

# Improving Consumer Health IT Application Development: Lessons From Other Industries

## Findings from Key Informant Interviews

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**Prepared by:**

Westat  
1600 Research Boulevard  
Rockville, Maryland 20850-3129  
(301) 251-1500

*Author:*

Enid Montague, Ph.D.

*Task Order Officer:*

Teresa Zayas-Cabán, AHRQ

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HEALTH IT

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# Executive Summary

## Background

There is a need to improve health care quality in the United States. Proliferation in the use of health information technology (health IT), including consumer health IT, applications targeted toward individuals who receive services related to health care, is viewed as a key component for improving health care quality. Consumer health IT has the potential to support fundamental improvements to the health care system by helping consumers to provide information to their care team and peers, manage their health needs, facilitate better informed decisions about their health and wellness, develop and enhance their emotional and social support networks, and develop positive health behaviors (Eng et al., 1999). Effective consumer health IT will support personal health information management “activities that support consumers’ access, integration, organization, and use of their personal health information” (Civan et al., 2006, page 156).

Development and dissemination of consumer health IT applications have expanded in recent years (Jimison et al., 2008), at the same time as technologies such as mobile devices, social networking, and Web-based technologies have become integrated into individuals’ home and work lives. In addition, use of Web-based technologies for health purposes has increased (Fox and Jones, 2009) as individuals learn about or interact with others about health-related topics. While consumer health IT applications have been shown to affect patient and health systems outcomes (Gibbons et al., 2009), barriers to their use have been identified at both the system and the individual levels. Examples of such barriers include lack of access to the technologies, system integration barriers, privacy and security concerns, usability issues, failure to meet consumer expectations, and perceptions about usefulness of technologies (e.g., belief that health IT will not improve current care). Many of these barriers may be the result of inadequate design and evaluation methods and approaches (Zayas-Cabán and Marquard, 2012). Many consumer health IT products do not use a specific design framework, and do not include “human factors and human-computer interaction principles and methods in their design process” (Zayas-Cabán and Dixon, 2010).

A 2009 Agency for Healthcare Research Quality (AHRQ) workshop led to the development of an agenda for advancing the field of consumer health IT that included specific recommendations for research, industry, and policy. Within that action agenda was a specific research-related recommendation to “investigate the application of design methodologies used in other industries to personal health information management” and the design of consumer health IT. In 2010, AHRQ awarded a task order titled *Understanding Development Methods from Other Industries to Improve the Design of Consumer Health IT* to Westat.

The objective of the task order is to elucidate which design methods used in other industries might be extended to the design of consumer health IT applications. Design methods that led to the success of other consumer products bear direct relevance to improving the design of consumer health IT applications.

A previous deliverable for this task order summarized findings from an environmental scan and grey literature review of design methods used in the development of successful consumer

products in industries other than consumer health IT (Agarwal, et al. 2011, available at <http://healthit.ahrq.gov/developmentmethodsbackgroundreport>).

The purpose of this report, also a key deliverable for the task order, is to describe lessons learned from interviews with key informants (such as application developers, design managers, and company executives) about consumer product development methods used in other industries. The report presents design methods, processes, and approaches used in the development of successful consumer products, as described by key informants.

## **Approach**

The project team created a list of approximately 250 successful consumer products based on the criteria of market penetration, sales revenue, accolades in the design press, and customer adoption and enjoyment. Successful consumer products were identified from periodicals such as *Consumer Reports* and *PC Magazine's* best and most successful products of the year, and from product design organizations that grant awards for consumer products such as the Industrial Designers Society of America. The selected products had a profile of features or functions that are relevant to personal health information management and consumer health IT. The project team selected 15 products most relevant to consumer health IT that represented six consumer product categories defined as (1) monitoring information, (2) making comparisons, (3) communication, (4) logging and recording activities or measures, (5) searching for information, and (6) storing, archiving, and retrieving information. The project team identified key informants associated with the 15 products. Informants were selected based on having knowledge of their product design processes and their ability to represent a range of roles (e.g., designers involved with product development, company founders, and senior product managers) and company sizes.

Nine key informants participated in the in-depth interviews. The interview protocol was based on the product development phases (defined within this report) of (1) idea generation, (2) identification of customers, (3) concept development, (4) testing (which may occur iteratively), (5) implementation, and (6) commercialization (Urban and Hauser, 1993). Verbatim transcripts were produced for the interview data. A qualitative analysis software program was then used to apply a coding scheme based on the six product development phases.

## Findings and Implications

The interview participants identified specific methods and techniques that they applied at each of the development phases; these are discussed in more detail in the body of this report. The following seven main findings were identified from the participant interviews. These findings are listed below with commentary indicating implications for extension to the design of consumer health IT.

- Generating ideas for successful consumer products involves a mixture of intuition and an in-depth understanding of the market and customers, which includes researching both customers and markets.
  - **Implication:** Market-based, customer-centered, and intuition-based approaches should all be utilized to understand customers (existing customers, if upgrading products; potential customers, if developing new products) and inform design, along with approaches that involve understanding the context of consumer health needs and activities.
- Identifying end customers and their needs involves understanding existing and potential customer experiences in the real world and observing their successes and frustrations with existing products. It also involves conducting research with customers and translating research findings into measures of product success and customer profiles.
  - **Implication:** Observational methods to identify customer needs and frustrations hold promise for understanding customers' real world experiences with products in the development of consumer health IT. However, developers should not be discouraged from pursuing novel product concepts if they do not find support for their design ideas using these methods.
- Prototyping is commonly used in the concept development phase of the design process. Multiple prototyping techniques are used, with an emphasis on use of low fidelity methods in early phases of design and development.
  - **Implication:** Prototyping early and throughout the design process may be a useful technique for refining product concepts for consumer health IT products.
- Commonly used methods to develop product concepts included releasing imperfect products into the market and providing updates, and conducting in-depth observations of human behaviors to inform design.
  - **Implication:** Techniques such as early release, in-depth human observation, and rapid prototyping may be useful for consumer health IT application design. However, customer safety and privacy concerns must be evaluated throughout the consumer health IT design process and balanced against customer needs.



- Testing takes place throughout the design process and is a key feature of an iterative design process. Testing is conducted in a variety of settings, from customer homes to usability laboratories.
  - **Implication:** Developers should consider evaluating products throughout the design process in environments relevant to the customer, including his or her home, workplace, and other environments in addition to usability testing in a laboratory setting.
- Participants reported that usefulness is considered important in design, but the concept is loosely defined. Similarly, participants felt ease of use to be important in their design activities, but definitions and measures of the construct varied (for example, ease of use was defined as “making sense” or as scores on scales measuring satisfaction, “hedonic” or pleasure-related qualities, and system usability).
  - **Implication:** Usefulness and ease of use should be defined early, so that these constructs can be evaluated with consistent measures throughout the product development phases.
- Participants believe that without usability products are not likely to achieve success. However, it likely takes more than a usable product to achieve product success. Many factors influence product success, ranging from the product’s design, to marketing strategies, to customer support services.
  - **Implication:** Usability should be considered to be of primary importance in consumer health IT design. Developers of consumer health IT products should also consider using a comprehensive approach to designing successful products that includes ensuring sound product design with thoughtful application of marketing strategies and integration with other necessary systems such as support services.

In addition, due to the fact that consumer health IT products are relatively new to the market, developers may want to pay attention to health consumer needs and how they relate to potential design goals. For example, it may be more important to ascertain outcomes that are relevant to some consumer products in the context of health, such as persuasiveness of a product and motivation to use it.

Furthermore, consumer health IT applications need to be available and useful to a wide range of customers from differing cultural backgrounds. While participants did not describe the process of understanding culture and translating these cultural characteristics into design features, consumer health IT developers may want to also pay special attention to cultural needs to ensure that consumer health IT applications are effective across consumer populations (Tedre et al., 2006; Montague and Perchonok, 2012).

# Chapter 1. Introduction

There is a need to improve health care quality in the United States. Proliferation in the use of health IT, including consumer health IT (Committee on Quality of Health in America, Institute of Medicine, 2001) applications targeted toward individuals who receive services related to health care, is viewed as a key component for improving health care quality.

Consumer health IT has the potential to fundamentally change the health care system for the better. Eng et al., (1999) argue that “few other health interventions have the potential to simultaneously improve health outcomes, decrease health costs and increase customer satisfaction,” (page 11) as consumer health IT. Consumer health IT holds a great deal of promise in helping consumers, such as by providing information to their care team and peers, managing their health needs, facilitating better informed decisions about their health and wellness, developing and enhancing their emotional and social support networks, and developing positive health behaviors (Eng et al., 1999). Effective consumer health IT will support personal health information management “activities that support consumers’ access, integration, organization, and use of their personal health information” (Civan et al., 2006, page 156). These activities include information storage, archival and retrieval, health monitoring, and information seeking and searching. Consumer health IT will provide needed infrastructure, tools, and artifacts to support health management.

A great deal of progress has been made toward achieving these goals. Consumer health IT applications have grown in both development and dissemination (Jimison et al., 2008). Simultaneously, individuals have increased their usage of consumer technologies in general, as mobile, social networking, and Web-based technologies have integrated many aspects of one’s home and work lives. Utilization of Web-based technologies for health purposes has also increased. Fox and Jones (2009) report that in 2009, more than 60 percent of adults used the Internet to find health information, and some used social networking tools to follow their peers’ health status. Nearly 60 percent of the surveyed consumers used other new media technologies to discuss or learn about health; these included blogs, podcasts, and creating or consulting reviews of providers. The growth in adoption of consumer IT products affords additional opportunities for developing consumer health IT applications.

In addition to the potential promise of enhancing the health care delivery system, consumer health IT applications have been shown to affect a variety of patient and health systems outcomes (Gibbons et al., 2009). In a review of 137 scholarly publications about consumer health IT, Gibbons et al., (2009) found evidence of its effectiveness on a variety of outcomes including health care processes, intermediate health outcomes, relationship-centered outcomes, clinical outcomes, and economic outcomes.

Despite the potential benefits of consumer health IT tools and opportunities in the environment, barriers to their use at system and individual levels have been identified in the literature. The following are the main categories of barriers identified, with some examples that explicitly relate to design (Gibbons et al., 2009; Jimison et al., 2008; Zayas-Cabán and Marquard, 2012):

- Access barriers (e.g., costs; access to new technologies or to the Internet);

- System integration barriers (which may affect use by providers, such as applications that do not integrate seamlessly with existing clinical health IT systems; or which may affect use by patients, such as technology that does not fit seamlessly into routines of normal daily living, or overly cumbersome data entry or poor customization options);
- Privacy and security barriers;
- Usability barriers (e.g., poorly designed system, system not designed to complement human capabilities and limitations);
- Failure to meet consumer expectations (e.g., technology does not work as expected, does not help customers to meet their goals); and
- Usefulness barriers (e.g., belief that health IT would not improve current care).

Many of the listed barriers may be the result of inadequate design and evaluation methods or approaches. Though there is a great deal of growth in consumer health IT, “there is little consensus about how consumer health informatics interventions should be designed and implemented, or how they should be evaluated” (Zayas-Cabán and Marquard, 2012, page 23). Many consumer health IT products do not use a specific design framework, and do not include “human factors and human-computer interaction principles and methods in their design process” (Zayas-Cabán and Dixon, 2010).

One way to overcome barriers to use and improve health outcomes is to learn from products that have achieved success and utilize design methods and approaches that have been implemented in the design of consumer products that have achieved success. To design products that are more responsive to consumer needs and are more effective, some basic information gaps need to be filled with respect to what constitutes effective design in the broader domain of consumer IT products that could be relevant to the design of consumer health IT.

## 1.1 Project Background

In July 2009, AHRQ convened a group of multidisciplinary experts for a 2-day workshop titled “Building Bridges: Consumer Needs and the Design of Health Information Technology.” The outcome of the workshop was a framework for characterizing consumers’ personal health information management practices to inform the design of effective consumer health IT applications. The resulting report also included a set of recommendations to advance the field of consumer health IT that included recommendations for research, industry, and policy. One of the recommendations in that action agenda was to “investigate the application of design methodologies used in other industries to personal health information management” and the design of consumer health IT.

To that end, in 2010, AHRQ awarded a task order titled *Understanding Development Methods from Other Industries to Improve the Design of Consumer Health IT* to Westat. The work under this task order is intended to elucidate which design methods used in other industries could be applied in the design of consumer health IT applications. This report is a deliverable under this project; a previous deliverable summarized findings from an environmental scan and grey literature review of design methods used in the development of successful consumer products in industries other than

consumer health IT (Agarwal et al., 2011; available at <http://healthit.ahrq.gov/developmentmethodsbackgroundreport>).

This report describes findings from interviews conducted with key informants representing organizations that have developed successful consumer products. The report also discusses potential relevance of findings from those interviews for consumer health IT design.

## Chapter 2. Approach

The primary approach used to learn about the design processes that was utilized in the development of successful consumer products was to conduct in-depth interviews of key informants within representative companies who designed and developed these products, followed by qualitative thematic analysis of interview transcripts (Creswell, 2007). The steps to complete these activities included: creation of an interview guide, selection of products relevant to consumer health IT, identification of key informants employed by the companies who designed products, in-depth individual interviews, and thematic qualitative data analysis of the interview data. These are described in detail in the subsequent sections.

### 2.1 Interview Guide Design

The interview protocol was developed by generating general questions based on commonly accepted product development phases: (1) idea generation, (2) identification of customers, (3) concept development, (4) testing (which may occur iteratively), (5) implementation, and (6) commercialization (see Figure 1, based on information from Urban and Hauser 1993). Each phase is defined below. Specific follow-up questions (“probes”) for each general question were also drafted and included in the protocol. The guide reflected this project’s focus on consumer products and features relevant to consumer health IT. Interview participants were asked to provide their insights into methods used in the design of successful consumer products as well as the perspectives of the companies they worked for.

**Figure 1. Product development phases**



Idea Generation is defined as the phase during which designers develop ideas for new products. The questions in this section of the interview guide focus on how the designers begin the product development process. The questions concern both the research methods that designers might use and how they analyze their findings. The main question for this phase is: “How does your company begin the product development process?”

Identification of Customers is defined in the interview guide as the phase during which designers identify the potential or existing customers for their products. These questions focus on how the designers identify customers and assess their needs for a product, and how a product could meet those

needs in a way that distinguishes it from existing products. The main question for this phase is: “How does your company identify customers of the product?”

Concept Development is defined as the process of developing and refining a product concept. This part of the interview focuses on: (1) how designers define the characteristics (features) of a product, (2) techniques that designers use to define the product characteristics, and (3) whether designers use any additional or nontraditional approaches (such as prototyping) to define the product concept. The main question for this phase is: “How does your company define the characteristics of a product?”

Testing refers to the role of testing and evaluating the product during the design lifecycle. This part of the interview focuses on a designer’s perception regarding the role of testing as the company moves its product from a prototype to a more finished product. The questions address both the kinds of testing that the informant might employ, and the nature of the questions that the testing might be designed to answer. The interview questions also address the iterative nature of the process in which results of a test guide the subsequent test. Questions also focus on whether the designer’s company segments the consumer market (e.g., by income, demographics, and interests) and, if so, whether testing is then tailored to the various consumer segments. Finally, questions were also included in the interview to learn how the companies defined and assessed the concepts of usefulness and ease of use (usability) for the products they designed (Davis, 1989). The main question for this phase is: “What role does testing play as the product moves from a prototype to a more finished product?”

Implementation is defined as the phase where products move from concepts to development. This part of the interview addresses what goals designers believe need to be attained before a company’s product can move from a testing phase to an implementation (development) phase. For this phase, the main question is: “What goals need to be attained before the product can move from a testing phase to an implementation phase?”

Commercialization is defined as the phase that introduces the product to the public. This part of the interview asks designers about the metrics that their company uses to monitor the success of a product once it is released to the public. Questions in this section focus on the metrics designers use to evaluate product success once it is released to the public, and the strategies companies use to influence product success. Additional questions address when and where products are launched and choices the company makes regarding pricing and marketing. For this phase, the two main questions are: “What determines the success of a product once it is released to the public?” and “How does your company determine when and where to launch a product, what price to charge consumers, and how to market the product?”

## **Interview Guide Review**

The interview guide was reviewed and revised through a comprehensive series of steps. First, AHRQ carefully reviewed and revised the content and format of the draft guide. Next, four individuals from various backgrounds were asked to provide feedback about the clarity and comprehensiveness of the questions in the guide. During a meeting of the project’s Technical Expert Panel (TEP), panel members reviewed and commented on the content and structure of the guide and ways to make efficient and effective use of the interview time. Finally, a pretest interview was conducted with a product developer. Based on the various review steps, several questions were

revised to improve clarity and context, and to take into account the insight from the pretesting process that the model was incomplete and needed to incorporate the potential iterative and simultaneous aspects of the design process.

## 2.2 Procedures

The interview team members contacted the identified informants directly or approached the public relations office associated with each product (e.g., through contact information provided on their Web sites). Letters requesting participation were signed by the AHRQ Health IT director, a senior manager of AHRQ Health IT with oversight responsibility for the project, and the principal investigator for the project. The recruitment materials indicated that key informants would not be asked to discuss trade secrets or other sensitive material in order to overcome any skepticism about participating in an interview. Each interview was expected to last up to 60 minutes to allow adequate time to cover the interview questions and avoid interviewee fatigue. Interviews were all conducted by telephone by an interviewer familiar with the project objectives. Informed consent was obtained from all interview participants, as the study had been approved by human subjects research committees. Finally, interviews were transcribed after the interview. The data from the interviews included the interviewer's notes, the interview audio file, and the interview transcript.

## 2.3 Selection of Products and Identification of Potential Key Informants

In November 2010, the project team created an initial list of successful consumer products that were considered relevant to the management of personal health information. Consumer products were deemed successful based on market penetration, sales revenue, accolades in the design press, and customer adoption and enjoyment. Successful consumer products were identified from periodicals such as *Consumer Reports* and *PC Magazine's* best and most successful products of the year, and from product design organizations that grant awards for consumer products such as the Industrial Designers Society of America.

The selected products have a profile of features or functions that are relevant to personal health information management and consumer health IT. The team identified products that support the following types of activities (Agarwal and Khuntia, 2009).

- Storing, archiving, and retrieving information;
- Monitoring information;
- Searching for information; and
- Supporting and facilitating completion of tasks such as—
  - Logging and/or recording activities;
  - Making comparisons; and
  - Making decisions.

From a list of approximately 250 products, those that were most successful or relevant to consumer health IT were selected for further exploration. Fifteen initial products of interest and most relevant to consumer health IT were selected with input from the TEP, project team, and AHRQ. To mitigate any possible recruitment issues, a list of 15 alternate products was generated.

The process for selecting successful products and key informants is shown in Figure 2. From the final list of products, key informants or individuals who were involved in the design and development of the products of interest were identified as potential participants in the study. Efforts were made to select informants who represented a range of roles, such as design engineer through executive management, as long as the non-engineering informants were cognizant of their design processes. When a previously identified key informant was unavailable or unwilling to participate, an alternate informant (involved in the design of one of the alternate products) was invited to participate.

**Figure 2. Process of selecting successful products and identifying potential key informants**



## 2.4 Key Informant Recruitment

Key informants were contacted through multiple modalities including telephone, email, mail delivery services, and social networking Web sites. Recruiting efforts revealed a significant level of turnover in the companies that were contacted. Many of the potential informants changed positions between the time they had been identified as potential informants and the beginning of recruiting efforts. Several informants who had taken new jobs felt that they could not represent products they were no longer associated with. These barriers required identifying new informants and completing the same steps to obtain contact information and recruit them.

Due to lower than expected response and participation rates, the team discussed additional recruiting methods with AHRQ, and then utilized them. The additional recruiting methods included the following:

- The TEP chair sent a message to the TEP members requesting their assistance with making contacts with any known informants (or associates of the informants).
- For cases where an alternate informant for the primary one could be identified, after collecting relevant contact information, the team completed the steps described above for each informant.



- The team sent emails to product or design groups within several of the primary product companies to request assistance with recruiting potential informants.

Using the methods mentioned above, nine interviews were completed. Potential informants who did not participate: did not respond to the invitation to participate, were not reachable, were willing but unable to participate (e.g., due to company policies that prohibit participation in research studies of this nature), or were not willing to participate.

## **2.5 Data Analysis and Result Generation**

A thematic analysis method was used to identify key findings within and across each of the phases and concepts of product development.

Interviews were transcribed and combined with the interviewers' notes. The responses were organized around the interview questions and then reduced to codes or measureable units of analysis (Patton 2001). These codes were organized based on each stage of the design process and were then grouped to form themes. Multiple evaluators reviewed the interview data, codes, and themes. The findings from these analytical activities are reported as themes in this report.

Evidentiary adequacy is integral to establish rigor in qualitative research (Erickson, 1998; Morrow, 2005). Data for the analysis consisted of recorded interviews and notes taken during and after the interviews about salient themes and observations by either the interviewer or a member of the research team. Additional demographic data were collected about the design team and company.

To prepare for analysis, the nine audio files were transcribed verbatim. The interview transcripts were analyzed using a thematic analytical framework (Creswell, 2007). Individual interviews were reviewed and coded, then reviewed collectively. Coding is an activity that reduces large volumes of data generated from transcripts into labeled fragments (Schwandt, 2007). Data were coded using a scheme based on phases of the design process that contribute to a product's success. The phases included generating ideas, identifying customers, developing product concepts, testing products, implementation, and commercializing products.

The coding scheme was created after three researchers read each transcript in its entirety. Coding was completed collaboratively by two of the researchers. Differences between coders were discussed. A table of themes with associated codes was later reviewed by a larger group of researchers. Codes were created from participants' responses and own experiences. A hierarchal coding structure was created to include major and minor codes; for example, the code "idea generation" was the major code, with individual minor codes such as intuition- and market-based methods.

After the coding scheme was established, codes were assigned to passages of the transcript. As the coding process continued, some codes were added and reconfigured. When new codes were added or reconfigured, previous transcripts were reanalyzed as needed to maintain consistency with the evolving coding scheme. A qualitative analysis software program was used to store transcripts, manage the coding scheme, and assign codes to transcript sections. The software also managed the study's audit trail; this audit trail outlined the research process and the iterations of the code scheme, categories, and resultant themes (Miles and Hubberman, 1994; Wolf, 2003).

During the coding process, methodological and analytical memos were written to augment the data. Methodological memos documented the methods used to code and sort the data; they included definitions of codes and categories and rules for inclusion or exclusion. Analytical memos consisted of thoughts, questions, reflections, and speculations about the data.

Accountability was achieved through maintaining an audit trail that outlined the research process and evolution of codes, categories, and theory (Miles and Hubberman, 1994; Wolf, 2003). The audit trail consisted of chronological narrative entries of research activities, interviews, transcription, coding, and analytical activities. The audit trail also included a list of the codes for the design process that formed the basis of analysis.

## Chapter 3. Interview Findings

A total of nine individuals participated in interviews. These participants were involved in the design of the products listed and described in Table 1. The table also lists the type of activity the product supports (i.e., product category), lists the product name, includes a brief description of the product, lists the company that developed the product, and notes evidence of the product's success (criteria that were used in selecting the products).

**Table 1. Consumer products**

No.	Product category	Product name	Brief product description	Company name	Evidence of success
1	Monitoring home information	<b>4Home Energy System</b>	Energy consumption monitoring system	4Home	Award for Best of Innovations for Eco-Design and Sustainable Technology, 300% revenue growth (2010).
2	Making comparisons	<b>Red Laser</b>	Tag scanning application	Occipital	Approximately 9 million users; Condé Nast Traveler's Innovation and Design Awards 2011.
3	Communication	<b>Peek Mobile Device</b>	Sends and receives unlimited email from anywhere in the U.S.	IDEO	<i>Time</i> : One of the 50 Best Inventions of the Year 2008; <i>Wired</i> : 2008 Gadget of the Year.
4	Monitoring health-related information	<b>Xbox</b>	Game console	Microsoft	In the device's first 25 days at market, 2.5 million Kinects; Winner! Parents' Choice Awards.
5	Logging and recording activities or measures	<b>Nokia 1100</b>	Cellular phone	Nokia	Top-selling mobile phone, more than 250 million users, best-selling consumer device in the world.
6	Communication	<b>AT&amp;T Uverse</b>	Mobile, home integrated communication system	AT&T	Widely used and received consumer information quality award.
7	Searching for information and making comparisons	<b>Quicken Health Expense Tracker</b>	Web-based application that tracks health care expenses	Intuit	Developed using customer-driven innovation approaches that made Intuit's TurboTax a household name. More than 4 million patients are registered to use Intuit Health's patient portal.

**Table 1. Consumer products (continued)**

No.	Product category	Product name	Brief product description	Company name	Evidence of success
8	Searching for information and making comparisons	<b>Medicare.gov</b>	Web site for adults (50 years and older)	MITRE corporation	More than 1 million unique visitors and 8 million page views. The official U.S. government Web site for Medicare. The 2008 Bronze Award for Health Promotion/Disease and Injury Prevention Information for Web site geared to audience of only older adults, 60+ years. Silver Award for Web site geared to audience of only older adults, 60+ years. eHealthcare Leadership Awards.
9	Information storage, archival, and retrieval	<b>EasyShare Software</b>	Software for photo storage, retrieval, and tagging	Kodak	"Best of Innovation Award" 2007 Design and Engineering Awards (Consumer Electronics Association); endorsed by the Industrial Designers Society of America; consistent top 10 best-selling digital camera system in the United States.

Company sizes and design team composition varied. The company sizes ranged from 4 to 50,000. The sizes of the design team also varied in size, ranging from 2 to 35 members. The design teams included a variety of types of individuals, from teams that consisted of just the designers and usability researchers<sup>1</sup> to teams that included artists, customers, and test researchers,<sup>2</sup> developers (those who implement the plans of a designer), and marketing experts. The types of team members mentioned are illustrated in Figure 3. As shown in the figure, 18 different types of professionals were involved in the design teams across all the products.

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<sup>1</sup> Usability researchers study the interaction between people and electronic media products, such as computer programs, to determine ways to make those products easier to use and more helpful for the customer.  
Source: [Usability Researcher Job Description, StateUniversity.com](http://careers.stateuniversity.com/pages/141/Usability-Researcher.html#ixzz1un4lGfGk)<http://careers.stateuniversity.com/pages/141/Usability-Researcher.html#ixzz1un4lGfGk>.

<sup>2</sup> Test researchers are those with expertise in product and prototype testing and evaluation.

**Figure 3. Types of design team members mentioned by participants**



\* A person with expertise in what will work regarding introducing a product to another country and how best to use the company's resources to achieve this.

### **3.1 Approaches to Idea Generation**

When asked about generating ideas, participants reported processes that ranged from an emphasis on intuition and innovation to more structured market-driven approaches. For example, one participant described a process that involves creating something that has not been previously developed, by reviewing current products on the market and using intuition to develop new ideas.

*We just follow our own intuition. It's a very changing landscape, and so it's very hard, I think, right now to implement an exact procedure to achieve this. I think you really just have to look at the latest and greatest examples that are out there in the market that have been released within the last six to twelve months. Look at those examples, see what they're doing that's really cool, and then try to do at least as good as that. That is what*

*we do for everything other than the core thing, and really, the core special thing, we usually have to figure it out from scratch because it's never been done before.*

When asked how their company began the product design process, participants reported using a variety of methods to generate ideas. These included: brainstorming, market research, internal communication, intuition, gap analysis, product benchmarking, participatory design (with customers and internally), and talking to existing customers. Table 2 presents details of how participants used these methods during the idea generation stage. Participants reported that these activities usually took place after they received approval from supervisors, when the team had interest in a new innovation, when the development team had an interest, or when resources were in place to begin a new project.

**Table 2. Examples of methods used at the idea generation stage**

<b>Method</b>	<b>Illustrating quotes from participants</b>
Internal communication	<i>"We pose as the customer ourselves, either through role-playing or through... someone internal that can help us to interpret what people like this want and need. Then we will just make it for them."</i>
Intuition	<i>"There's a lot of market research, consumer insights type work that goes on to understand, not just what are people interested in, but what are people going to be interested in, [in] two to three years."</i>
Gap analysis	<i>"We did an analysis of software that was in the marketplace at the time and selected where we wanted our product to go. We didn't want...[to] cover all the capabilities of what might have been a rich product.... We thought we wanted to be a little bit simpler. We wanted to focus on a couple of features that would fit with our brand...."</i>
Product benchmarking	<i>"We began with an understanding—you know, a review of our existing product—we had an earlier version of that—and we identified what were the gaps that we wanted to close and how we wanted the product to—the new product to compete better before it was on the market at the time. So we identified loosely areas that we were interested—this was with marketing—collaborating with marketing who had—and business research. We had some strengths to work with; some points to work with. We supplemented those by doing some competitive assessments—benchmarking products...to see what the status quo was and by that we did a SWOT (strengths, weaknesses, opportunities, and threats) analysis."</i>
Participatory design	<i>"[After defining what the overall] functionality would be...[we would] make some concept mockups of the screens. We did some participatory design with a few target users and also just of the human factors, and junior designers on the team.... We often have design reviews in which we bring people with other skills to critique and to give ideas."</i>
Talking to existing customers to learn about how they use products	<i>"You look at a lot of different social mega [media] channels and listen to what people are saying. You can either try to listen in, or you can actually have a hypothesis [about how people want to use a product], and so we did a search... and found numerous people talking about it, and it went beyond just chatter on like Twitter. It went to full blog...people talking about it, writing about it, feeling strongly about it, and you've got to assume that for every one blog post there are a hundred people that thought about writing one, and for every one... at least ten other people thought about saying something. It is also effective to then follow up with some of those people and try to... find out whether they even thought of the idea in the first place."</i>

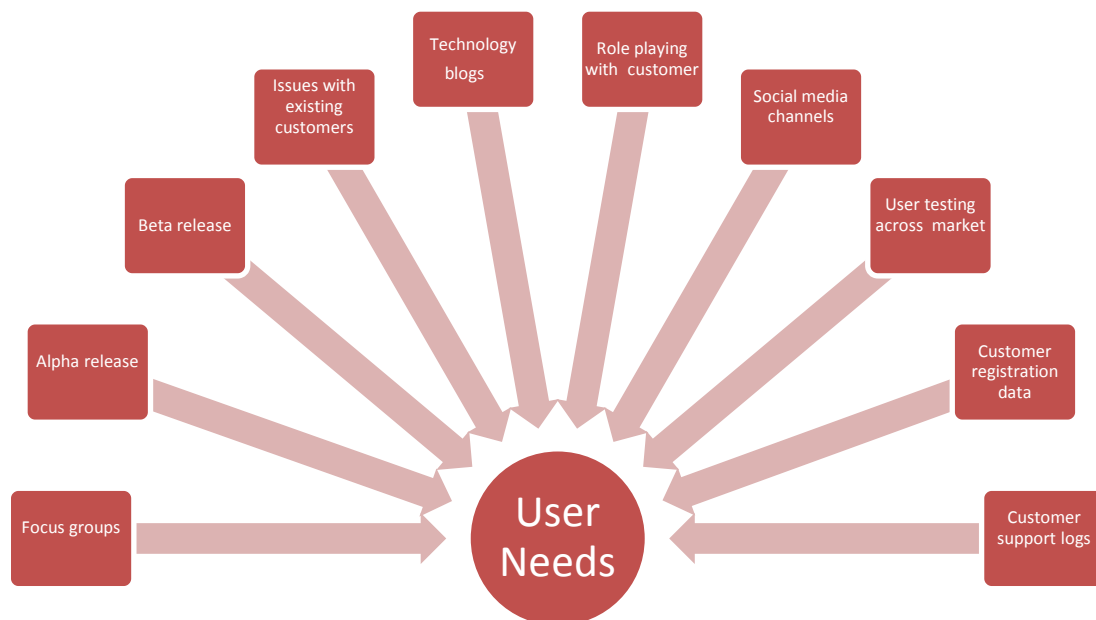
## 3.2 Approaches to Identifying Customers and Their Needs

Participants reported using a variety of specific methods to identify customers, such as focus groups, contextual inquiry, brainstorming, market research, internal communication, discussions with current customers, discussions with customers of other products, benchmarking, and developing personas. Participants also stated that identifying a population of potential customers from the market was an effective strategy; for example, one participant stated that, “*business needs may point to targeting a particular set of customers.*” Several participants described using customer profiles or personas to help them identify customers. Nearly all of the participants described using more than one method, such as a combination of market research and research with current customers. These activities took place at different times in the design process. Most participants stated that the methods began before the design process, but one participant made a distinction between innovation products and market products. This participant noted that for innovation products, customers are identified before the product is launched, while for market-driven products, customers are identified before the design activities begin.

Participants described other methods of identifying customer needs that ranged from participant-based to surveillance-based techniques (see Figure 4). These included methods such as developing an idea for a product or feature, then searching online forums to see if potential customers described a need for that new product or feature. Participants also described exploring technology blogs to gain more insight into customer needs by identifying their frustrations with their own or a competitor’s product, and designing to alleviate those annoyances. Participants also stated that good ideas might not always be rooted in customer needs that were perceivable in the market or environment. For example, one participant said:

*If you see nobody talking about it at all, it doesn’t mean it’s not valuable or you shouldn’t go there. It just means that nobody’s been thinking about it yet.*

**Figure 4. Methods used to identify customer needs**



From a more participant-based approach, one participant reported on conducting a great deal of empirical research and testing to understand customer needs. The participant described this approach by stating that “...you really do have to understand what their vision is for the experience, and then gauge whether it’s matching up or not.”

This participant’s company creates customer-based metrics or measures that are meaningful assessments of their products and related products. The company has customers interact with a particular product of interest and then provide feedback on their perceptions of their experience. The participant described—

*If we ran play tests on 100 [products] that have been released, so maybe we would call this like a competitor, competitive evaluation of other [products] that are out there. The real value of those data that we’re collecting comes when we compare it to the big database of scores we have, where we run the exact same test the exact same way, with the exact same questions in the same order, with the same wording, so that we can start talking about okay, this [product] that we just tested, it, you know, it falls in the lower, lowest quartile of all tested [products] in this genre, with this particular [user type]. And so we’re able to really understand how these [products] stack up against each other with respect to the category of [product], with respect to the segment of the audience that we’re testing with. We’re not just asking about what I would sort of call high level constructs like fun, or excitement, or frustration, or challenge, but we’re asking a number of subcomponents to those higher level constructs that we know through all the data we collected, happen to be very meaningful components of what makes something fun, what makes something challenging, what makes something frustrating. It allows us to not just categorize [products] by genre, by audience type, but also by these sorts of experience scores and underlying component scores that make up those experiences.*

Finally, another participant described using data from a variety of sources to understand potential customers’ motivations for using a product. They then translated the different customer motivations into personas that could be explored in future stages of the design process. For example, they were able to ascertain from existing customers, empirical data, and customer support systems that some customers were interested in using the product for pure enjoyment of using it, while others were interested in the technical side of using the product.

### **3.3 Methods Used in Concept Development**

Participants reported using a variety of prototyping techniques during the concept development stage, including low, medium, and high fidelity prototypes<sup>3</sup> (Catani and Biers, 1998; see Table 3). Prior to prototyping, other techniques are used to generate ideas and identify customers (see

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<sup>3</sup> Low fidelity prototypes are low cost, simple illustrations of a design or concept, usually on paper (Source: Usability Professionals Association). High fidelity prototypes are interactive prototypes that behave as the real system will in terms of interaction and functionality. They are typically more expensive than low fidelity prototypes and more closely resemble the look and feel of the actual product. Medium fidelity prototypes are prototypes that are between low and high fidelity levels, they may more closely resemble the actual product, but use inexpensive materials such as HTML, PowerPoint, or flash.



Sections 3.1 and 3.2); these techniques may be revisited throughout the design process until the designers are convinced that their product is worthy of moving to more advanced stages of the development process.

**Table 3. Low, medium, and high fidelity prototyping techniques described by participants**

Low fidelity	Medium fidelity	High fidelity
Paper	Flash	Software
Clickable Portable Document Format (PDF)	Three-dimensional applications	Live mockup*
Electronic storyboard	Animation of the software	Throw-away software**
Sequence of still pictures	HTML, Web-based	
Prototype design in an image editor (e.g., Photoshop)		
Conceptual prototypes		
Sketching		

\* A live mockup is a prototype that is released in incomplete form to the public for early testing and evaluation.

\*\* A software prototype that will eventually be discarded rather than become part of the final product.

Participants reported that prototyping activities occurred early on in the design process and throughout the process, often emphasizing the use of multiple prototypes. Concepts emerge from prototyping basic interaction questions. One participant described this as follows:

*...basic interaction questions are questions that we tackle very early in a prototype because really what that means is that we're prototyping experiences that really show how this is going to work, and we're able to answer some basic, basic interaction questions with those low fidelity prototypes.*

Concepts also emerge from iterative testing and marrying proven mechanics and aesthetics from prototype testing: one participant stated:

*For example, I might break prototype into sort of an early prototyping stage where... we're not really interested in anything pretty or anything that works really well, but really just sort of proves out the mechanics, or proves out an art style, or proves out an audio esthetic, or something like that. Then once something has been proven out and, you know, the team has decided, all right, we're going to go down this path, we start layering on all of the stuff that makes that sort of blocky geometric shaped [concept] actually start to look like a real [product], and you have multiple passes on everything from design, to art, to audio, to, you know, all aspects of the creative process.*

Finally, participants reported that they use a variety of contemporary or modern approaches in product development, such as—

- Launching products that are not perfect to get customers using them, and then improving the product.
- Observing a variety of human activities to understand how to design for specific interactions with the product.

- Rapid prototyping and discount usability methods (e.g., scenarios, simplified thinking aloud, heuristic evaluation).
- Using testing to inform a holistic assessment, future testing, or design changes.

An example of using testing to inform assessment or future designs is one participant's statement that—

*The truth is that the question for everyone is: Is this as it should be? Not does it meet the requirement or the spec, or whatever was written down at the beginning, but does this make sense to you, do you like using it this way? And that's true on every aspect of the thing.*

Another participant made a similar statement regarding how testing prototypes drives concept development:

*If in one of our tests we felt that we didn't get enough information—maybe the prototype wasn't developed enough and so people...couldn't comment on a feature that we were expecting to learn more about, that might be pushed off to the next test.... [Also], we definitely try to change the design if there's—you know, if there's a strong enough argument recommendation that we can make behind the finding to make a change.*

### **3.4 The Role of Testing and Implementation in Consumer Product Design**

Testing was viewed as an important design activity and generally described as an activity that took place throughout the design and development (implementation) process. Participants illustrated the importance of testing by stating, “*we need to test everything*” and “*all test cases need to be tested.*” When asked what methods their company used to test prototypes or product concepts, participants described a range of methods, including qualitative methods such as focus groups, interviews, and surveys. They also described using design methods such as committee reviews of design. One participant described this as:

*You get a bunch of people in the room and walk through things, and you have people beat on it and tear it apart to get a sense of how it could be better.*

Many participants discussed the importance of usability testing. Specific methods involved in usability testing were also described; these included interviews, think-aloud techniques, formal laboratory-based testing, and testing with individuals who were not current customers of the product. One participant noted that testing in the laboratory was not conducted to determine whether a product was fun, enjoyable, or whether a customer would purchase it, because these questions were evaluated in other stages of the design process. Rather, participants noted that laboratory-based testing was conducted solely to ensure that customers could accomplish specific tasks. For example,

*... understanding how people do those [tasks]...is understanding the kind of variability that people exhibit when they're doing these [tasks], so that's sort of a form of [testing]*

*even before a prototype exists, understanding what we're trying to build towards...and fundamental questions about just how people interact in this brand new model for interaction.*

Another participant noted—

*...as it works, we start testing it. We just start using it, and we're testing it both for bugs, but also for usability or design flaws. ...We don't test it with customers. We do [quality assurance] testing where we accumulate a list of sort of test procedures...and as it gets closer to the end and something's going final, we'll have people who are assigned to make sure they go through every single step repetitively because, you know, bugs can hide in things you don't do often, so they may not be discovered if you just rely on day to day use...*

In the context of testing and implementation, participants were asked how they define usefulness and ease of use, and whether and how they assess products' usefulness and ease of use. Participants reported a range of perspectives with regard to definitions of the concepts and approaches to ensuring products were useful to and easy to use by customers. Several participants stated that usefulness and ease of use were not defined internally at their company, or that they did not have specific definitions or metrics for assessing these concepts.

The definitions of usefulness differed across participants. Examples of these definitions are: “*matching users' needs,*” products that “*do what you want it to do,*” or a “*cool product.*” One participant described it as—

*Usefulness is ignoring whether or not the user can do it in the first minute, is there a way that the application can give them whatever they're trying to get? That information, that output, whatever they're trying to get. If the answer is yes, then that application has great usefulness.*

Participants also differed in their definitions of ease of use, defining it as “usable”; “making sense”; or scores on scale measures such as “satisfaction level,” “hedonic” qualities, and system usability. One participant defined ease of use as follows:

*So how we define ease of use is basically something like this. The first time that the user picks up the application, are they able to experience, within the first couple of minutes, probably the first minute, are they able to experience what is great about that application successfully? That's ease of use. Are they able to, on their own, get to a delightful experience where whatever you're trying to get to them is actually working for them, and they see the potential of it? That's ease of use, or usability.*

Participants described the importance of designing for usefulness and ease of use by stating that customers would not be able to appreciate a product's usefulness if it were not first easy to use. One participant illustrated the relationship between the two constructs by saying—

*If it doesn't have ease of use for the user, it's effectively useless to the user. They will say, 'It's useless to me.' They'll actually say that. Even if it is really useful, they just don't know how to get it. If they just can't figure it out, it's useless to them.*

Participants also stated that concepts such as usefulness and ease of use may vary given the context and goals of the product. One participant discussed the challenge of defining usefulness and ease of use across types of products. For example, the participant felt that usefulness was traditionally defined as whether or not a product has a component that people would be able to use to accomplish their goals when using the product, but this definition was not helpful in that participant's product domain. For instance, the participant stated—

*Is there some component of this [product] that people are able to accomplish their goals by using this system or this tool in some way? Is it useful in the sense that it helps them achieve some goal? I don't think that we would really think of it quite in those terms. We'd think of it more in terms of, do people understand what their goal is, do they understand how they can use these different tools to accomplish that goal, and are they then able to actually execute that plan that they've figured out? So they know what to do, they then know how to do it, are they able to actually do it?*

When discussing how to evaluate ease of use, one participant stated that products that are easy to use are not always the most interesting to their customers. Specifically, the participant stated that there must be a balance between keeping customers engaged and challenged when using the product and designing a product that is easy to use. For example, the participant stated that it is not necessarily true that all aspects of a product should be easy to use for all purposes. Menu and controllers should be “approachable” and easy to navigate, but long-term engagement depends on introducing some level of challenge that leads to fun and enjoyment.

Another participant described similar decisions that should be made when designing for ease of use that involved choosing the most used aspects of the product and prioritizing ease of use for those aspects. For example, one participant stated—

*Ease of use could be a big task to try to achieve on every test point, so we focus on a subset of the functionality that is most important—that is, what is the most frequently used functions on the product. Settings, for example, will be least frequently used, so that will have a lower value rating, a lower weight. Our focus will be on those touch points that the user will first use frequently. We focus on making sure ease of use is achieved—on that subset.*

Some participants stated they used a variety of methods to assess or measure perceived usefulness, including customer reviews and evaluations from usability experts. Others reported that usefulness was something that was integrated into the design process (such as identifying early functionality) or considered throughout the design process. Finally, some noted that they did not have objective measures for usefulness. Similar methods were reported to assess ease of use; these included customer reviews, evaluations from usability experts, objective measures related to usability testing (such as number of clicks), a customer's ability to complete use cases, and System Usability

Scale (SUS) scores (Bangor, Kortum, and Miller, 2008) and performance measures, such as time to complete tasks. Some participants reported not using objective measures for evaluating usability.

One participant stated that products that are not usable are not going to be successful early on, whereas products that are not useful may see early adoption but not sustained adoption. The importance of usability was described by one participant as—

*If you didn't succeed in the first place in making it usable, in other words making it a probability that you go from starting the product to actually getting some excitement out of it, and getting what you want to get out of it, whatever information or experience you're trying to get from it, if you're not getting that, then it's going to be a failure, period, and no amount of marketing or customer support can help.*

### 3.5 Strategies Used To Influence a Product's Commercial Success

Participants described strategies they use to influence a product's success as occurring before and after the products are released into the market. Before the product is released or launched, strategies range from marketing to evaluating the quality of the product against competitors' products. After the launch, strategies include providing incentives for purchasing the product, making quick changes to the product so that the customers feel the product is improving, and providing easy access to customer support. Strategies that participants mentioned are listed in Table 4.

**Table 4. Strategies for influencing product success before and after product launch**

Before launch	After launch
Train retailers and distributors who will sell the product	Provide incentives (e.g., coupons) for product purchase
Provide marketing campaign to partners	Make quick changes to product that customers perceive as improvements
Meet with distributors and electronic stores	Respond to customer input and requests for help
Diversify marketing processes	Provide a channel for eliciting feedback
Use social media networks to generate interest about the product	Monitor communications (e.g., social media) that indicate how people use the product
Ensure product works as expected	Provide updates that match customers' goals and desires identified through customer feedback
Ensure product is equivalent in quality to competitors' product	Allow the customers' experience to drive the experience with the current product and not just the next version

For two of the larger companies, preplanning with retail stores seemed to be an important key to success. One participant explained—

*For some of the products...marketing will...meet up with the distributors. That's when they try to pave a way through the distributors of the product. The...key in the success of selling [consumer electronics today] is the readiness for the consumer electronic stores...how ready [and willing] they are to...back our product...give us the shelf space and all that kind of stuff. So all [this] preplanning is very important.*

Marketing strategies were also used to ensure success in the retail market. For example, one participant noted—

*We may develop some prototypes that...mimic the final product before the final product is available. It's for marketing to work with our distributors to excite them basically and to explain to them what this new product is going to be like... it's not the end users as much as the [retail stores and they] know their targets—consumers...*

Social media mechanisms were used both prior to and after product release as a communication tool to directly reach customers. One participant explained—

*We do have an emphasis on our social networking, you know [on] Facebook and so forth, ...so that kind of interaction [that] we hear directly from some customers...can have...some influence in how we might market the product. ...I believe that [this connection to consumers through social media] ...is providing valuable—a sense of community, right? So people who feel it is important to have access to [our company] and communicate through that, and we are responsive—I think it's important.*

One participant stated the importance of providing a channel for customers to provide feedback after product release by saying—

*We've found that being responsive to customers, giving them a channel to talk with your rep or something, really does really reduce any negative area that could throw our products, so that you can really feel that negativity by giving users a way to actually ask for help.*

After product release, providing quick substantive improvements was a prominent strategy used to influence the product's success. One participant explained—

*The main things that we do to influence success are to make sure that there are pretty quick updates to the product so that the users of the product feel like it is always getting better, and they feel like their investment in it is worth something.... So we've arranged a fast clip of updates with one caveat. That caveat is that the update actually do something, because one thing that we've often noticed is that if you do... a lot of updates for your products but you don't add anything, you don't improve anything [other than a bug fix], that actually has a negative effect.*

This constant tweaking and updating by smaller consumer product companies, and maintaining communication channels with customers throughout this process, was found to be an important approach for larger companies as well. One participant from a larger company explained that customers' experience with the company's responsiveness and product improvements seemed to be just as important as was the actual functioning of the product. The participant said that—

*The same approach certainly applies, where really understanding as much as you can about how people are interacting with that product...should not only drive your next version of that product, but [also] drive the experience of that product...*

Participants also discussed factors that contribute to products not being successful. These included high prices, poor quality, design problems, and inappropriate or inadequate promotion. They also stated that misreading the marketing in the early stages could contribute to creating products that did not meet customer needs. This includes creating the wrong product or designing something that is not consistent with the trends that exist when the product is released. Ensuring that the product is of equivalent quality to others available could contribute to the product's success, one participant described this as:

*When the quality of the product is not met...[for example] a cheaper display was chosen to be used...[or if] we had [an inferior] touch screen input...compared to what users of touch screens were [used] to on other products...it [the product] might not be as successful.*

One participant stated that products that are not usable are not going to be successful early on, whereas products that are not useful may see early adoption but not sustained adoption. The importance of usability was described by one participant as—

*If you didn't succeed in the first place in making it usable, in other words making it a probability that you go from starting the product to actually getting some excitement out of it, and getting what you want to get out of it, whatever information or experience you're trying to get from it, if you're not getting that, then it's going to be a failure, period, and no amount of marketing or customer support can help.*

Also of note was that participants described the importance of social networks in promoting products in a distinct way. Potential customers are able to see which products others in their social networks are using, and that can also contribute to product success.

### **3.6 Summary of Findings**

The following are the overarching findings that emerged across interviews.

- Generating ideas for successful consumer products involves a mixture of intuition and in-depth understanding of the market and customers, which includes both creativity and customer and market research.
- Identifying customers and their needs involves understanding customer experiences in the real world, based on observing their successes and frustrations with existing products. It also involves conducting research with customers and translating research findings into measures of product success and customer profiles.
- Prototyping is commonly used in the concept development phase of design process. Multiple prototyping techniques are used, with an emphasis on use of low fidelity methods in early phases of design and development.

- Other commonly used concept development design methods include releasing imperfect products into the market and providing updates, conducting in-depth observations of human behavior to inform design, and employing rapid prototyping and evaluation techniques.
- Testing takes place throughout the design process.
- Participants reported that usefulness is considered important in design, but the concept is loosely defined. Similarly, participants believe ease of use to be important in their design activities, but definitions and measures of the construct vary.
- Many techniques are used to influence success, ranging from the product's design, to marketing strategies, to customer support services. Participants believe that, without usability, products are not likely to achieve success. However, it likely takes more than a usable product to achieve product success.



## Chapter 4. Methods That May be Relevant for Consumer Health IT Design

Chapter 3 identified the methods that participants reported using when developing their companies' successful products. As shown in Table 5, for the phases of the development process—idea generation, identifying customers, concept development, testing (including evaluating usefulness and ease of use) and implementation, and commercialization—participants described using multiple methods.

**Table 5. Design methods used during development phases**

Idea generation	Identifying customers	Concept development	Testing and implementation	Commercialization
Brainstorming	Focus groups	Low fidelity prototypes	Customer reviews	Train partners to sell product
Market research	Contextual inquiry	Medium fidelity prototypes	Evaluations from usability experts	Provide marketing campaign to partners
Internal communication	Brainstorming	High fidelity prototypes	Usability testing (e.g., performance measures such as number of clicks, rate of completion for use cases)	Meet with distributors and electronics stores
Intuition	Market research	Multiple prototypes	Evaluations of satisfaction (e.g., SUS scores)	Use diversified marketing processes
Gap analysis	Internal communication	Launch of imperfect products to learn from customers		Use social media networks to monitor communications about the product
Product benchmarking	Discussions with current product customers	Observation of human behavior		Ensure product works as expected
Participatory design	Discussions with customers of other products	Rapid prototyping and evaluation		Ensure product is equivalent in quality to competitor's product
Discussions with current product customers	Product benchmarking	Testing to inform holistic assessment or design change		Offer incentives and coupons
	Personas (i.e., hypothetical archetypes of actual customers)			Introduce quick improvements to product
	Online forums			Respond to customer input and requests for help

**Table 5. Design methods used during development phases (continued)**

Idea generation	Identifying customers	Concept development	Testing and implementation	Commercialization
	Review of technology blogs			Provide a channel for eliciting feedback
	Long-term customer research			Monitor communications (e.g., social media) that indicate how people use the product
				Provide updates that match customers' goals and desires identified through customer feedback
				Allow the customers' experience to drive the experience with the current product and not just the next version

## **4.1 Idea Generation Methods That May be Relevant for Consumer Health IT Design**

Participants described a variety of methods regarding generating ideas for successful consumer products. Many of these methods fit into one of the following three categories:

1. Market-based approaches (market research, gap analysis, product benchmarking);
2. Customer-centered approaches (participatory design, talking with existing customers); or
3. Intuition-based approaches (brainstorming).

The market-based approaches may be relevant for consumer health IT, as market research and knowledge that relate to health and current consumer health IT products can inform the next generation of products. However, the market-based approaches may not be helpful when developing ideas for new and innovative products, as products and markets may not currently exist that are defined enough to evaluate.

Customer-centered approaches, such as talking to existing customers, may also be helpful for consumer health IT for understanding limitations of unsuccessful products. However, participants did not mention generating new ideas for products from more contextually relevant methods such as ethnographic analyses of how people accomplish everyday activities or research with domain experts. In consumer health IT, customer-centered methods that identify consumer challenges and successes (in storing, archiving, and retrieving information; monitoring health-related information; searching for information and using tools for completing tasks such as: logging and recording activities, making comparisons, and making decisions) may be more useful methods for developing new ideas for consumer health IT products.

Intuition-based approaches may be helpful in developing new ideas for consumer health IT products. These methods rely on design groups that include experts in design. These methods should also be informed with contextual knowledge related to health. The methods used by participants to

generate ideas for consumer health IT are all relevant, however, they may need to be modified for the consumer health IT domain.

Each of these three approaches could be used to maximize the potential of generating ideas that will lead to successful products. However, these approaches can be augmented with contextual methods that explore sociotechnical system elements that will inform the design of consumer health IT. A human factors approach can help consumer health IT designers understand customers and the sociotechnical system in which the product will be used (e.g., physical, organizational, and cultural environments in which the products will be used). Using a human factors approach can help designers develop better designs by implementing systematic approaches for considering individual customers and their attributes (e.g., health status, health literacy level, health goals), environment in which the application would be used (e.g., home, work, mobile), tasks that the application will support (i.e., personal health information management practices), and technology (Smith and Sainfort, 1989).

## **4.2 Methods for Identifying Customers and Their Needs That May Be Relevant for Consumer Health IT Design**

Participants reported using a variety of methods to identify customers. These ranged from participant-based methods to surveillance methods. Each of the methods used by participants is relevant to identifying customers for consumer health IT applications. Social networking sites and Internet searches could be used to identify challenges that consumers face and may be particularly useful in the design of consumer health IT. Consumers are increasingly sharing insights and knowledge in Web-based forums, whether they are well or managing illness. However, due to slow adoption of information technologies to manage health and wellness, customer surveillance methods may not always prove to be successful to assess the potential usefulness or acceptance of a new idea. Designers should not be discouraged if they do not find support for novel ideas using surveillance methods.

## **4.3 Methods for Concept Development That May be Relevant for Consumer Health IT Design**

Building and evaluating a variety of prototypes was particularly important in each of the design activities for the successful consumer products. These prototypes ranged from low fidelity prototypes to high fidelity prototypes. Using prototypes early on and throughout the design process to evaluate different aspects of the design and customer reactions to the design of consumer health IT applications may prove useful. The following approaches described by participants may be particularly relevant.

- One approach was described as launching imperfect products early to garner customer feedback, with plans to introduce improvements. This approach might be particularly helpful for gaining customer feedback on early iterations of Web-based consumer health IT and mobile applications, but might not be relevant for applications that are more costly and difficult to update.

- A second approach was described as observing a variety of human activities to understand how to design for specific interactions with the product. Observing human activities across contexts can prove particularly useful for understanding whether consumer health needs can be met with consumer IT solutions, and ensuring that consumer health IT designs reflect customer needs in context.
- The use of rapid prototyping and other evaluation techniques may allow consumer health IT developers to design numerous iterations of the product and incorporate both customer and expert feedback.

#### **4.4 Methods for Product Testing and Implementation That May Be Relevant for Consumer Health IT Design**

Participants reported that testing takes place at numerous times during the product development (implementation) process, which is particularly relevant to the design of consumer health IT applications. Consumer health IT products might also benefit from prototype evaluations that are conducted with potential customers in their own environments, as contextual variables may be more important influences of success for health-related products.

When asked about assessing products' usefulness and ease of use, participants reported a range of perspectives with regards to definitions of the concepts and approaches to achieving these concepts as goals. The variations in definitions could reflect a failure to clearly define constructs and metrics relevant to product adoption and use. The wide variation could also reflect designers' use of definitions relevant to the context of individual products.

Consumer health IT products vary in terms of the types of intended customers and their intended purposes. Consumer health IT products will serve a variety of customers across demographic groups (e.g., age, gender, race, and ethnicity), health statuses, needs and preferences, and personal health information management strategies. Consumer health IT will also facilitate the completion of a variety of tasks (e.g., recordkeeping; scheduling; communicating with clinicians; and tracking medication, symptoms, and other health-related information) and their frequency and the individuals involved (e.g., daily monitoring, single-event monitoring, shared monitoring with a caregiver, and monitoring with or by a clinician). Given the diversity of the purposes and customers served for consumer health IT applications, what is considered useful will likely vary for each product.

#### **4.5 Strategies Used to Influence Commercial Success That May Be Relevant for Consumer Health IT Design**

Participants reported using strategies to ensure success that not only involved the design of the system, but also ensuring a successful "product launch." Multiple approaches to marketing may influence the success of consumer products, but additional levels of the external environment may need to be considered in order to achieve success for consumer health IT products. For example, legal, education, medical intuitions, and economic systems may need to be involved in influencing the commercial success of consumer health IT products. Specifically, other institutions may need to encourage the use of promising products such as medical institutions or institutions that educate

clinicians. Economic incentives may need to be made available to help health consumers afford health technologies. Educational systems that clarify the health-related benefits of consumer health IT products may be needed to encourage initial and sustained adoption of products.

## 4.6 Overall Findings That May Be Relevant for Consumer Health IT Design

The interview participants identified specific methods and techniques that they applied at each of the development phases; these are discussed in more detail in the body of this report. The following seven main findings were identified from the participant interviews. These findings are listed below with commentary indicating implications for extension to the design of consumer health IT.

- Generating ideas for successful consumer products involves a mixture of intuition and an in-depth understanding of the market and customers, which includes both researching customers and markets.
  - **Implication:** Market-based, customer-centered, and intuition-based approaches should all be utilized to understand customers (existing customers, if upgrading products; potential customers, if developing new products) and inform design, along with approaches that involve understanding the context of consumer health needs and activities.
- Identifying end customers and their needs involves understanding existing and potential customer experiences in the real world and observing their successes and frustrations with existing products. It also involves conducting research with customers and translating research findings into measures of product success and customer profiles.
  - **Implication:** Observational methods to identify customer needs and frustrations hold promise for understanding customers' real world experiences with products in the development of consumer health IT. However, developers should not be discouraged from pursuing novel product concepts if they do not find support for their design ideas using these methods.
- Prototyping is commonly used in the concept development phase of the design process. Multiple prototyping techniques are used, with an emphasis on use of low fidelity methods in early phases of design and development.
  - **Implication:** Prototyping early and throughout the design process may be a useful technique for refining product concepts for consumer health IT products.
- Commonly used methods to develop product concepts included releasing imperfect products into the market and providing updates, and conducting in-depth observations of human behaviors to inform design.
  - **Implication:** Techniques such as early release, in-depth human observation, and rapid prototyping may be useful for consumer health IT application design. However, customer safety and privacy concerns must be evaluated throughout the consumer health IT design process and balanced against customer needs.

- Testing takes place throughout the design process and is a key feature of an iterative design process. Testing is conducted in a variety of settings, from customer homes to usability laboratories.
  - **Implication:** Developers should consider evaluating products throughout the design process, in environments relevant to the customer, including his or her home, workplace, and other environments in addition to usability testing in a laboratory setting.
- Participants reported that usefulness is considered important in design, but the concept is loosely defined. Similarly, participants felt ease of use to be important in their design activities, but definitions and measures of the construct varied (for example, ease of use was defined as “making sense” or as scores on scales measuring customer satisfaction, “hedonic” or pleasure-related qualities, and system usability).
  - **Implication:** Usefulness and ease of use should be defined early, so that these constructs can be evaluated with consistent measures throughout the product development phases.
- Participants believe that, without usability, products are not likely to achieve success. However, it likely takes more than a usable product to achieve product success. Many factors influence product success, ranging from the product’s design, to marketing strategies, to customer support services.
  - **Implication:** Usability should be considered to be of primary importance in consumer health IT design. Developers of consumer health IT products should also consider using a comprehensive approach to designing successful products that includes ensuring sound product design with thoughtful application of marketing strategies and integration with other necessary systems such as support services.

In addition, due to the fact that consumer health IT products are relatively new to the market, developers may want to pay attention to health consumer needs and how they relate to potential design goals. For example, it may be more important to ascertain outcomes that are relevant to some consumer products in the context of health, such as persuasiveness of a product and motivation to use it.

Furthermore, consumer health IT applications need to be available and useful to a wide range of customers from differing cultural backgrounds. While participants did not describe the process of understanding culture and translating these cultural characteristics into design features, consumer health IT developers may want to also pay special attention to cultural needs to ensure that consumer health IT applications are effective across consumer populations (Montague and Perchonok, 2012; Tedre et al., 2006).

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