Commentary

Building a digital republic to reduce health disparities and improve population health in the United States

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Income, schooling, and healthcare are key ingredients for health, but most government programs that are designed to provide these social benefits are difficult to access. While many Americans struggle to pay taxes, few understand how difficult it can be for needy Americans to enroll in public social benefits such as Temporary Assistance for Needy Families (one of many income support programs), Pell grants (one of many tuition assistance programs), or Medicaid (one of many public health insurance programs). Perhaps because such programs are difficult to enroll in, only a fraction of needy families receive the social benefits to which they are entitled. That percentage is smaller for those most in need (e.g., those with disabilities or caregiving responsibilities). In this editorial, we discuss a novel method for improving health while also improving privacy, reducing fraud, and improving data system compatibility. Specifically, we propose a digital identity card that allows for the creation of a "digital republic" in which enrollment in social benefits can be automated, and the benefits can be targeted to those most in need. While there are large potential population health and health disparities benefits that could arise from a digital republic, more empirical work is needed to understand the extent to which nations have benefited from digital identity programs in the past and the political economy associated with implementing such programs.

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Introduction

Only well-off Americans are adroit at navigating the complex bureaucracies of banks, taxes, and licensure requirements required for day-to-day survival in a complex society. But failing to navigate these

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bureaucracies impacts not only Americans' wallets, but likely also their health. In this commentary, we describe how social services and government benefits can be automatically delivered to eligible participants by creating a universal digital identity that opens the door to turning the US into a digital republic.

Social benefits and population health in the US

Social benefits have long been hypothesized to improve health by providing key social goods that are needed for survival (housing, health care, education) to socially disadvantaged populations.[1][2] Recently, randomized controlled trials have shown that social policies that are effective at increasing economic well-being can also improve population health.[3]

For a social policy to improve health, though, it must also improve economic well-being. Unfortunately, most social policies simply don't do what they are supposed to do (provide health insurance, deliver income support for low-income workers).[4][5] Perhaps the largest reason that social benefits fail to reach their recipients is that they are simply too difficult for the neediest Americans to access. Most social benefits require long forms to be filled out and arduous proof of eligibility to be provided to different government agencies. The most prevalent and difficult barrier to leap is "means testing," which requires the applicant to prove that their household income is below the threshold for benefit eligibility. Unemployed people can find it especially difficult to provide proof of income simply because they have no paycheck.

In experimental trials of social benefits, participants are aided in filling out forms and finding documents needed to prove their eligibility. But even under these circumstances, only about half of eligible participants typically succeeded in obtaining tax credits, Medicaid benefits, or housing vouchers.[6][7] Clearly, removing barriers to receiving social benefits would help. Identifying eligible participants and automatically enrolling them would be better still.

Automating payments

Benefits that are ostensibly automatic do not reach all their intended recipients because the government lacks data on the most disadvantaged Americans. If one has never worked, is homeless, or works in the informal sector, he or she is unlikely to have a recorded address in which to receive a payment.

The American Rescue Plan passed under President Biden recognized that the neediest Americans were not all receiving economic stimulus checks intended to provide economic support during the Covid-19 pandemic.[8] As a result, when planning for the extended child tax credit, the Biden administration charged the Internal Revenue Service (IRS) with the task of finding custodial parents that were missing in the IRS database, and then sending out checks. This was no small task for an underfunded federal agency. The IRS nevertheless managed to find many eligible parents and sent checks with no need for the recipient to apply.[9]

The US misses the target

The average caregiver is probably less likely to have a disabling mental illness or a physical disability than other recipients of social benefits. Therefore, providing custodial parents with an automatic child tax credit may seem like a relatively straightforward task. However, the government must first verify that the intended beneficiary is a parent, that the child is alive, that the child is living with the parent, and that the combined household income is under $75,000 if there is a single parent (or $150,000 if there are two parents filing taxes together). Doing so requires a lot of secondary data that allows eligible recipients to be correctly targeted without the need for them to fill out additional forms.

In an ideal world, all social benefits would be targeted in a way similar to the extended child tax credit. For instance, a self-employed worker with an income of $30,000/year may be able to afford most survival needs except for private health insurance, which could consume over a third of pre-tax income. Were public insurance (Obamacare, Medicaid) provided to this individual automatically, there would be no need for the worker to research cryptic insurance plans (with different deductibles and co-payments) or to fill out complex forms (with proof of income and residence requirements). When insurance is provided automatically, the recipient can devote more time to work. Likewise, government agencies would need fewer workers to check paperwork. The key issues of finding those in need of services, targeting services to those with specific needs based on individual characteristics, and then enrolling them in services could be solved by the creation of a digital republic.

What is a digital republic?

A digital republic is a nation that offers integrated government services via online access. This is done via a single secure login credential that gives the user control over their data (also known as a "self-sovereign identity." Estonia was the first nation on earth to use a digital identity card to secure linkages

between troves of individual-level data in order to bring all government services online, thereby building a digital republic.[10] In Estonia, each citizen has a digital identity that links all of the individual's data together no matter where it resides. This allows the individual to receive government and private services virtually, such that the government can continue to operate from another nation in the event of an occupation by Russia (thus the term "digital republic").[10]

Having a secure digital identity is central to running a digital republic; e-Estonia has not had a major data breach since 2007.[11][12] Sweden, China, and South Korea have also all been able to automate most of the tasks that people need to get ahead in society—to obtain a loan, obtain a credit card, apply for university, or open a business. In China, for instance, a loan can be obtained in 3 minutes in a way that is more secure than methods used by banks in the US.[13]

Were everyone able to participate in formal services (banking, licensing) while also receiving social benefits (housing, health insurance), economic and health disparities may begin to fade. This is because many people are effectively excluded from the formal economy since it is difficult for them to bank, to apply for a driver's license, or to pay bills. Many such people rely instead on expensive check cashing services and stamp-on-envelope payments that require a permanent address (see **Example1**).

> **Example 1: The hurdles that low-income workers must jump just to receive a bill.** As housing prices increase, working-class Americans are often forced to be mobile, moving from house to house or living in trailer parks. This often makes it hard to open a bank account or to pay basic bills, such as mobile phone bills. However, getting a post office box is no easy task. As official post offices close their doors and more Americans become temporarily housed or homeless, post office boxes are scarce. It is therefore often necessary to rely on private mailboxes. To sign up for a private postal box, though, the applicant must fill out United States Postal Service Form 1583 (Application for Delivery of Mail Through Agent). This form requires a printer. Once the form is printed out, the form must be taken to a notary public, signed, and stamped, and then provided to the mailbox provider before the box can be issued. It is easy to see, then, why so many Americans face bankruptcy; bills can pile up, accrue fines, and go to collection agencies. With bad credit, life becomes much more difficult and expensive. As one example, a mobile phone is essential for survival in modern-day society. But inexpensive plans that provide free phones require a credit check.

Users must therefore purchase their own phone and pay gigabyte to gigabyte on a limited data plan.

When the identity is certain, it is possible to create a safe linkage between multiple encrypted datasets in both the public (Social Security, Department of Motor Vehicles) and private (bank, college) sectors. For example, a person applying for a job as a truck driver would provide the employer with permission to verify the applicant's employment history, licensure to drive a truck, and driving violations all while granting the employer permission to deposit paychecks by accessing each database.

Improving privacy, reducing fraud

An important element of the truck driver example is that the private information that the employer receives is limited only to that for which the user provides permission. In the US, if a customer wishes to buy alcohol, the storeowner is provided with the customer's name, driver's license number, and date of birth. When the identity is digital, the storeowner only needs to know whether the person is over or under the age of 21, and this can be verified with a tap of the phone or ID card against a console. Age eligibility can even be encoded in the digital payment (credit card, Venmo) so that the purchase and verification happen at the same time. In this way, digital identities can increase privacy by returning control of one's identity and personal data back to the user. But it could make getting a free drink on one's 21st birthday a bit more difficult because the bartender would only know that the ID holder is over the age of 21.

In a digital republic, privacy features such as these extend beyond in-person transactions. Typically, when a user logs into an email or bank account, that person's "credentials" are certified by a username and password. This is ideally followed by a second verification, such as a text message. An ultra-secure system might use a state-issued card with a chip or a live satellite-linked code to verify that the user is who they claim to be. This secure credential ensures that "Tanya Jones" is the one who is accessing Tanya Jones' data within any given dataset. However, for all the privacy features of a digital identity to work, a nation must adhere to a set of standards that ensure both that privacy is put in the hands of the user and that all databases that contain information about the user can communicate with one another.

Setting standards

A set of transparent but secure international standards for identities, data formats, and data infrastructure have been developed. One leading set of standards is called "Trust Over IP."[14] Trust Over

IP is built on the concept of "self-sovereign identity," which gives a user control over access to their data and sets standards for data formats and use. Such standards are necessary if the US is to implement a system like Estonia's—without them, it is difficult to link the Department of Motor Vehicles registry with private driver's education institutions, for example. Standards for software work much in the same way that standards for hardware work; if all bicycle cranks have the same threading and size, then any pedal can be used on any crank. Likewise, databases built on the same standards become easily interoperable.

Proper data structures do not centralize data in one spot, but rather allow access to different datasets located in different systems. It is important to decentralize the data where it resides (the Department of Motor Vehicles, Unemployment Insurance) because it is unlikely that a hacker would be able to breach more than one system. This is one of the shortcomings of e-Estonia—the centralized nature of the data system offers hackers a single target.

International successes and failures

That e-Estonia fails to de-centralize its databases highlights the difficulty in assessing how one should gauge a nation's success in building a comprehensive and equitable digital republic. While leading experts agree that Estonia offers all services online in an accessible way that protects privacy, not all agree that it is the ideal example of a digital republic.[15] Most egregiously, China has created a *Black Mirror* digital republic in which citizens pay for the convenience of not carrying cash, having to fill out tax forms, or being victims of crime with their privacy. The government tracks every move, and when a citizen steps out of line they are censored at best or disappear at worst. By contrast, data access in Estonia can only happen with user consent, and any citizen logging into Estonia.ee can see which agencies or companies have accessed their data but can't offer the same convenience as China.[16] It is therefore difficult to compare one nation to the next (see **Example 2**).

> **Example 2: The *United Nations E-Government Survey.*** The United Nations E-Government survey ranks nations based on telecommunications infrastructure, human capital, and online services.[17] The United States, well known for its failures to bring government services to its people in a secure and private way (healthcare.gov, ID.me), for its continued reliance on cash, for private and public security breaches (Equifax, Office of Personnel Management), and for its atrocious privacy blunders (Cambridge Analytica, the Snowden files) ranks relatively high in the United Nation's *E-Government Survey*. Estonia, a nation

with half the per capita gross domestic product, ranks roughly on par with the United States.

While the UN's focus on the benefits of a digital republic for vulnerable populations is laudable, a much better way of viewing the world is to therefore assess the proportion of transactions that can be conducted online, the proportion of the population that does so, and how adherent those transactions are to standards. By these criteria, Northern Europe and Korea stand out. Both analog America and the super-digital republic of China would fail on privacy and protection standards no matter how advanced the telecommunications infrastructure is. Only after a system is accessible, secure, and private will a system serve its vulnerable.

How a digital republic might benefit population health

The effort required to achieve a digital republic in the US would be immense, but so too would be the health and economic benefits that might arise from such an effort. This is in no small part because a digital republic could provide targeted automatic enrollment in social benefits, such as public health insurance or income support, that reduce hardships like living in deteriorating housing, being a victim of crime, or being able to afford healthy food.(3) But being able to pay the bills produces health effects that extend beyond overcoming material hardship because it also potentially reduces psychological stress.

The hassles of life, psychological stress, and population health

Just as a car would be of little use if it could not gear up to climb a hill, humans would not survive without the ability to rev up the stress response to escape a large cat. But constantly revving an engine will cause the car to wear out quickly.[18] The stress response in humans produces neurohumoral changes like increased levels of adrenaline and steroids.(18) The result is wear and tear on the body's organs, damaging health through a process called "allostatic load."[19]

The hassles of daily living are stressful and take a health toll on the wealthy and poor alike. But this stress is probably much more acute and severe in socially disadvantaged groups.[20][21] If one cannot pay bills, these hassles are amplified (heat going off, collection agencies). A digital republic potentially revs down the human engine by removing the daily stress associated with navigating modern complex societies; less time is spent on automated phone systems and more time working and playing.

An analog life requires executive function skills

Just as stress takes a toll on the body, it takes a toll on the brain, making it more difficult for socially disadvantaged groups to perform basic tasks, such as opening a bank account and enrolling in bill payments. These tasks require "executive function" skills, which are located in the forebrain and atrophy quickly when a person is chronically stressed.[22][23][24][25] If socially disadvantaged people are unable to engage in the hassles of daily living, they can enter a downward spiral in which poverty leads to poor executive function, which leads to lower earnings, which leads to worse executive function. Given this, it is easy to see why homelessness is growing rather than receding.

An analog life limits political participation

In addition to reducing material hardship (bad housing, crime), making it easier to participate in everyday society (paying bills, getting a driver's license), and overcoming executive function deficits that are more common among socially disadvantaged people, a digital republic may also improve health by increasing political participation. As of May 2022, 27 states have enacted over 436 laws that restrict voting rights.[26] These laws disproportionately impact individuals from low-income households, racial minority groups, and younger US residents. As a result, these groups do not have elected representatives who can advocate for their survival needs, such as housing, healthcare, and education.[27] By reducing barriers to receiving social benefits, reducing stress, increasing access to everyday services, and increasing voter participation, a digital republic can potentially reduce health disparities, while also potentially improving overall population health.

Precision welfare, precision public health, precision medicine

In the US, some medical providers continue to take notes on pen and paper. Large healthcare providers sometimes find that systems in one clinic do not communicate with systems in another clinic because they are using multiple billing or electronic medical record providers.[28] As a result, there is a need to replicate forms, redo laboratory tests, and maintain personnel just to deal with redundant administrative bureaucracies.(29) These are just two reasons why administrative costs in the US health system are upwards of four times higher than in other wealthy nations.[29]

When data systems are unified, it not only saves patients time and reduces redundancy in the health system, but it also becomes possible to better understand how different treatments work in different

populations.[28][30] This is because medical records can be mined to explore how specific treatments predict outcomes in specific patients. This approach to tailoring medicine based upon a given individual's characteristics is called precision medicine.

Medical data are becoming sufficiently detailed that patients are not only defined by demographic characteristics, but also by genetic characteristics, epigenetic data, metabolomics, and proteomics.[28][31][32] Big data-driven precision medicine is particularly important for racial and ethnic minorities, groups that tend to be left out of clinical trials.[33] Precision medicine and precision welfare could also serve as a form of precision public health, easing the social risk factors that drive poor health.

Frighteningly, the same paper and pen tools used in doctors' offices are sometimes used to record some disease surveillance activities in the US, too. This is often done by faxing information from one office to the next.[34] South Korea, which deploys sophisticated centralized public health and real-time tracking data systems, had an operational application for testing and tracking Covid-19 cases down to the street level within a month of the first case.[35] Taiwan, which is a world leader in unifying health data systems, had an operational system within three months of the first detected case of Covid-19.[28] At the time of writing, three years into the Covid-19 pandemic, there was no way to track the crudest measures of progress such as tests or vaccinations in the US.

Limitations

There are also drawbacks to digital identity schemes. Foremost, they must be implemented in a very user-friendly way to avoid increasing health and economic disparities rather than reducing them. Some elderly, disabled, and homeless people will require special one-on-one assistance. One solution is to open walk-in centers that provide digital services to those who cannot access services from their phone or laptop. A single point of in-person accommodation can replace a wide array of government and private services at a tiny fraction of current taxpayer outlays for in-person services.

Undocumented immigrants would also require special attention. At present, undocumented immigrants in sanctuary cities require a parallel system of social benefits in which little by way of an identity verification is needed for enrollment. Were digital identities implemented, these services would have to remain within a parallel system.

Of course, it is much easier to solve these problems in writing than in practice. From the management of Hurricane Katrina to the rollout of Obamacare on Healthcare.gov, the US has a long history of failing

where other governments have succeeded. Fortunately, Estonia, South Korea, Japan, and Denmark offer assistance to other nations who wish to replicate their successes.[17]

For any system to work, transparency must be ensured. Currently, the approach to digital identity schemes in both the private and public sectors within the US appears to be stealth implementation. Apple implemented biometrics to conveniently unlock a phone. It then subsequently used the data collected by the users for unlocking the phone to credential third-party website logins. This includes logins to banks. While passwords can be easily changed, facial dimensions cannot. A data breach in Shanghai included the first large-scale case of biometric data theft.[36] This is particularly dangerous in a country where facial recognition software is in widespread use, not just in shopping and banking but also in police activities. Stolen biometric data could also potentially implicate innocent citizens in state crimes.

A self-sovereign identity requirement largely solves these problems but is not favored by most big tech lobby groups (Microsoft and MasterCard are two exceptions to this rule).[14] With power in the hands of big technology corporations, transparency carries its own political risks. The longer rollout takes, the longer the process would be subject to the US' Machiavellian politics. However, the US increasingly faces existential threats to its dominance as a superpower, and these threats may create political momentum for change.

Likewise, in a federalist system, the voting guarantee afforded by digital identities may have to ultimately be granted by the state. State of residence is becoming more important than skin color as a social determinant of health.[37]

Future work

Future interdisciplinary research is needed to examine how to implement a digital republic given the political economy of the US (political science), how to deploy digital identity schemes in a federalist republic (implementation science, law), and on which data systems can be integrated and which must be rebuilt (information technology). The literature on the health benefits of a digital republic is thin, and work should be done to explore differences in population health and health disparities before and after nations enacted policies to expand digital identity systems. To the extent possible, this work should use causal methods, exploiting variations in program rollout across nations and over time. While journalism has investigated different digital republics, the academic literature could also benefit from in-depth qualitative case studies.

Conclusions

The challenges confronting American society in the second half of the 21st century are much broader and more complex than those in the second half of the 20th century, including ever-growing differences between those with more or less education. But the technology available to address these problems is also exponentially more powerful. A digital republic can put privacy and security back in the hands of the user while greatly simplifying day-to-day tasks, making it a "no-brainer" policy tool. Were automatic enrollment in welfare systems achievable in a Rawlsian world, then the remaining arsenal of welfare programs could, in theory, be targeted to individuals using predictive analytics.

Were it to be successfully implemented, automation of social policies would likely pay for itself many times over by targeting programs to individuals in need, ferreting out fraud, reducing government personnel, advancing predictive analytics that can improve precision medicine and precision public health, and improving population health. Baby steps are needed, with automatic enrollment in public health insurance programs (Medicaid, Indian Health Services, Obamacare) a logical first step.[38]

Ethics statement

No institutional review board approval was required.

Competing interests

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