

Scales, belts, and pyramids: back to the future of digital healthcare

Abstract

Adoption of digital health technologies has been relatively limited despite their potential to have meaningful impact on health. For deployment to improve patient adherence, it is imperative to link desired behavioral changes to patient value chains, many of which are instilled at an early age. There exists a clear opportunity for parents, schools, and communities to play a mentoring role in the deployment of digital health tools by future generations, ahead of their journey to becoming patients in the managed healthcare system. In addition, for existing adult populations and senior citizens, appropriate motivating factors can be deployed to inspire effective use of digital adherence tools and contribute to enhanced health outcomes in the immediate future. Coupled with new approaches in managed care and health insurance provisions the full promise of digital health technologies might then be realized in the nearer term.

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Introduction

Our bombardment with new advances in digital health technologies has been relentless. These range from smartphone-based health apps through wearable trackers and sensors to sophisticated monitoring devices in care facilities and homes.¹ Indeed over 300,000 health related apps have been released to date and new health technologies are being incorporated into consumer products at an increasing pace. Despite numerous projections however, these technologies are yet to revolutionize healthcare and have had at best a limited impact on outcome measures, the traditional gold standard. However, though we can all agree on paths to improvement, prior to the digital age life expectancy had been steadily rising over the past century in most nations, a consequence of improvements in medical care, nutrition, workplace safety, air quality and water purity to name a few. Part of the conundrum for large scale digital health technology adoption lies in understanding changing patient behaviors and needs. Indeed, entire divisions of product development organizations are now devoted to user experience (UX), human factor engineering (HFE) and patient archetypes. To solve for these seemingly complex puzzles however, one could do worse than look back in time before the lexicon of digital health even entered our thinking.

Analog rules

One of the simplest of all health measures is the bathroom scales. Inexpensive, uncomplicated, unambiguous, and available in a variety of styles it offers instant output, can be used with privacy and gives the user a measure of success in achieving a specific target. When used frequently it provides longitudinal analysis of meaningful health parameters, such as body mass index when coupled to height. Indeed, the first LED/LCD versions of such might even be considered pioneer digital health technologies? Many users might have opted to measure weight at intervals e.g., weekly, and this may have more relevance to health outcomes as it provides an overall assessment of a sustained period of activities, dietary inputs, and behaviors. Today's digital health measures are often tied to complex apps and inputs that might cause the user to fixate on near term actions - e.g., sleep, hydration levels, heart rate variability, oxygen saturation etc. However,

measurement within the confines of a particular day or event can often prove highly contextual and less relevant for overall outcomes. Another crude but effective measure relates to waist measurement. The simple process of closing a waist belt gives the user an instant response on circumference of the abdomen as does the degree of fit of a familiar item of clothing. While the number of 'clicks' used on a waist belt can serve as a warning (or compliment), the instant gratification of something fitting may serve as a more apt motivator than say a series of technical health measures e.g. A1C/HDL values in the case of diabetes. Indeed, stories abound of people delighted to confirm they can still fit into outfits after many years have elapsed, and others adhering to rigorous diets and exercise regimens in order to achieve a target for an upcoming event where photographs will be taken. This skates onto elements of human desire, and we are well served to recall the learnings of Bertrand Russell who posits that vanity and rivalry are two of the four desires driving all human behavior.² In other words appearing attractive to others or feeling attractive ourselves serves to motivate behaviors which might achieve this.

Parents and schoolteachers as influencers

A central element of healthcare and particularly digital health lies in understanding patient behavior. An underlying theory is that adapting a service or product based on behaviors can increase its attractiveness, adoption and adherence. While this is logical, it can be considered a reactive approach. Prior to becoming a patient, a child follows a journey from being a cared for individual through adolescence into an independent member of society, and a consumer of products. Let us forget these formative stages on the road to adulthood, and the fact that influencers and role models in the form of family members, education and religious establishments, and the peers we interacted with had an impact which must also be factored.

The role of the parent in promoting healthy behaviors is paramount. Children often mimic parental preferences in adulthood, so the importance of appropriate diets (balance, composition, quantity, frequency) is important, as are views towards other choices impacting health e.g., tobacco and alcohol consumption, drug use and risk-taking behaviors. These learnings can be amplified in schools,

with age-appropriate means to deliver content and materials which may not be available in the home environment. Schools are attended approximately 180 days per year, relying on reaffirmation of key values in the household setting during the 50% of the year they are closed. Conversely, a physician visit may typically be only annual unless existing conditions are being managed, so the HCP's sphere of influence is also limited and dependent on caregiver reinforcement. Worse, the episodic/annual encounter may fail to uncover critical points regarding health risk (presumably a function of the degree of skill applied in asking questions of the young patient) which in later life may translate to similar blind spots as an adult e.g., lack of candor in revealing exact dietary, smoking, drinking, and exercise habits. It is also important that realistic information and expectations be conveyed to help effect desired outcomes. For example, many US students are (painfully) aware of the daily need to consume 5 servings of fruits and vegetables, and drink 2L of water. However, at the point of decision, e.g., in a grocery store, fast food restaurant, canteen, vending machine etc. there may be little connection to these rubrics. In this case it is essential that families, schools and influencers make the practical connections needed -e.g., the number of fat calories in a particular offering, the amount of exercise needed to offset this caloric load, and the longer-term impact of such choices using real life (ideally branded) examples that the students will actually remember. There is obvious resistance to this from parts of the food industry. Another critical issue is the cost of fresh produce versus less healthy processed and fast foods. Families living on a tight budget will be forced to make decisions on quality versus quantity with obvious consequences. Various food assistance and meal voucher programs do not address this issue either, but could become a nexus for change if governments/authorities mandated they be used for healthy and nutritional products only (and made practical through subsidy from providers).

If not addressed properly, the seeds of bad habits might be sewn, and have a small but incremental impact on eventual health outcomes in adult life. This is presumably one of the reasons that type II diabetes is rising, as the onset is not immediate so the cause-and-effect correlation between consuming unhealthy products is not evident. Simultaneously, adults are bombarded with messaging and marketing which is often derelict in responsibility towards human's health. Prevention measures do not appeal on a par with products and interventions which promise instant cures - e.g., cosmetic surgeries, dietary supplements and exercise equipment purported to effect instant change. One digital measure which could assist here could be universal smart food packaging, where a consumer scans a QR code on an item and it aggregates consumption over a (weekly?) time period, providing a dashboard style reading similar to a fuel tank gauge. There also seems little reason why a grocery bill could not provide a digital link to a nutrition guide, in the same way a credit card report categorizes all purchases made over the billing period. Finding a way to connect food triangles and pyramids with positive benefit is thus one of the key responsibilities of a parent. Failure to accomplish this can have a 'gateway' effect on the growing adult in terms of choices they will make. Most parents are sensitized to this process with respect to drugs and substances of abuse, and also petty criminal activity which could escalate. Health must become an equivalent priority, and a bond forged between families, schools, and influencers to amplify its importance.

Lifelong learning in the real world

As we transition through to independence, behaviors both good and bad will impact aspects of our life. It seems appropriate that we consider these as we seek to develop digital health tools that are likely to be embraced.

(i) Pressures and demands on the young adult

Health and wellness may come as a lower priority as young adults grapple with the stresses of careers, relationships, and parenting. Financial, personal and emotional security become important and the realities of managing budgets, long term debts and work/life balance become a challenge. This can have immediate impact as the cost of healthy food will become evident, children may be swayed by marketing towards unhealthy products, and consumption of conveniently pre-packaged so called comfort foods may increase to help manage the multi-tasking induced stresses of parenthood. Alcohol consumption and tobacco use may even surface, as components of self-medicating coping and anxiety relief mechanisms. Additionally, at a time when metabolism may slow down, the availability of automobiles and public transport may limit the amount of exercise people routinely enjoy. Worse, free time to deliberately engage in such (runs, walks, gym visits) may become more limited as career and family demands erode free time. Any learned habits on weight management, portion control and mindfulness will undoubtedly help. The myriad stresses and obligations of young adults can lead to information overload, and may also go some way to explaining why educated, competent, and successful individuals sometimes make choices which perplex healthcare providers - e.g., failure to adhere to medications as prescribed. This should be a *nota bene* for app developers wishing to influence / correct such behaviors, as many of the actions which compete for free time (e.g., preparing food, clearing dishes, house upkeep, reading to children etc.) typically deliver instant results and give the person immediate satisfaction. Compare this with taking a medication which may take days to work, gives no instant gratification to the person or sense of accomplishment, and where failure to comply may have no immediate visible detrimental consequence and the outcome is perhaps understandable.

(ii) power of community

In some instances, the power of group / community learning has proven beneficial. One of the central features of Weight Watchers is a periodic (weekly is common) weighing and public celebration of achievement of goals (though individual readings are not shared with the group). The public act component contributes to adherence to the program, and is coupled to education on nutrition and activity which promote healthy behaviors, and reflections on best practice from group members. This type of community support is evidently powerful, and seen as more credible than the myriad of opinions offered on the internet, often interspersed with commercially motivated epithets, proclamations and scaremongering. In a similar vein, personalized health education offered through the assignment of a coach has proven successful for a variety of health management applications. Companies have evolved to refine this model such as Omada Health for management of diabetes, cardiovascular disease and more recently CNS disorders.³ As they note in coaching materials, three tenets guide efforts to develop appropriate patient behaviors:

- I. Changing behavior is dependent on managing a patient's motivations
- II. Some of the most important behavior changes take place *between* caregiver visits
- III. Short term incentives and so-called health "nudges" do not have prolonged impact.

(iii) It's never too late - healthy aging

In late adult life particularly as individuals approach retirement (and children have established their own families) the lure of community

often resurfaces. Many adults and early seniors with more leisure time available travel extensively, take up hobbies, and sometimes learn new languages. It is well known that practice of a new language in groups/peers is effective, as is immersion in the community speaking that language. The same is true for seniors approaching or near retirement who have to face health challenges either of their own or a loved one. As we know, in addition to cardiovascular and metabolic diseases this includes neurodegenerative and osteoarthritic conditions which impact cognition and movement respectively. In this regard, peer support in communities may be very useful. Indeed, many senior independent living residences (55+) offer suites of programs, and learning from peers in group sessions has been shown to be beneficial. Digital health devices e.g., step counters, trackers, HRV monitors etc. could be useful in providing a gamification / challenge element, and new smart neighborhood networks could simplify connectivity of devices within and throughout communities.⁴ Success here could also help slow/prevent transition to assisted living and ultimately managed care admissions.

If all else fails, legislate

In the digital age the availability of scientific data from which to make informed decisions on health (diet, exercise, medications etc.) is widespread. However, although informed choices can be made there is often a compromise faced between cost and desirability and this is particularly evident in foods. Additionally, there may be unhealthy foods which we develop chemical or psychologic cravings for and marketing campaigns which may promote over indulgence. Though much needs to be done to understand the biochemical origins of such, it is clear that the food industry is aware that many healthy foods do not sell well unless deliberately modified (e.g., low fat Greek yogurts with refined sugars added). There is pressure on the industry to require labeling on the health implications of foods high in sugars and processed elements in the same way that the tobacco industry was required to modify packaging, particularly with products marketed towards younger consumers. Ultimately much firmer legislation may be necessary. A similar debate enacted with the requirements for seat belts in aircraft and automobiles. As with tobacco use, once legislation is enacted then choice becomes mute and the social playing field (and any associated stigmas) is leveled. Some nations have proposed additional taxation on unhealthy foods. The UK's so called 'sugar tax' on soft drinks although not generating the expected income, drove manufacturers to develop, market and ultimately sell more of the lower calorie versions of the drinks. Successful digital health adoption by patients will involve an interplay between rules and regulations, a push from the health technology industry and a pull from the consumer society which endorses then normalizes acceptance of a new idea or product.

The new generation of physician scientists

All of the above cannot of course be realized without the full engagement of physicians who are of course primarily responsible for administration of managed care. Enlightened by the benefit of holistic treatment of the individual, healthcare professionals and providers are modifying approaches to patients.⁵ For example, clinical guidance and recommendations towards improving medication adherence are being modified to consider the best approaches to patient behavioral change. In one example, the UK National Institute of Health are considering the Capability, Opportunity and Motivation (COM-B) model of behavior as part of its (NICE) recommendations.⁶ This model approaches behavioral change by considering social, structural and environmental factors in a composite framework. Related approaches designed to improve the impact of digital adherence technologies advocate the

use of a SPUR framework (Social, Psychological, Usage, Rational) to assess patient risk and their associate drivers.⁷ This in turn is spearheading a movement to develop assessment tools which provide prescribers a more accurate projection of adherence, for example the MMA scale developed by Morisky, which is based on a four question approach.⁸

Summary and recommendations

There are multiple touch points that the digital health community can and must make with the patient. Many of these points stem from patient's background before illness and need to be respectful and responsive to their origins. Whereas learning new, improved behaviors may have natural limits, it is likely that the patient still has loyalties and affinities which can influence and drive best actions when prompted appropriately. Linking these potential solutions, products, and services to a digital health platform could be via patients receiving them in response to voluntary digital 'opt in' through their EHR. Some examples could include:

- I. Medication dispensers printed with the image of a loved one [e.g., family member, pet, or deceased relative] may serve to motivate the person to stay adherent under the notion that they do not wish to 'let them down'. Similar tactics might work for those enamored with a particular sports team and would merely require label printing at the pharmacy level or the manufacturer supplying customized decals that can be applied.
- II. For non-adherent patients with adult children, sharing health vitals / EMR with them (e.g., HRV, A1C, HDL) may serve to promote healthy behaviors (exercise, diet etc.) as they may be influenced and motivated by children differently to their HCP.
- III. Linking cause and effect with visual prompts associated with routines. For example, an anti-histamine /allergen medication taken before a person mows the lawn prompts an association with the lawn mower. A (drug) branded accessory for the machinery might underscore the benefits of adherence by providing timely and visual prompts. A medication for skin conditions (acne, PsO, HS etc.) might resonate when patients venture outside for walks or visits to the beach, leaving skin exposed and could be tied to a decade sunscreen product (ointment, UV proof clothing, umbrella, hat etc.).
- IV. Providing patients the option to share data and or experiences in communities so others can benefit from their learnings. This has become a popular feature with a number of rating apps (restaurants, travel destinations, consumer products) and might be particularly useful in healthcare if policed appropriately. Another effective means to value patient inputs and experiences could be via an electronic 'wall of fame' much like digital influencers are ranked.
- V. There may be means to tokenize actions and good behaviors, much like the airline industry has accomplished with their frequent flyer points/rewards programs tied to credit card usage and preferred vendors. Tokens awarded for purchasing healthy groceries, achieving a step count goal, medication adherence, weight target or gym activity might be redeemed for cash (against insurance premiums) or health related products and activities.
- VI. There may be relevant learnings from the financial industry wherein healthy behaviors in terms of (retirement) saving

can be encouraged through graphic visualization of current and projected net worth estimated with compounded growth. Could such a wellness/ illness barometer index do likewise for healthy behaviors and preventative health, rendering estimated longevity the health equivalent of retirement income projections?

In parallel to any of these activities, there is clearly ample opportunity for the biopharmaceutical industry to develop more integrated approaches to digital health adoption by working even closer with patients and patient advocate groups.⁸ In one recent example, by quantifying behavioral and cognitive drivers, more impactful Patient Reported Outcome (PRO) measures were identified and developed, which might ultimately be used to improve treatment experiences.⁹ Ultimately, optimizing the impact of new digital health offerings will be guided and inspired by age old behaviors and knowledge central to each patient.¹⁰ A quote inscribed on weighing scales in 18th century Paris may be apt: “he who often weighs himself knows himself well. He who knows himself well lives well.”

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Conflicts of interest

The author is an employee of Novartis Pharmaceuticals but otherwise declares no competing interests.

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