

Appendix 1: Summary of analysis

Study	Technology intervention	Effectiveness or efficiency	Bias and quality measures
A randomized trial of telemedicine efficacy and safety for nonacute headaches [15]	One-time telemedicine consultations for nonacute headache	Health characteristics of all participants were collected for both the control and intervention group: body mass index, neck pain, insomnia, and hypertension. Although there were slight changes for both groups in these characteristics, there was no significant difference between them.	No bias detected Randomized noninferiority trial telemedicine group (N=200), traditional (N=202)
Results from a clinical yoga program for veterans: yoga via telehealth provides comparable satisfaction and health improvements to in-person yoga [16]	telehealth (yoga)	More than 80% of participants who endorsed a problem with pain, energy level, depression, or anxiety reported improvement in these symptoms. Those who participated via telehealth did not differ from those who participated in-person in any measure of satisfaction, overall improvement ($P=.40$), or improvement in any of 16 specific health problems: back pain, other pain, headaches, upset stomach, constipation or diarrhea, trouble falling or staying asleep, energy level, irritable, angry outbursts, depression, difficulty	Participants were predominantly male. True experiment, control (N=29), intervention (N=30)

		concentrating, anxiety, easily startled, repeated disturbing memories, and other.	
Comparison of robotic and laparoscopic colorectal resections with respect to 30-day perioperative morbidity [17]	Robot-assisted surgery for laparoscopic colorectal resections	No difference in operative duration or requirement for blood transfusion. Robotic method had decreased incidence of unplanned conversion to open surgery compared with laparoscopic. No difference in postoperative outcomes of postoperative ileus, anastomotic leak, venous thromboembolism, wound infection, cardiac complications, and pulmonary complications. No difference in operative duration or requirement for blood transfusion. Robotic method had decreased incidence of unplanned conversion to open surgery compared with laparoscopic.	No bias identified. Quasi-experimental (nonrandomized), control (N=7920), intervention (N=472).
Adherence and factors affecting satisfaction in long-term telerehabilitation for patients with	Telemedicine for rehabilitation of chronic obstructive pulmonary disease (COPD) patients	Intervention group participants experienced increased self-efficacy and independence, greater emotional safety, and maintenance of motivation. Adherence rate for this	Small sample size (<30), elderly patients ($\sigma=55.2$). Two-year pilot study, (N=10)

chronic obstructive pulmonary disease: a mixed methods study [18]		telerehabilitation program was higher than that reported by the World Health Organization for long-term therapy in chronic diseases.	
The effect of interactive Web-based monitoring on breastfeeding exclusivity, intensity, and duration in healthy, term infants after hospital discharge [19]	Web-based monitoring on breastfeeding exclusivity, intensity, and duration	No difference in postpartum depression between intervention and control groups (both decreased and were equally as effective). Effects of exclusivity and intensity were higher with intervention group, and effects on duration were equally effective in both groups.	The study underrepresented Hispanic and Asian populations. Randomized controlled trial (RCT), control (N=57), intervention (N=49).
A randomized controlled trial of personalized text message reminders to promote medication adherence among HIV-positive adolescents and young adults [20]	Personalized_text message reminders to promote medication adherence among human immunodeficiency virus-positive adolescents and young adults	The intervention group demonstrated increased medication adherence and demonstrated durability of adherence post intervention.	Convenience sample of one geographical area, participants received payment. RCT, control (N=55), intervention (N=54).
A telehealth behavioral coaching intervention for	Telehealth program for depressive symptoms	Depressive symptoms, upset following disruptive behaviors, and negative mood states were statistically lower in the	Small sample size (<30). True experiment, pre-post design,

<p>neurocognitive disorder family carers [21]</p>		<p>behavioral coaching condition than in the basic education and support condition. Caregiving self-efficacy scores for obtaining respite and for managing patient behavioral disturbances were significantly higher in the coaching condition.</p>	<p>control (N=50), intervention (N=50).</p>
<p>Clinical decision support and palivizumab: a means to protect from respiratory syncytial virus [22]</p>	<p>Using clinical decision support systems (CDSSs) to determine when palivizumab (expensive treatment) should be administered (under a complicated condition list).</p>	<p>A quality improvement initiative supported by clinical decision support (CDS) and workflow tools integrated in the electronic health record (EHR) improved recognition of eligibility and may have increased palivizumab administration rates; the palivizumab-focused group performed significantly better than a comprehensive intervention. Comprehensive intervention was associated with a trend toward increased missed doses that may be related to alert fatigue.</p>	<p>Coinventors involved in conducting the experiment. True experiment, control (N=162), intervention (N=194).</p>

<p>Scalable hospital at home with virtual physician visits: pilot study [23]</p>	<p>Hospital at Home (HaH) model with virtual physician visits</p>	<p>Safety and convenience were significantly higher rated than traditional method of treatment, Activities of daily living were significantly higher in the HaH group (5.81-5.39, $P=.064$), service utilization and mortality at 30 days was significantly lower in the HaH group (12-41, $P<.001$), number of specialty appointments was lower (0.34-1.50, $P<.001$), number of patients with hospital readmissions was lower (7-17, $P=.072$), cumulative service utilization and mortality at 90 days, total number of hospital readmissions (14-39, $P<.002$). Death was not statistically significant for 30 days or 90 days.</p>	<p>A large number of participants eligible for HaH refused. Quasi-experimental (nonrandomized), control (N=52), intervention (N=50).</p>
<p>Mortality benefits of antibiotic computerized decision support system: modifying effects of age [24]</p>	<p>CDSS for antibiotics</p>	<p>Patients aged ≤ 65 had greater mortality benefit (odds ratio, OR 0.45, 95% CI 0.20-1.00, $P=.05$) than patients that were older than 65 (OR 1.28, 95% CI 0.91-1.82, $P=.16$). No effect was observed on incidence of colostridium difficile (OR 1.02, 95% CI 0.34-3.01) and multidrug-resistant organism</p>	<p>Study does not include children. True experiment, control (N=99), intervention (N=99).</p>

		(OR 1.06, 95% CI 0.42-2.71) infections. No increase in infection-related readmission (OR 1.16, 95% CI 0.48-2.79) was found in survivors. Receipt of CDSS-recommended antibiotics reduced mortality risk in patients aged 65 years or younger and did not increase the risk in older patients.	
Electronic stroke CarePath: integrated approach to stroke care [25]	Electronic stroke CarePath	There was a significant reduction in observed or expected inpatient mortality after implementation of the stroke CarePath in patients with ischemic stroke (OR 0.59, 95% CI 0.42-0.83), but not in the control patients with intracerebral hemorrhage (OR 0.90, 95% CI 0.59-1.38) or subarachnoid hemorrhage (OR 1.05, 95% CI 0.67-1.65). There was a significant increase in the proportion of ischemic stroke patients with length of stay (LOS) equal or less than expected LOS after CarePath implementation ($P=.047$), but there was no significant difference in patients with intracerebral hemorrhage	Significant technical challenges were experienced that resulted in delays in data availability. Quasi-experimental (nonrandomized), control (N=2852), intervention (N=1106).

		($P=.117$) or subarachnoid hemorrhage ($P=.943$).	
Electronic ordering system improves postoperative pain management after total knee or hip arthroplasty [26]	Electronic ordering system	The time to initiation of analgesia from arrival in the post-anesthesia care unit (PACU) was significantly lower in the electronic group compared with the conventional group (mean=24.5, standard deviation [SD]=28.3 min vs mean=51.1, SD=26.2 min; $P<.001$), as were visual analog scale pain scores (mean=0.82, SD=1.08 vs mean=1.5, SD=1.52; $P<.001$) and the volume of patient-controlled epidural analgesia needed to control pain (mean=27.9, SD=20.2 mL vs mean=34.8, SD=20.3 mL; $P=.001$) at 4 hours postoperatively. PACU LOS and hospital LOS did not significantly differ in the two groups.	No bias identified. Quasi-experimental (nonrandomized), control (N=106), intervention (N=96).

<p>The effectiveness of a patient-centered assessment with a solution-focused approach (DIALOG+) for patients with psychosis: a pragmatic cluster-randomized controlled trial in community care [27]</p>	<p>Patient-centered assessment with a solution-focused approach (DIALOG+) for patients with psychosis</p>	<p>Patients in the DIALOG+ arm had better subjective quality of life at 3, 6, and 2 months ($P=.035, .058, \text{ and } .014$, respectively; Cohen $d=0.29-0.34$). The also had significantly fewer unmet needs at 3 and 6 months, fewer general psychopathological symptoms at all-time points, and better objective social outcomes at 12 months, with no significant differences in other outcomes.</p>	<p>No bias identified. Pragmatic, exploratory, parallel-group, cluster-RCT, control (N=85), intervention (N=94).</p>
<p>Reducing preconception risks among African American women with conversational agent technology [28]</p>	<p>Web-based preconception conversational agent system, “Gabby”</p>	<p>Emotional and mental health, risks triggered that were resolved/total no. of risks triggered (15/35, SD 43.0 vs 4/32, SD 13.0; $P=.01$). Health care, risks triggered that were resolved/total no. of risks triggered (8/24, SD 23.5 vs 7/64, SD 10.9); $P=.09$. Immunizations and vaccines, risks triggered that were resolved/total no. of risks triggered (25/80, SD 31.3 vs 21/111, SD 18.9; $P=.05$). Men and health care, risks triggered that were resolved/ total no. of risks triggered (7/64, SD 10.9 vs</p>	<p>African American women only. Results may not translate to the general population. RCT, control (N=31), intervention (N=46).</p>

		14/39, SD 35.9; $P=.01$). Nutrition and activity, risks triggered that were resolved/total no. of risks triggered (101/292, SD 34 vs 67/302, SD 22.2; $P=.01$). Total risks triggered that were resolved/total no. of risks triggered (297/1067, SD 27.8 vs 224/1091, SD 20.5; $P=.01$)	
Feasibility and acute care utilization outcomes of a postacute transitional telemonitoring program for underserved chronic disease patients [29]	Telemonitoring of COPD and heart failure (HF) patients (for underserved population)	COPD patients who completed the program sustained clinically meaningful improvements in their health status. HF patients also improved their health through the program. Significantly reduction in the 30-day readmission rate.	Only for underserved population. Quasi-experimental (nonrandomized), controlHF (N=59), controlCOPD (N=174) interventionHF (N=59), interventionCOPD (N=58).
An electronic tool for the evaluation and treatment of sepsis in the ICU: a randomized controlled trial [30]	Electronic sepsis evaluation and management tool	There was no significant difference for mortality (14.3% vs 14.9%), ICU-free days (17 vs 19), or vasopressor-free days (22.2 vs 22.6) for the intervention compared with control.	No bias identified. Pragmatic randomized trial, control (N=189), intervention (N=218).
Effect of a computer-guided,	Computer-guided quality	Improved cardiovascular disease risk management,	No bias identified. Cluster-

<p>quality improvement program for cardiovascular disease risk management in primary health care: the treatment of cardiovascular risk using electronic decision support cluster-randomized trial [31]</p>	<p>improvement intervention</p>	<p>patient in intervention were more likely to receive screening compared with control (62.8% vs 53.4%). No difference in prescription rates.</p>	<p>randomized trial, control (N=19,340), intervention (N=19,385).</p>
<p>Expert advice provided through telemedicine improves healing of chronic wounds: prospective cluster controlled study [32]</p>	<p>Telemedicine wound care</p>	<p>Significant improvement in wound healing compared with conventional practices (70% vs 45%).</p>	<p>No bias identified. Prospective cluster-controlled study, control (N=40), intervention (N=50).</p>
<p>Using electronic health record clinical decision support is associated with improved quality of care [33]</p>	<p>CDSS</p>	<p>Patients who visited clinics that were missing at least one of the CDS functions were more likely to have controlled blood pressure (86% vs 82%, OR 1.3; 95% CI 1.1-1.5) and more likely to not have adverse drug event visits (99.9% vs 99.8%; OR 3.0, 95% CI 1.3-7.3).</p>	<p>No bias identified. Retrospective review, quasi-experimental (nonrandomized), control (N=10,466), intervention (N=40,588).</p>

<p>Comparison of community health worker-led diabetes medication decision-making support for low-income Latino and African American adults with diabetes using e-health tools versus print materials: a randomized controlled trial [34]</p>	<p>Customized, interactive, Web-based tablet-computer delivered tools</p>	<p>Decrease in diabetes distress for the intervention group compared with control, but no difference in other outcomes.</p>	<p>No bias identified. Randomized clinical trial, control (N=95), intervention (N=93).</p>
<p>Integrating real-time clinical information to provide estimates of net clinical benefit of antithrombotic therapy for patients with atrial fibrillation [35]</p>	<p>Atrial fibrillation decision support tool</p>	<p>Significant gain in quality-adjusted life expectancy in 832/1876 patients (44.3%).</p>	<p>No bias identified. Retrospective cohort, (N=1876).</p>

<p>Implementation and evaluation of an integrated computerized asthma management system in a pediatric emergency department: a randomized clinical trial [36]</p>	<p>Computerized asthma management system in a pediatric emergency department (ED)</p>	<p>No difference in time to disposition decision. No change in hospital admission rate. No difference in ED length of stay.</p>	<p>Study of one center only. Randomized clinical trial, control (N=394), intervention (N=394).</p>
<p>The Utah Remote Monitoring Project: improving health care one patient at a time [37]</p>	<p>Telemonitoring</p>	<p>Reduced average A1C, declined systolic and diastolic blood pressure, decreased low-density lipoprotein (LDL) content</p>	<p>Used a convenience sample. Nonrandomized prospective observational preintervention-postintervention study, tracked A1C and blood pressure (BP) (N=89), tracked A1C only (N=12), tracked BP only (N=14).</p>
<p>Improving adherence for management of acute exacerbation of chronic</p>	<p>Electronic order sets for COPD management</p>	<p>Pneumococcal vaccination rate was higher (57% vs 45%, $P=.02$), there was an increase in long acting muscarinic antagonist usage during</p>	<p>No bias identified. Pre-post design, pre intervention (N=203), post intervention</p>

obstructive pulmonary disease [38]		hospitalization (13% vs 25%, $P=.002$), and the median corticosteroid usage decreased by 49% in the postintervention group compared with the preintervention period.	(N=217).
Impact of nurse-led remote screening and prompting for evidence-based practices in the ICU [39]	Remote screening and prompting for evidence-based practices in the intensive care unit (ICU)	Patients in the postintervention period were more likely to receive daily sedation interruptions (interrater reliability [IRR]=1.57, 95% CI 1.45-1.71, $P<.001$) and daily spontaneous breathing trials (IRR=1.24, 95% CI 1.20-1.29). Patients in the postintervention period experienced shorter mean duration mechanical ventilation, ICU length of stay, and hospital length of stay.	No bias identified. Pre-post design, Pre intervention (N=4339), post intervention (N=8938).
Feasibility and effectiveness of an automated telehealth intervention to improve illness self-management in people with serious psychiatric and medical disorders [40]	Telehealth	Improvements in self-efficacy for managing depression and diastolic blood pressure. Reduction in urgent care and primary care visits	No bias identified. Single-arm pilot trial (N=70).

Effects of an individually tailored Web-based chronic pain management program on pain severity, psychological health, and functioning [41]	Web-based interventions	Decreased pain intensity and unpleasantness. Increase in quality of life.	No bias identified. Nonexperimental, pre-post design, (N=645).
Development and pilot testing of a mobile health solution for asthma self-management: asthma action plan smartphone application pilot study [42]	Mobile health technology	Patients demonstrated an improved asthma-related quality of life, the mean mini-Asthma Quality of Life Questionnaire score improved by 0.5 ($P=.047$). The Canadian Asthma Consensus Guidelines symptom benchmarks of asthma control reduced in the postintervention group.	Lack of control group, seasonal influence on asthma not controlled for as the study was only conducted during the summer months on 82% women, small sample size <30. (N=22)
The impact of EHR and HIE on reducing avoidable admissions: controlling main differential diagnoses [43]	Health information exchange	Fewer single day and 7-day readmission rates when medical history was viewed via EHR	No bias identified. Retrospective observational, (N=281,750).

Reliable individualized monitoring improves cholesterol control in kidney transplant recipients [44]	Automated previsit support from an EHR	Increased proportion of visits during which cholesterol monitoring was completed. Significant improvement with controlled LDL.	No bias identified. Interrupted time series cohort design, (N=62).
Web-based intervention to promote physical activity by sedentary older adults: randomized controlled trial [45]	Internet intervention with automated video and text for physical activity	Participants in the intervention group had significant gains in the level of activity compared with the control group	Large participant dropout. RCT, control (N=177), intervention (N=125).
Practice-based versus telemedicine-based collaborative care for depression in rural federally qualified health centers: a pragmatic randomized comparative effectiveness trial [46]	Telemedicine	Significant effects on response and admission rates. Greater reduction in severity over time.	No bias identified. Pragmatic randomized comparative effectiveness trial, control (N=151), intervention (N=132).

<p>Internet-delivered cognitive-behavioral therapy v. conventional guided self-help for bulimia nervosa: long-term evaluation of a randomized controlled trial [47]</p>	<p>Internet-based guided self-help program for bulimia nervosa patients.</p>	<p>Intervention group had no significant difference in outcomes.</p>	<p>No bias identified. RCT, control (N=28), intervention (N=48).</p>
<p>Efficacy of a clinical decision-support system in an HIV practice: a randomized trial [48]</p>	<p>CDS</p>	<p>Participants in the intervention group had a higher average increase in cluster of differentiation 4 count compared with the control group (5.3 vs 3.2)</p>	<p>No bias identified. RCT, control (N=505), intervention (N=506).</p>
<p>Hospital implementation of health information technology and quality of care: are they related? [49]</p>	<p>Health information technology</p>	<p>Lower mortality, higher patient satisfaction, and higher assessments of quality of patient care.</p>	<p>On the basis of quality manager's survey response, (N=470).</p>
<p>How to improve drug dosing for patients with renal impairment in primary care—a cluster-randomized controlled trial [50]</p>	<p>Software program</p>	<p>Reduced inappropriately high doses of renally excreted medications compared with the control group (19.2% vs 34.5%)</p>	<p>No bias identified. Cluster-RCT, control (N=206), intervention (N=198).</p>

The effects of combining Web-based eHealth with telephone nurse case management for pediatric asthma control: a randomized controlled trial [51]	Electronic health for kids with asthma	Asthma control as measured by Asthma Control Questionnaire improved significantly for the intervention group but not the control group (-0.42, -0.11)	No bias identified. RCT, control (N=127), intervention (N=132).
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