

## POLICY ANALYSIS

# Service supply chains for population health: Overcoming fragmentation of service delivery ecosystems

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## Abstract

**Introduction:** Population health involves integration of health, education, and social services to keep a defined population healthy, to address health challenges holistically, and to assist with the realities of being mortal. The fragmentation of the US population health delivery system is addressed. The impacts of this fragmentation on the treatment of substance abuse in the United States are considered. Innovations needed to overcome this fragmentation are proposed.

**Approach:** Treatment capacity issues, including scheduling practices, are discussed. Costs of treatment and lack of treatment are considered. Models of integrated care delivery are reviewed. Potential innovations from systems science, behavioral economics, and social networks are considered. The implications of these innovations are discussed in terms of information technology (IT) systems and governance.

**Conclusions:** Enormous savings are possible with more integrated treatment. Based on a range of empirical findings, it is argued that investments of these resources in integrated delivery of care have the potential to dramatically improve health outcomes, thereby significantly reducing the costs of population health.

## KEYWORDS

behavioral economics, governance, population health, social networks, substance abuse, systems science

## 1 | INTRODUCTION

In product supply chains, components from suppliers flow to equipment manufacturers who assemble products; products then flow to distributors and eventually end users. Service supply chains are different. For business-to-consumer supply chains, consumers often flow from service to service. Health services are a good example as patients visit clinics, primary care physicians, and specialists and seek services provided by outpatient centers and hospitals.

Health service supply chains are highly fragmented in the United States, with each component service (or bundle of components) often owned by independent businesses and provided at different locations.

Griek's video *If Air Travel Worked Liked Healthcare* provides a compelling illustration of this fragmentation.<sup>1</sup>

### 1.1 | Example

Quinones' *Dreamland*<sup>2</sup> provides a portrayal of the panorama of the substance abuse epidemic in America. Pharma's business model for pain pills included misleading advertising, an aggressive sales force, and incentives for doctors to prescribe opioids. Central to this was the delusion that opioids are not addictive, based on a one-paragraph letter to the editor.<sup>3</sup> Once addicted, people found heroin to be much cheaper than prescription drugs, and more powerful. Unfortunately,

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heroin laced with fentanyl has become increasingly deadly. Product supply chains, whether for prescription or illicit drugs, are highly integrated in this example. However, the service supply chain for treating substance abuse is highly fragmented.

## 1.2 | Implications

Society knows—medically, psychologically, and socially—how to help those who are addicted.<sup>4,5</sup> But our highly fragmented delivery system is not capable of delivering integrated services. The fragmentation of the US systems for health, education, and social services results in underinvestment in upstream social services, which leads to greater downstream health difficulties and costs.<sup>6</sup>

The consequences of inadequate treatment of substance abuse illnesses are immense. The long waiting times, across the health care ecosystem, because of inadequate and poorly organized treatment capacities, increase the likelihood of patients avoiding or postponing treatment and result in a higher rate of missed appointments.<sup>7-10</sup> Walker et al<sup>11</sup> reported that mental disorders reduce life span by 10 years.

## 1.3 | Overview

We next discuss the source of delays in treating substance abuse, with emphasis on treatment capacity issues and scheduling practices. Siloed information systems and the lack of incentives for integrated care contribute to these problems. The resulting costs are summarized.

We then discuss the full spectrum of services needed to address substance abuse. We portray the nature and impact of the fragmentation of the health delivery system, across population health services (health care, education, and social), with providers, payers, and regulators at local, state, and federal levels.

We outline an approach to addressing fragmentation, drawing upon the construct of service supply chains and enterprise architectures. We review the extent to which attempts at integration have been successful. We conclude with a discussion of innovations needed to fully realize integration, including the information technology (IT) and governance implications of these innovations.

## 2 | SOURCES OF DELAYS

Demand management is a central issue in service supply chains. Service providers want to avoid idle capacities. Providers cannot achieve near 100% utilization of capacities without managing demands. The airlines achieve this by dynamic pricing.

In health care, demand is managed by stretching it out in time. The long delays in entering and receiving treatment for substance abuse reflect this practice. Within-hospital demand management has been the subject of much research, including the construct of patient flow<sup>12</sup> and approaches to coordinating in-hospital services,<sup>13,14</sup> combining appointments for in-hospital services,<sup>15</sup> and social network analysis of clinic use.<sup>16</sup>

Scheduling practices affect delays. The difficulties in this area are well known.<sup>10,17</sup> A central issue is matching capacities to demands. Demands for substance abuse treatment have been increasing much faster than capacities. Average delays have been found to range from more than 2 months<sup>7,18</sup> to more than a year.<sup>19</sup>

Special clinics have been opened, but there is huge shortage of trained personnel. The US Department of Health and Human Services<sup>20</sup> has projected needs for nine specialties that relate to opioid abuse. It projected that by 2025, most of these specialties will have shortages exceeding 10 000 full-time equivalents.

## 2.1 | Scheduling practices

The waiting times for the full spectrum of services needed for substance abuse treatment can be months or longer because,

- patients do not know which service they will need next until they get the results of the current service;
- patients often need a referral from the provider of the current service for the payer to approve the next service;
- services that are not highly reimbursed have longer waits, in the United States at least, eg, mental health services<sup>21</sup> and the elderly with chronic diseases; and
- waiting times are increased by prioritization of highly reimbursed patients and underinvestment in capacities for poorly reimbursed services.<sup>10</sup>

The capacity and scheduling problems are immense, with the dire consequences outlined earlier. Siloed information systems and lack of incentives for integrated care exacerbate these problems.

## 3 | COSTS OF FRAGMENTATION

There are more than 20 million people in the United States needing treatment.<sup>22-24</sup> Roughly 10% receive treatment. Of those who do not receive treatment, more than 95% did not think they needed treatment, partially because of the stigma associated with substance abuse.<sup>25</sup> Roughly 50% of those receiving treatment drop out.<sup>26,27</sup>

Delays from onset, as opposed to diagnosis, to treatment average more than a decade,<sup>28</sup> although delays once treatment is sought average months, not years. Lack of health insurance coverage affects whether treatment is sought.<sup>29</sup>

Substance abuse treatment costs \$1583 per patient and saves \$11 487 annually.<sup>30</sup> These savings include the costs of medical care, mental health services, criminal activity, earnings loss, and transfer program payments. Another study found that medical and hospitalization costs were \$4308 lower per year for those in treatment, compared with those not in treatment.<sup>31</sup>

Substance abuse deaths have increased 10% annually over the period 1999-2015.<sup>32</sup> There were 33 000 deaths in 1999 and 150 000 in 2015, for both legal and illegal drugs. The result has been the widely reported decreases of average life expectancy in the United States.

A recent analysis<sup>33</sup> reports 2016 costs of roughly \$100 billion annually for addressing opioid abuse, not substance abuse more broadly. They project annual costs of \$200 billion in 2020. Lost productivity, rather than health care, accounts for more than half of these costs. They project a loss of \$800 000 per opioid overdose victim.

Considering total costs, the National Institutes of Health<sup>34</sup> reported that substance abuse, which includes tobacco, alcohol, illicit drugs, and prescription opioids, costs the United States \$740 billion annually in terms of crime, lost work productivity, and health care; \$232 billion (31%) is for health care. We should be willing to invest significantly to decrease the burden of substance abuse.

#### 4 | SERVICES NEEDED

Sussman et al<sup>35</sup> outlined 14 components of addiction and associated interventions/services. Only a few of these interventions/services are traditionally associated with the health care system but are nevertheless very relevant to the concept of population health. Figure 1 portrays who is involved in providing many of these services and the inherent difficulty of accessing these services in the United States.

Our approach to addressing the complexity of Figure 1 draws upon service supply chain management. Managing supply chains of services poses different problems than flows of component parts to Original Equipment Manufacturers (OEMs) or foodstuffs to grocery shelves.

##### 4.1 | Service supply chains

Voudouris et al<sup>36</sup> addressed service supply chain management in terms of optimized forecasting, planning, and scheduling of the service chain and its associated resources. They advocated metrics typically associated with queuing systems.<sup>37</sup>

Wang et al<sup>38</sup> provided a review of operations research methods and tools applied to service supply chain management. They distinguished service-only supply chains from product service supply chains.

Sakhuja and Jain<sup>39</sup> provided a broad conceptual model and also offered a literature review of service supply chains.

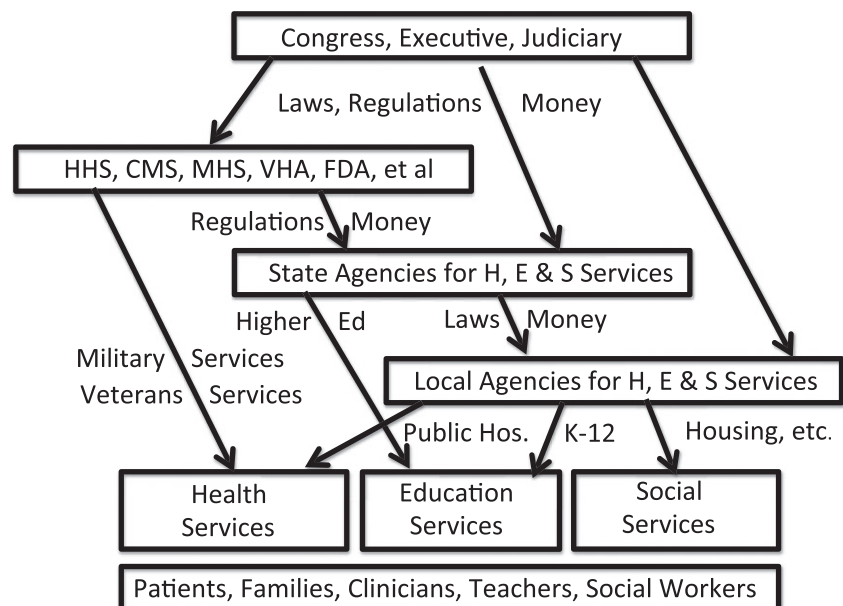
Choi et al<sup>40</sup> discussed risk management and coordination in service supply chains. They considered outsourcing, information sharing, incentives alignment, and risk analysis, including sources of uncertainty and disruptions. They noted that these risks can influence pricing. Ellram et al<sup>41</sup> addressed strategies for mitigating outsourcing risks.

Considering service supply chains in health care, Yap and Tan<sup>42</sup> addressed health care organizational performance and concluded that supply chain innovation and efficiency are positively related to organizational performance. Baltacioglu et al<sup>43</sup> reported that enhanced information sharing, coordination, and synergy among entities result in decreased lead times, inventories, and costs in hospitals. Al-Saa'da et al<sup>44</sup> reported that the quality of service supply chains correlates significantly with health care service quality.

##### 4.2 | Problems in population health

Two service supply chain problems are of particular importance to population health. The first is “passing the baton” to get the patient to the next service with all the information needed to facilitate this service—the baton here is the information. The service chain quite likely involves disparate organizations whose objectives may be far from aligned. Success for the organization is typically defined as successful completion of the step for which it is responsible. Success for the patient, however, involves successful completion of *all* steps. Quite often, assurance of overall success is left to the patient, who for substance abuse is unlikely to be capable of performing the task.

The second problem is “service coordination” across service supply chains. Difficulties arise when any step in a service chain identifies a needed service unrelated to this step. It might be an unrelated medical need or perhaps a social need. There are gaps between steps that hinder providing integrated services. The network may



**FIGURE 1** Relationships among organizations and services

not know what services are needed until servicing begins. Only then does the clinician, for example, discover that the patient does not have a home address.

### 4.3 | Population health ecosystem

Our approach employs a framework we have developed for modeling complex social enterprises,<sup>45</sup> and it is applied in domains ranging from health care delivery<sup>46,47</sup> to higher education.<sup>48</sup> This framework addresses the physical, human, economic, and social phenomena underlying complex ecosystems. A population health version of this framework is shown in Figure 2. The inclusion of health, education, and social services caused the broadening of this framework.

### 4.4 | Phenomena at each level

At the people level, central phenomena include establishing a route through the many needed services. People may balk (not become patients) or renege (drop out of treatment) along the route, because of delays and other factors.

Process level phenomena include getting appointments for each service in the route. Delays are highly affected by the aforementioned capacity constraints. Processes also involve the flow of information among service providers. Inefficiencies in the flows of information can disrupt the flow of patients to services.

At the organization level, capacity constraints are due to investments. Organizations tend to invest in capacities needed to provide services that are highly reimbursed. Thus, for example, cancer, cardio, and ortho services are typically better provisioned than is chronic disease management.

On the level of society, investment policies are related to payer reimbursement policies and how value is defined. Healthy people not only have lower health care costs but also typically work, earn incomes, pay taxes, consume, etc. Thus, society benefits from a healthy population far in excess of the lower health care costs.

Fragmentation at the highest level undermines accounting for the full benefits of population health.

## 5 | INTEGRATED DELIVERY OF CARE

The Substance Abuse and Mental Health Services Administration (SAMHSA)<sup>24</sup> reported that, "Back and forth referrals between behavioral health and primary care services result in up to 80% of individuals not receiving care." SAMHSA<sup>49</sup> also reported that persons with substance abuse disorders have greatly increased risks of congestive heart failure, liver cirrhosis, and pneumonia. Despite such comorbidities, they reported that more than half of addiction treatment programs have no physician.

A fully integrated, comprehensive treatment program would include the proper array of clinicians (doctors, nurses, psychologists, social workers, etc) accessible in one location. Payment for these services is later addressed. Another issue is whether there are enough drug treatment centers and whether they are conveniently located.

Is an integrated approach to treatment effective? Many studies have addressed this question, with promising but rarely definitive evidence.<sup>50-57</sup>

Program features associated with effectiveness included assertive outreach, case management, and a longitudinal, stage-wise, motivational approach.<sup>51</sup> Court-ordered treatments were more likely to be completed.<sup>58</sup> DuPont<sup>59</sup> summarized metrics for success from the perspectives of patients, providers, and payers.

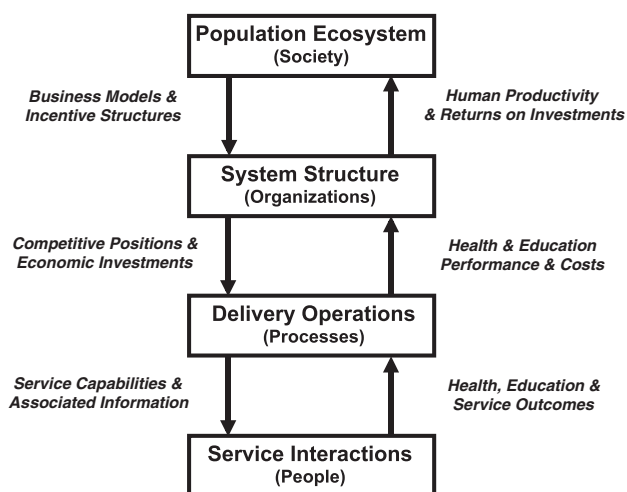
Approaches to the design of integrated health systems have emerged from the range of studies reviewed above. Marlatt et al<sup>60</sup> proposed eight design principles for integrated treatment programs. SAMHSA<sup>49</sup> outlined capabilities needed for integrated treatment and provided a six level framework.

Integrated treatment of substance abuse disorders is very promising but is a work in progress. Such offerings need significant refinement. We need to better understand the behavioral and social factors that affect substance abuse, including how best to foster patient engagement and retention.

## 6 | ECOSYSTEM INTEGRATION

A primary limitation of the above studies of integrated care is the simple fact that most of these studies were conducted in the fragmented US delivery system. How might integration of the overall population health ecosystem be accomplished? Table 1 summarizes our suggestions, organized using the framework of Figure 2.

The columns for innovations—that is, change in the marketplace—rely on many well-known ideas and inventions that have not, as yet, pervasively changed the ecosystem. We focus on systems science in terms of systems thinking, systems engineering,<sup>61</sup> operations research, and decision analysis.<sup>62</sup> Behavioral economics includes human-centered design,<sup>63</sup> prospect theory,<sup>64</sup> and the notion of nudges.<sup>65</sup> Social networks include emergent networks such as analyzed in the Framingham Study,<sup>66</sup> pervasive platforms like Facebook and LinkedIn, and the evolving concept of cyber-social learning systems.



**FIGURE 2** Population health enterprise (based on Rouse<sup>45,46</sup> modified for population health)

**TABLE 1** Innovations and implications for integrating fragmented delivery ecosystem

Level	Innovation			Implication	
	Systems Science	Behavioral Economics	Social Network	IT	Governance
Population ecosystem	Policy flight simulators employed to anticipate likely consequences of policies	Shared understanding of how behavioral and social factors contribute to perceptions of value	Social networks embraced as a complement to typical culture of individual accomplishment	Seamless integration across stakeholders—patients, providers, payers, pharma, etc	Broad evidence-based view of the “system” of population health across all relevant services
System structure	Hedging uncertainties of patient demands and payment systems via portfolios of options	Human-centered decision support of humans' bounded rationality and satisficing	Understanding of how networks of networks function across friends, family, employment, affiliations, etc	Platform orientation, eg, infrastructure for numerous apps (eg, cognitive assistants)	Adoption of “public good” values across all players; those undermining such values are penalized
Delivery operations	Operations research methods to improve process efficiencies and allocation of capacities to processes	Understanding of behavioral and social contributions to process variability enable increasing predictability	Enable access to and use of multiple social networks, including Facebook, LinkedIn, alumni groups, etc	Seamless integration across processes, including those that cross organizations	Clearly defined and communicated processes for issue identification, development, and decision making
Service interactions	Decision-theoretic approaches to support decision making by clinicians, patients, and families	Use of prospect theory; human-centered understanding of incentives and “nudges”	“People like me” provides pervasive support for patients and caregivers	Consumer friendly and responsive infrastructure; user experience drives all design and development	Mechanisms for feedback from people to enable publicly available benchmarking and learning

Abbreviation: IT, information technology.

## 6.1 | Service interactions (people)

The people level needs decision support, ranging from methods to help clinicians access, organize, and take advantage of the rapidly evolving science base within their specialties to methods to support patients in understanding and weighing the costs and benefits of the range of services they may need. There are well-known decision-theoretic approaches to do this, perhaps amplified with recent developments in artificial intelligence.<sup>67</sup>

These normative approaches need to be augmented by descriptive findings from behavioral economics. Prospect theory provides a basis for understanding human heuristics and biases<sup>64</sup> as well as the types of nudges that can influence humans' choices.<sup>65</sup> The notion of nudges, as they affect health related decisions, is receiving increased attention.<sup>68</sup>

Variations of “people like me” can provide pervasive support for patients and caregivers. In fact, “clinicians like me” is a target of ongoing artificial intelligence research. Social networks can be invaluable for helping to negotiate fragmented enterprises. Often the most efficient way to determine how to navigate is to ask someone who has done it before.

The possible impacts of behavioral economic nudges and social networks on health have received considerable attention.<sup>68,69</sup> Carroll<sup>70</sup> reported on several studies aimed at increasing compliance with treatment regimes. Most failed to achieve improvements. Johnson<sup>71</sup> reviewed a 2016 effort by IBM where, despite economic incentives, less than 10% of those targeted signed up and fewer actually used it. Clearly, this area presents a significant challenge.

The IT implications of the needed innovations outlined here include consumer-friendly and responsive infrastructure. Desired user experiences should drive all IT design and development. This includes

clinician experiences with electronic health records. When user experiences involve tedious use of opaque and confusing user interfaces, people simply avoid using such systems. If use is required, burnout can be a consequence.

From a governance perspective, there need to be mechanisms for feedback from people to enable improvements as well as publicly available benchmarking and learning. The immense frustrations with the fragmented delivery ecosystem need to be made visible. The operators of the various elements of the ecosystem need to be accountable for poor service.

Reducing the complexity of the service network, from users' points of view, combined with well-designed behavioral economics nudges is likely to be important keys to success. Users here refer to clinicians, patients, and families.

## 6.2 | Delivery operations (processes)

Operations research methods have been employed to improve process efficiencies and allocate capacities to processes.<sup>46</sup> These endeavors have mainly happened within delivery organizations rather than across organizations. The only “glue” between siloed organizations tends to be the patients who are often ill-prepared to play these roles. More of these types of efforts need to focus at the enterprise level.<sup>45</sup>

We have long known that understanding of behavioral and social contributions to process variability can enable increasing predictability and control (eg, Deming<sup>72</sup>). Within health care, such efforts have tended to focus on treatment processes. Attention needs to be paid to the processes whereby patients interact with the whole

delivery system, ie, the processes underlying the phenomena in Figures 1 and 2.

People often belong to several social groups, eg, Facebook, LinkedIn, and alumni groups. The IT infrastructure needs to enable access to and use of these multiple social networks. This does not imply the actual integration of these platforms but instead requires integrated access. A user-controlled resource should have seamless access across processes, including those that cross organizations.

From a governance perspective, there need to be clearly defined and communicated processes for issue identification and learning. When things do not work well and especially when they lead to unfortunate consequences, problems need to be identified, solutions need to be developed, and decisions need to be made by involved stakeholders. This is a learning challenge for the ecosystem described by Figure 1. Gaps in responsibilities can result in there being no stakeholders who “own” problems, as was identified to be a major challenge in the National Academy’s study of US abilities to address terrorist threats.<sup>73</sup>

### 6.3 | System structure (organizations)

The organizations represented at the structure level of the ecosystem face considerable uncertainties. The nature and magnitude of patient demands are uncertain as clearly illustrated by the exponential growth of the opioid epidemic. Payment systems in the United States are also highly uncertain with a range of value-based schemes being proposed and evaluated to replace fee-for-service payments.

To hedge against such uncertainties, organizations need to formulate a portfolio of options, ie, modest investments that enable organizations to respond quickly to whatever eventualities arise.<sup>74,75</sup> In this way, rather than being stymied by risks, organizations can see risk management as a core competency. The formulation of portfolios of options tends to be an invaluable learning experience.

Human-centered decision support<sup>63</sup> should be central to organizational decision making. Unaided humans inevitably face Simon’s<sup>76,77</sup> bounded rationality and satisficing. Appropriate methods and tools are needed to support executives and senior managers to cope with the complexity of the evolving health marketplace. Organizational fragmentation is not a medical problem.

The marketplace increasingly involves networks of networks across organizations, suppliers, etc, and also across patients’ friends, family, employment, affiliations, etc. While a source of complexity in itself, these networks of networks are also central to overcoming fragmentation. Clinicians’ and patients’ experiences can lead them to perceive the ecosystem as integrated if these networks are dovetailed appropriately.

From an IT perspective, a platform orientation is needed.<sup>78</sup> The platform should provide the infrastructure for numerous “apps.” For example, the emerging capabilities of “cognitive assistants”<sup>67</sup> can be deployed on the platform, as apps are currently available on smartphones. This may be challenging for IT vendors but very beneficial for clinicians and patients.

Governance implications include needs to adopt “public good” values across all players. Broad agreement is needed that we are all

better off if everyone is healthy, as well as educated. The marketplace should penalize organizations undermining such values.

### 6.4 | Population ecosystem (society)

This level of the enterprise defines the incentive structures that motivate business models intended to result in human productivity and returns on investments. Policies, procedures, regulations, and laws define incentive structures. Ideally, policies should be evidence based.<sup>79</sup>

Policy flight simulators are computational models employed to anticipate likely consequences of policies.<sup>80</sup> These models drive large interactive visualizations that enable stakeholders to explore alternative futures. Thus, they can computationally experiment with policy alternatives to avoid rolling out policies where, for example, compliance does not make sense.

Policy makers need shared understanding of how behavioral and social factors contribute to perceptions of value, or perhaps lack of value. This will enable them to craft policies that foster engagement rather than just compliance. For example, they need to understand how best to communicate the notion of health being a public good.

The roles and benefits of social networks should be embraced. A compelling example is a recent initiative to treat a neighborhood as a patient.<sup>81</sup> This involved the hospital treating the adjacent neighborhood to address social determinants. Treatment involved a multifaceted housing intervention that leveraged the social network of the community.

Seamless IT integration across stakeholders—patients, providers, payers, suppliers, etc—is a key enabler. The Internet, of course, provides an excellent example of such integration. However, sharing consumer information across product and service providers presents privacy and security issues. Blockchain, for instance, may help with these concerns.

Policy makers need broad evidence-based views of the “system” of population health across all relevant services. Health, education, and social services should not be silos. Difficulties accessing services across these silos were elaborated earlier. Payment for services merits some discussion.

Bundled payments for substance abuse treatment might help overcome some of the effects of fragmentation. Payment for outcomes such as sustained abstinence has some intuitive appeal but might lead providers to avoid very difficult patients. Of course, the impact and unpredictability of payment schemes are pervasive problems across health care.<sup>82</sup>

A broad view of payments would consider both expenditures for health and returns in terms of human productivity, salaries and wages, and taxes paid, as well as children raised, educated, and subsequently employed. From this perspective, health expenditures are investments that create human assets that provide returns over generations.<sup>83</sup>

### 6.5 | A scenario

The levels of integration outlined in Table 1 could enable the following scenario. Patients, families, clinicians, and other service providers

would have an app on their digital devices called *Open Health*. These users would feel like they were being served and supported by an integrated system, despite the inherent silos across providers, payers, and regulators at local, state, and federal levels.

This highly vetted app would provide access to curated content related to all aspects of health—education, medicine, environment, social, etc. *Open Health* would enable users to access the full range of services discussed in this article. Users could schedule services, both those delivered online and face to face. They could access data resulting from these services. They could share data to the extent desired.

Users of *Open Health* would configure their own portals, for example, designing their home page and what is bookmarked. Users and those providing them with services would be able to share information and communicate via text and voice. Each user would have a personal cognitive assistant that would understand their domain as well as their workflows, calendars, and contacts. This assistant would learn about them over time and adapt its support accordingly.

*Open Health* would be designed by taking advantage of the elements of systems science, behavioral economics, and social networks outlined in Table 1, and it would be deployed in the IT and governance context described in this table. This would include, in particular, carefully designed incentives for all participants to share information and coordinate services.

Elsewhere, we have elaborated concepts of learning in the health care enterprise, with particular emphasis on single- versus double-loop learning.<sup>84</sup> Learning depends, of course, on feedback. Fragmentation impedes feedback across the elements of service supply chains. This hinders learning and consequent improvements of services. Integration, as illustrated by this scenario, would provide a powerful platform for learning.

## 6.6 | Summary

Many of the innovations compiled in Table 1 represent ideas that have been around for some time. An overarching innovation would be the joint accomplishment of many or all the component innovations in this table. However, Table 1 is best seen as an agenda for efforts and investments, not something that can happen all at once or quickly. The technical hurdles to providing *Open Health* are likely minor compared with the economic challenges of who pays and who gains, and the legal and regulatory constraints to be overcome. There may be social barriers, but the public has become increasingly comfortable with the types of digital services illustrated by *Open Health*.

## 7 | CONCLUSIONS

This article has discussed the fragmentation of the US population health delivery system. Enormous improvements appear possible. Resources could be effectively reallocated from treating expensive downstream consequences of substance abuse to upstream early interventions that can mitigate these expensive consequences. We are not underestimating the difficulties of such a reallocation (eg, Bailey<sup>82</sup>) just arguing its enormous value, in terms of both health outcomes and costs.

Based on a range of empirical findings, it was argued that investments of these resources in integrated delivery of care, enabled by systems science, behavioral economics, and social networks, have the potential to dramatically improve health outcomes, thereby significantly reducing the costs of population health. This will require that we address the implications for IT systems and governance.

The key ingredients are a shared vision and a shared will to act. This includes seeing population health as investments in human capital that will generate the revenues that yield the returns that warrant these investments. Formalizing and quantifying these arguments require a broad systems perspective to which this article is intended to contribute.

## CONFLICT OF INTEREST

The authors have no conflicts of interest.

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