Task–Technology Fit of Video Telehealth for Nurses in an Outpatient Clinic Setting

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Abstract

Background: Incorporating telehealth into outpatient care delivery supports management of consumer health between clinic visits. Task–technology fit is a framework for understanding how technology helps and/or hinders a person during work processes. Evaluating the task–technology fit of video telehealth for personnel working in a pediatric outpatient clinic and providing care between clinic visits ensures the information provided matches the information needed to support work processes. **Materials and Methods:** The workflow of advanced practice registered nurse (APRN) care coordination provided via telephone and video telehealth was described and measured using a mixed-methods workflow analysis protocol that incorporated cognitive ethnography and time–motion study. Qualitative and quantitative results were merged and analyzed within the task–technology fit framework to determine the workflow fit of video telehealth for APRN care coordination. **Results:** Incorporating video telehealth into APRN care coordination workflow provided visual information unavailable during telephone interactions. Despite additional tasks and interactions needed to obtain the visual information, APRN workflow efficiency, as measured by time, was not significantly changed. Analyzed within the task–technology fit framework, the increased visual information afforded by video telehealth supported the assessment and diagnostic information needs of the APRN. **Conclusions:** Telehealth must provide the right information to the right clinician at the right time. Evaluating task–technology fit using a mixed-methods protocol ensured rigorous analysis of fit within work processes and identified workflows that benefit most from the technology.

Key words: telehealth, telenursing, home health monitoring, pediatrics, workflow

Introduction

The use of telehealth technology for chronic condition management in outpatient clinic settings is expanding.¹ With delivery-centric interventions ranging from telemonitoring to video telehealth (VTH), the primary purpose of such interventions² is supporting clinician management of consumer health between clinic visits. Evaluating the impact of delivery-centric interventions on consumer health outcomes is paramount to

adoption. Studies conducted within randomized controlled trials have shown telemonitoring^{3,4} and VTH⁵ can improve health outcomes while increasing patient satisfaction and reducing costs.^{6–8} Equally important is evaluating the workflow impact of delivery-centric telehealth interventions on clinical personnel.

Acceptance of technology is an important consideration for organizations planning technology implementations,⁹ and research has focused on two primary frameworks: technology acceptance¹⁰ and postacceptance.¹¹ Technology acceptance evaluates attitudes and behaviors that predict the adoption and initial use of technology,^{12–15} and postacceptance evaluates attitudes and behaviors that predict the continued use of technology.^{16,17} Research using these models focused on information technology–centric constructs such as end-user satisfaction and adoption of technology.¹⁸ Missing from this research is a focus on work-centric constructs that evaluate the impact or “fit” of technology on end-user workflow tasks and information needs.

Task–technology fit (TTF) is an established information systems model that focuses on actual postimplementation technology use instead of intended pre/postimplementation technology use.¹⁹ The TTF model uses a work-centric viewpoint to evaluate how technology assists a person performing his or her work tasks and postulates the importance of fitting technology with user tasks to achieve maximum workflow benefit.²⁰ This is especially important for technology users in outpatient clinics, such as advanced practice registered nurses (APRNs) providing care coordination for children with complex health conditions.

APRNs are licensed providers who build on competencies of registered nurses via graduate-level course work and clinical experience.²¹ APRN depth and breadth of knowledge, synthesis of data, and complexity of skills result in role autonomy as an independent practitioner who can assess, diagnosis, and manage patient populations with pharmacologic and nonpharmacologic interventions.²¹ An emerging area in outpatient clinics using APRN advanced scope of practice is care coordination for persons with chronic and complex health conditions. The cornerstone of care coordination is proactive interactions when a person’s chronic condition is relatively stable by providing support, referrals, and teaching.

Incorporating the work-centric viewpoint of TTF is critical when implementing telehealth technology in the outpatient setting. Prior research illustrated the importance of identifying consumer populations benefiting from telehealth interventions.^{3,22,23} Missing from this research is a mechanism to evaluate enhancement or disruption of clinician workflow and information needs.²⁴ Research identifying workflow changes and the TTF of telehealth interventions

for outpatient clinic personnel addresses this gap in telehealth knowledge and a previously identified research priority: the use of telehealth in primary care settings by nonphysician providers.²⁵

The purpose of this study was to explore the impact of including VTH in the workflow of an APRN conducting between-visit care coordination for children with complex health conditions, enrolled in a pediatric medical home. Results were examined within the TTF framework²⁰ to explore the workflow fit of VTH for APRN care coordination. In the context of this study, VTH is the use of Health Insurance Portability and Accountability Act-compliant video-conferencing software between the outpatient clinic and the patient's home to facilitate communication among the APRN, parent, and child that would otherwise take place by telephone.

Materials and Methods

A two-phase sequential mixed methods workflow analysis protocol,² consisting of qualitative, connecting, quantitative, and merging components,²⁶ explored the impact of VTH on APRN workflow. This protocol was selected over singular methodological approaches because the workflow of care coordination has not been documented and because activities and interactions requiring measurement are unknown.²⁷ Equally important is that the mixed-methods protocol provides a robust design, with qualitative and quantitative components offsetting the weaknesses of one method with the strengths of the other²⁷ and allowing corroboration of findings across methods.²⁸ Appropriate Institutional Review Boards approved the study protocol.

The setting for the current exploratory study was the TeleFamilies care coordination office of a large urban general pediatrics clinic affiliated with a nonprofit children's hospital that provides a medical home for children with complex health conditions. TeleFamilies is an ongoing randomized controlled trial testing the effectiveness of increasing levels of telehealth technology for care coordination delivery. Over 150 children were randomized into a usual-care group and two intervention groups. One full-time APRN provided care coordination to all intervention subjects. One intervention group received care coordination by telephone only, and one group received care coordination by telephone and supplemented with VTH.²⁹ APRN care coordination encompassed proactive health promotion for acute and chronic conditions, effective communication among home, provider, and community resources, and diagnosis and treatment of emerging health issues. Families of children randomized to the telephone + VTH group were provided with a netbook computer, broadband Internet connection, and access to the video-conferencing Web site.

The workflow analysis was conducted within the context of the TeleFamilies study. The single TeleFamilies APRN care coordinator was recruited for the workflow analysis and provided written informed consent. This nurse was the primary informant, and no incentives were provided. The workflow analysis focused on the APRN care coordinator and her interactions with persons and artifacts (things). In this protocol, artifacts were any artificial device that stores, displays, or transforms information³⁰ and include paper records, electronic records, telephone, video, fax, voice mail, and e-mail.

DATA COLLECTION

All qualitative and quantitative data were collected by a single observer (R.G.C.) in the TeleFamilies care coordination office. The focus of data collection was the workflow of the TeleFamilies APRN care coordinator during telephone and VTH care coordination activities; no data were collected from subjects enrolled in the TeleFamilies study.

The qualitative phase of the workflow analysis protocol used ethnographic data collection² via direct observation and semistructured interviews with the APRN informant to describe the workflows of telephone and VTH care coordination. The single informant was not a limitation to the consistency or reliability of the qualitative analysis because data collection focused on purposeful observations of telephone and VTH care coordination from a knowledgeable informant to yield information-rich cases.³¹ Direct observation of the APRN informant provided purposive and specific information about work activities and the things (artifacts) with which and people with whom she interacted. Observations were captured in handwritten notes for later transcription. Semistructured interviews clarified questions from observation sessions and utilized "member checking,"³² ensuring accurate workflow documentation by comparing the researcher's description with the nurse's description.

Qualitative workflow observation continued until data saturation, or the repeated observation of activities and interactions,³³ was achieved. The workflow of VTH care coordination was observed during eight separate sessions with eight TeleFamilies subjects for a total of 4 h. Data saturation occurred during the fifth VTH session and was validated during three additional sessions. The workflow of telephone care coordination was observed during three separate 2-h sessions conducted on different days for a total of 6 h. During each session, the APRN performed numerous activities with 15 TeleFamilies subjects and other persons and artifacts. Data saturation occurred during the second session and was validated during the third.

The quantitative phase of the workflow analysis was initiated upon completion of the qualitative phase and used time-motion data collection to measure the frequency and time of activities and interactions. Time-motion data were collected by observation of the single APRN informant during 27 sessions over a 2½-month period using the repetitive or snap-back timing method.³⁴ At the beginning of each data collection session, a digital stop-clock was snapped-back or set to zero. As the APRN changed activities, four data items were coded: stopwatch time, activity observed, person(s) interacted with, and artifact(s) interacted with. Activity, person, and artifact were coded from the validated care coordination workflow list generated from the qualitative data^{2,26} (Table 1). Data from the coded observations made up the sample used in the time-motion study.

Primary observer reliability in collecting time-motion data was established during an 80-min observation session of care coordination workflow with a secondary observer who was a doctoral-prepared nurse researcher with extensive knowledge of care coordination activities. Both observers used the data collection method described above. The primary and secondary observers watched the APRN perform 27 activities and recorded the same time for one activity and

Table 1. Care Coordination Workflow List

WORKFLOW	ITEMS
Activity list	
Coordination of care	1. Coordinate episode of care
	2. Coordinate new prescription/refill request
	3. Coordinate new/rejected prior authorization
	4. Coordinate appointment/test scheduling
	5. Coordinate/process forms and service request
	6. Coordinate preparation for VTH ^a
	7. Routine follow-up
Coordination of research	8. Subject recruitment
	9. Coordinate/facilitate research protocol
	10. Data collection
	11. Dissemination
Information flow	12. Collect, sort, send or file forms
	13. Document new episode
	14. Check e-mail/mail
	15. Consultation/referral/teaching
	16. Update plan of care
Problem solving	17. Assess and diagnose new episode of care
	18. Evaluate plan of care/outcome metrics
	19. Search for information (non-EMR)
Interaction artifacts	1. EMR create/review/update clinical document
	2. EMR create/review/update telehealth message
	3. EMR e-prescribe
	4. Telephone
	5. Fax
	6. Printer
	7. Call log
	8. Clinical paper form
	9. Paper prescription form (controlled substances)
	10. Internet
	11. Reference manuals
	12. Paging system
	13. Children's "tube system"
	14. Voice mail
	15. Video/audio headset ^a
	16. Research paper form
	17. Research electronic form

Table 1. continued

WORKFLOW	ITEMS
	18. E-mail
	19. Clinical electronic, non-EMR document
Interaction persons	1. Parent/caregiver
	2. General pediatrics MD/nurse practitioner
	3. General pediatrics medical assistant
	4. Triage nurse/SNP coordinator
	5. Other general pediatrics staff

^aAn activity/interaction added by videotelehealth (VTH).
SNP, special needs program.

differed by 1 min or less for the remaining 26 activities. The intraclass correlation was 0.99. Observer agreement in categorizing the APRN activities using the care coordination workflow list was strong (25 of 27), with 85% agreement and a kappa statistic of 0.75.

DATA ANALYSIS

Qualitative analysis of the ethnographic workflow data used directed content analysis grounded in the framework of distributed cognition.^{2,35} Ethnographic transcripts were color-coded using previously described distributed cognition categories: coordination of activity, interaction with artifacts, interaction with persons, information flow, changes in representational state, problem solving, and interruptions and inefficiencies.² Conducting the content analysis within a theoretical framework strengthened external validity³⁶ of the qualitative component.

Connecting qualitative and quantitative data sources is fundamental to mixed-methods design. Qualitative categories and sub-categories that emerged during ethnographic data analysis informed development of the care coordination workflow list (Table 1). The workflow list contained the activities, persons, and artifacts measured during the time-motion study.

Quantitative analysis of time-motion data used Intercooled Stata version 9.0 (StataCorp, College Station, TX) and Excel™ 2007 (Microsoft®, Redmond, WA). A power calculation based on the current sample and observed standard deviation indicated the study had 70% power to find a significant difference between the times of telephone and VTH care coordination activities. Time-motion observation data exhibited a left-skewed, non-normal distribution that required nonparametric tests for significance. Between-group comparison using the Wilcoxon rank sum test looked for a difference in activity times of APRN telephone and VTH care coordination. The final component of the mixed-methods design analyzed qualitative and quantitative results within the TTF framework²⁰ to describe the "fit" of VTH to APRN care coordination workflow.

Table 2. Frequency and Time of Telephone and Video Telehealth Care Coordination Observation Samples

CARE COORDINATION WORKFLOW LIST	TELEPHONE CARE COORDINATION OBSERVATION SAMPLE ^a			VTH CARE COORDINATION OBSERVATION SAMPLE ^b		
	ACTIVITY FREQUENCY (NUMBER)	ACTIVITY TIME (TOTAL)	MEAN	ACTIVITY FREQUENCY (NUMBER)	ACTIVITY TIME (TOTAL)	MEAN
Workflow categories						
Coordination of activities						
Coordination of clinical activities	100	7:09:48	04:18	70	6:49:36	05:51
Coordination of research activities	2	0:29:19	14:40	0	0:00:00	00:00
Information flow	35	5:36:09	09:36	2	0:01:57	00:59
Problem solving	34	2:50:10	05:00	5	0:11:22	02:16
Workarounds, interruptions, inefficiencies	8	0:18:58	02:22	0	0:00:00	00:00
Totals	179	16:24:24	05:30	77	7:02:55	05:30
Workflow artifacts						
EMR create/review/update clinical document	40	5:42:40	08:34	1	0:02:27	02:27
EMR create/review/update telehealth message	29	2:49:33	05:56	4	0:27:33	06:53
EMR e-prescribe	8	0:43:27	05:26	5	0:14:42	02:56
Telephone	36	2:48:52	04:41	28	1:07:26	02:25
Fax	3	0:03:41	01:14	1	0:00:56	00:56
Call log	5	0:04:03	00:49	1	0:00:27	00:27
Clinical paper form	22	1:30:31	04:07	1	0:04:03	04:03
Internet	13	0:36:43	02:49	1	0:00:38	00:38
Paging system	1	0:03:36	03:36	1	0:01:19	01:19
Children's "tube system"	0	0:00:00	00:00	1	0:05:15	05:15
Voice mail	6	0:10:45	01:48		0:00:00	00:00
Video/audio headset	0	0:00:00	00:00	31	4:54:44	00:00
Research electronic form	0	0:00:00	00:00	1	0:00:45	00:00
E-mail	1	0:12:46	12:46		0:00:00	00:00
Clinical electronic, non-EMR	4	0:14:37	03:39		0:00:00	00:00
No artifact used	11	1:23:10	07:34	1	0:02:40	00:00
Totals	179	16:24:24	05:30	77	7:02:55	05:30
Workflow persons						
Parent/caregiver	30	3:09:28	06:19	50	5:06:01	06:07
Clinic provider (MD/NP)	5	0:19:24	03:53		0:00:00	00:00
Other clinic staff	1	0:01:15	01:15	1	0:02:26	02:26
Community providers (MD, RN, ER, HHA, dentist)	9	0:32:55	03:39	2	0:04:37	02:19
Child		0:00:00	00:00	4	0:46:19	11:35
Research investigators/research assistants	3	0:27:45	09:15	3	0:05:27	01:49
No person involved	131	11:53:37	05:27	17	0:58:05	03:25
Totals	179	16:24:24	05:30	77	7:02:55	05:30

^aObservations collected during 39 episodes of telephone care coordination.

^bObservations collected during 24 episodes of videotelehealth (VTH) care coordination.

EMR, electronic medical record; ER, emergency room; HHA, home health aide; NP, nurse practitioner.

Results

Qualitative ethnographic observation of APRN telephone and VTH care coordination workflow occurred during 14 sessions and was documented in 18 pages of typed notes. The workflow categories emerging from the ethnographic data matched the categories from a previously reported workflow analysis of registered nurse (RN) triage²⁶ and included coordination of activities, information flow, problem solving and inefficiencies, interruptions, and workarounds. Coordination of activities was subcategorized to capture the APRN's dual role on a research project: coordination of clinical activities and coordination of research activities. The workflow categories and subcategories that emerged from the qualitative analysis informed development of the care coordination workflow list, which specified the activities, persons, and artifacts measured during the time-motion study (*Table 1*). Validity of the workflow list was established across content, concurrent, and convergent domains.²

The APRN care coordination quantitative time-motion sample consisted of 256 observations recorded during 23½ hours of data collection, using the activities and interactions from the validated care coordination workflow list (*Table 1*). During this time, 39 telephone care coordination episodes with 29 families and 24 VTH care coordination episodes with 22 families occurred. Time was the primary measurement of each observation. Frequency and time of telephone and VTH care coordination observations grouped by workflow category, workflow artifact, and workflow person are given in *Table 2*.

IMPACT OF VTH ON CARE COORDINATION WORKFLOW

Care coordination delivered by VTH changed APRN workflow by adding activities (prepare for VTH, troubleshoot VTH) and person/artifact interactions (child, video software/audio headset). More important is that VTH changed APRN workflow by allowing "face-to-face" communication between the APRN in the clinic and the parent and child in the home. During proactive health promotion interactions, VTH provided a visual baseline of the child's "healthy state." During interactions to assess and diagnosis acute and chronic health issues, VTH provided additional visual information unavailable by telephone.

The changes to APRN care coordination workflow are further illustrated in *Table 2*, with time-motion observations grouped by workflow artifact and person. During telephone care coordination activities, parents were the most common interaction person, but frequent APRN interactions with the electronic medical record artifact suggest multitasking during telephone interactions. Parents were also the most common interaction person during VTH care coordination activities, but interactions expanded to include the child. Interactions with the electronic medical record artifact were less frequent during VTH care coordination activities, suggesting reduced multitasking. These findings were corroborated by ethnographic observation data.

Despite additional visual information and interactions with children during VTH, between-group comparison of time spent on 39 telephone and 24 VTH care coordination episodes yielded no significant difference ($p=0.10$). These findings suggest that the impact of VTH on APRN care coordination workflow, as measured by time, is not statistically significant.

TTF OF VTH FOR APRN CARE COORDINATION

The APRN, with an advanced scope of practice, required information that supported autonomous diagnosis and treatment. During this workflow analysis, the APRN conducted diagnosis and treatment using verbal information from the parent via telephone or using verbal and visual information from both the parent and child via video. Examined within the TTF²⁰ framework, VTH increased the interactions and information of APRN workflow but "fit" the APRN scope of practice by supporting assessment and diagnostic information needs. This finding was corroborated by time-motion results showing that VTH had no significant impact on APRN work performance.

Discussion

This study explored the impact of adding a delivery-centric VTH intervention to the workflow of APRN care coordination and examined the TTF of the intervention for pediatric outpatient clinic personnel. VTH changed care coordination workflow by adding new activities and interactions. These are the same activities and interactions described in an earlier workflow analysis²⁶ of RNs conducting telephone and VTH triage in an outpatient pediatric clinic. Their presence in both RN and APRN workflows suggests the activities and interactions of VTH generalize across the work of pediatric outpatient clinic nurses.

During APRN care coordination, the time spent on activities delivered by VTH was not significantly different than the time spent on activities delivered by telephone. These findings suggest that workflow changes resulting from VTH do not affect the efficiency of APRN care coordination. Previous studies of delivery-centric interventions support this finding. Time-motion study of medical-surgical RN workflow measured the impact of electronic medication administration on nurse task time and found no significant difference.³⁷ Time-motion study of ambulatory care physician workflow measured the impact of the electronic medical record on physician task time and found no significant difference.³⁸

The TTF framework postulates technology must not only be used, but also must "fit the requirements of a task"²⁰ to "have a performance impact."²⁰ The prescribed method for evaluating the TTF of a work process is survey data collection,²⁰ but qualitative methods including focus groups and interviewing have been used during TTF evaluations.¹⁹ In this research, evaluation of TTF used a mixed-methods protocol that relied on direct observation of work processes² and uncovered findings that have implications for future telehealth implementations.

To maximize the benefit of incorporating technology into clinic personnel workflow, the information provided by technology must match the information needs of the clinician. Information needs are set by the clinician's scope of practice. This research showed that the increased visual information provided by VTH had no impact on the efficiency of care coordination workflow because the information was directly used by the APRN to support diagnosis and treatment decisions. Previous studies using the TTF framework to evaluate fit among users, technology, and clinical processes support this finding. Evaluation of a nursing documentation implementation showed the same technology implemented in different clinical settings resulted in different rates of adoption and use.³⁹

Evidence for the role of TTF in telehealth research is further examined by reviewing results from a previously reported workflow analysis of RNs conducting telephone and VTH triage in an outpatient pediatric clinic.²⁶ Triage workflow represented RN scope of practice, which is limited to data collection and assessment and communicating information to providers for diagnosis and treatment.⁴⁰ The triage workflow analysis showed VTH significantly reduced efficiency of the triage RN, as measured by time.²⁶ Examining this finding within the TTF framework indicated additional VTH information did not match triage RN information needs because the information was not directly used by the RN; it was transferred to the provider for diagnostic and treatment decisions. The mismatch of information needs reduced RN triage efficiency, but the additional information passed to the provider could increase diagnostic and treatment decision efficiency. Understanding the TTF of VTH for all outpatient clinic personnel involved in care delivery is essential when evaluating workflow efficiency.

This study has limitations that affect the generalizability of results. Although a purposeful sample of care coordination workflow was selected to yield information-rich cases, sampling limitations occurred. Only one APRN was employed by the TeleFamilies study to provide care coordination to intervention subjects and may inject bias into the sample. Although additional APRN informants could yield different results, this exploratory study is not presenting definitive conclusions that require large-scale effort. Future workflow analysis should incorporate multiple informants. The VTH workflow sample is limited by self-selection and timing bias. All VTH care coordination workflow was conducted with children enrolling in the first 3 months of the TeleFamilies study. VTH care coordination with children enrolling later in the TeleFamilies study could yield different results. APRN and parent inexperience with technology could impact activity times for VTH care coordination compared with telephone care coordination. This threat was minimized by excluding the time spent preparing for VTH in the analysis. Even with "inexperienced" APRN and parent informants, there was no significant difference in telephone and VTH activity times. What remains unknown is whether experience with the technology would further decrease the activity times of VTH care coordination.

Conclusions

Healthcare organizations are implementing delivery-centric interventions at unprecedented levels.⁴¹ These interventions must provide the right information to the right clinician at the right time. Evaluating intervention acceptance prior to implementation⁹ uncovers potential obstacles and barriers. Evaluating actual intervention use after implementation reveals workflow changes and provides a rigorous analysis of the interventions fit within work processes. Future studies should address the workflow impact and TTF of delivery-centric interventions using the mixed-methods protocol described in this article. Results from these studies would provide internal guidance for workflow and/or technology use adjustments and generate evidence-based guidelines that inform implementation strategies of other organizations.

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REFERENCES

- Koch S. Home telehealth—Current state and future trends. *Int J Med Inf* **2006**; 75:565–576.
- Cady RG, Finkelstein SM. A mixed methods approach for measuring the impact of delivery-centric interventions on clinician workflow. *AMIA Annu Symp Proc* **2012**;1168–1175.
- Kobb R, Hoffman N, Lodge R, Kline S. Enhancing elder chronic care through technology and care coordination: Report from a pilot. *Telemed J E Health* **2003**;9:189–195.
- Adam TJ, Finkelstein SM, Parente ST, Hertz MI. Cost analysis of home monitoring in lung transplant recipients. *Int J Technol Assess Health Care* **2007**;23:216–222.
- Finkelstein SM, Speedie SM, Potthoff S. Home telehealth improves clinical outcomes at lower cost for home healthcare. *Telemed J E Health* **2006**;12: 128–136.
- Jia H, Chuang H, Wu SS, Wang X, Chumbler NR. Long-term effect of home telehealth services on preventable hospitalization use. *J Rehabil Res Dev* **2009**;46:557–566.
- Jerant AF, Azari R, Martinez C, Nesbitt TS. A randomized trial of telenursing to reduce hospitalization for heart failure: Patient-centered outcomes and nursing indicators. *Home Health Care Serv Q* **2003**;22:1–20.
- Baker LC, Johnson SJ, Macaulay D, Birnbaum H. Integrated telehealth and care management program for medicare beneficiaries with chronic disease linked to savings. *Health Aff (Millwood)* **2011**;30:1689–1697.
- Saeed KA, Abidinour S, Lengnick-Hall ML, Lengnick-Hall CA. Examining the impact of pre-implementation expectations on post-implementation use of enterprise systems: A longitudinal study. *Decision Sci* **2010**;41:659–688.
- Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q* **1989**;13:319–340.
- Bhattacharjee A. Understanding information systems continuance: An expectation-confirmation model. *MIS Q* **2001**;25:351–370.
- Halbach M, Gong T. What predicts commercial bank leaders' intention to use mobile commerce? The roles of leadership behaviors, resistance to change, and technology acceptance model. *J Electron Commerce Organ* **2011**;9:1–19.
- Mangin J, Bourgault N, León J, Moriano A. Testing the application of the technology acceptance model in the French Quebecer banking environment. *Int Adv Econ Res* **2011**;17:364–365.
- Lu CH, Hsiao JL, Chen RF. Factors determining nurse acceptance of hospital information systems. *Comput Inform Nurs* **2012**;30:257–264.
- Gagnon MP, Orruno E, Asua J, Abdeljelil AB, Emparanza J. Using a modified technology acceptance model to evaluate healthcare professionals' adoption of a new telemonitoring system. *Telemed J E Health* **2012**;18:54–59.
- Mettler T. Post-acceptance of electronic medical records: Evidence from a longitudinal field study. *33rd International Conference on Information Systems*. Champaign, IL: Association for Information Systems, **2012**:1–19.
- Larsen TJ, Sørensen AM, Sørensen Ø. The role of task-technology fit as users' motivation to continue information system use. *Comput Hum Behav* **2009**;25:778–784.
- Alter S. 18 reasons why IT-reliant work systems should replace "the IT artifact" as the core subject matter of the IS field. *Commun AIS* **2003**;2003:365–394.

19. Cane S, McCarthy R. Analyzing the factors that affect information systems use: A task-technology fit meta-analysis. *J Comput Inform Syst* **2009**;50:108–123.
20. Goodhue DL, Thompson RL. Task-technology fit and individual performance. *MIS Q* **1995**;19:213–236.
21. APRN consensus model and endorsing organizations. Available at www.nursingworld.org/HomepageCategory/NursingInsider/Archive_1/2009-NI/Feb09NI/APRN-Consensus-Model-Endorsing-Organizations-.html (last accessed October 8, 2013).
22. Ryan P, Kobb R, Hilsen P. Making the right connection: Matching patients to technology. *Telemed J E Health* **2003**;9:81–88.
23. Wang V, Smith VA, Bosworth HB, et al. Economic evaluation of telephone self-management interventions for blood pressure control. *Am Heart J* **2012**; 163:980–986.
24. Demiris G, Charness N, Krupinski E, et al. The role of human factors in telehealth. *Telemed J E Health* **2010**;16:446–453.
25. Puskin DS, Cohen Z, Ferguson AS, Krupinski E, Spaulding R. Implementation and evaluation of telehealth tools and technologies. *Telemed J E Health* **2010**;16:96–102.
26. Cady RG, Finkelstein SM. Mixed-methods approach for measuring the impact of video telehealth on outpatient clinic triage nurse workflow. *Comput Inform Nurs* **2013**;31:439–449.
27. Creswell JW. *Designing and conducting mixed methods research*. Los Angeles: SAGE Publications, **2011**.
28. Bryman A. Integrating quantitative and qualitative research: How is it done? *Qual Res* **2006**;6:97–113.
29. Looman WS, Presler E, Erickson MM, et al. Care coordination for children with complex special healthcare needs: The value of the advanced practice nurse's enhanced scope of knowledge and practice. *J Pediatr Health Care* **2013**;27:293–303.
30. Carroll JM, ed. *Cambridge series on human-computer interaction, Volume 3: Designing interaction: Psychology at the human-computer interface*. Cambridge, United Kingdom: Cambridge University Press, **1991**.
31. Muecke MA. On the evaluation of ethnographies. In: Morse JM, ed. *Critical issues in qualitative research methods*. Thousand Oaks, CA: Sage Publications, **1994**:187–209.
32. Mays N, Pope C. Qualitative research in healthcare: Assessing quality in qualitative research. *BMJ* **2000**;320:50.
33. Leininger M. Evaluation criteria and critique of qualitative research studies. In: Morse JM, ed. *Critical issues in qualitative research methods*. Thousand Oaks, CA: Sage Publications, **1994**:95–115.
34. Barnes RM. *Motion and time study*. New York: Wiley, **1958**.
35. Hollan J, Hutchins E, Kirsh D. Distributed cognition: Toward a new foundation for human-computer interaction research. *ACM Trans Comput Hum Interact* **2000**;7:174–196.
36. Boyle JS. Styles of ethnography. In: Morse JM, ed. *Critical issues in qualitative research methods*. Thousand Oaks, CA: Sage Publications, **1994**:159–185.
37. Cornell P, Riordan M, Herrin-Griffith D. Transforming nursing workflow, part 2: The impact of technology on nurse activities. *J Nurs Adm* **2010**;40:432–439.
38. Pizziferri L, Kittler AF, Volk LA, et al. Primary care physician time utilization before and after implementation of an electronic health record: A time-motion study. *J Biomed Inform* **2005**;38:176–188.
39. Ammenwerth E, Iller C, Mahler C. IT-adoption and the interaction of task, technology and individuals: A fit framework and a case study. *BMC Med Inform Decis* **2006**;6:3.
40. Considering nursing? Available at www.nursingworld.org/EspeciallyForYou/StudentNurses.aspx (last accessed October 8, 2013).
41. Taking a bigger bite: IT to consume larger share of capital budgets. *Mod Healthc* **2011**;41(8):S3–S3.

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