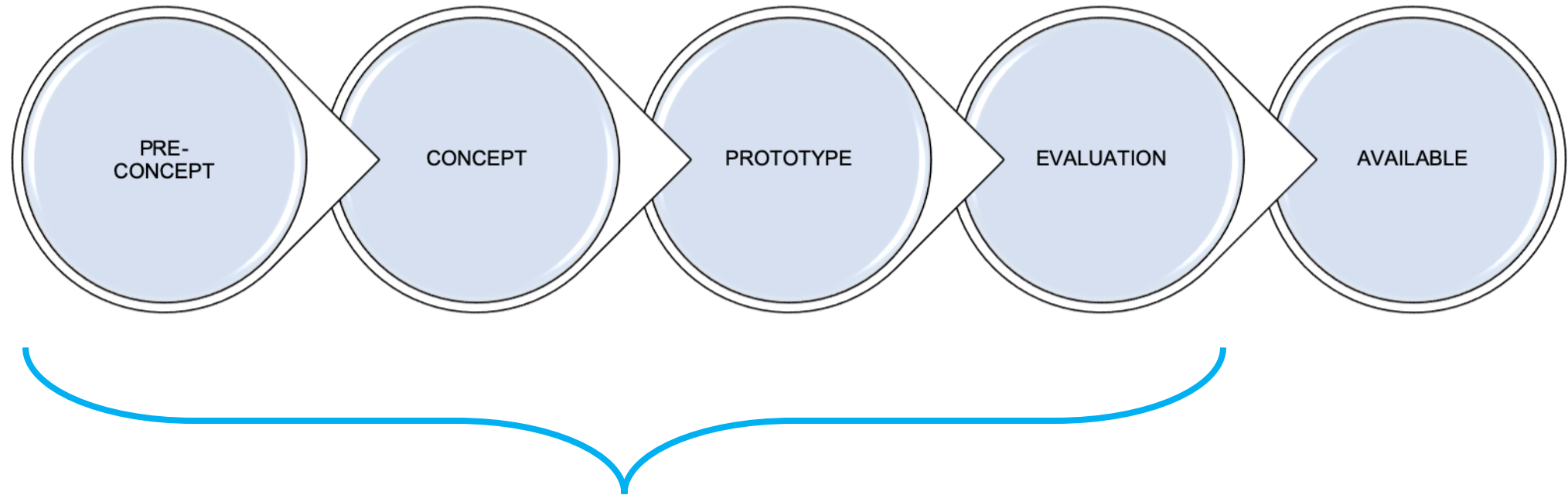
Disclaimer:

Data for this study have been gathered from a substantial number of sources, including recommendations and desktop research. While every reasonable effort has been made to verify the source and accuracy of the data collected, the research team cannot exclude potential errors and omissions.

2. Findings

What are the initial observations and findings from the mapping exercise?

3.1 Initial Maturity Framework



NO PRODUCT/ SERVICE AVAILABLE

Revised Maturity Framework

Available

- Product or service has been brought to market and are freely available. Apps can be downloaded, platforms signed up to and there is a verifiable list of clients and partners

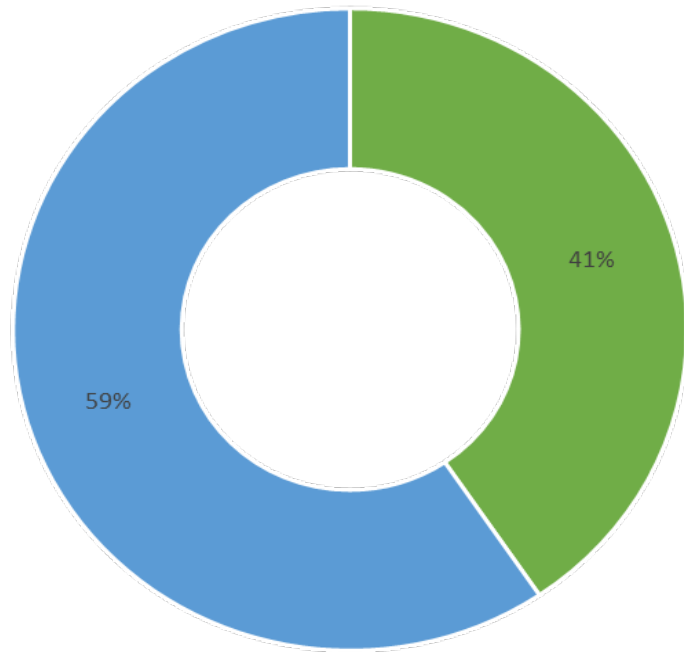
In
Development

- No product or service available yet. At different stages such as from funding, Github repository, beta and proof of concept.

Maturity Framework – May '19 vs. Nov '19

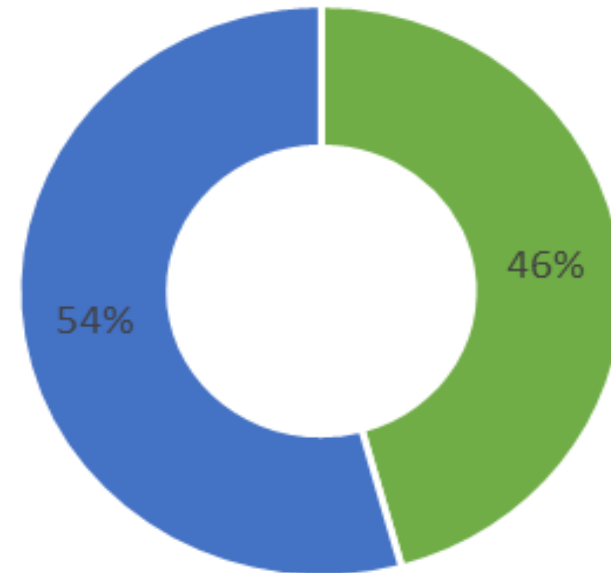
Application Maturity - May '19

■ Available ■ In Development



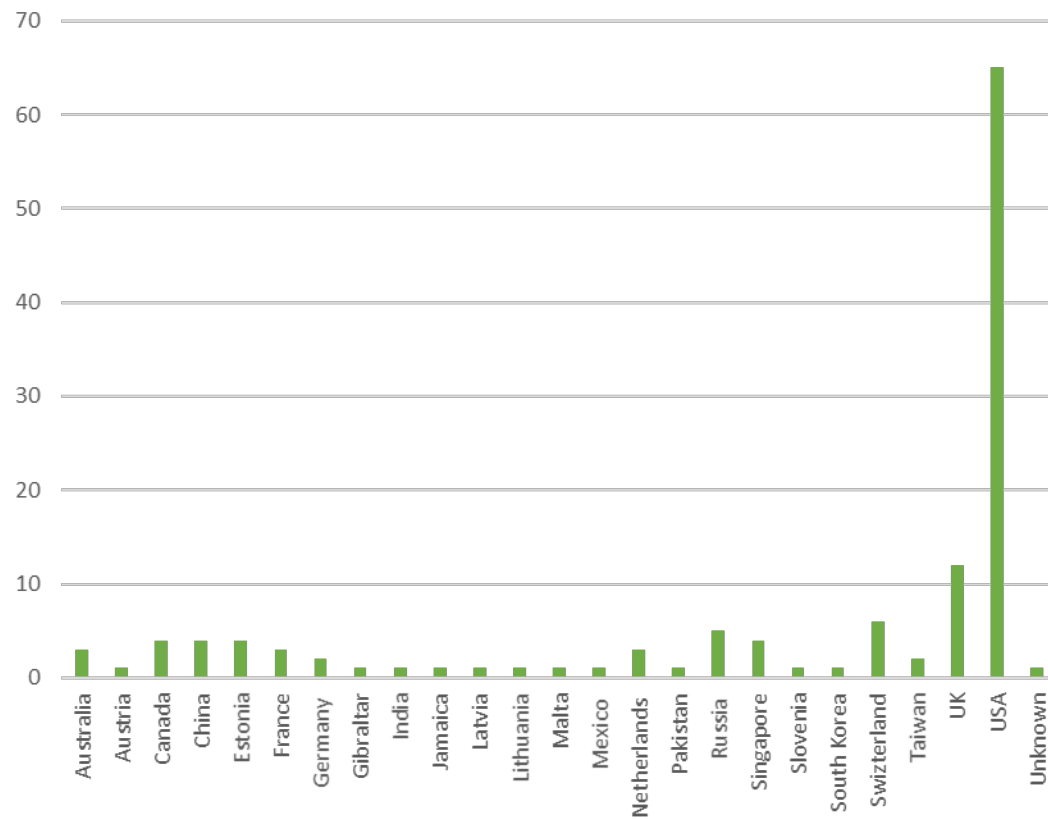
Application Maturity - Nov '19

■ Available ■ In Development

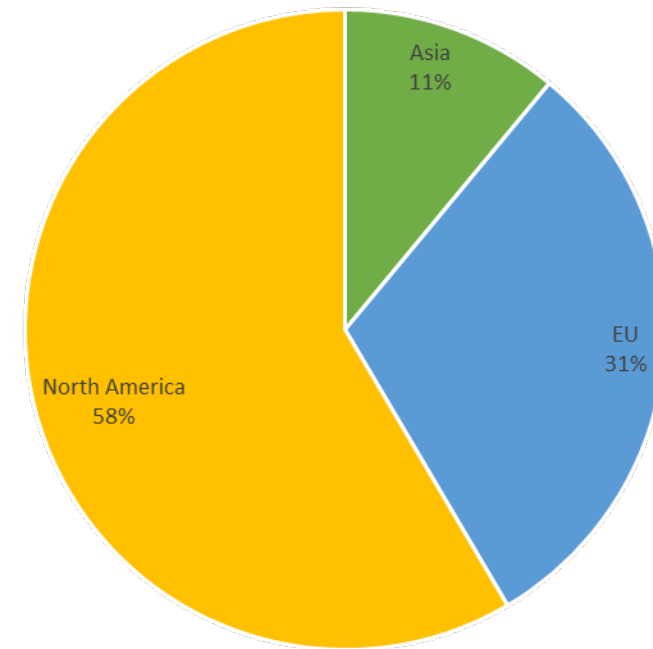


Location

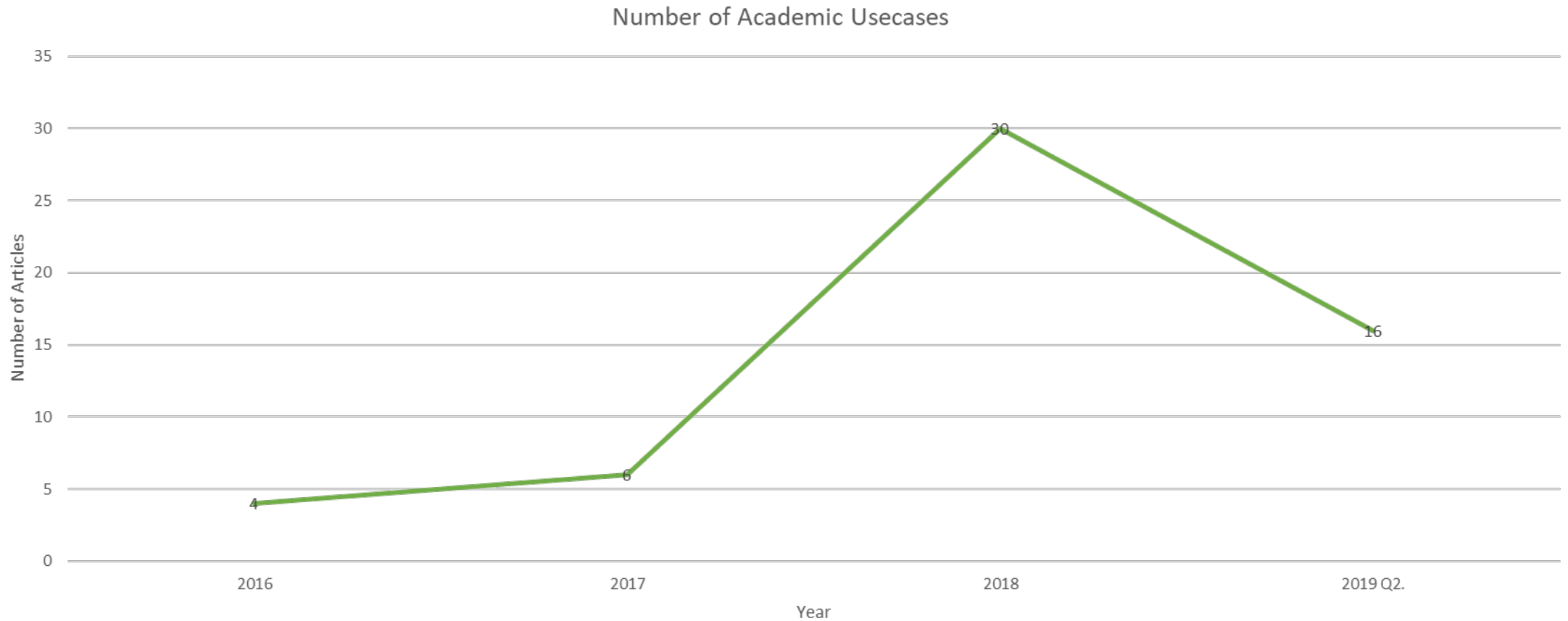
Locations of Blockchain for Healthcare Applications



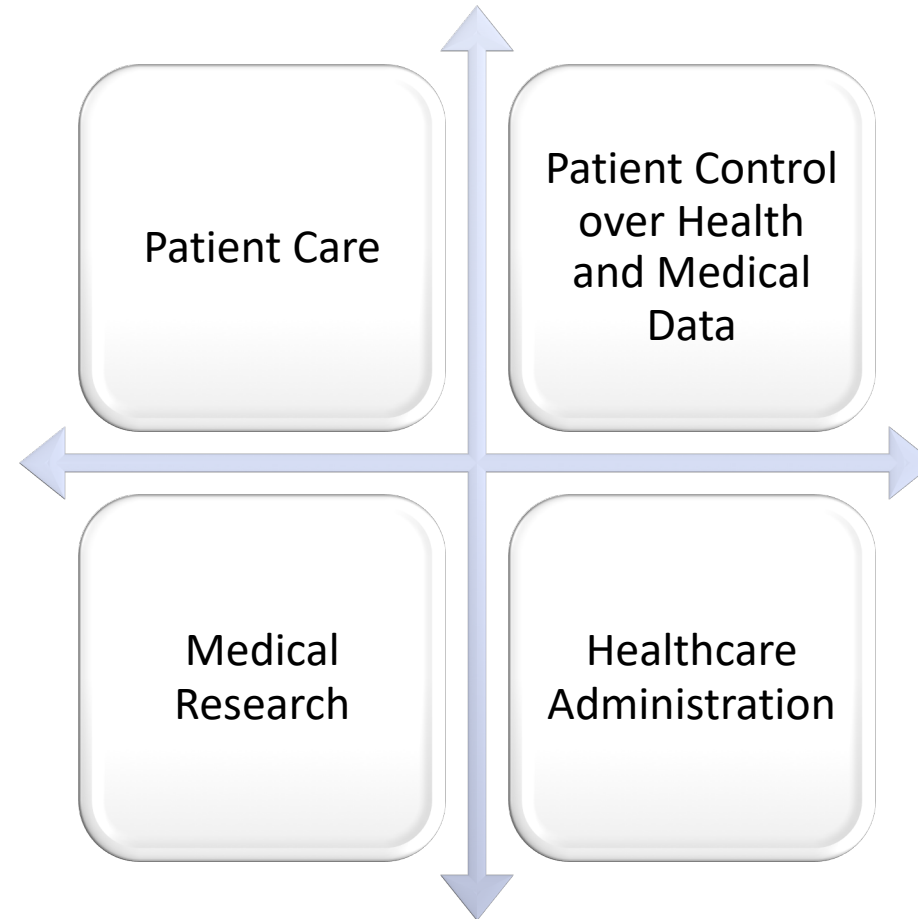
Percentage of Blockchain for Healthcare Applications in N.America, EU and Asia



Academic Usecases

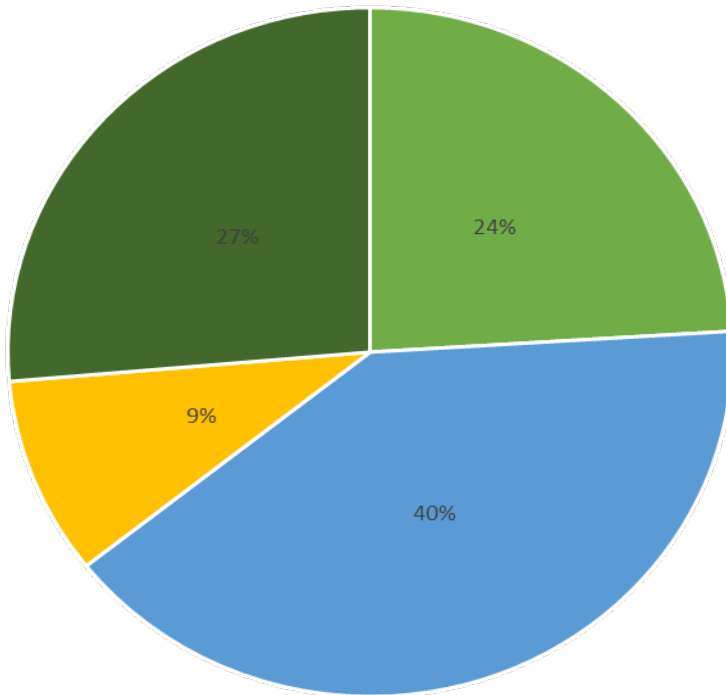


3.2 Categories of Applications and Use Cases



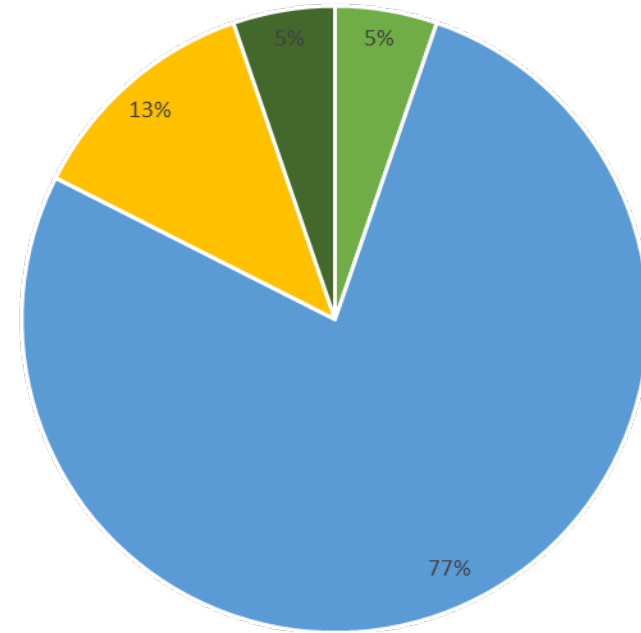
Applications & Usecases by Category

Number of Industry Applications by Category



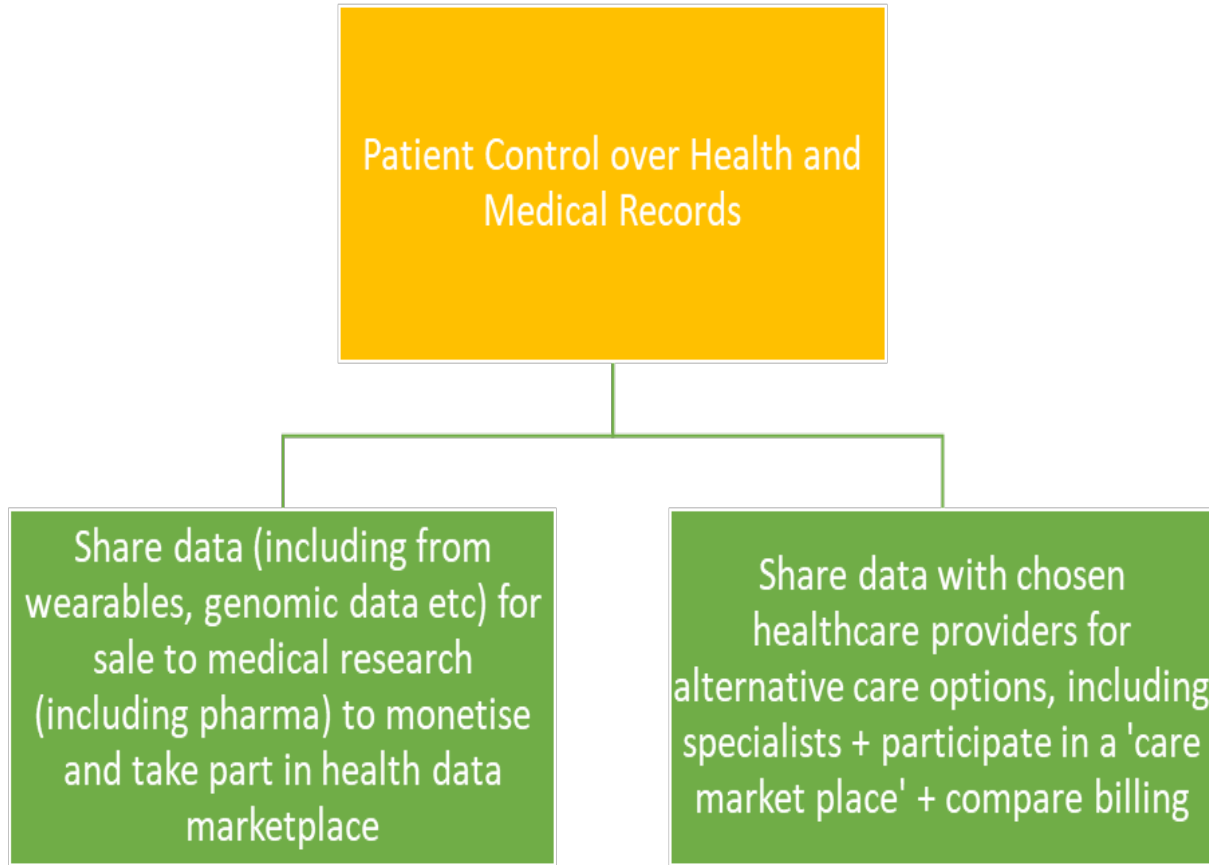
■ Patient Care ■ Patient Sovereignty ■ Medical Research ■ Healthcare Administration

Number of Academic Usecases by Category



■ Patient Care ■ Patient Sovereignty ■ Medical Research ■ Healthcare Administration

(a) Patient Control over Health and Medical Records

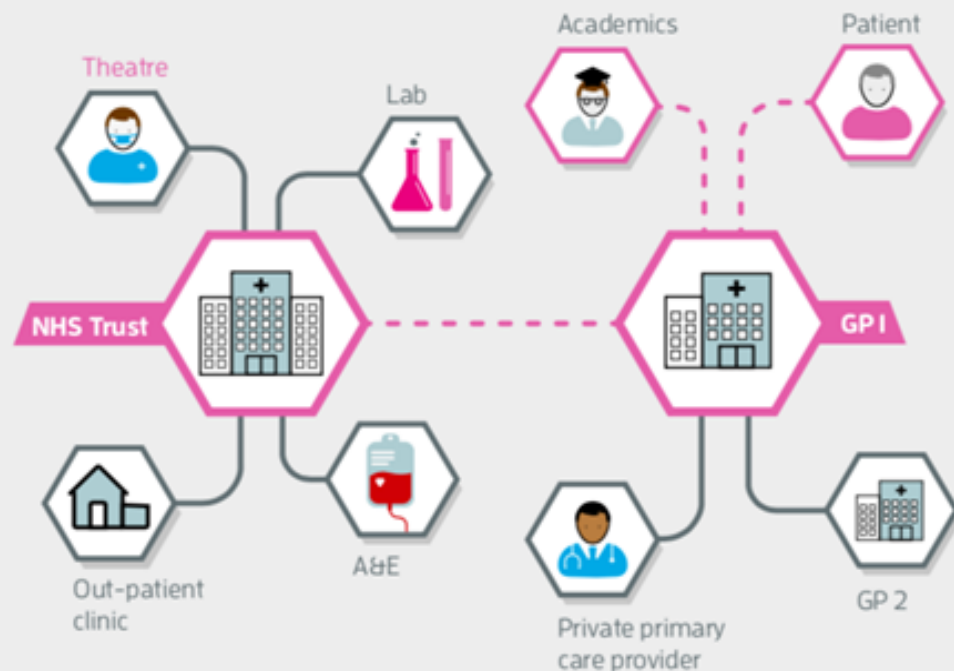


➤ 43 Academic Usecases (77%)

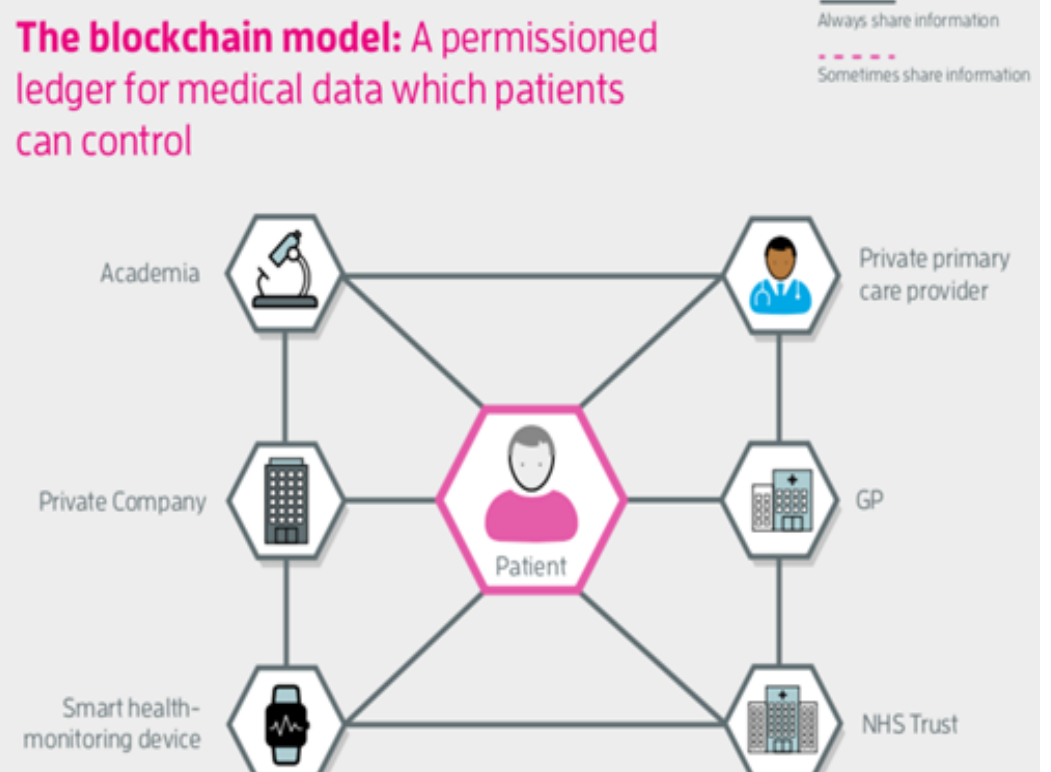
➤ 52 Industry Application (40%)

Patient Control Premise

Now: A decentralised data-sharing landscape



The blockchain model: A permissioned ledger for medical data which patients can control



Source: <https://reform.uk/>

Patient Control - Examples

Medical Chain

- “Our aim is to put the patient in control of their medical data, giving them the power to share the single, most comprehensive version of their record, with every organisation in their medical network”.

Patientory

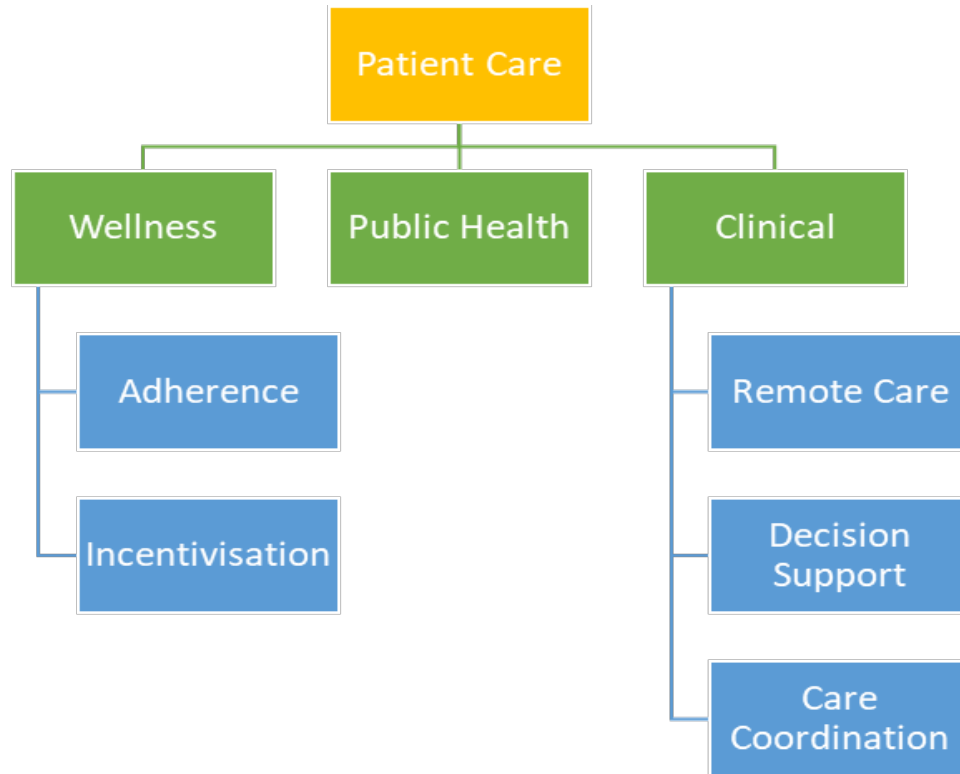
- “An application that empowers end users globally with a secure platform to manage and transfer their health data, to achieve actionable insights for improved health outcomes and well-being”.

Healthcare Data Market

- “**Medoplex** will be the economic engine driving Citizen Health. It’s designed to be a 100% online transparent marketplace where healthcare “buyers” and healthcare “sellers” can connect & transact directly without the need of insurance intermediaries.”
- “Our business model is based on the data we collect from the thousands of consults we do every day. This data is stored on the **doc.com** blockchain and made available for third parties for research or analysis .”



(b) Patient Care



- 3 Academic Usecases (5%)
- 31 Applications (34%)
- Subcategories – Wellness, Public Health, Clinical

Patient Care - Wellness

App/Platform	Company	Maturity	Description	Location
Hayver	Hayver	Available	Blockchain monitoring platform to address drug and alcohol addiction using a flexible open architecture and cryptocurrency incentives.	USA
MyPCR	Guardtime	Available	MyPCR provides patients with instant access to their primary care information, their personal care pathways and medication adherence support through their smartphone.	Switzerland
Healthcoin	Healthcoin	Available	An application that monitors diabetes related biomarkers and issues tokens for measurable improvements in health.	USA
Eterly	Eterly	Available	Health and fitness advisor application focusing on longevity, using token-based incentives.	Canada
WELL	WELL	Available	A blockchain application that monitors data from wearables in order to incentivise and monetise healthy choices.	USA
Humanitiv	Citizen Health	In development	An operating system for health & wellness that incentivizes people to pursue healthy lifestyles with the help of wearable technology.	USA
SciCHAIN	SciCoins	In development	A shared, universal ledger designed to track patient data and monitor health and wellness using wearables.	USA
LifesDNA	LifesDNA	In development	Blockchain AI search engine and marketplace for wellness, healthcare, and lifestyle information.	UK
Amchart	Amysys	In development	A patient driven EMR on a public/private blockchain with AI for analytics and incentive driven model for better outcomes.	USA
AIM	Aimedix	In development	Incentivized healthcare through a medical ecosystem and a social medical network.	Netherlands
Gainfit	Gainfy	In development	An incentive platform for fitness and healthcare.	USA
Clinicoin	Clinicoin	In development	Clinicoin is an open source wellness platform that rewards users with cryptocurrency for engaging in healthy activities.	USA
Coinhealth	Coinhealth	In development	A health-focused platform that rewards you with Coinhealth tokens each time you engage in activities that promotes health and wellness and allows you to share data with chosen providers.	USA
Nano	nanoVision	In development	Nano directs your personalized wellness path by connecting you with the right health resources and experts.	USA
Curaserve	Curaizon	In development	Platform for improving drug adherence through big data analysis delivered via blockchain that allows for the collection of fully anonymized data about how and when patients take medications.	UK
Dentacoin	Dentacoin	In development	A dental care ecosystem that makes preventive dental care affordable by helping people improve their oral hygiene habits.	Netherlands

Wellness – Incentivisation

- Humantiv, which is a Citizen Health project, uses a mobile application to measure user's health by combining wearable data, medical records, and genetics to create a 'personal health score'. This score is calculated by a 'Proof of Health' algorithm, which tracks and measures the changes in health metrics. Once goals are accomplished, the algorithm generates a unit of value called a Medit (ERC-20 token) which can then be used to pay for health transaction on the platform. This means that the more users engage in wellness activities such as walking or getting more sleep, the more Medit tokens they earn. <https://citizenhealth.io/humantiv/>

Wellness – Adherence

- My PCR



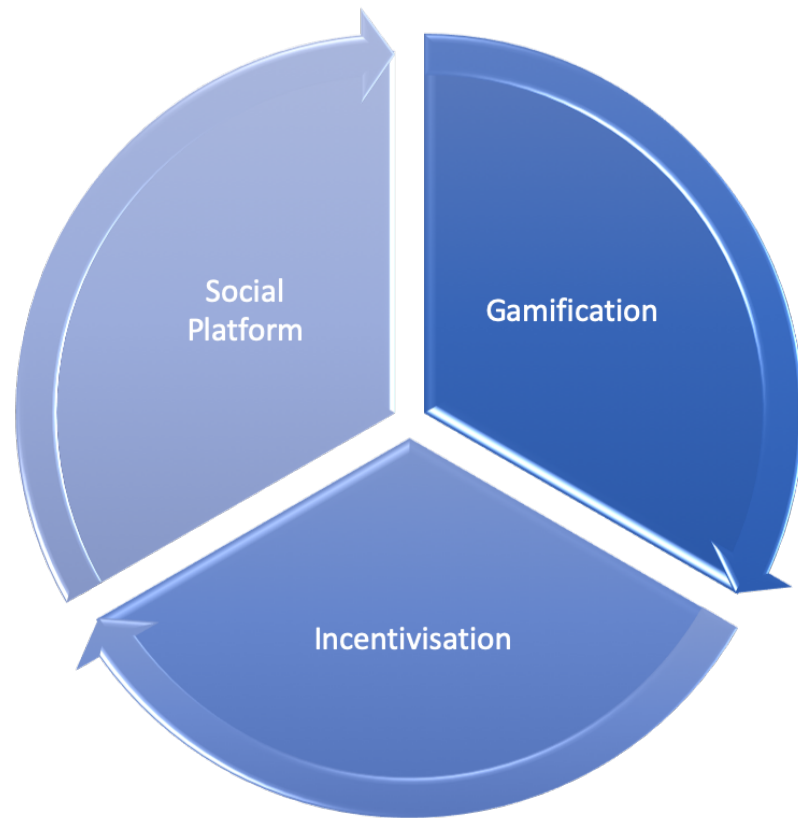
“enables automated verification of medication adherence and the continuous monitoring and verification of patients to a specific, personalized treatment plan.”

- Hayver



“Hayver is adding blockchain to overcome drug and alcohol addiction-related diseases through peer-to-peer monitoring apps and crypto-rewards.”

Community Care Ecosystem Creation



- “The Nano Cure Platform is dedicated to shifting “point of care” to “perpetual care” through health connectivity, data and intelligence. By tracking the molecular interplay between our lifestyles, the world around us and our health indicators, we are providing the high resolution view of health needed for care providers.”

Patient Care - Clinical

App/Platform	Company	Maturity	Description	Location
Etheal	Etheal	Available	Blockchain-based global list of health professionals that helps patients save on elective care costs by searching for and booking specialists from around the world.	Estonia
Bowhead Health	Bowhead Health	Available	A platform is composed of a hardware device that monitors a user's biometric data to disperse personalised medicine and supplements.	Singapore
Aidoc	Aidoc	Available	Combines blockchain and AI to provide real-time monitoring of data that can detect abnormal statuses and provide advice accordingly.	China
Panacea	RoboMed Network	Available	A medical platform managed by a blockchain token, designed to provide remote medical care.	Russia
Rejuvenan	BitMED	Available	A blockchain and AI telehealth platform that offers its members on-demand 24/7 access to medical practitioners via text and video.	USA
Doc Health	Doc.com	Available	A blockchain platform that offers free remote care in exchange for medical data.	Mexico
Medvice	Medvice	Available	A medical consultation system using AI and blockchain technology doctor-to-client e-consultations.	Netherlands
Alphacon	Alphacon	Evaluation	A blockchain platform that analyses gene, functional medicine, immunity, and smart devices to provide remote healthcare optimized for each customer.	Singapore
Minthealth	Minthealth	In development	A global, decentralized health platform that aligns healthcare stakeholders around the shared goal of improved clinical outcomes.	USA
HealPoint	HealPoint	In development	A blockchain-based AI powered healthcare platform delivering a second opinion consensus from multiple experts at a time, thus reducing the risk of misdiagnosis.	UK
Medicohealth	Medicohealth	In development	Telemedicine platform that allows patients to share health data with doctors.	Switzerland
Yazom Care	Yazom	In development	Blockchain platform to makes medical assistance from doctors and pharmacies accessible to everyone regardless of their location.	Jamaica
Neo Blockchain	NeoHealth	In development	A medical information resource, clinical decision support tool, and complete medical ecosystem using Neo blockchain technology.	Malta

Clinical Sub-Categories

- Remote Care - (e.g. Panacea, Rejuvenan, Doc Health, Aidoc and Medvice)
- Decision Support – (e.g. Healpoint, which is developing a “blockchain-based AI-powered healthcare platform delivering a second opinion consensus from multiple experts at a time).
- Care Coordination – (e.g. Minthealth, A global, decentralized health platform that aligns healthcare stakeholders around the shared goal of improved clinical outcomes).

Remote Care - Example



“Get quality care, right from your couch. Chat with a **BitMED** provider and schedule video consults as-needed. Get reliable healthcare information and news from BitMED providers. Connect, share, and learn from people just like you in communities based on shared life experiences”.

Public Health – Examples

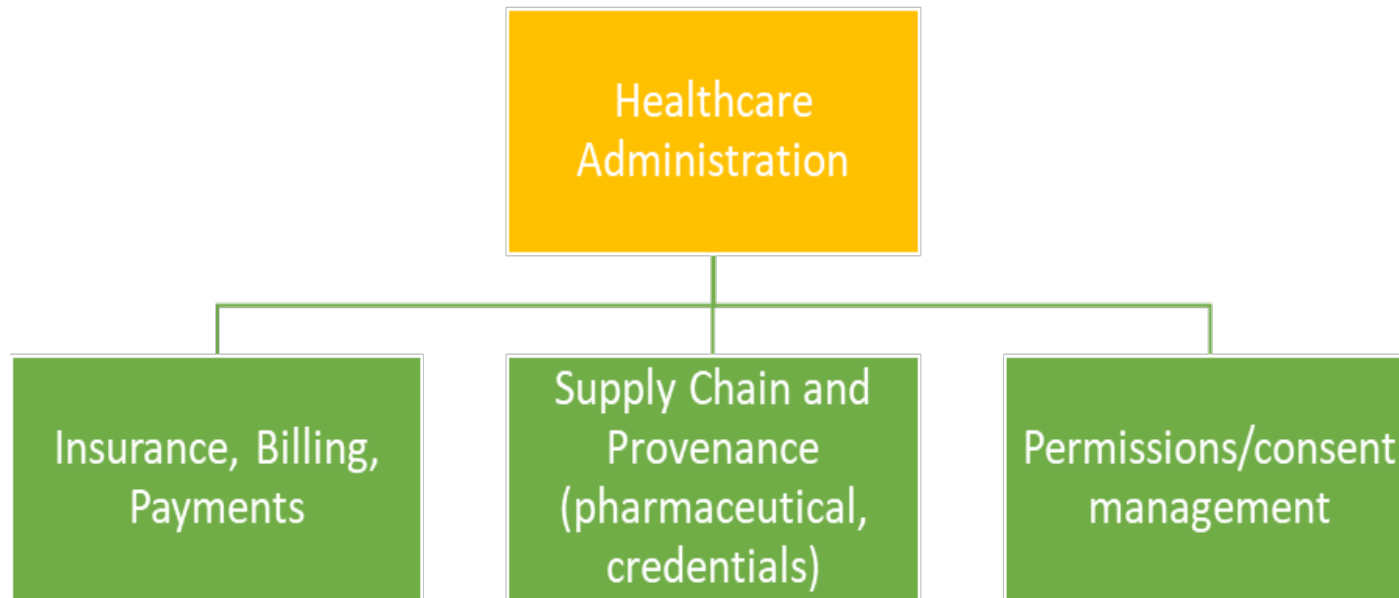
- e-Estonia

System is designed to “compile data for national statistics, so the ministry can measure health trends, track epidemics, and make sure that its health resources are being spent wisely”.

- Kinecthub

“captures medical treatment and outcomes, provides private and institutional donors with real-time data on how their funding is used, and a [creates a] reward system for patients who attend medical appointments”

c) Healthcare Administration



➤ 3 (5%) Academic Usecases

➤ 34 (27%) Industry Applications

Healthcare Administration - Themes



Billings, Insurance,
Payments,
Contracting



Pharmaceuticals



Supply Chain
Management



Medical Asset
Management



Medical
Credentials



Consultancy

Healthcare Administration

App/Platform	Company	Maturity	Details	Location
Decent	Decent	Available	Smart contracts for health claims and insurance for the self-employed.	USA
Reimburse	Digipharma	Available	Blockchain-based solution for performance-based contracting of pharmaceuticals, medical devices and wider healthcare services.	Switzerland
Solve.Care	Solve.Care	Available	Blockchain platform for decentralized administration and payments of healthcare.	Estonia
Blockverify	Blockverify	Available	Extending anti-counterfeit solutions from luxury valuables to medications and pharmaceuticals.	UK
Intelligent Healthcare Network	Change Healthcare	Available	Change Healthcare develops a wide variety of products focused on claims management, payments and data management in the healthcare sector using Hyperledger Fabric.	USA
Scalamed	ScalaMed	Available	A mobile prescription exchange system for patients, doctors, and pharmacists to manage, prescribe, as well as dispense prescription medications.	Australia
MediLedger	MediLedger	Available	Permissioned blockchain for tracking and tracing regulations to improve the operation of the supply chain in the pharmaceutical industry.	USA
Procredex	Hashed Health	Available	A blockchain exchange providing healthcare organisations with both access to verified credentials information about medical staff.	USA
Intiva Health	Intiva Health	Available	Platform for healthcare professionals for credential management, networking, and marketplace.	USA
SafeInsure	SafeInsure	Available	A decentralized insurance marketplace bringing equitable price discovery and global access to insurance policy shoppers worldwide.	USA
Medishares	Medishares	Available	A blockchain-based decentralised mutual aid insurance marketplace.	Singapore
Meditect	Meditect	Available	A blockchain platform build to trace and authenticate provenance of medicines in Africa.	France
Healthverity Consent	Health Verity	Available	Cloud and blockchain-based platform that helps healthcare organisations manage and govern consumer data-use permissions and consent across internal systems and external suppliers.	USA
phrOS	phrOS	Available	Healthcare blockchain operating system for data sharing in a hospital context.	Taiwan
MTBC	MTBC	Available	Medical Billing Company the offers a blockchain-based integrated EHR & Practice Management System.	USA
Grapevine Worlds	Grapevine World	Available	Network for global institutions to share health records in an effective, inexpensive, quick and, above all, standardized data exchange.	Austria
Days. Exchange	Days.Exchange	In development	Unit-linked insurance plans for healthcare, life insurance, and wealth management markets.	Switzerland
Curisium	Curisium	In development	Platform to allow payers, providers, and life science companies to engage with patient-value-based contracts.	USA
CuraBlox	Hs Blox	In development	Uses smart contracts to make payment disbursement, reconciliation, and reporting of metrics easy to track and efficient, reducing time wasted waiting for payments and coordination.	USA
RevBlox	Hs Blox	In development	Uses blockchain to prospectively help providers reduce claims denials and secure payment of patient financial responsibilities for care.	USA
Universal Health Coin	Universal Health Coin	In development	A privacy focused, token-based healthcare finance system that utilizes blockchain to arbitrage, decentralize and provision payment of health services.	USA
Veris	Veris Foundation	In development	The Veris Platform uses Smart contracts to bring together healthcare service providers, insurers and banks to authorise the provisioning and payment of health services	USA
Ecpom	ELCoin	In development	Seeks to combine the manufacturing of medical and healthcare equipment to a blockchain medical platform	Latvia
MedXchange	MedXchange	In development	A supply chain system for handling transactions, data transfer and storage, and payments of medical devices and supplies.	China
Spiritus	Spiritus	In development	Blockchain-based medical device life cycle management platform to allow all involved parties to record evidence of service for critical assets and infrastructure.	UK
Mexc	Mexc	In development	Ecosystem for purchasing Emergency Medical Services (EMS) products and services.	Singapore
Synthium Health	Synthium Health	In development	A blockchain enabled healthcare technology platform that addresses supply chain participants in Health Industry by seamlessly linking Manufacturers, GPOs, Distributors and Providers.	USA
Ambrosus	Ambrosus	In development	Quality control and assurance of pharmaceutical products	Switzerland
BlockMedx	BlockMedx	In development	Electronic prescription drug supply chain management, focused on opioids and other notoriously mismanaged drugs.	USA
Healthchain	Healthchain	In development	Software solutions that integrate with existing healthcare management systems and workflows to make outdated technologies and paper-based processes more efficient	Canada
Blockpharma	Crystalchain	In development	Blockchain platform for drug traceability and anti-counterfeiting	France
Connecting Care	Simply Vital Health	In development	Uses care coordination and financial forecasting to help providers in bundled payments get insight into what happens to patients when they leave the hospital.	USA
Skychain	Skychain	In development	Blockchain infrastructure aimed to host, train and use AI to reduce medical errors in healthcare.	Russia
HealthLinkages	HealthLinkages	In Development	A blockchain and AI software system for collecting and analyzing health data, enabling organizations to save time while allowing better analytics and regulatory compliance.	USA

Healthcare Administration - Examples

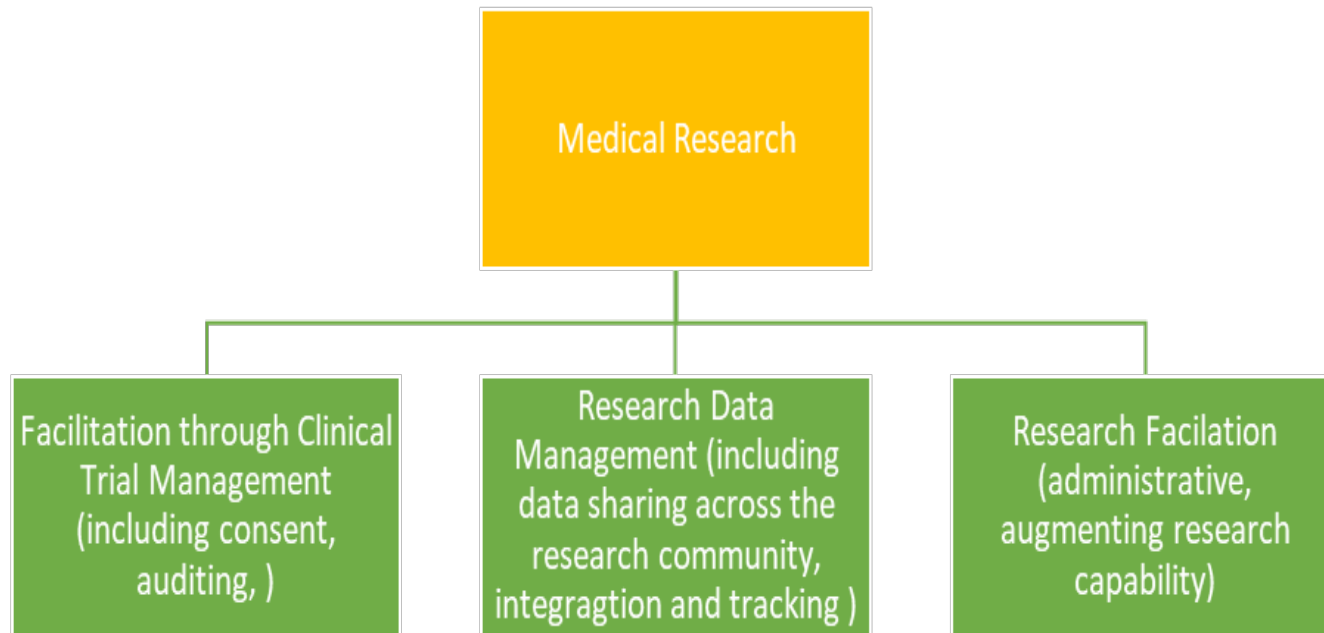
- Revenue Improvement 'Solutions' - to help hospitals, health systems, and physician practices improve revenue cycle efficiency and optimize net patient revenue.
- Payment Accuracy 'Solutions' - Innovative, end-to-end payment accuracy product suite for payers that want to improve claims adjudication and streamline payment operations across all payment modalities.
- (<https://www.changehealthcare.com/>)



PROFESSIONAL
CREDENTIALS
EXCHANGE



d) Medical Research



➤ 3 Academic Usecases (5%)

➤ 12 Industry Applications (9%)

Medical Research

App/Platform	Company	Maturity	Description	Location
ARNA Panacea	ARNA Panacea	Available	A platform that allows processing of clinical trials data and administrative support for researchers during R&D phase.	Russia
Curecoin	Curecoin	Available	A cryptographic utility token dedicated to replacing ASIC mining with protein folding computations aimed at helping scientists find new medicines in lieu of mining hashes.	USA
Shivom	Shivom	Available	A platform which utilizes blockchain and smart-contract technology to verify ownership of DNA data and to authorize genomic data transactions between both consumers, enterprises and research organizations.	Germany
Lifedger	ConsilX	Available	A clinical trial solutions, powered by Blockchain, to address the imperatives and initiatives in clinical trial management.	India
DNATix	DNATix	Available	An accessible, secure and anonymous platform for Genetic Labs, healthcare providers, and genetic researchers working with large amounts of genetic data.	USA
Bitmark	Bitmark	Available	Bitmark Health app is being used to track health data and consent for medical research and Pfizer is using Bitmark to for clinical trial matching at cost-effective scale.	Taiwan
FarmaTrust	FarmaTrust	Available	Provides blockchain and AI based provenance systems for clinical trials, medical devices, cell and gene therapy and pharmaceutical tracking.	UK
Longgenesis	Longgenesis	Available	A blockchain-based consent management solution for doctors and patients that streamlines data collection for medical research	Hongkong
Blockchain Health	Blockchain Health	In Development	A blockchain platform that provides advanced auditing for medical research assuring that the chain of custody of sensitive health data is easily auditable.	USA
Translo	Translo	In Development	A platform for sharing biomedical data in a decentralized, secure, efficient, and permissioned manner that harnesses the power of the blockchain.	USA
Digital Sample Manager	Hs Blox	In Development	Uses DLT for sample tracking that ensures a streamlined and transparent process across participants, real-time status updates that can be tracked efficiently, and eliminates lost sample issues.	USA
BlockRX	BlockRx	In Development	A platform that provides a comprehensive solution of fully integrate life science researchers, biopharma, medical device manufacturers and healthcare providers to ensure pharmaceutical supply chains.	USA
ADLT	iSolve	In Development	Enterprise Blockchain solution for BioPharma, Healthcare, Medical Device Manufacturers and the Life Sciences. which connects Manufacturer to Patient and from Patient to the rest of the Healthcare System.	USA

Medical Research - Examples



- “Our platform helps pharmaceutical companies gain access to secure DNA data for quick and efficient research, all the while incentivizing and protecting patient confidentiality.
- Platform allows for Data Discovery; Blockchain Verification; Analysis, Patient Recruitment.”

(<https://www.shivom.io/>)

5. Discussion

What are the significant insights generated from the mapping exercise?

Rise of the Consortium – Implications?

- IBM's health utility network includes Aetna, Anthem, Health Care Service Corporation (HCSC), and PNC Bank.
- Humana and United Health Group, two of the largest health insurers, teamed up on a blockchain platform with data providers Quest Diagnostics, Multiplan and Optum.

Healthcare consortia are tackling small problems incrementally



Select Partners:



Goals: Develop proof of concepts where blockchain protocols can improve healthcare.

Notes: Consortia has slowly added more members over time, has released project on verifying if a healthcare provider is licensed for the services they're providing and their geography.



Goals: Create a central provider directory with up to date information; a shared directory would prevent duplicative work.

Notes: It's a win for all parties involved: insurers have up to date directories for less work, providers have a singular place to update their information, and consumers have a clear source for correct information. Additional buy-in from health giants will make it increasingly valuable.

Location and Maturity – Implications?

- US Applications 58%
- 54% 'In Development'



Is there a Blockchain delay in healthcare?

However, despite initial bullish projections and enthusiasm around blockchain use in healthcare, with a 2016 survey predicting that 16% of healthcare institutions would to have a commercial blockchain solution at scale in 2017, more recent analyses has shown the healthcare industry to be lagging behind other industries in blockchain adoption. (IBM Institute for Business Value blockchain study which surveyed 200 healthcare executives – both payers and providers in 16 countries).

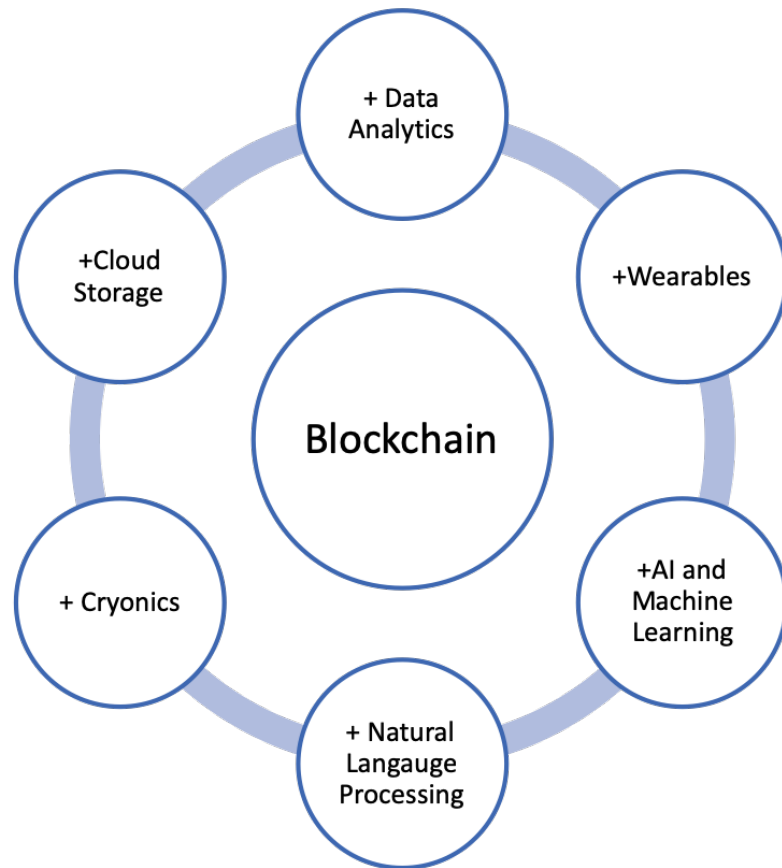
*(M. Treshock and M. Piao, 'Is there a blockchain delay in healthcare?'
IBM Blockchain Blog 12 August 2019)*

Between half-baked and overly optimistic?

“Many of these blockchain projects fall somewhere between half-baked and overly optimistic, with strong marketing teams and shaky technical fortitude (we excluded the outright scams and strove to be generous to the remaining early projects)”. They further state that “compared to projects that focus on blockchain infrastructure across industries, many health care teams are missing blockchain domain knowledge and the technical expertise to execute their vision — and are often overstating their blockchain project’s ability to solve the perceived health care problem”

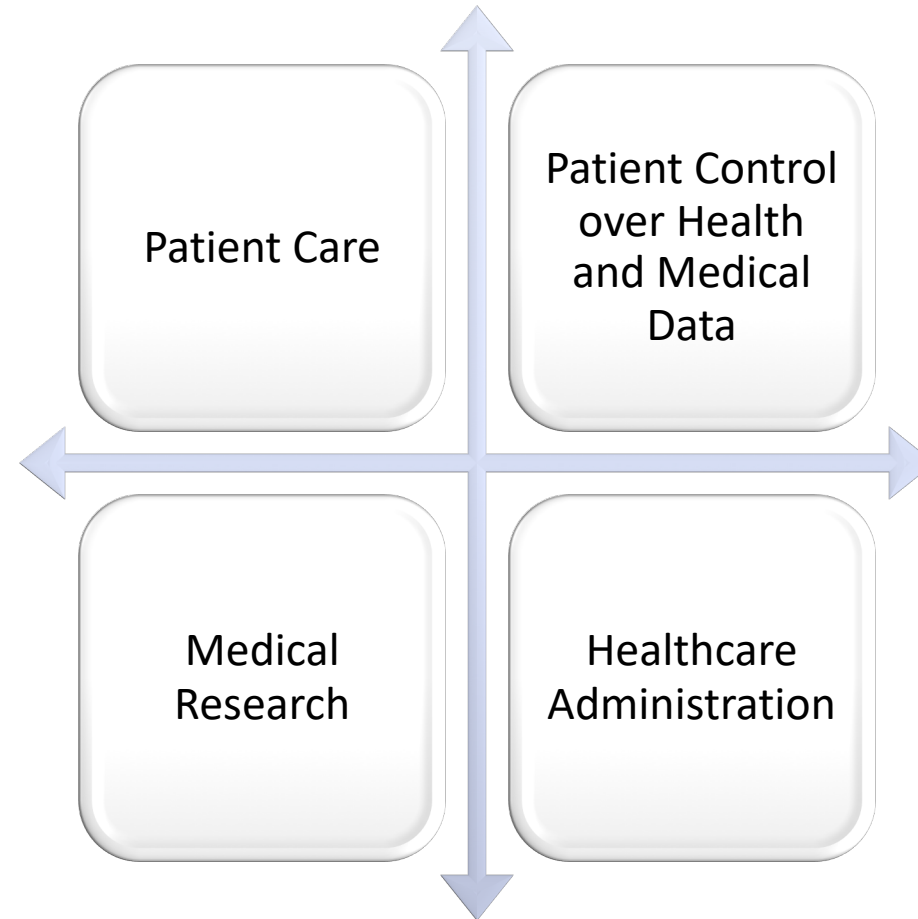
(Coravos: 2018)

Multi-Technology Tools – Implications?



- “Users can aggregate all of their wearable devices data such as Fitbit and SDK such as HealthKit, and Google Fit to get a comprehensive view of their progress”.
Eterly’s blockchain and AI-driven app “works seamlessly with your wearable device, helping you record steps, heart, activity and sleep data, whilst its extra features ensures that the app understands you on a deeply personal level”

Most promising category?



Comments, Observations, Discussion



<https://www.blockchain-healthcare.org/>