Decentralized Health Insurance Protocol

Team

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Goals

- Implement a working proof-of-concept for a community-owned insurance pool
- Use ChainLink oracle for procedure pricing information and supply-chain data
- Learn Solidity/ChainLink together as a team

Roadmap

Target Date	**Milestone**
09/12/2020	Complete initial design and understand our tech stack
09/19/2020	Testable prototype
09/26/2020	Finished project

Definitions

Smart Contract	Immutable code on the ethereum blockchain that handles transactions
Contract Owner	Deployer of the insurance contract and a trusted member of the community (e.g Town Hall)
Insurance Pool	Funds stored in the smart contract to cover qualified expenses
Member	Insured participant approved by the contract owner
(HCP) Healthcare Provider	Hospitals, pharmacies, doctors, etc

Approved Provider	Healthcare providers that have been invited to the contract
$	Stable coin unit such as USD, but could be something else
Price	Membership cost paid annually
Membership ID	Unique identifier cryptographically generated for a member from a combination of personal information and a secure password
Chainlink Alarm Clock	ChainLink feature to schedule function execution for a later date
Membership Period	Length of membership - 12 months from purchase date

Design Overview

Insurance Pool Contract

- Funded by annual subscription model and community donations
- Ethereum smart contract holds the funds and handles all transactions
- Members are entitled to a percentage of the overall funds, up to a dollar limit
- Disbursements are approved by the patient and/or Contract Owner
- New members and providers are approved by the contract owner
- Funds disbursed to physicians and hospitals by request for payment; delivery of professional and technical fee request

Membership

- Membership approval granted by the contract owner for the address
- Hospitals bill the pool directly, and funds are available for the next membership period.
- Personal data is stored off-chain and verified against the ETH address
- ChainLink Alarm Clock job used for renewing the plan automatically after expiration

Contract Owner

- Trusted member or entity for the community
- Represents a security layer against fraud
- Eventually replaced with a DAO for community votes
- Administrative Permissions:
    - Approve new healthcare providers
    - Create invite tokens for new members
    - Contribute funds to the pool
    - Disable automatic renewal for members
    - Determine insurance parameters during deployment

- Restrictions:
    - Cannot revoke membership
    - Cannot remove any funds
    - Cannot enable automatic renewal for members
    - Cannot purchase insurance membership directly

Private Verification Server [out of scope]

- Verifies private healthcare data from the hospital off-chain
- Maintained and owned by the contract owner and community
- Hosts a data adapter for the smart contract
- Hosts a payment interface for the claims providers
- Modular component that could be replaced with a private blockchain solution
- Acts as a node to provide anonymous oracle data

ChainLink Oracle Node

- Private verification servers provide anonymous data
- Provides supply chain data as a resource for external entities
- Provides real-time pricing data to keep everyone honest

General Public

- Has access to the following anonymous information:
    - Anonymous disbursement history
    - Membership count
    - Contract owner public address
    - Pool balance

Smart Contract

Parameters

Independent Variables - set ONCE by the contract owner

Name	**Description**	**Units**
price	Price for membership, paid annually	ether
coverageMultiple	Constant multiple used for the limit calculations	uint
duration	Subscription duration in days	days

Dependent Variables - updated after each transaction

Name	Description	Formula	Units
V	Value of the current pool in ETH	Current balance	ether
N	Number of active members	Member count	uint
dL	Dollar coverage limit	P * K	ether
pL	Percent coverage limit	Func(N, K)	%
L	Coverage limit available for each participant	MIN(dL, pL * V)	ether
D	Disbursements paid since membership purchase	Accumulated balance	ether
C	Coverage available to a specific participant for any one disbursement	L - D	ether

Transactions

Description	Accessibility	Parameters
Fund the pool with a donation	Public	amount
Approve member	Owner	ID, address
Approve healthcare provider	Owner	ID, address
Purchase membership token	Approved member	Price (TUSD)
Request payment	HCP	ID, amount
Approve payment	Member	ID, amount
View available coverage	Public	address
View disbursement	Public	transactionID
Check for approval of role	Public	Address, bytes32

Purpose

- Highlights broad human societal potential for blockchain utility and adoption; in an effort to help certain societies opt into universal healthcare adoption

- Current system lacks democratized checks and balances; current business model enables hospitals to overbill without transparency or integrity; current business model employs “purposeful inefficiency” to short-change patients and physicians
- Professional fee disbursement (payment to doctors) can take up to 6-months currently
- Massive lack of transparency perpetrated by Hospital Corporations and Insurance industry alleged across the industry
    - “Purposeful business inefficiency”
    - Deceitful use of “discounted rate” conveyed to patients renders unknown the truthful cost of healthcare
- Supply chain information to be supplied by Chainlink Oracles
- En masse cross-industry, trans-national hospital billing price transparency provides powerful checks and balance mechanism for patients in the community insurance pool

How should we make it?

- Funds stored and paid from a public blockchain
- Validation between the professional side (physician), the technical side (hospital), the patient, and the contract
- Shares represent a right to a higher percent of the pool than you purchased originally, only for a qualified purpose

Who benefits?

- People who want control over their medical insurance
- Doctors who don’t trust insurance companies and hospital corporations, and require guaranteed payment mechanisms
- Supply side companies by evaluating trends in utilization (International Classification of Disease-10, ICD-10 inputs; CPT codes; incoming supply purchases)
    - Powerful supply chain data
    - Pharmaceutical companies and large online e-commerce companies by allowing them to feed into supply chain information to assess real-time supply/demand needs allowing them to strategically position themselves in a way to provision hospital/physician supply needs
- Hospitals corporations, physicians by enabling them to monetize digitized supply chain information in return for ChainLink enables new source of revenue for medical businesses

Risk

- Insurance / healthcare is highly regulated
- Pool of funds must cover potential health care costs at scale
- Schemes, to charge the DAO erroneously and extract funds (need strong validation)
- Transaction fees, immutability, and public health data

- Using funds for non-approved or inaccurate use cases (charging for a procedure that never happened)

Payoff

- Insurance/healthcare industry is 17.8% of the US GDP
    - $3.8 trillion and is expected to reach $6.0 trillion by 2027
- Cross-border, transparent universal healthcare
- Custom health insurance pools for small communities
- Health insurance as a public utility, not a profiteering business model
- Confidence and transparency about what is covered
- Improved public health and insurance integrity
- True cost of healthcare is determined and validated

Technologies

- Ethereum (Blockchain)
- Chainlink (alarm clock)
- ENS (domain registration)
- React (front end)
- Open Zeppelin (utility/security libraries)