

“Disrupting Health Care with Blockchain”
Alexander Kowalski, DO and Michael Milovich, Jr, PhD,

Disrupting Health Care with Blockchain

PENNSYLVANIA OSTEOPATHIC FAMILY PHYSICIANS SOCIETY
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Dr. Kowalski has provided no disclosures.
Mr. Milovich has provided no disclosures.

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Agenda

- What is Blockchain?
Michael Milovich, Ph.D.
- How Can Blockchain Apply to Health Care?
Alexander Kowalski, D.O.

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What is Blockchain?

MICHAEL MILOVICH, ASSISTANT PROFESSOR



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Disruption

Webster defines “**disruption**” as breaking apart or throwing into disorder.

That is, changing something from its current form.



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Television

- **Disruptive Innovation**
 - Developed in 1897, cathode ray tube technology (CRT) was developed by J. J. Thomas for displaying images
 - CRT was the technology before today's Plasma and liquid crystal display (LCD)
 - Mass production of CRT for the consumer turns out to be the Television set as society moved into the 1940s
 - Not knowing how to integrate the TV, the production processes followed radio

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Internet

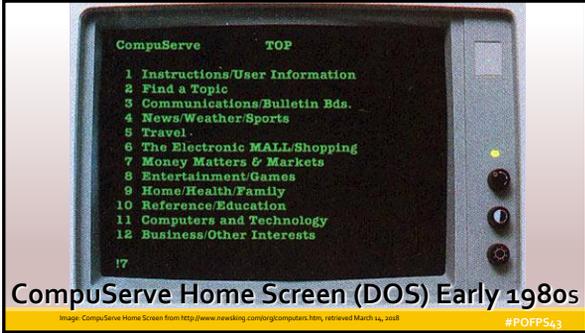
- **Disruptive Innovation**
- Internet developed as a communication tool for the United States military in the 1960s
- In 1990s the mass deployment of the internet for consumers turns out to be the start of the internet of things (IoT)
- Not knowing how to integrate the internet, communication mirrored the telephone in text mode

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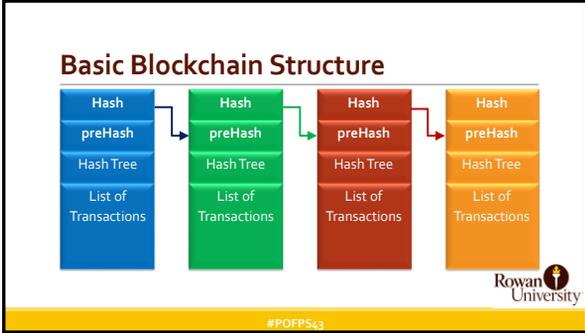


Blockchain

- **Disruptive Innovation**
 - Tracking debits and credits—database-embedded commands that track the change in assets
 - Concatenates (links in a chain) in a canonical order cryptographic (encrypted) codes of verified transactions, which are added to a sequence of lists (blocks)
 - Once a block is appended it cannot be altered or erased
 - Design is to eliminate any single point of failure

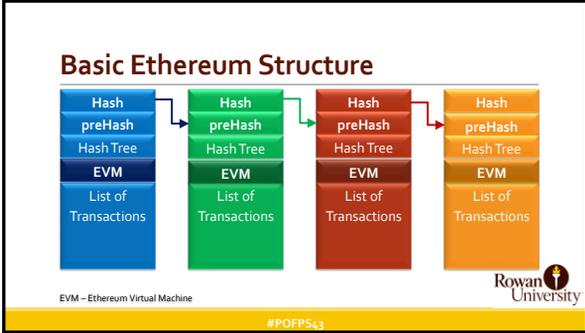
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- ### Blockchain Technology Approach
- Digital transaction system in a decentralized database
 - Peer-to-peer network where nodes join and add a block
 - Block creation is based on mathematics and cryptography then distributed throughout the network
 - Certain number of nodes on the network validate each transaction and leader node appends to the blockchain
 - Blockchain is a programming language (Stack-based)
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- ### Blockchain Platform
- **Bitcoin blockchain (2009)**
 - Underlying platform of cryptocurrency
 - Primary use is digital currency
 - **Ethereum blockchain (2015)**
 - Expands the blockchain platform
 - Protocol that executes the terms of smart contracts and distributed applications
 - Contains a currency known as Ether
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- ### Additional Technology for Ethereum
- Ethereum Virtual Machine (EVM) is a store of compiled smart contract information
 - **Balance** – ethereum digital currency, Ether is recorded on the ledger
 - **Code** – executable JavaScript where the blockchain nodes execute and enforce programmed contract terms
 - **Storage** – code to be executed or remote reference to code to be executed on the nodes
 - Blockchain is a language (Turing-complete)
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- ### Advantages
- Secure tracking of any defined asset, whether private (permissioned) or public (unpermissioned)
 - Data integrity of asset tracking for every transaction ever executed in a ledger
 - Efficient auditing of an assets complete history
 - Each user has a key, which is used to identify each transaction in the chain
 - Strengthen cybersecurity
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Early Adopter Relationships

- **Business-to-Business** transactions without a third party (smart contract)
- **Business-to-Investor** confidence in fiscal responsibility (secure collateral)
- **Business-to-Government** customs and homeland security (movement of goods)
- **Business-to-Consumer** assurance that transactions are complete (debit management)
- **Consumer-to-Consumer** (asset control rights)

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Anticipated Future (1/3)

1. Public and private chains will eventually interconnect
2. Chains will consist of a federated structure: global chains, industry chains, company chains, personal chains
3. Vision for growth will be far reaching and the marketplace will vet the value of that growth
4. Ethereum will barely be noticed by the general public in their user interfaces

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Anticipated Future (2/3)

5. Regardless of digital currency's future, the underlying technology will go on
6. Ethereum Blockchain as a Service (EBaaS) will be a development platform
7. Open source software development sites will become a mainstay
8. Blockchain will be used as a secure protocol when connecting IoT devices

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Anticipated Future (3/3)

9. Personal identities and credentials will be secured from birth records to credit score
10. Around the world, farm-to-market and ranch-to-market products will be monitored
11. For-profit & not-for-profit organizations, social impact & commercial application processes will be reengineered
12. Blockchain will continue the process of decentralizing and eliminating the middleman



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How Can Blockchain Apply to Health Care?

ALEXANDER KOWALSKI, ASSISTANT PROFESSOR



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Health Care as an Industry

- Multiple facets
 - Each with individual challenges, concerns, and incentives
- Healthcare is slow to adopt new technology
- Patient ≠ consumer



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Health Care – Where have we been?

- Paper charts



Courtesy of Dr. Marco Herzig

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Health Care – Where have we been?

- Paper charts
- Separate files at separate locations



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Health Care – Where have we been?

- Paper charts
- Separate files at separate locations
- Faxes and mail



Courtesy of Dr. Marco Herzig

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Health Care – Where are we now?

- Still faxes and mail
- Electronic medical record
 - individual “silos”
- HIPAA (Health Insurance Portability and Accountability Act of 1996)
- Cybersecurity concerns



“Somehow your medical records got faxed to a complete stranger. He has no idea what’s wrong with you either.”

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Role for Blockchain in Health Care

- Allowing secure exchange of data
- Interoperability, transparency and security
- Insures “audit points” and makes information sequential
- With patient permissions and input



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Innovation in Healthcare - examples

- Health Records by Apple – records from multiple locations
- MedRec - MIT
- DoctorSmart - global health
- DNAtix – anonymous genetic testing
- Timicoin – patient data storage
- Patientory/Dentalfix - caveat emptor



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Where are we going?

- Drug testing and development, supply chain
- Claims adjudication, billing management
- Health information exchange
 - Patient centered universal chart

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Questions



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