Abstract — Delivery strategy in a consumer-centric healthcare system focuses on identifying, facilitating, and integrating online and offline communication and care delivery channels needed to reach and coordinate end goals (value) as defined by disparate customer segments (patient, provider, payor, policymaker, caretaker, etcetera).

Services are location independent, time independent, provider de-linked, and value-generating. Rising healthcare costs, increasing chronic conditions, and barriers to access drive the search for a new route to safer, cost-effective quality care.

Health 2.0 is content and community: patients trusting patients. The semantic web sparks Health 2.0 evolution towards more consumer-centric care by enabling viral network growth and increasing personal-usage value of patient-created, "human-to-human" centric networks.

Semantic web technology and open source API development provide opportunities to build consumer-centric services. But the roadmap for true consumer-centric care does not end with semantic web growth – rather it begins there.

The authors present a conceptual roadmap for reaching consumer-centric care at the intersection of two rapidly-evolving developmental axes: joining patients and professionals in the healthcare conversation and combining brick-and-mortar real world systems with virtual online services. Future evolutionary phases Health 3.0 and 4.0 are defined using examples.

The authors provide a model, termed "nexthealth," which gives stakeholders concrete tools to define their position (using existing service lines and development initiatives) and focus on four critical factors needed to realize complete consumer-centric care: content, community, commerce and coherence.

Index Terms — consumer-centric care, health 2.0, health 3.0, health 4.0, neXthealth, semantic web, healthcare consumerism

I. INTRODUCTION

The power and role of the internet for patients, and for also caregivers, medical professionals and other stakeholders in health, is increasing: the era of the e-patient, e-doctor and e-medicine dawns. But while patients are increasingly communicating and collaborating with ‘likes’ (other patients), barriers to seamless, productive online and offline communications with ‘non-likes’ (providers, payors) persist.

Early web-based healthcare activities were limited to providing information (provider side) and searching for information (consumer side). Health 1.0 was all about content - medical dictionaries, hospital websites and finding information on new or obscure treatments. But patients lacked a relevant way to form meaningful connections around information obtained online.

The advent of Health 2.0 – content combined with communities – provides a way for patients to establish online relationships oriented around the achievement of personal health and wellness goals.

However, current virtual services still do not allow patients to transport the full value of these communities back offline – they do not completely integrate ‘traditional’ brick-and-mortar healthcare providers and care processes with online services.

As Health 2.0 evolves, two important changes will take place. First, a cultural change – revising the traditional, exclusionary definition of who participates in healthcare and wellness management conversations (to include patients as integral partners in care and prevention). Second, a technical or business model change - which involves joining online services targeting patients with existing offline services, providing seamless semantic interoperability [2], emphasizing the importance of consumer engagement and patient responsibility.

Health 2.0 is one stop on the roadmap towards true consumer-centric care, but it is not our final destination. The next stop on the roadmap, Health 3.0, harnesses the value of communities through value-based interactions. Health 4.0 is the stage that connects all earlier phases.

Although semantic web development sparks the evolution of consumer-centric care, we define it not as the end-stage but rather the route that leverages new ways of communicating and collaborating. Complete consumer-centric care (C4) consists.
of four important C’s: content, community, commerce and coherence. The ultimate goal of the consumer-centric movement is the 5th and final ‘C’ – care that is more efficient and empathic.

II. EVOLUTIONARY STAGES OF CONSUMER-CENTRIC CARE

Health 1.0 (1C) = content, the “read-only” Web. Examples are WebMD, early DrKoop e-newsletters, and searching for clinical information on MedScape.com.

Health 2.0 (2Cs) = content + community. Health 2.0 adds community on top of new and existing content. Health 2.0 services provide ways for patients to collaborate using information accessed online: patients start trusting patients. An example of a Health 2.0 service is DiabetesMine.com, run by blogger Amy Tenderich [3].

Health 3.0 (3Cs) = content + community+ commerce. Health 3.0 is Health 2.0 plus the addition of commerce, which involves firms building business models based on consumers accessing content and forming groups. Commerce is the portion of Health 3.0 that successfully adds value. Value is defined by four important characteristics: (1) spans the complete process, (2) always connects to a specific stakeholder (3) differs for every individual stakeholder, (4) must be delivered through a sustainable process [4].

Commerce is the function that adds value for both the consumer and the clinician. It is important to note here that ‘commerce’ in a consumer-centric system can be defined as any transaction-based model, not necessarily one that is monetized. The commerce requirement of Health 3.0 can be satisfied simply, with the consumer sending information/data to the service, ‘transacting’ with the system via transmission of personal identifying information – for example, by establishing a user account and logging in repeatedly to a website.

Indeed, many Health 2.0 companies are built upon ‘free’ or ‘freemium’ access models. In a ‘freemium’ model, basic interaction with a site is free, but users are charged for a premium membership, which provides additional value-added services (e.g. SugarStats.com).

Examples of current Health 3.0 companies are American Well, Carol.com and Organized Wisdom. In some Health 3.0 models, like searching for a condition-based WisdomCard™ on Organized Wisdom, consumers transact with the system by interacting using personal identification data (user login, etc).

This method of commerce, the 3rd C of Health 3.0, maximizes value for both parties - the consumer gains a WisdomCard compiled by a Health Guide utilizing semantic web techniques (“smart search” or “human powered search”), while the company gains additional user data and demomodelics that inform future search topics. This user interaction is precisely what creates value, literally ‘organizing wisdom’ via an informed user base. In the Health 3.0 sphere, simply gaining a new user increases value for companies, as user-strength/community-strength numbers often drive market valuations and are a primary data set used to secure advertisers and venture capital.

At an industry-wide level, with the onset of the Health 3.0 phase entrepreneurs will test business models that move beyond traditional ad-revenue based income streams. Health 3.0 will be heralded by an era of mergers and acquisitions: small, inefficient, redundant offerings die out, some organizations will merge with larger firms, and additional partnerships will develop among Health 2.0 startups.

Health 4.0 (4Cs) = content + community + commerce + coherence. This evolutionary stage connects the real world of brick-and-mortar systems with the virtual world of online services.

Coherence features in Health 4.0 companies will connect patients and professionals in new ways: facilitating human-to-human conversations that determine care pathways both on and offline. Health literacy developed in earlier stages is employed here – patients become an integral part of the healthcare conversation, proactive partners in care responsible for setting and working towards personal wellness goals.

At the Health 4.0 stage we begin to move beyond a flawed encapsulation approach to treating illness and injury, which has resulted in today’s perpetually fragmented delivery system. At the Health 4.0 stage we see an emphasis placed on optimizing health and wellness, prior to a disease state, all along a consumer’s timeline.

Health 4.0 will begin to emerge when multiple stakeholder groups realize the system lacks coherence necessary to evolve. Businesses, hospital systems, NGOs, governmental agencies, consumers, nonprofits, foundations, providers, caregivers, pundits, academics et. al. begin to agree that although many offerings provide access to content and community, as well as to the most advanced medical technologies, there remains a catastrophic gulf. New coalitions and partnerships will acknowledge the value of cooperative work groups in building a bridge to better care.

As a result, interactions between consumers at the intersection of the “real/virtual” axis and the “patient/professional” axis, as the authors will illustrate using the ‘neXthealth model’, become much more coherent. Real-time, seamless interoperability is achieved as companies join forces. Here we present a scenario that incorporates multiple stakeholder interactions and illustrates what is possible with the advent of Health 4.0.

III. AN EXAMPLE OF HEALTH 4.0

A consumer is out shopping and begins having difficulty breathing – but the problem is not so severe that she immediately seeks emergency care. The patient logs onto a web browser from the store, using her BlackBerry. This is a new symptom onset.

She accesses a chat with a doctor function, which includes live streaming video, via the American Well system. American Well is an existing Health 3.0 firm which allows users to access online physician services. Access is paid for by the
consumer’s insurance provider.

This first portion of our scenario is not far off in the future – a physician-chat function will actually be available using the American Well software as a service (SaaS) platform later this year. However, American Well is currently only enabling live video via a computer access point, not a mobile phone access point. Scientists are, however, working on telemedicine capabilities for mobile phones [5].

Back to our patient, who is concerned about her respiratory issue. The physician chatting with her through the American Well portal also becomes concerned, and begins simultaneously transmitting a transcript of the call to the patient’s local emergency room. Such a service is not yet available, but when it emerges, provides the coherence necessary to connect the 4Cs of complete consumer centric care.

This case scenario allows our consumer to access expert content via a community portal (American Well’s SaaS service which connects consumers to providers in real-time), and fulfills the 3rd C, commerce, via a value-added transaction where she gains the physician’s recommendation, virtually, that she should visit her local emergency room, where the physician on duty has received a summary of their call.

Value for the consumer is maximized through this commerce function as well – our patient can reach a physician literally ‘on call’ who guides her offline back to the brick and mortar hospital environment using information gained online.

With Health 4.0, consumers are able to ‘dip’ in and out of online and offline healthcare/wellness management systems (hospitals, clinics) and services (communities, search) at will.

Again, the reason we have not yet arrived at the Health 4.0 stage is because the system lacks cohesive goods/services that connect the first 3Cs: content, community, and commerce. Innovation and continuity among multiple stakeholder groups, not just patients and providers, are needed to prevent disparate strategy development and episodic access and usage.

At this moment we cannot identify any true examples of Health 4.0 companies. Even companies such as American Well cannot yet send a transcript of the patient/physician chat back to a local emergency room doctor in real-time, as we illustrated in the example above. The service is ‘stuck’ in Health 3.0 stage because it does not provide coherence that ties the virtual interaction seamlessly back into multiple care delivery nodes within the brick-and-mortar system.

IV. CURRENT EVOLUTIONARY STAGE: DEFINING HEALTH 2.0

IN DEPTH (CONTENT + COMMUNITY)

It is no coincidence that this paper terms evolutionary stages of consumer-centric care ‘the 4Cs’ – the authors import inspiration for this lexicon from original web pioneers, including Tim Berners-Lee [6]. The Cs present in Health 1.0 and 2.0 detailed above, content + community, are also often used to describe the evolution of Web 1.0 to Web 2.0.

Searching and reading information (content) was a key function of the first generation internet – Web 1.0, also sometimes called the “read-only” web. Control was in the hands of a few publishers, who unilaterally determined what information had value.

With Health 2.0, content + community, we witness a new source of online authority – patient publishers entering the space via blogs and other communities. Patients start to express themselves and take an active role in the healthcare process, beginning to ‘own’ care definitions. Patients begin to communicate increasingly proprietary views on disease and wellness management and its impact on personal identity.

With this new self-awareness comes curiosity about others – patients begin asking questions (forums), establishing relationships in online communities (social networks) and collaborate to create authoritative, participatory content (wikis). The 2008 Edelman Trust Barometer shows people tend to trust “a person like me” more than authority figures from business, government, and media” [7].

Although there is a great deal of debate about how precisely to define Health 2.0, the subsector can also be described as “the use of social software and its ability to promote collaborations between patients, their caregivers, medical professionals, and other stakeholders in health” [1]. An example of patients trusting patients is TuDiabetes.com: “a community for people touched by diabetes.” It currently connects more than 2700 diabetics sharing experiences and advice about their diseases through forums, chat, photos and video.

Via sites like TuDiabetes.com, viewpoints such as “my condition informs who I am, but does not equal my total identity” and “I am a person who is also a patient, not a patient who is also a person” ricochet around the web, and self-advocacy begins to migrate offline.

Although Health 2.0 is positively advancing patient self-advocacy, empowering us through new channels, the current movement is still largely focused on the virtual, or ‘e-patient’ experience.

Another weakness of current Health 2.0 initiatives is the tendency of communities to attract similar people. Many focus on connecting “like-minds,” relatively homogeneous groups such as patients with the same diagnosis or physicians in the same subspecialty. Similar groups then generate very similar content. Users become settled and ‘comfortable’ and thus less inclined to venture out and advocate for other consumer groups and systemic change.

Although people will always build communities that allow us to establish a sense of belonging (“like attracts like”), the semantic web can help solve this issue by enabling seamless communications, thus making it ‘eay’ to establish relatively ‘pain free’ online and offline connections between many different stakeholder groups (as illustrated in our respiratory patient example above).

The current issue of online/virtual services often being disconnected from real brick and mortar systems cannot be addressed by technology alone. As a result, within the Health 2.0 community we already see evidence of an emerging need for adding true value by making the service commercially interesting (commerce) and a nebulous desire to connect virtual services and brick and mortar systems (coherence).
What we have been lacking, until now, is a practical, relatively easy-to-follow model describing how to connect the dots on the roadmap to consumer care.

V. SPARKING HEALTH 2.0 CHANGE: THE SEMANTIC WEB

The power of the semantic web is its ability to join many different entities – it merges the ability to connect minds with machines. This is precisely what is needed to break down silos caused by disparate data ownership (and resulting authority positions) in the current hierarchical system of care delivery.

To succeed in connecting myriad data points of health/wellness/injury/illness data along a consumer’s lifeline, a superhuman amount of computational capability is needed.

Minds or machines working separately cannot accomplish the data sifting, prioritizing, and storing capabilities needed to achieve Health 4.0 (4Cs): content + community + commerce + coherence = fully realized consumer centric care.

But minds and machines working in concert can. The semantic web and concurrent open source API movement harnesses the cognitive surplus of human and machine computational power - using machines to help us get more value for ‘mind time.’

Smart search is thus becoming the holy grail of Health 2.0 growth – how to harness user-centricity in disjointed systems, connect communities with content, and build coherent platforms that recombine brick and mortar “real world” existing systems with virtual online software-as-a-service (SaaS) offerings.

The semantic web is the holy grail of the Web dot-o developmental crusade, just as fully realized consumer centric care is Valhalla for Health 2.0 proponents.

VI. neXthealth: A CONCRETE MODEL FOR ORGANIZATIONS JOURNEYING TOWARDS CONSUMER-CENTRIC CARE

Consumer-centric care is at the intersection of two important developments: (1) joining patients and providers in a collaborative conversation and (2) combining brick-and-mortar systems with virtual services to allow seamless interoperability.

Again, the arrival of Health 4.0 heralds fully realized consumer-centric care, when consumers are able to selectively ‘dip’ in and out of online and offline systems and services at will.

The ultimate goal of consumer-centric care on the clinical side is to maximize efficient, empathic care. The ultimate goal of consumer-centric care on the customer side is to encourage ‘staying well’ and the achievement of personal wellness goals.

A consumer-centric system relies on consumers sharing responsibility. When consumers choose to assume responsibility in the neXthealth model, they move towards becoming proactive partners in care.

Full realization of Health 4.0 absolutely requires active consumer engagement – not 100% engagement, which is impossible to achieve, but consumer engagement according to the 10-80-10 rule, where 10 percent of consumers will choose not to engage the healthcare system, 10 percent will be ‘hyper-engaged super-patients,’ and most consumers will fall in the middle 80 percent, choosing to become engaged some of the time and to remain disengaged at other intersections of care planning and delivery.

“At will” engagement means consumers select when and where they wish to be engaged. Just as a patient today can choose to refuse a medication or not follow doctors’ orders, a consumer in the Health 4.0 era can refuse to engage with semantic web advances, or can choose to adopt the latest HIT or software-as-a-service (SaaS) offerings.

The central point is access at will, according to the consumers’ wants – in Health 4.0 consumer access is not limited according to an externally-dictated classification of ‘needs’ that results in the narrowing of access channels we see in the current care delivery system.

It is also important to note consumer responsibility, as detailed at the center of the neXthealth model (see Figure 1), relies on transparency, which is certainly missing in the current brick-and-mortar system.

Consumer-centric healthcare, Health 4.0, necessitates consumers having shared access to data and thus a shared role in decision making. The realization of consumer-centric care also relies on valuation made possible by minds and machines working together, which is what the semantic web provides.

Developments in semantic web technology are organized and built out/developed according to value for the end user – the consumer. It’s harnessing algorithms to meet the end-goals of the user-base, as defined by developers.

In the next section of this paper, and during the concurrent presentation at SWWS ‘08, the authors will use their neXthealth model to modelically illustrate how to plot both current service lines and conceptual development initiatives.
along the evolutionary stages moving us towards consumer-centric care.

Modelic illustration of how to, literally and figuratively, connect the dots on the road to realizing Health 4.0 is vital because the sector faces significant challenges related to the divide between current brick-and-mortar systems and online services. Some of the challenges are detailed below.

VII. CONSIDERATIONS FOR neXthealth

Although the authors optimistically map out a future where consumers access web and real-world services that are seamlessly integrated, the current reality is quite different.

Few doctors are even willing to answer e-mail. [8] Refusal to integrate relatively ‘basic’ tech adoption into current medical practice, such as using email and implementing electronic health record systems (EHRs), demonstrates that moving current healthcare providers (delivery) to more extensive reliance on Web 2.0, HIT, Health 3.0, and other internet-related services will be excruciatingly difficult.

Part of this reluctance results from financial systems that don’t yet incentivize or pay doctors and other caregivers for early adoption of new services to communicate and collaborate with patients and other stakeholders [9]. Health 2.0 and 3.0 firms such as American Well are just starting to change this [10].

In order to advance to Health 4.0, we need killer apps [11] that promote access by decreasing complexity inherent in the backend combination of multiple web-based technologies. A killer app for consumer-centric care must be easy to use, presented in a web-based format that is familiar to ‘basic’ internet users (email, online banking, auctions, chat room use, photo upload/hosting, etc.) safe, and provided by a trusted entity which takes consumers’ security concerns and providers cost and portability concerns seriously.

Health 2.0 proponents must also be careful not to make the same mistake as some developers working on the semantic web: we must remain focused on the need for practicality. What will consumer-centric killer apps be used for? By whom will they be used?

We must not become so enthralled with multi-functionality and elegant design that we ignore the value contributed by simplistic, easy to use features – remembering always that better care is the 5th C realized via consumer-centric health.

The moment multiple stakeholder categories can clearly see the added value of Health 2.0 initiatives (and beyond), they will start adjusting patterns of usage and behavior. Slowly at first, but remember the goal is to first engage the 10% of the population composed of ‘super patients,’ and then work on building market-share among the middle 80%, the ‘sometimes engaged.’

Although new to healthcare, driving behavior change by marketing to consumers is certainly not new to other customer-driven sectors such as online banking, online travel, media, communications, and entertainment – an example is a technological innovation like the iPhone. While mobile internet technology has existed for quite some time, Apple’s focus on ease of use and overall attractiveness of the offering pulled customers over the line from polite interest to purchase at point-of-sale. We must do the same in healthcare – provide products and services that pull consumers from polite interest to purchase.

At some point it really is all about ROI; value as return on investment for the business entity and value as return on individual goal realization for the healthcare consumer.

New dynamics enabled by the semantic web will enable a brave 10% of super-patients to take the plunge and connect with other than ‘standard’ stakeholders. Health 2.0 companies must ensure they market aggressively to this segment, which will become early evangelizers, embodying disruptive innovation within the current system. During our presentation, the authors will illustrate several real-world examples of how to do this using the neXthealth model.

The authors will then literally connect the dots, moving beyond Health 2.0 towards Health 4.0, by plotting service line points. This visual representation makes it easy for audience members to see how patients can connect with payers, physicians with family, and many other forms of communication that cause inefficiencies.

Looking at the horizontal axis of Figure 1, this means that patients and other stakeholders will have to expand beyond what they view as their current network to deliver true consumer-centric care.

The battle over control of information will be another important issue that has to be addressed on the road to Health 4.0, as we will demonstrate using neXthealth. Hospitals currently control much of the patient information, however ‘ownership’ of medical records and personal health information is a hotly debated issue that will continue to gather coverage [12]. Using a far more detailed model than the basic neXthealth model above, the authors will illustrate why co-creation and co-ownership is the only solution capable of driving the consumer-health movement.

Co-ownership of records and cooperation with determining personal wellness goals and resultant care pathways along a consumer’s lifetime also necessitates a sea change in the current relationship between patients and providers. We must move from the current ‘dictation’ model to a ‘conversation’ where the input of both parties is valued.

This paradigm shift also asks the patient to trust service providers with very intimate details of their lives, including deeply personal wellness goals, which is more likely to happen if the movement towards consumer-centric health is well documented and gradual rather than highly reactionary and sporadically defined. It is this desire to have all stakeholders working from a commonly accepted, practical model that inspired the authors to complete this paper. The authors, in addition to other authorizes, realize that to change the views of patient-provider interaction and encourage the sharing of such intimate details, we must first bring personal health application (PHAs) to full fruition via the semantic web, where consumers are already used to sharing very intimate details of our lives [13].

The final important barrier standing in the way of full Health 4.0 realization is the joining of real brick and mortar services with virtual online services. Different developments
and stakeholder groups in healthcare do not ‘play well’ together – it’s not a team sport yet.

Health 2.0 initiatives are currently relatively small startups filling specialized niches. But in healthcare filling niches is of little use if complete industry steering remains solely in the hands of massive, slow-moving conglomerates such as multihospital systems.

This means that the true value of Health 2.0 and beyond only exists as part of a larger, interconnected whole, as the authors demonstrate using an expanded model based on Figure 1. This neXthealth model gives stakeholders concrete tools needed to define their position (using existing service lines and development initiatives) and focus on four critical factors needed to realize true consumer-centric care: content, community, commerce and coherency.

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APPENDIX

Different factors drive the evolution of Health 2.0 towards true consumer-centric care (neXthealth). For the purposes of this presentation, providing a practical roadmap to consumer centric care, the authors didn’t wish to focus extensively on barriers to entry or contributing factors. However, the authors have identified five important trends which they will detail in future publications. For SWWS ’08 attendees interested in the evolution of Health 2.0, however, we provide some publications and suggestions for further reading.

Five primary trends include (1) increasing costs and competition (2) increasing complexity (3) changing control responsibility, (4) focus on personalization, (5) continuous innovation.

(1) Increasing costs and competition. Healthcare costs for the individual are increasing [14] and current spend levels of healthcare in many countries are unsustainable. Total costs of the American healthcare system are currently 2.2 trillion dollars. This clearly signals the need for systems and services enabling less costs and better outcomes [15]. Incentives should be more focused on quality and less on quantity [9]. Health 2.0 tends to fill a portion of this gap by delivering high value (highly patient-oriented care options) at relatively low cost.

(2) Increasing complexity. The global amount of data is exponentially expanding and rapidly dispersing at the same time, signifying the need for improved communication, visualization, and prioritization of information. Data is spread between hospital EHRs, pharmacy databases, and GP systems etcetera. Complexity is further increased by global collaboration [2]; medical robotics [16] personalized medicine (genomics), disparities in access in the developing/developed countries, and the ‘explosion’ of healthcare IT in general. Not only do these developments stress the need for communication and visualization (‘being in control’), but also the need for navigators – both people and services that coordinate care and guide users through the complex delivery system. There is great potential for semantic web initiatives to combine minds and machines to address this need.

(3) Changing control responsibilities. Consumers are increasingly becoming engaged and taking responsibility for their own healthcare decision making [14]. This increases the need for systems and services that help manage conditions [17] as well as track, share and reach life and wellness goals. While some of these initiatives stir extremely contentious debates related to privacy and access concerns (e.g. the discussion of PatientsLikeMe members sharing information about drug use), at the same time ultimately consumer-centric applications address those concerns by giving control to the patient (PHR) instead of the system (EHR). This clash of the ‘data titans’ is will be an important driver for the adoption and development Health 2.0 (and neXthealth) initiatives.

(4) Focus on personalization. Personalization in healthcare is not only apparent in the shifting of costs and coordination responsibilities, but also in other innovations such as personalized medicine (genomics) and changing business models (retail medicine). These developments propel the evolution of Health 2.0 by providing the healthcare consumer with new personalized tools. Examples are new genetic screening services (23andme) consumer-oriented PHR providers (HealthVault, Google Health) and retail clinics (Wal-Mart, MinuteClinic).

(5) Continuous, concurrent innovation. Innovation in healthcare is happening in many areas, all at once: medicine and treatments, IT/technology, processes etcetera. These innovations are continuous rather than sporadic [18]. While one could argue a myriad of smaller innovations are less likely to have widespread disruptive effects similar to the invention of penicillin or anesthetics or discovering the polio vaccine, we must be cautious not to underestimate the combined valuation of many smaller scale innovations and inventions now focusing on the consumer (cf. the Long Tail [19]). This increasing focus on the consumer is visible in current practices of evidence based medicine and evidence based design [20].

REFERENCES


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