Comments from David A. Asch, MD, University of Pennsylvania

Extending behavior theory

What do you think are the 'necessary ingredients' to develop models of health-related behavior that can account for momentary, short-term and long-term behavior change?

The development in behavior theory that I have found most exciting is the expanding understanding of the pervasiveness of irrational behavior, the development of a taxonomy of those systematic elements of irrationality, and the practical approach, embodied in behavioral economics, to redirect that irrationality to promote better decisions. A second necessary ingredient is the increased reach into people's lives provided through more personal information technology (IT) use. Another necessary ingredient, or at least a welcome development, is an engaged audience of stakeholders who recognize behavior change as essential to health. These include provider organizations, insurers, employers—all stakeholders who see how behavior change advances their interests. Those stakeholders are at least as necessary an ingredient as anything else, because they provide the resources that accompany policy relevance. These stakeholders are a source of funding and naturalized environments in which theories can be tested in practice, where they can be put to use, refined, or demonstrated to be wrong or useless.

Measurement of behavior

How might high-frequency human-computer interaction be used to support longitudinal engagement with a wellness system?

While there cannot be an app for every ill, the unique contribution of information technology to health behavior seems likely to come from its ability to provide scale to high frequency health-related engagement. One creative challenge is figuring out how to incorporate such IT-mediated engagement into people's lives in ways that are not just acceptable and convenient, but ideally even welcomed.

Some colleagues and I have focused on what we call "Automated Hovering." [Asch DA, Muller RW, Volpp KG. Automated hovering in health care: watching over the 5,000 hours. NEJM. In press.] Even individuals with chronic illness might spend only a few hours a year in front of a doctor or nurse, but they spend over 5,000 waking hours each year engaged in everything else—including deciding whether to take prescribed medications or follow other medical advice; deciding what to eat, drink, and smoke; and making other choices about activities that can profoundly affect their health.

More attention is being directed to those 5,000 hours. Employers are focusing more on employees' wellness—how they eat, whether they smoke, and how much they exercise. Medication adherence has become a more explicit goal, given growing recognition that many people with chronic conditions fail to take their medications regularly and therefore do not get the benefits that health care can provide. Home biometric assessments, including glucose, blood pressure, and weight measurements, are emerging as part of longitudinal clinical care. Transitional care models are being touted as a way of coordinating care beyond hospitalizations. And hospitals and health plans are developing "hotspotter" approaches to

manage the care of their most challenging patients. What links all these activities is that they occur outside the conventional, billable, clinical encounter—and all reflect some sort of hovering over people in their daily lives in an effort to encourage health promoting behavior.

However, smart phone apps and automatic pill-bottle reminders are unlikely to offer much to patients who are frequently hospitalized due to a combination of severe illness and challenging life circumstances. These patients, at one end of the spectrum of intensity of health care needs, require a more personnel-intensive approach that focuses as much on social circumstances as on complex medical care. The best targets for automated hovering are conditions whose management depends substantially on individual patients' behavior. Good targets are medication adherence in patients with chronic medical conditions (diabetes, hypertension, hyperlipidemia, heart failure, coronary artery disease) and efforts to manage diet, exercise, or weight.

Evaluation

How should systems designed to work for years be evaluated if they depend on technology that may change at a much more rapid pace?
How should behavioral, social, and computer scientists and engineers structure their scientific inquiries to support development of sound theories that use technology but without too much dependence on any particular implementation of the technology?
Devices and software applications that claim to promote health and behavior change are being introduced at a rapid pace, but with little or no rigorous validation. Does this, or should this, impact future research and development of health behavior measurement and motivation systems?

This is a side thought, but maybe it is relevant: I think one of the most important recent theoretical contributions to medical sociology was the Fundamental Cause work of Bruce Link and Jo Phelan. [Link BG, Phelan J. Social conditions as fundamental causes of disease. J Health and Social Behavior. 1995;(extra issue): 80-94.] They recognized that most analyses of health risk factors aim too close to the outcome and too far from the exposure. We may see high cholesterol as a risk factor for coronary heart disease (and it is), but we need to understand the risks for the risks. The burden of hyperlipidemia has shifted over recent years from the rich to the poor and yet, despite that, the poor have always been more disadvantaged. Their risks of risks is poverty, and their poverty remains. That poverty will always find many outlets that lead to disadvantage.

I think the same structure about what is fundamental and what is fleeting can apply when our understanding of behavior can lead to practical application, but those applications depend critically on technologies that change quickly. We can ask whether it was the app that led to the better management of hypertension, or whether it was the underlying behavioral tendency the app unleashed. But if in the end we care about theories of behavior because they allow us to make people better, then both the underlying and perhaps enduring behavioral tendency and the app of the moment are important.

I also think there are ways to think about class effects to make research more efficient. There will be different kinds of electronic pill bottles and it is possible that some will surprise us because they produce outcomes completely different from the others, but we'd probably be justified in having as our prior assumption that one electronic pill bottle will function pretty much the ones before it—even though that assumption at some point needs to be tested. I suspect this is very similar to the world of pharmaceuticals: In the early 1980s, several large clinical trials revealed that beta blockers save lives in the setting of heart attack. The trials were performed with propranolol, which was an early beta blocker. But we were very willing to try out *new* beta blockers in other clinical care—different molecules, but molecules in the same class because they had similar structures and similar effects on physiology, but perhaps different kinds of promise: they could be taken less frequently; they were more cardioselective and so had fewer side effects, etc. Industry had an interest in developing these "me too" drugs because they could capture more of the market. And we gave each one of these new molecules more of the benefit of the doubt because they were in the same drug class—in this case, the class of beta blockers. If propranolol is good for heart attacks, why shouldn't metoprolol be good for heart attacks? They are like Coke and Pepsi: both colas.

But we still needed to test each one to make sure it worked. We still need the Pepsi challenge. One lesson about behavior is that seemingly small differences sometimes make big differences. Motrin and Vioxx are not in the same class, but they target parts of related pathways. They have a remarkably distinct clinical history. In fact, learning how they differ tells us a lot about underlying mechanisms we wouldn't have learned otherwise.

Although I am all in favor of testing new technology because the "me too" app might work better or it might not work at all, I also recognize there are diminishing marginal returns in testing me too applications. They produce less scientific glory; they attract less external sponsorship, and more conflicted external sponsorship; and really they should be tested against other *active* interventions and, as those get increasingly effective, evaluations require increasingly larger samples to demonstrate smaller and smaller incremental gains, meaning that trials get more expensive even as they produce less benefit. On the other hand untested interventions that are hyped in order to advance their commercial potential are a real social welfare drain.

I think there are some rapid cycle innovation approaches that can help here.

General question *(please respond to this question)*
What could participants in the meeting collectively do before, during, and after the meeting to significantly impact the field of health behavior change and maintenance? Be as concrete as you can, and think boldly.

I think a big boost to the field would come from increasing the awareness of the potential value of these approaches among companies and other institutions in a position to offer financial resources to test them, and also offer their environments as laboratories in which to test them.

It's a hard sell, but I think we all win with that. I am not sure how the meeting participants can advance that goal, but that seems to me to be something to target.

Another big boost would come from making substantial progress on a previously vexing big problem in world health: increasing use of mosquito netting for malaria prevention; reducing maternal to child HIV infection; reducing trypanosomiasis. The latter two are like moon landing kinds of grand challenges. A win there would open eyes.