Harnessing Digital Information to Improve Population Health

Samyukta Mullangi, John P. Pollak, Said Ibrahim

Health systems do not systematically collect information on social determinants of health (SDH) — the conditions in which people are born, live, grow, and age — despite knowing that they have a big impact on individual and population health. But the shift from reimbursing providers for the volume of services they deliver (fee for service) to the quality of patient outcomes relative to cost (value) is causing them to focus more on maintaining patients health and not just curing disease. This shift is causing providers to start investing in population health management strategies, which require them to better understand the local population and identify unmet needs.

The challenge is that the SDH information that physicians collect from patients and enter into their electronic medical records (EMRs) is pretty limited. Even though 83% of family physicians agree that the Institute of Medicine's 2014 recommendation that they collect sociodemographic, psychological, and behavioral information from patients and put it into their EMRs, only 20% say they have the time to do so. But alternative means of collecting such information are emerging: smartphones, credit card transactions, and social media.

Smartphones. The Pew Research Center estimates that more than three-fourths of Americans now own smartphones. One example of how these devices could be used to collect SDH information involves the mobile applications that health systems offer to allow patients to easily book appointments or contact medical providers. These apps can also access information on patients' location, which can be cross-referenced with rich databases like Foursquare's book of local businesses or city-level heat maps on crime/domestic violence to understand a patient's experience of his or her neighborhood — e.g., the availability of fresh food via local grocers or bodegas and the ability to exercise outside in relative safety. In a research setting, this type of location sharing has yielded startling insights.

In one interesting study on smoking cessation and relapses, patients' location data, along with their self-reporting on their craving levels and smoking status, was overlaid on a point-of-sale tobacco outlet geodatabase to demonstrate that an individuals' daily exposure to these retail outlets was significantly associated with lapses even when cravings were low. This real-time quantification about an individual's interactions with her local environment unearthed novel influences on health behaviors that were likely invisible to the patient herself. This type of geolocation data is currently still being developed and tested in the research setting, but one day it may be used to make patients more aware of these triggers and resist unhealthy temptations.

Credit-card transactions. These are another goldmine of information that can help round out the medical record. For instance, a Gates Foundation- and United Nations Foundation-funded investigation into the economic, social, and health status of women in developing countries combined credit card records with records on their phone calls to identify patterns in people's socioeconomic behaviors. The analysis resulted in six distinct lifestyle clusters in terms of expenditure patterns, age, mobility, and social networks. One can imagine that this type of aggregation can be useful as health systems increasingly work to tailor community and outreach programs to patients.

Credit-card statements do not contain the details necessary to generate insights (i.e., what actual items make up a bill from the grocery store). That level of granular detail would go a long way into understanding whether patients fill their prescriptions, purchase cigarettes, or order salads. Some digital grocers (e.g., Instacart, Peapod), drug retailers (e.g., CVS, Walgreens), and payment kiosks (e.g., Square) are now emailing itemized receipts to consumers (with their consent). One group at Cornell Tech has created software tools that scrape these receipts and analyze purchases against a patient's personal nutritional goals, a research effort with commercial potential. Such approaches not only collect information on SDH but also raise the patients' level of awareness of the relationship between healthy behaviors and health itself.

Social media. Leveraging the willingness of people to divulge personal details on social media is yet another emerging frontierin the effort to collect SDH data. It is being used to successfully access populations that have historically been considered hard to reach: younger people, females, and low-income individuals. New features on popular sites like Facebook that allow individuals to mark themselves safe during natural disasters represent an initial foray to using this medium for gathering more SDH data. Health systems that engage patients via social media can elicit answers to questions around food insecurity, employment status, physical activity, and so on. In fact, new research suggests that many adult Facebook and Twitter users are willing to share their social media and medical data and link it with EMR data for research purposes.

Certainly, several pragmatic issues might create barriers to applying these approaches. An obvious one is privacy. More research will need to be done to ascertain patients' comfort with novel ideas such as giving physicians access to their purchase histories or locations. It is also critical that the information gathered through these novel mechanisms not be used in a punitive manner but rather to inform clinician counseling and to support patients in their efforts to pursue healthy behaviors. Patients are not likely to share credit card or social media data, for example, if they perceive there to be a link between the information gathered and punitive responses such as the denial of insurance coverage or increased co-pays.

Another obstacle lies in the very act of obtaining consent from a large number of patients to participate in such information-gathering programs. One notable effort at Parkland Hospital in Dallas, which linked data about patients' usage of food pantries, homeless shelters, and other social services with their medical records, found that patients were more willing to be enrolled into a digital database when asked to do so by community partners that had earned their trust rather than in the emergency room. Discouragingly, privacy concerns over the Trump administration's policies tying social services usage with legal status has caused many undocumented immigrants to ask to be erased from social services' IT systems.

Finally, it may be difficult to obtain buy-in from physicians who are already suffering from information overload. To overcome it, data will need to be turned into intelligent summaries with clear visuals and actionable takeaways. Additionally, clinics need to invest in support staff and ancillary services that help at-risk patients. For example, clinics can be outfitted with connections to community-based resources (housing programs, job training centers, and nutritional supplement programs). These investments will go a long way to ensuring that physicians are receptive to the work of monitoring additional data about SDH.

With these elements in place, health care systems will be able to harness digital technologies to identify the needs and interventions required to create healthier communities.