Background

What is eHealth?

eHealth is a multidisciplinary field focused on the delivery or enhancement of health information and health services through information and communication technologies (Eysenbach, 2001). eHealth helps consumers engage and collaborate more fully in their healthcare (Calabretta, 2002; Klein-Fedyshin, 2002), independent of geographic location. eHealth also enhances access to healthcare services by offering novel channels for communication and information flow that complement existing systems (Hogan, Wakefield, Nazi, Houston, & Weaver, 2011). There are multiple terms used to describe eHealth including consumer health informatics, digital health, virtual care, and telehealth. For purposes of consistency, we use the term eHealth.

Patient-facing eHealth technologies (Ahern, Woods, Lightowler, Finley, & Houston, 2011) include personal health records and patient portals accessed via computers or mobile devices, and other telehealth devices designed for use primarily by patients and caregivers, even though some patient-facing technologies (e.g., secure patient-provider messaging) are also used by clinicians. In contrast, clinician-facing eHealth technologies, such as the electronic health record and decision support systems, are used primarily by clinicians. The work proposed in this application focuses primarily on metrics that evaluate use of **patient-facing** eHealth technologies.

Ongoing Measure Compendium Efforts

Measure compendiums are currently available that categorize metrics for patient-reported outcomes. PROMIS, which stands for Patient-Reported Outcomes Measurement System, is one such database. Developed by the National Institutes of Health, the purpose of PROMIS is to develop, validate, and standardize item banks to measure patient-reported outcomes common across medical conditions (Cella et al., 2007). PROMIS is collecting and testing *items* focused on patient-reported outcomes of interest, as opposed to validated *instruments* such as the SF-36 or Minnesota Living with Heart Failure questionnaire. For example, the item banks for physical function, fatigue, and sleep disturbance contain 124, 95, and 27 calibrated items respectively (Cella et al., 2010). These item banks are being tested in large populations (Lai et al., 2011; Rothrock et al., 2010; Yost, Eton, Garcia, & Cella, 2011).

Similarly, the Grid-Enabled Measures (GEM) database is sponsored by the National Cancer Institute. The GEM was developed starting in 2010 with the purpose of moving social and behavioral science forward by promoting use of standardized measures tied to theoretically-based constructs and facilitating sharing of data from use of standardized measures (Moser et al., 2011). GEM is open source, i.e., it solicits scientific community participation in contributing and selecting measures. Users can add information about constructs, find measures related to constructs, upload new measures, provide feedback on existing measures, and search for and share harmonized data for meta-analyses. In addition to providing useful information such as associated references and information on validity and reliability, the GEM allows researchers to see how often other researchers have used a measure and the feedback and ratings they have provided.

Both PROMIS and GEM promote use of standardized metrics and data analysis across multiple studies and conditions. While these measures can be an important component of studies focused on use of patient-facing e-Health technologies, the items and instruments contained in these compendiums do not specifically focus on issues surrounding use of eHealth technology with and by patients. For example, while GEM or PROMIS may include instruments or items that measure satisfaction with communication with a physician, they do not include items specific to physician-patient communication when using telehealth or secure messaging, nor address technology usability issues. Searching the GEM database, we found one potential measure (see Table 3, Atkinson, 2007).

Types of Metrics

We will focus on <u>three different types of metrics</u> in this project: instruments, items, and performance measures.

Instruments are defined as a set of items to assess a single underlying characteristic. Individual items within the instrument may (or may not) be weighted to reflect each item's importance in its contribution to the

instrument total score. In order to accurately measure the concept or construct of interest (validity) in the same way across time and patients (reliability) (McDowell & Newell, 1996; Streiner & Norman, 1996), instruments should be subjected to rigorous psychometric testing. One example of an instrument we will likely review and include in our compendium is the Telecare Perceptions Questionnaire (Demiris, Speedie, & Finkelstein, 2000) designed to evaluate specific aspects of patients' perceptions about use of a videophone in the home to manage chronic illness. This instrument is used to provide an example of the type of information we will extract for this project (see Table 1 below).

Items/item banks contain a selection of items or single questions that can be used individually or several items may be used collectively in an evaluation. Items may be grouped into categories, but typically have not been assembled into a set/instrument nor undergone psychometric testing used in developing instruments. The PROMIS database, described above, is a collection of item banks focused on several concepts that may be applied across multiple chronic illnesses. A sample of items from a telehealth item bank (Wakefield, Lowery, Kobb, Clements, & Brady, 2002) that can be used to measure a provider's perceptions of telemedicine (using a Likert scale ranging from strongly agree to strongly disagree) include: *The system is easy to use; The image quality is good; The training I received adequately prepared me for using the system; Telemedicine consultation is a good use of my time.* If funded for this project, we also expect to find items or sets of items used to evaluate eHealth technologies that have not been developed and tested as an instrument. We will include these findings as well, but will notate these as "investigator-developed" items, i.e., these items or sets of items will lack formal psychometric testing. In this way, the final compendium can shed light on potentially promising items that could be used in a research or operations project and also eventually used as a starting point for further instrument development and psychometric testing.

Performance measures estimate the extent to which organizational/institutional goals are met. Performance measures are composed of a numerator or number which quantifies how often the goal is met, a denominator which indicates the population to which the performance measure applies. Performance measures are tied to a goal or target, for example the percentage of Veterans who are registered for My HealtheVet (MHV). Most often, performance measures are developed to address processes or outcomes and focus on effectiveness, efficiency, quality, timeliness, and safety. Examples of performance measures from a current eHealth study include: rates of MHV registration and MHV in-person authentication status; and percent of Veterans registered for MHV who are using MHV for prescription refills. Other performance measures may include performance of the system, e.g., the number of times a video telemedicine session is terminated due to technical difficulties.

Although each (instrument, item, performance measure) is a different type of metric, for ease of reading, we will subsequently collectively refer to them as metrics.

What led to our focus on measurement?

As noted earlier, evaluation of eHealth is unique from evaluation of other interventions in three important ways; 1) it must include evaluation of the technology in terms of usability, functionality, and availability of the technology to target users; 2) eHealth applications are typically used to improve efficiency and accessibility; and 3) because most eHealth interventions aim to improve communication, metrics are needed to quantify the degree to which communication is improved.

At the first face-to-face meeting of the eHealth QUERI Executive Committee (April 2011), we used the Nominal Group Technique (NGT) to provide guidance on the QUERI's future priorities. Nominal Group Technique process is a formal "brainstorming" or idea generating technique. The NGT fosters creativity and participation by all group members and is particularly effective in helping members of the group articulate meaningful responses to a question. At the Executive Committee meeting, we asked Committee members to respond to the question: "Given our eHealth QUERI's strategic goals and the goals of the My HealtheVet Program Office, what sort of research projects and products should we focus on in the next 3 years?" Working individually, members wrote down as many ideas as they could generate; those ideas were collated into a list and generated forty-seven unique ideas. From this list, we then asked our Executive Committee members to independently identify their five highest priority areas for the QUERI over the next three years. Following that meeting, we subsequently surveyed both MHV Clinical Advisory Board members and eHealth QUERI investigators to independently select their top five priority areas from the same list of 47 ideas generated by the

Executive Committee. Overall, 32 individuals participated in the process: 12 members of the EC, 14 eHealth QUERI investigators, and 6 MHV Clinical Advisory Board members.

The highest priority areas across all three groups included: (1) secure messaging implementation and use; (2) integration of MHV tools into clinical settings; (3) how eHealth can more fully enable a patient-centered medical home; (4) individualized clinical decision support for patients (drawing on patient-specific data); (5) development of a MHV tool to enable patient-specific decision support; (6) developing patient-centered outcome measures related to eHealth implementation; and (7) developing patient-centered metrics for meaningful use. Other funded eHealth QUERI studies are addressing the first 5 priority areas identified. The project proposed in this application will focus on #6 and #7 from this priority list to identify currently available patient-centered metrics addressing meaningful use, patient satisfaction, perceptions of usability and usefulness, and Veterans preferences. Acknowledging that there may sometimes be overlap between patient and clinician metrics, in order to draw clear boundaries around this project, our efforts will be limited to metrics which evaluate patient-facing technologies, focusing primarily but not exclusively on patient-centered measures relevant to implementation of patient-facing eHealth. However, we will include metrics where patient-facing technologies affect clinicians (e.g., impact on clinical workflow of secure messaging).

Significance

Advances in ehealth offer tremendous potential to improve access to care, efficiency of care delivery processes, and overall quality. The VA is investing significant resources into eHealth care for Veterans. This project has implications for the ability of VA operations and clinical offices to evaluate the use of eHealth and its impact on health outcomes. It will provide VA with the tools necessary to accurately measure the impacts of the eHealth movement that is now unfolding across healthcare systems.

Identification of metrics has important potential to contribute to improved implementation, clinical practice, and ultimately Veteran's health since insights gleaned from standardized measurement can directly inform system improvements and optimal implementation strategies. In addition, having better metrics to evaluate implementation of patient-facing technologies will help us improve Veterans' experiences with technologies and assess whether we are making a difference in quality of care. For example, the American Customer Satisfaction Index (ACSI) survey tool is an effective way to collect direct feedback from Veterans in order to optimize the My Health***e***Vet portal system. In addition to model questions intended to measure satisfaction, custom questions have also been included in this industry standard tool. Question sets about specific topics have been used to gain early insights that inform program improvement and also to identify more targeted evaluation needs to support research collaboration. A standardized set of metrics will enable the collection of data that is congruent with other methods and studies, leading to greater insights.

Along with the eHealth QUERI, the My HealtheVet Program Office will be involved in sustaining and spreading use of the compendium (see letter of support). Other potential partners include the Connected Health Office, the Office of Telehealth Services, the Office of Informatics and Analytics (Web and Mobile Solutions) as well as the VA Information Resource Center (VIReC). Taken together, the proposed study team members have strong working relationships with all of these potential partners.

The development of a standardized set of metrics is crucial for the attainment of the eHealth QUERI goals. Goal 1 is to augment access and meaningful use of eHealth tools. The metrics we identify will directly assist the QUERI in improving the measurement of access (including understanding differences due to disparities versus Veteran preferences) and meaningful use of eHealth. For Goal 2, to enhance Veteran self-management and participation in collaborative care through the design, evaluation, and implementation of appropriate eHealth tools, the identified metrics will improve evaluation of the effectiveness of patient-facing eHealth tools, including their impact on patient and family/caregiver participation in collaborative care and health management. Finally, this project will identify existing gaps in measurement for future metric development by eHealth QUERI investigators.

Implementation science will be advanced through the use of common metrics across eHealth projects to facilitate prospective or retrospective data aggregation techniques such as meta-analysis to assess the implementation and effectiveness of eHealth care in the VA. Such metrics are needed to better measure adoption and meaningful use and the relation of these concepts to Veteran health outcomes. Thus, it is of

great importance that we evaluate what currently exists and is in use and create a standardized recommended set of metrics.

In summary, development and sharing of a metric compendium will accomplish several goals related to promoting implementation and evaluation of eHealth. The compendium will: 1) promote use of appropriate and psychometrically sound metrics; 2) enable analyses across multiple eHealth studies that use common metrics, e.g., meta-analysis; 3) identify gaps in measurement where development is needed; and 4) provide data for eHealth QUERI to recommend core metrics for VA operations programs and to be included in future eHealth QUERI studies and 5) better demonstrate the mediators and moderators of the relation between patient engagement in eHealth and its impact on health outcomes.

Methods

Study Design. The study design will include a systematic search and review of multiple sources for currently available metrics that focus on patient–facing eHealth technologies. Our process will include a systematic review of the literature, identification and review of currently funded eHealth projects both within and outside the VA, including the NIH Research Portfolio Online Reporting Tools (RePORT) database, and existing instrument/measure compendiums. We will also query at least two healthcare systems, Kaiser and Group Health, who are known leaders in the using patient-facing technologies. eHealth QUERI leadership has contacts at both systems which will facilitate this aspect of our work.

We have conducted a series of investigator meetings to cull key concepts from existing models and published studies of technology use and adoption, e.g., the Technology Acceptance Model (Holden & Karsh, 2010) sociotechnical models (Sittig & Singh, 2010), and the Unified Theory of Acceptance and Use of Technology model (Venkatesh, Morris, Davis, Davis, 2003). Using these conceptual and theoretical frameworks, and our knowledge of the field, we developed a working list of key concepts and patient-facing technologies to focus our review (Table 2). We will use this list to begin to organize our framework, and add to it as needed as the project progresses. We aim to identify metrics that could be used for any of these concepts as well as metrics that may be relevant to only one or two of these.

Literature Search Strategy. We have conducted a preliminary search using two distinct strategies. First, we culled the currently funded eHealth QUERI projects for metrics used, as well as our own knowledge regarding available metrics. These measures are listed in Table 3. Second, with the assistance of a reference librarian at the University of Iowa Health Sciences Library, we conducted a preliminary search of the literature using the search terms in Table 2. First, for each Set we included each term combined by “or” using the OVID search engine for Medline publications. This resulted in 1,087,943 citations for Set A; 640,686 citations for Set B; and 243,621 citations for Set C. We then combined the results of Set B (Measurement) with Set A (Platforms) and Set C (Function/Information Use) separately, using “and”, resulting in 82,434 and 37,040 citations respectively. We then combined these using “and” resulting in 7697 citations. This set was limited to human, English language and a date range from 2003 to 2013, resulting in 5227 citations.

With the assistance of our librarian, we will re-run this search at the beginning of our project, and include a review of the IEEE (Institute of Electrical and Electronics Engineers) and ACM (Association for Computing Machinery) digital libraries, Embase, and Cochrane databases and current QUERI- and HSR&D-funded funded eHealth studies on the HSR&D website and the NIH Research Portfolio Online Reporting Tools (RePORT) database and request information from investigators regarding metrics being used in those studies. The resulting set of citations will be divided among the study investigators for review of the titles and abstracts to evaluate whether the publication should be included in our review. Our inclusion criteria will be broad in order to assess the full extent of metrics available. Thus, we propose two criteria: 1) the metric focuses on a patient eHealth-specific construct (Platform; Function/Information Use from Table 2); and 2) the metric is available for review. Once this list is finalized, the publications will be divided among the investigators for full-text review. If the metric is only available by purchasing it, we have included a line item in the budget for this. At a minimum we will include it in our final report but may not provide a review of the instrument. If the metric is available, but the scoring algorithm must be purchased, we will review the metric and note that the scoring must be purchased. Once this final set of publications is created, each publication will be reviewed by 2 investigators who will come to consensus on which Platform(s) and which Function/Information use(s) the metric is intended to measure. The publication reference list will be hand-searched for information to retrieve

articles reporting development or validation of the instrument. Simultaneously, we will extract psychometric information about the metric, if available, and include it in the final compendium in the format shown in Table 1 below. All metrics will be reviewed for information on published uses of the metric.

We will not limit our review to metrics that report psychometric results of development or validation. The rationale for this is to obtain the most comprehensive list of "what's out there" and what could be developed further. For example, because there is no currently available metric to assess patient perceptions of home telehealth messaging devices, the PI developed a set of items to measure this (Wakefield, Holman, Ray, & Scherubel, 2011); preliminary analyses demonstrated good internal consistency (Cronbach's alpha 0.86) but further psychometric testing has not been conducted.

Compendium Development and Review. An inventory will be developed which will list each metric or measure and then the types of reliability or validity demonstrated empirically. Reliability estimates will be explored using the range of current statistics available (e.g. internal consistency, test-retest reliability, alternate forms reliability) as will validity estimates (content validity, construct validity, predictive validity, discriminant validity). Each metric will be described using a uniform format. A brief overview of the instrument's development, scoring procedures, psychometric properties, key references on the development and/or use of the instrument, and the actual scale (if available) will be included. A sample instrument review is shown in Table 1 below.

Each quarter, progress on the project will be reported at the eHealth QUERI "All Hands" meeting. All eHealth QUERI-affiliated investigators join the coordinators on monthly "All Hands" calls. At these calls, investigators present progress on eHealth QUERI-affiliated projects, and present ideas for proposals to get feedback from the group. eHealth QUERI leadership also updates members on the eHealth QUERI. "All Hands" calls have a high participation rate by affiliated investigators, thus we expect this meeting to provide regular and valuable feedback on the activities and findings of the project.

The final compendium will be searchable by key words (using MeSH terms) so each metric will be cross-indexed by the topic/construct covered, the types of technology the metric addresses, and populations where the metric has been used. The database will also include references to articles or abstracts on use of the metric.

Work will be accomplished through a series of scheduled conference calls; findings will be discussed and work to be accomplished before the next scheduled call will be determined and assigned. Co-investigators will provide guidance regarding the literature search, review metrics for psychometric properties, organize metrics into categories (e.g., technology specific, construct addressed), design a process for condensing literature into tables, identify gaps where new metrics need to be created, and facilitate obtaining feedback on existing and new metrics from eHealth QUERI or other researchers.

Dissemination and Implementation Plan

We will design our review in a similar format as the Grid-Enabled Measures database. At the conclusion of this project, we will upload information on the metrics we find into the GEM, thus making our information widely available to both VA and non-VA researchers and clinicians for feedback and use (see attached communication with Katy Caperna). Engagement and support from eHealth Operations partners will be facilitated by Dr. Kim Nazi from the Veterans Consumer Health Informatics Office (V/CHIO), who will participate as a Co-Investigator on this study. She will bring a dual perspective on the identified metrics: ongoing connection with Operations partners and evaluation of the metric's practical use versus research use.

In addition to peer-reviewed publications which we will submit to eHealth-related venues, we will disseminate our findings to the VA operations and research community through a cyber seminar and white paper (Aim 3). The white paper will provide a critical synthesis and analysis of the current state of evaluation of eHealth in light of the strengths and weaknesses for each of the domains covered. The compendium will be uploaded to the eHealth QUERI website to facilitate use in Operations projects, and for investigators to use in future RRPs and SDPs. When eHealth QUERI is asked to review letters of intent and/or applications for letters of support, the QUERI will send them a link to the database and recommend investigators review the list for consideration of the metrics into their measurement plans (although they will not be required to do so, and investigators may

suggest new or alternative metrics to be added to the database). In order to update and sustain the database after the study, we will develop a work plan and train one of the eHealth QUERI's core research assistants to re-run our searches every 6 months to capture new metrics as they are published. Findings will be shared with eHealth QUERI leadership and decisions regarding whether to include newly discovered metrics in the database will be made through consensus. We will also incorporate input from potential and funded eHealth investigators, and knowledge gained from conference attendance. Finally, we will build into the database a "contact us" feature so that end users of the database can alert us to metrics that should be considered for inclusion in the compendium and/or provide feedback on the compendium.

Project Management Plan

Bonnie Wakefield, PhD, RN is the Clinical Coordinator of the eHealth QUERI, a member of the My HealtheVet Clinical Advisory Board, and Office of Telehealth Services Quality and Outcomes group, and an Investigator at the Iowa City HSR&D Center for Comprehensive Access and Delivery Research & Evaluation. Dr Wakefield will serve as PI on this project. She will have overall responsibility for the project, lead investigator meetings, supervise the Project Coordinator, and participate in reviewing potential instruments. Prior work involving measure development and evaluation includes an evaluation of delirium instruments (Rapp et al., 2000) and a longitudinal survey of over 1400 nurses in Iowa to develop an instrument to measure the reporting of medication administration errors (Wakefield et al., 2001; Wakefield, Uden-Holman, & Wakefield, 2005). With a group of VA colleagues that included VA researchers and clinicians, she led the development of a telehealth item bank (Wakefield, et al., 2002). This project grew out of a need for measures to evaluate telehealth implementation within the VA. This item bank was adopted by the American Telemedicine Association for inclusion in their telemedicine implementation toolkit. Finally, she worked with the VA Office of Telehealth Services to revise patient satisfaction questions for the home telehealth program. She also has experience conducting systematic reviews, including one manuscript (Wakefield, Boren, Groves, & Conn, 2013).

Stephanie Shimada, PhD, Co-investigator. Dr. Shimada is a QUERI-funded Career Development Awardee and the former Implementation Research Coordinator for the eHealth QUERI. Dr. Shimada will provide the PI and Project Manager with guidance on searches, database development, the process for selecting articles, and abstract articles. Dr. Shimada has been involved in the development and evaluation of a number of quality measures. She has been involved in the development and analysis of Consumer Assessment of Healthcare Providers and Systems (CAHPS) surveys which have been widely-used to assess patient experiences with health care. She has used the AHRQ Patient Safety Indicators (PSIs) and Inpatient Quality Indicators to study disparities in VA, and participated in a multi-year study validating the PSIs in the VA. She was also Co-Director of an AHRQ Contract to develop ambulatory trigger tools which involved a formative evaluation of the literature on existing trigger tool measures and development of a new set of measures for testing. She is also a member of the My HealtheVet Clinical Advisory Board Performance Evaluation Workgroup that advises the My HealtheVet Program Office on issues related to system evaluation. As part of this committee work, Dr. Shimada has had extensive experience using the American Customer Satisfaction Index, and developing custom questions to pair with the index's fixed items.

Timothy Hogan, PhD Co-investigator. Dr. Hogan is the eHealth QUERI Implementation Research Coordinator. Dr. Hogan will provide the PI and Project Manager with guidance on searches, database development, the process for selecting articles, and abstract articles. He has extensive experience using existing measures and developing items to assess experiences with and use of patient-facing technologies in complex patient populations, including Veterans with spinal cord injury and co-morbid chronic health conditions. This work has been funded both by QUERI and HSR&D. Beyond his funded research projects, he is also a member of the My HealtheVet Clinical Advisory Board Performance Evaluation Workgroup that advises the My HealtheVet Program Office on issues related to system evaluation. As part of this committee work, Dr. Hogan has had extensive experience using the American Customer Satisfaction Index, and developing custom questions to pair with the index's fixed items. Beyond his content expertise, Dr. Hogan's training in the information sciences positions him to monitor and provide feedback on the proposed search process to identify and compile the measures of interest in this RRP. He also has experience conducting systematic reviews related to the aims of this proposal, including one manuscript currently under review at the *American Journal of Public Health* and focused on the use of mobile technology among the homeless.

Carolyn Turvey, PhD, Co-investigator. Dr. Turvey is an Investigator at the Iowa City HSR&D Center for Comprehensive Access and Delivery Research & Evaluation, and Associate Professor in the Department of Psychiatry at the University of Iowa. Dr. Turvey is a clinical psychologist with formal training on psychometric evaluation. She has conducted two studies examining the psychometric properties of mental health assessments conducted through telehealth. She has also conducted two studies examining the psychometric properties of abbreviated assessments of depression and anxiety. Dr. Turvey will advise the team in examining the psychometric properties of the eHealth metrics as well as their relevance in research examining health care quality and outcomes.

Kim Nazi, PhD, Co-Investigator. Dr. Nazi is a Management Analyst in the Veterans and Consumer Health Informatics Office. She has held her position in the My Health*e*Vet Program Office for the past 6 years where she focuses on creating and implementing an evaluation program for the VA personal health record (PHR). As evidenced in her biosketch, she has worked extensively with the other investigators on this application and has been a key collaborator within the eHealth QUERI. Dr. Nazi will bring particular expertise regarding the applicability of metrics to evaluate eHealth within the sphere of VA operations.

John Holman, MS, Project Coordinator. Mr. Holman is the Administrative Assistant for the eHealth QUERI Clinical Coordinator (Dr. Wakefield) and Project Coordinator at the Iowa City HSR&D Center for Comprehensive Access and Delivery Research & Evaluation. Mr. Holman has more than 15 years of experience coordinating health services related research. His graduate training is in sociology and business administration, with a concentration in quantitative research methods and measurement. He completed a graduate summer research fellowship at the Air Force Human Resources Laboratory that included reliability and validity assessments of the Armed Services Vocational Aptitude Battery and related instruments, and has participated in numerous projects related to scale development and validity generalization. He will schedule all meetings, work with the PI and librarian to conduct the literature search, obtain articles, track study progress, and be administratively responsible for organization of the findings into the final compendium. Mr. Holman has served as Project Coordinator for several of Dr. Wakefield's studies over the past 10 years.

TBA Research Assistant (RA) will work under the supervision of Drs. Hogan and Shimada at the Boston site. The RA will work with Mr. Holman to get articles, arrange conference calls, take meeting minutes, and contact investigators for information about their use of eHealth instruments.

GANTT Chart

TASKS by MONTH	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Investigator meetings	x	x	x	x	x	x	x	x	x	x	x	x
Identification of concepts by study team	x	x	x									
Develop process to select metrics	x	x	x									
Meet with Librarian to conduct search		x	x	x								
Review HSR&D website for eHealth studies	x											
Contact QUERI Centers to identify studies using eHealth within each QUERI	x	x										
Review NIH Research Portfolio Online Reporting Tools (RePORT) database		x	x									
Contact VA and NIH investigators for instruments used in studies				x	x	x						
Contact Kaiser and Group health		x	x									
Review metrics for inclusion			x	x	x	x	x	x				
Review at All Hands meeting		x			x			x			x	
Create review table							x	x	x			
Submit compendium for uploading on QUERI website											x	
Contact GEM re: upload to site											x	
Write final report/white paper											x	x

Table 1. Sample Instrument Review

Citation	Demiris, G., Speedie, S., & Finkelstein, S. (2000). A questionnaire for the assessment of patients' impressions of the risks and benefits of home telecare. Journal of Telemedicine and Telecare, 6, 278-284.
Construct	Consumer perception of the risks and benefits of home telecare
Theoretical foundation	Not provided
# items	20 items
Length of administration	Not provided
Item development	Nine focus groups (n=64 participants)
Scoring	Likert-type scale with four categories ranging from strongly disagree to strongly agree, with one additional category of "no opinion"; some items are negatively worded, so must be reverse-scored for the total score. Total score ranges from 20-100, with higher scores indicating a more positive perception of home telecare.
Readability	Flesch Reading Ease Index 64%; Flesch Kincaid Grade Level 7
Sensitivity to change	Not reported
Reliability: test-retest	0.98 between two sessions one week apart
Reliability: internal consistency	Cronbach's alpha 0.8
Validity: content	Results from the focus group and feedback from telemedicine researchers
Validity: criterion	Not reported
Validity: construct	High correlations between similarly worded items
Keywords:	Telehealth; patient perception; videophone; chronically ill adults
Studies using the metric	Wakefield, B., Holman, J., Ray, A., Scherubel, M., Burns, T., Kienzle, M., & Rosenthal, G. (2009). Outcomes of a home telehealth intervention for patients with heart failure. *Journal of Telemedicine and Telecare,15*, 46-50.

Table 2. Search Terms

SET A: PLATFORMS	**SET B: MEASUREMENT**
Cell phone	Consumer health / informatics
Computer	Health Care Surveys
Computer application	Health literacy
Digital health	Health Surveys
eHealth	Instrument
Electronic communication	Interviews
Email	Measure
Ergonomics	Outcome assessment (health care)
Gaming software	Performance measure
Interactive voice response system	Process assessment (health care)
Internet	Psychometrics
Kiosk	Quality assurance, health care
Mobile health	Questionnaire(s)
Online	Reliability
Online community	Reproducibility of results
Online forum	Survey
Online support group	Survey Development
Patient portal	Tool
Personal digital assistant	Validation studies
Personal electronic health records	Validity
Personal health record	
Personal medical records	
Podcast	**SET C: FUNCTIONS/ INFORMATION USE**
Remote monitoring	Computer literacy

Secure Messaging	Coordination of care
Smart phone	eHealth literacy
Social networking	Health information seeking
Tablet	Heuristics
Technology	Human computer interaction
Telecommunication	Information literacy
Telehealth	Information seeking behavior
Telemedicine	Meaningful use
Telemonitoring	Patient access
Telephone	Patient activation
Text messaging	Patient engagement
User interface	Patient-provider communication
Video conferencing	Personal health information management
Web	Self-management
Wiki	Social support
Wireless	Usability
World wide web	User centered design

Table 3. Preliminary List of Instruments

Measure	Purpose	Reference
The eHealth Literacy Scale (eHEALS)	Computer literacy	Norman CD & Skinner HA. (2006). eHEALS: The eHealth Literacy Scale. *Journal of Medical Internet Research*, *8*(4), e27.
Computer-Email-Web (CEW) Fluency Scale	Computer literacy	Bunz, U. The Computer-Email-web (CEW) fluency scale - Development and validation *International Journal of Human-Computer Interaction*, *17*(4), 479-506.
Telemedicine Perceptions Questionnaire (TMPQ)	Assess patient's perceptions of home telecare	Demiris, G, Speedie, S, & Finkelstein, S. (2000). A questionnaire for the assessment of patients' impressions of the risks and benefits of home telecare. *Journal of Telemedicine & Telecare, 6*(5), 278-284.
Perceived Attributes of eHealth Innovations	Assess perceived attributes of technology-based health education innovations	*Atkinson, NL. (2007). Developing a questionnaire to measure perceived attributes of eHealth innovations. *American Journal of Health Behavior, 31*(6), 612-21.
Web Messaging	Two tools: provider and patient scales to measure use, ease of use, and satisfaction	Liederman EM & Morefield CS. (2003). Web messaging: a new tool for patient-physician communication. *Journal of the American Medical Informatics Association*, *10*(3):260-70.
Acceptability eScale	Ease of use and satisfaction with use of the Electronic Self-Report Assessment-Cancer (symptom and QOL screening program)	Tariman JD, et al. (2011). Validation and testing of the Acceptability E-scale for web-based patient-reported outcomes in cancer care. *Applied Nursing Research, 24*(1),53-8.
IT Acceptance	To assess patient's behavioral intention to use provider-delivered eHealth	Wilson, EV, Lankton, NK. (2004). Modeling patients' acceptance of provider-delivered e-health. *Journal of the American Medical Informatics Association, 11*(4), 241-8
System Usability Scale	Usability: ability to complete tasks (effectiveness); resources consumed to complete task (efficiency); users subjective reactions (satisfaction)	Brooke, J (1996). SUS: a "quick and dirty" usability scale. In P. W. Jordan, B. Thomas, B. A. Weerdmeester, & A. L. McClelland. *Usability Evaluation in Industry*. London: Taylor and Francis.

*from GEM data base