**Homework #4: Blockchain and Healthcare Use Cases:**  *IBM Health Passport is an example of a healthcare use case which leverages the features of blockchain to solve a healthcare challenge.* [*https://www.ibm.com/products/digital-health-pass*](https://www.ibm.com/products/digital-health-pass)(2 hours)

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| **IBM Health Passport Blockchain Use Case** | |
| Problem(s) that a blockchain network could solve | After the onset of the covid019 pandemic, a new problem that society has not faced for a long time emerged: how to conduct “life as usual”.  Need: After restrictions on gathering are eased, how do we prove that we are well enough to gather and interact as we did before?  -take people’s word for it?  -paper card certificates of vaccination? ( paper cards get lost, can be counterfeit and do we really need to know where the vaccine is from, batch, etc.)  -negative /positive testing status (or do we need to know where the test comes from, what batch and such)  -delays and costs (people power), in transmitting validated information  -data blocking  -one system may not “talk” to the next |
| *Application of BC Features* | |
| Trust | Smart contracts allow participants into the blockchain: no counterfeit vaccine information can partake in the blockchain record for example. |
| Verification | Business rules set by the verifier (such as the stake holders designing the blockchain, for instance the state of NY so people can enter restaurants, concerts etc.) but the consent to share that verification is held by the user.  Validated by “miners” to create a block or group of transactions that have been verified. |
| Data Provenance | Immutable data history allows the potential to provide data history from data origin regardless of episodes and incidents vs. fragmented or episodic information. The innate design of blockchain technology is based on a genesis node and subsequent nodes tied together directionally by hashes, creating a one way directional ledger. |
| HIPAA (patient right to privacy of HI) | The blockchain can allow necessary information to be connected to create a affirmative or negative result (green light or red light scenario) without divulging details such as type of vaccine, where received, patient age and other private health information). Patient controls what data is shared and level of privacy. Not having to request from a health system or provider adds another level of privacy. |
| Industry Adoption Standards | All stake holders communicating on the blockchain need to have the same API (Application Programming Interface) standards, a known challenge in health care because of variable electronic health record APIs. Most health records do not allow for efficient flow of information from one to another because of the privacy and proprietary nature of health information held within healthcare stake holder groups. With non-healthcare blockchains, this challenge is not as difficult because the data originates from data platforms that don’t require guarantees of private health information security. |
| Incentives | Tokens and monetization of transactions: Providers (Healthcare systems and laboratories) could be incentivized to provide data (if not mandated by law), and patients could be incentivized to provide approval for data to be on BC. |
| Other? | Time to mine data presents a challenge for expanded blockchain total electronic health records.  For a simple, single item health record blockchain transaction, like vaccines or covid testing, which create an occasional “yes or no” result, the time for mining is not as much of an issue, and might be more efficient than relying upon a series of providers and people trying to communicate in a sea of too much data. |

**Assignment: Identify another real life or potential healthcare or non-healthcare use case where blockchain is being used or can potentially be used and complete a similar table as the sample above.**

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| **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Blockchain Use Case** | |
| Problem that a blockchain network could solve | Rising global costs and the fragmented nature of the healthcare supply chain creates several challenges. The healthcare industry needs efficient solutions that can streamline supply chain operations and processes in a cost- effective manner. Leading healthcare players are exploring blockchain technologies to achieve efficiencies and gain better control over their supply chains.  Need: How do you know if what your ingesting is the correct Medicine?  -take pharmacy’s word for it?  -Label on the bottle? ( paper gets missed printed, can be counterfeit , etc.) |
| *Application of BC Features* | |
| Trust | Smart contracts allow participants into the blockchain: no counterfeit vaccine information can partake in the blockchain record for example |
| Verification | A supply chain is often described as a system of organizations, people, activities, information, and resources involved in moving  a good or service from the initial supplier to the final customer Similar to supply chain management in a manufacturing  setting, health supply chains can be characterized by different modes of integration:  • Integration and co-ordination of processes.  • Integration and co-ordination of information flows.  • Integration and co-ordination of planning processes.  • Integration of intra- and inter-organizational processes.  • Integration of market-approach.  • Integration of market-development |
| Data Provenance | Blockchain in healthcare improves overall security of patients’ moreover resolves the issues of drugs authenticity and drugs  supply chain traceability and enables secure interoperability between healthcare organizations. |
| HIPAA (patient right to privacy of HI) | Patients info doesnt have to be printed on the pill bottle. |
| Industry Adoption Standards | Step-1: A block is created upon the invention of a new medicine or medical care which includes patent protection and a long  process of clinical trials. This information is recorded in the digital ledger as a form of transaction.  • Step-2: Once the clinical trial is successful, the patent is sent to the manufacturing plant for test prototype and mass  production. Every product has its own unique identity that is integrated with another transaction or block in the blockchain  including other relevant information.  • Step-3: Once the mass production along with packaging is finished, medicine is gathered in a warehouse for future  distribution. Information such as, time, lot number, barcode, expiry date is included in the blockchain.  • Step-4: Transportation information is also included in the blockchain which may include time out from one warehouse (IN)  to other, mode of transportation, authorized agent, and other information.  • Step-5: A third-party distribution network is normally responsible for distributing drugs and medical supplies to healthcare  providers or retailers. A warehouse (OUT) for each third party is used for this purpose from where all distribution endpoints  are linked. A separate transaction is also integrated into the blockchain.  • Step-6: Care providers such as hospitals, or clinics need to provide information, for example, batch number, lot number,  product owner, expired date to authenticate, and prevent counterfeit.This is also included in the blockchain.  • Step-7: The actions taken by a retailer are similar to Step-6.  • Step-8: Patients are encouraged to determine authenticity throughout the whole process as blockchain supply chain offers  transparent information for verification to potential buyers. |
| Incentives | Tokens and monetization of transactions: Providers (Healthcare systems and laboratories) could be incentivized to provide data (if not mandated by law) |
| Other? | The one great benefit of Blockchain for healthcare supply chain is that it allows all stakeholders to verify the  authenticity of the transactions stored inside the ledger. |