

Article title: An Overview of Stakeholders, Methods, Topics, and Challenges in Participatory Approaches Used in the Development of Medical Devices: A Scoping Review

Journal name: International Journal of Health Policy and Management (IJHPM)

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Supplementary file 5. Overview of Included Papers, Their Characteristics, and the reported Challenges Grouped in the Three Participatory Approaches

Table D1: Papers grouped in the collaboration approach

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|----------------------|------|-------------|--|--|---|---|---|------------------------------------|
| 1 | Abrines Jaume et al. | 2015 | UK | An interactive application presented on a touch screen device that used animation to collect information on the health status of children | Collaboration | Patients, citizens | Interactive group session (woekshop) | Background, requirements, designing, procedure | Sample, social dynamic |
| 2 | Allin et al. | 2018 | Canada | Internet self-management program for spinal cord injury | Participatory design | Patients, HCPs, technical experts | Workshop, not-protocolled meeting | Background, requirements, designing, procedure | Sample |
| 3 | Baldereschi et al. | 2016 | Italy | A web app, named ICTUS3R, which refers to the three main messages: recognize stroke signs—react immediately and properly—reduce stroke risk | Collaboration | HCPs, citizens, technical experts, advocacy group members | Not-protocolled meeting, heuristic evaluation | Background, requirements | Not reported |
| 4 | Baskerville et al. | 2018 | Canada | Smartphone app for smoking cessation | Spiral technology action research | Patients, research experts, technical experts | Focus group, workshop | Background, requirements, designing | Not reported |
| 5 | Bjerkkan et al. | 2015 | Norway | A web-based plan for integrated care | Participatory design | Patients, relatives | Interview | Designing, testing | Sample, method and analysis, topic |
| 6 | Boman et al. | 2016 | Sweden | All-in-one device that is based on ICT for persons with cognitive impairment after acquired brain injury and persons with mild and moderate dementia | Inclusive design method | Patients, relatives, HCPs | Interview, focus group | Requirements, designing | Sample, feasibility |
| 7 | Bourazeri et al. | 2018 | UK | A smart home toolset for persons living with early-stage dementia or Parkinson's to plan, monitor and self-manage his or her life | PERCEPT (PERrsona-CEntred Participatory Technology) approach | Patients, informal care givers | Workshop | Designing | Sample |
| 8 | Cesar et al. | 2019 | USA | mHealth-enabled physical activity and cardiovascular health intervention (Step It Up) | Community-based participatory research | Patients, citizens | Focus group | Testing | Sample, feasibility, topics |
| 9 | Chhoun et al. | 2019 | Cambodia | mHealth intervention for female entertainment workers in Cambodia HIV as well as other sexual and reproductive health (SRH) outcomes | Iterative, participatory approach | Citizens | Interview, focus group, workshop | Procedure | Sample, social dynamic, topic |
| 10 | Cnossen et al. | 2015 | Netherlands | Web-based self-care program supporting early rehabilitation among patients after total laryngectomy | Participatory design approach | Patients, relatives, HCPs | Focus group, think-aloud, usability test | Background, requirements, testing, procedure | Sample |
| 11 | Cordova et al. | 2015 | USA | mHealth HIV/STI and drug abuse preventive intervention for primary care | Community-based participatory research | Patients | Focus group, interview | Requirements, designing, procedure | Sample |
| 12 | Crosby et al. | 2017 | USA | iManage: A self-management app co-designed by adolescents with sickle cell disease | Co-design | Patients | Interview, heuristic evaluation | Requirements, designing, testing | Sample, method and analysis |
| 13 | Dack et al. | 2019 | UK | A digital self-management intervention for adults with type 2 diabetes | Participatory design | Patients, HCPs | Interview, focus group | Testing | Sample, feasibility |
| 14 | Davis et al. | 2018 | Australia | An asthma s smartphone app for improving self-management, motivation and confidence in young people with asthma. | Patient-driven participatory design approach | Patients | Workshop, heuristic evaluation, observation | Designing, testing | Sample |
| 15 | de Souza et al. | 2017 | UK | A mobile application which provides relevant information for outpatient clinic attendees and data capture for clinicians | Co-design | Patients | Focus group, heuristic evaluation | Background, requirements, designing, testing, procedure | Social dynamic |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|--------------------------|------|-----------------|--|---|---|---|---|--|
| 16 | Duval et al. | 2018 | USA | A novel speech therapy game | Co-creation | HCPs | Interviews | Requirements, testing | Not reported |
| 17 | Dykes et al. | 2014 | USA | Web-based patient centred toolkit (PCTK) prototype to improve access to health information and to engage hospitalized patients and caregivers in the plan of care. | Iterative participatory design approach | Patients, relatives | Focus group, interview, not-protocolled meeting | Background, requirements, designing, testing, procedure | Sample |
| 18 | Easton et al. | 2019 | UK | Virtual agent to support individuals living with physical and mental comorbidities | Co-design and acceptability testing | Patients, informal care givers, HCPs | Workshop, usability test | Requirements, testing | Sample, social dynamic, topics |
| 19 | Elback et al. | 2018 | Denmark | e-Wall, a digital interactive gameified wall for movement | Collaboration / mixed methods approach | Patients, HCPs | Not-protocolled meeting, think-aloud | Background, requirements, testing | Method and analysis |
| 20 | Elsbernd et al. | 2018 | Denmark | Smartphone app for adolescents and young adults with cancer | Co-creation process | Patients | Workshop | Requirements | Sample, method and analysis |
| 21 | Ettinger et al. | 2016 | South Africa | ClinicalGuide, a mHealth app | User driven approach | HCPs, informal care givers, research experts, technical experts | Unsystematic meeting | Background, requirements, designing | Sample, method and analysis |
| 22 | Feldner et al. | 2019 | USA | Mobility device | Co-production | Patients, relatives | Photovoice | Background, requirements, designing, procedure | Sample, method and analysis, social dynamic, feasibility |
| 23 | Gardsten et al. | 2017 | Sweden | Information and communication technology (ICT) self-management service | Participatory design | Patients, HCPs, research experts | Focus group | Background | Sample |
| 24 | Goncu-Berk and Topcuoglu | 2017 | Turkey | a Smart Glove for Rheumatoid Arthritis | Iterative and multifaceted design process | Patients, HCPs | Interview, heuristic evaluation | Background, requirements, designing, testing | Not reported |
| 25 | Gordon et al. | 2016 | USA | eHealth solutions for women from vulnerable populations with perinatal depression | Participatory design group | Patients, HCPs, research experts, technical experts, managers | Workshop | Requirements, testing | Not reported |
| 26 | Grainger et al. | 2017 | New Zealand | RACONnect, a patient-held app for RA monitoring and communication with rheumatology care providers | Co-design | Patients, HCPs | Interview, heuristic evaluation | Background, requirements, designing | Not reported |
| 27 | Groussard et al. | 2018 | Canada | An assistive device, SAMI (Services Assistance Mobile and Intelligent), to improve the social participation of people with tuberculosis | Participatory design approach | Patients, HCPs | Interview, focus group, questionnaire | Background, requirements | Method and analysis, topics |
| 28 | Guedon et al. | 2015 | The Netherlands | Real-Time Location Systems in the Operating Room | Participatory approach | HCPs | Interview | Background, requirements, designing | Method and analysis |
| 29 | Hauffman et al. | 2017 | Sweden | Nurse-Led Internet-Based Learning and Self-care Program for Cancer Patients With Symptoms of Anxiety and Depression | Interdisciplinary multiprofessional working group | Patients, HCPs | Focus group | Background, requirements, testing | Sample |
| 30 | Ho et al. | 2015 | Canada | Metabolic diet app suite for inborn errors of amino acid metabolism | Collaboration | HCPs, citizens, advocacy group members, student HCPs | Workshop, think aloud, questionnaire | Procedure | Method and analysis |
| 31 | Hochstenbach et al. | 2017 | Netherlands | eHealth nursing intervention: self-management support for outpatients with cancer pain | Co-creative method | Patients, HCPs, research experts, technical experts | Interview, brainstorm, not-protocolled meeting, questionnaire | Background, requirements, testing | Method and analysis, feasibility, topics |
| 32 | Hodson et al. | 2019 | Canada | Mellow: a self- help holistic crisis planning mobile application by youth, for youth | Co-design | Patients, HCPs, policy makers | Interview, workshop | Background, requirements, designing, testing | Feasibility |
| 33 | Holm et al. | 2017 | Denmark | A clinical telehealth service for neonatal homecare | Collaboration | Patients, HCPs | Workshop | Background, requirements, procedure | Sample |
| 34 | Islind et al. | 2019 | Sweden | An information portal (front-end of the platform) for the patients to access information to feed their self-care process | Co-designing with boundary objects | Patients, HCPs, research experts | Workshop | Background, requirements, designing, testing, procedure | Not reported |
| 35 | Jaensson et al. | 2015 | Sweden | Recovery Assessments by Phone Points (RAPP): A Mobile Phone App for Postoperative Recovery Monitoring and Assessment | Interdisciplinary task force and needs and app evaluation | HCPs, research experts | Unsystematic meeting | Background, requirements, designing | Social dynamic, topics |
| 36 | Jamin et al. | 2017 | Netherlands | VENSTER, an interactive artwork for nursing home residents with dementia | Cocreation | Patients, informal care givers, HCPs, HC manager | Workshop, think-aloud | Requirements, testing | Sample, social dynamic |
| 37 | Joensson et al. | 2019 | Denmark | A cardiac telerehabilitation web portal, called the 'HeartPortal', for use among heart failure (HF) patients | Participatory design | Patients, HCPs | Workshop | Requirements, designing | Sample |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|------------------------|------|---|--|--|--|---|--|-------------------------------------|
| 38 | Kildea et al. | 2019 | Canada | A Person-Centered Patient Portal | Stakeholder co-design approach | HCPs, technical experts | Unsystematic meeting | Background, designing, testing, procedure | Sample, method and analysis |
| 39 | Kim et al. | 2015 | USA | iN Touch mobile self-management program for overweight/obesity | Participatory design approach | Patients | Interview, unsystematic meeting, questionnaire | Requirements | Sample |
| 40 | Lee et al. | 2017 | USA | A social robot for adults with depression | Participatory design | Patients, HCPs | Interview | Designing | Sampling, social dynamics |
| 41 | Leorin et al. | 2019 | Italy | eHealth technologies for people with dementia | Co-design | Research experts | Workshop | Designing | Sample, social dynamic |
| 42 | Lipson-Smith et al. | 2019 | Australia | Audio-recording mobile app for people with cancer: the Secondears App | Co-design and stakeholder engagement | Patients, HCPs, technical experts, legal experts, advocacy group members, managers | Not-protocolled meeting, workshop | Background, requirements, designing, testing | Sample |
| 43 | Marent et al. | 2018 | UK, Portugal, Belgium, Croatia | mHealth platform for HIV Care | Co-design process | Patients, HCPs | Workshop, interview | Background, requirements | Sample, method and analysis |
| 44 | Marent et al. | 2018 | UK | mHealth platform to support follow-up and self-management in HIV | Co-design | Patients, HCPs, technical experts | Interview, workshop | Requirements, testing, procedure | Not reported |
| 45 | Michalak et al. | 2019 | Canada | Web-based bipolar wellness centre | Community-based participatory research | Patients | Interview | Background, procedure | Sample |
| 46 | Nagele et al. | 2018 | Panama, Columbia, USA, Croatia, Denmark | Self-administered "Localized Morphine medicine" device | Participatory Design and Design Fiction | Patients, HCPs | Workshop, observation | Requirements, testing | Social dynamics |
| 47 | Newby et al. | 2019 | UK | Digital intervention to increase condom use amongst those selftesting for chlamydia (Wrapped) | Co-design methods | Patients, citizens, HCPs, research experts, technical experts, artists, advocacy group members | Not-protocolled meeting, workshop, think-aloud | Requirements, designing, testing | Not reported |
| 48 | Noergaard et al. | 2017 | Denmark | Web-based health care intervention for patients with heart disease | Participatory design study | Patients, HCPs | Workshop | Requirements, testing, procedure | Sample, social dynamic |
| 49 | O'Brien et al. | 2016 | UK | Web-based intervention for people in the retirement transition | Iterative co-design process | Citizens, HCPs, research experts | Workshop, not-protocolled meeting | Requirements, designing, testing | Sample, feasibility |
| 50 | Ogrin et al. | 2018 | Australia | A diabetes foot app | Co-design | Patients, relatives, technical experts | Workshop | Requirements, designing, testing | Sample, social dynamic, feasibility |
| 51 | Ortiz-Fernandez et al. | 2018 | Spain | "Decision Support and Self- Management System for StRoke SurvivoRs" (STARR) for self- management and reduction of recurrent strok | Participatory action research | Patients | Interview | Requirements, designing, procedure | Sample, feasibility |
| 52 | Ospina-Pinillos et al. | 2018 | Australia | Mental health eclinic to improve access to and quality of mental health care for young people | Participatory design methodologies | Patients, HCPs | Workshop, think-aloud | Background, requirements, designing, testing | Sample |
| 53 | Page | 2018 | USA | Cochlear implant (CI) systems | Co-design 'Speculative Co-design' approach | Patients, HCPs | Workshop | Requirements, designing, procedure | Not reported |
| 54 | Panek et al. | 2017 | Austria | A new type of ICT enhanced modular toilet system which shall be able to support autonomy, dignity and safety of older persons living at home | Participatory Design | Patients, HCPs, informal care givers | Interview, focus group | Requirements, designing | Not reported |
| 55 | Qin et al. | 2017 | China | An ICIS a critical care information system in a Chinese hospital | Participative design process | HCPs | Unsystematic meeting, heuristic evaluation | Background, requirements | Sample |
| 56 | Rasmussen et al. | 2015 | USA | The Applicator: an easy to operate pump-action lever providing consistently accurate dose delivery | Collaborative Approach | Patients, HCPs | Interview, workshop, photovoice | Background, requirements, testing, procedure | Not reported |
| 57 | Reaple et al. | 2019 | UK | Virtual world with young people to deliver social cognition therapy in early psychosis | Co-design | Citizens | Workshop | Requirements, designing, testing | Feasibility |
| 58 | Redwood et al | 2017 | UK | New universal assessment tool named "My Family Profile" for use within Northamptonshire, United Kingdom, from pregnancy until a child reaches 2/2.5 years of age | Co-design | Parents | Not-protocolled meeting, focus group, Interview, usability test | Background, requirements | Sample, method and analysis |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|-----------------------|------|---|---|--|---|--|--|---|
| 59 | Revenas et al. | 2015 | Sweden | Web-based and mobile app to support physical activity in individuals with rheumatoid arthritis | Participatory action research | Patients, HCPs, research experts, technical experts, advocacy group members | Workshop | Testing | Sample, method and analysis, social dynamic, topics |
| 60 | Stalberg et al. | 2016 | Sweden | “Inter-Active Communication Tool for Activities” [IACTA], is intended to facilitate young children’s participation in healthcare situations | Participatory design | Patients | Heuristic evaluation | Requirements, design | Method and analysis |
| 61 | Terp | 2018 | Denmark | Smartphone app in the everyday management of living with schizophrenia: | Participatory design thinking and methods | Patients | Interview | Testing | Sample, method and analysis |
| 62 | Toefy et al. | 2018 | South Africa | A mobile phone, audio messaging intervention | Participative qualitative methods | Patients, relatives, communication expert | Focus group, not-protocolled meeting, think-aloud, heuristic evaluation, questionnaire | Background, requirements, designing, testing | Not reported |
| 63 | Tongpeth et al. | 2018 | Thailand | Avatar-based education application for patients with acute coronary syndrome | Participatory action research | Patients, HCPs, research experts | Not-protocolled meeting | Requirements, testing | Sample, method and analysis, social dynamic |
| 64 | Torres et al. | 2019 | India, Sri Lanka, Egypt, UAE, Mexico, UK, USA | Affordable Smart Wheelchair (ASW) a system that is accessible and affordable to users across the globe | Participatory design | Patients, HCPs | Interview | Background, requirements | Sample |
| 65 | Vacha and Kandusova | 2018 | Czech Republic | Smart Home Care system | Participatory design and multi-stakeholder collaboration | Patients, HCPs, citizens, relatives, technical experts, politicians | Workshop, heuristic evaluation | Testing | Sample |
| 66 | Van der Velden et al. | 2016 | Norway | Transition app: a mobile application that would support young patients during their transition to adult health care and the Transition Game: a game to support young patients in transition | Participatory Design: SHARM Framework (Situation-based action, Having a say, Adaptability, Respect, Mutual Learning) | Patients | Workshop, diary writing | Background, requirements, designing, testing | Method and analysis |
| 67 | Verbiest et al. | 2019 | Australia | Behavior change mHealth intervention for indigenous and other priority communities | Co-design | Citizens, research experts | Not-protocolled meeting, focus group | Background, requirements, testing, procedure | Sample |
| 68 | Voorend et al. | 2019 | The Netherlands | A personalized mobile application to help people with fertility problems to manage their condition and encourages a healthy lifestyle in order to improve the outcomes of fertility treatment | Co-design | Patients | Interviews, forum | Background, requirements | Not reported |
| 69 | Ward et al. | 2015 | UK | Warm Neighbourhoods service to help people live at home | Co-creation methodologies | Patients, HCPs, informal care givers, relatives, industry representatives | Interview, workshop | Requirements, testing | Not reported |
| 70 | Waterman | 2018 | Canada | A web-based app that helps youth in crisis to develop their own support plans, access community-based services, and encourage self-reflection as alternative methods of crisis-management | Collaborative design | Patients, HCPs | Interview, workshop | Background, requirements, testing, procedure | Social dynamic, topics |
| 71 | Wentzel et al. | 2014 | The Netherlands | A concept for a nurse information application | The CeHRes Road map / Participatory Design | Patients, HCPs, research experts, pharmasists | Focus groups, heuristic evaluation, observation | Problem, requirements | Sample, method and analysis, topics |
| 72 | Winterling et al. | 2016 | Sweden | Self-help web-based intervention targeting young cancer patients with sexual problems and fertility distress | Co-creative participatory process | Patients | Not-protocolled meeting | Background, requirements, designing, procedure | Sample, method and analysis, social dynamic |
| 73 | Wolpin et al. | 2015 | USA | Web-based cancer symptom and quality-of-life support intervention | Participatory design with a user-centred focus | Patients, informal care givers | Focus group, think-aloud | Background, designing, testing, procedure | Sample, method and analysis |
| 74 | Woods | 2019 | Australia | A Consumer Mobile Health App for Heart Failure: Care4myHeart | Co-Design | Patients, HCPs, informal care givers, relatives | Interview, workshop | Requirements, design, testing | Sample, method and analysis |
| 75 | Zachary et al. | 2018 | USA | Social networking app to support type II diabetes self-management in low-income minority communities | Participatory design | Patients, HCPs, technical experts | Forum | Background, requirements | Not reported |

Abbreviations: USA = United States of America, UK = United Kingdom, HCPs = healthcare professionals, app = application

Table D2: Papers grouped in the involvement approach

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|---------------------------|------|----------------------------|---|--|---|--|--|--|
| 1 | Amirabdollahian et al. | 2014 | UK, the Netherlands, Italy | A hand/wrist rehabilitation device for home-based therapy after stroke | User-centred design methodology | Patients, HCPs, informal care givers | Interview, focus group, think-aloud, heuristic | Testing | Not reported |
| 2 | Anglada-Martinez et al. | 2017 | Spain | Medplan, a platform for patients/caregivers and healthcare professionals | User-centered design | Patients, HCPs | Not-protocolled meeting | Requirements, design, testing | Feasibility, topics |
| 3 | Argent et al. | 2018 | Ireland | A prototype wearable exercise biofeedback system for orthopaedic rehabilitation | User-centred design | HCPs | Interview, questionnaire | Requirements | Feasibility, topics |
| 4 | Arvidsson et al. | 2016 | Sweden | Interactive assessment and communication tool for children with cancer | User-experience design | Patients, citizens, Parents, HCPs | Usability test, observation, interview | Background, testing | Sample |
| 5 | Baek et al. | 2018 | Korea | An mHealth Tool for Self-Management and Care Engagement of Cardiovascular Disease Patients | User research and user experience investigations | Patients, HCPs | Interview, focus group, heuristic evaluation | Requirements | Method and analysis, topics |
| 6 | Ben-Zeev et al. | 2017 | USA | FOCUS, a mobile system that delivers daily assessments and interventions designed to support self-management of their illness | A staged approach | Patients, HCPs | Focus group, think-aloud | Not reported | Sample, method and analysis, feasibility, topics |
| 7 | Bendixen et al. | 2017 | USA | App for people with brain and spinal cord anomalies | User-centred approach | Patients | Focus group | Not mentioned | Not reported |
| 8 | Bevan Jones et al. | 2018 | Wales | Web-based psychoeducational intervention for adolescent depression | Person-based or person centred approach | Patients, parents, informal care givers | Interview, focus group, workshop, not-protocolled meeting, | Requirements | Not reported |
| 9 | Birmie et al. | 2019 | Canada | Smartphone-based app for self-management of postoperative pain in children and adolescents | User-centred design | Patients, HCPs, research experts | Interview, focus group, delphi study, workshop | Background, requirements, designing, testing | Topics |
| 10 | Birmie et al. | 2018 | Canada | Achy Penguin, a parent-developed iOS app to help assess and manage acute pain in young children | User-centered design approach | Patients | Heuristic evaluation | Requirements, testing | Sample, social dynamics, topics |
| 11 | Blijleven et al. | 2019 | The Netherlands | A conceptual framework, SEWA, to address challenges of studying workarounds emerging from Electronic Health Record (EHR) system usage | Iterative process | HCPs, technical experts | Heuristic evaluation, questionnaire | Background, requirements, testing | Sample, method and analysis, feasibility |
| 12 | Borosund et al. | 2018 | Norway | Stress management app intervention for cancer survivors | User-centred design and service design methods | Patients, HCPs, technical experts | Interview, usability test | Background, requirements, testing | Sample, topics |
| 13 | Brox et al. | 2017 | Norway | Kinect exergame for seniors | User-centred design | Patients | Questionnaire, observation, interview, not-protocolled meeting, usability test | Requirements, designing, testing, procedure | Social dynamic |
| 14 | Buitenweg | 2019 | The Netherlands | An innovative, visual, and personalized QoL assessment app for people with severe mental health problems: the QoL-ME | User-centred design | Patients | Focus group | Problem, requirements, testing | Sample, feasibility |
| 15 | Cai et al. | 2017 | UK | Smartphone app system to improve self-management in young people with juvenile idiopathic arthritis | User-centred design | Patients, parents, HCPs | Focus group, interview | Requirements, designing, testing | Method and analysis |
| 16 | Calvillo-Arbizo et al. | 2019 | Spain | e-Health system for renal patients at home (AppNephro) | User-centred design approach | Patients, informal care givers, HCPs | Interview, questionnaire | Requirements, testing | Not reported |
| 17 | Connelly et al. | 2016 | USA | Ecological momentary assessment mobile app for a low-literacy, Mexican American population to collect disordered eating behaviors | User-centred, iterative design process | Patients, citizens | Focus group, interview | Background | Sample |
| 18 | Coons et al. | 2019 | USA | Medivate, a mobile app to collect medication list | Iterative, user-centred design process | Patients, HCPs | Interview, questionnaire, not-protocolled meeting | Background, testing | Not reported |
| 19 | Crehan et al. | 2019 | Malawi | NeoTree application: developing an integrated mHealth solution to improve quality of newborn care and survival | Iterative, user-centric development | HCPs, Student HCPs | Focus group, workshop, questionnaire | Testing | Not reported |
| 20 | Cristancho-Lacroix et al. | 2019 | France | A fully automated Web-based program for caregivers of PWAD (people with alzheimers disease) | User-centred design | Patients, HCPs, technical experts | Interview, workshop, heuristic evaluation | Requirements, testing | Sample, method and analysis, feasibility |
| 21 | Curtis et al. | 2015 | UK | Healthy eating app | User-centred design | HCPs, citizens | Not-protocolled meeting | Designing | |
| 22 | Danbjorg et al. | 2018 | Denmark | An Exercise App in the Care for People With Osteoarthritis | User-driven exploratory study | Patients | Focus group, heuristic evaluation, observation | Requirements, testing | Sample |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|--------------------|------|---|---|---|--|---|--|---|
| 23 | De La Vega et al. | 2014 | Spain | Painometer, a Smartphone app that helps users to assess pain intensity | Two iterative cycles | HCPs, citizens | Interview | Background, requirements, designing | Sample |
| 24 | Dimeff et al. | 2018 | USA | Avatar in EDs to perform a CAMS suicide risk assessment with suicidal ED patients, to teach behavioral skills for reducing imminent distress, and to generate hope by hearing personal stories from persons with lived experience | Iterative user-centred design | Patients, HCPs | Interview, usability test | Background, requirements, testing | Sample |
| 25 | Dirin et al. | 2015 | Finland | A Context-Aware Nurse Assistant (CANA) | User-centred design | HCPs | Interview, think-aloud, questionnaire | Requirements, designing, testing | Not reported |
| 26 | Dorrington | 2016 | UK | Assistive Switch Devices for electromyography standalone switch users who have complex disabilities | User-centred design | Patients | Interview | Background, designing, testing | Method and analysis, feasibility |
| 27 | Dowd et al. | 2018 | Canada | Self-regulatory app to effectively manage celiac disease | Participatory approach/user-centred design | Patients, HCPs | Focus group, questionnaire | Background, requirements, testing | Feasibility |
| 28 | Edmonds et al. | 2019 | USA | A decision support tool for expectant parents facing threatened periviable delivery | User-centred design | Patients, relatives | Not-protocolled meeting | Designing | Sample |
| 29 | Feron et al. | 2016 | Australia | eTool for gout management | User-centred design | Patients | Focus group | Background, testing | Sample |
| 30 | Fledderus et al. | 2015 | Netherlands | Online relapse-prevention program based on acceptance and commitment therapy for chronic pain patients | User-centred design | Patients, technical experts | Focus group, interview, think-aloud | Requirements, testing | Sample |
| 31 | Fortuna et al. | 2017 | USA | Psychosocial intervention for smartphone delivery to middle-aged and older adults with serious mental illness | User-centred design | Patients, HCPs, technical experts | Not-protocolled meeting, usability test | Designing, testing | Sample, method and analysis, feasibility |
| 32 | Gabrielli et al. | 2017 | Italy | Mobile app for nutrition education (TreC-LifeStyle)and formative evaluation with families of overweight children | User-centred design | Parents, HCPs, research experts | Not-protocolled meeting, interview | Background, requirements, designing | Sample |
| 33 | Garzo et al. | 2018 | France | Gait training system for Parkinson's disease | User-centred design | Patients, citizens, technical experts, consultants | Interview, observation, workshop, think-aloud | Background, requirements, designing, testing | Feasibility, topics |
| 34 | Geraghty et al. | 2016 | UK, United States, Spain, China and India | Internet-delivered intervention for emotional distress in primary care patients | Person-based approach | Patients | Interview, think-aloud | Background, testing | Sample |
| 35 | Ghysels et al. | 2017 | Belgium | A digital tool 'H-OPP' was developed to make the tool easier, more applicable and practical for use | Client-centred approach | Research experts | Not-protocolled meeting, questionnaire, observation | Requirements, designing, testing, procedure | Sample |
| 36 | Gill et al. | 2019 | Canada (British Columbia) | Mobile technology intervention to support postabortion care | User-centred design | Patients | Interview | Testing | Sample, feasibility |
| 37 | Giordanengo et al. | 2018 | Norway | Prototype for extracting relevant information and documenting information gaps from self-collected health data by patients with type 1 diabetes | User-centred design | Patients, HCPs | Workshop | Requirements, procedure | Sample |
| 38 | Gracey et al. | 2018 | USA | myEczema, a smartphone application for patient-reported outcomes in atopic dermatitis | User-centred design | Patients, HCPs, informal care givers, technical experts | Interview, focus group | Background, requirements | Not reported |
| 39 | Gray et al. | 2016 | Canada | Electronic Patient-Reported Outcomes Tool | User-centred design | Patients, HCPs, informal care givers, research experts, technical experts, content experts | Interview, focus group | Requirements, testing | Sample, method and analysis, social dynamics, feasibility, topics |
| 40 | Han et al. | 2018 | South Korea | DrugTEAM" (Drug Therapy Evaluation And Management), a Patient-oriented, Collaborative, Advanced, Renovated, and Excellent (P-CARE) service | Focus group discussions, interviews, observations | Patients, HCPs | Interview, focus group, questionnaire | Requirements, testing | Sample |
| 41 | Hanschke et al. | 2017 | UK | A social machine (echnology-enabled social systems) for the Heart Manual service | User-centred design | HCPs | Interview, workshop, think-aloud, brainstorm | Testing | Sample, method and analysis, feasibility |
| 42 | Hardy et al. | 2018 | UK | SlowMo, is an innovative blended digital therapy for people who fear harm from others | User-centred design | Patients, HCPs | Interview, observation | Background, requirements, procedure | Not reported |
| 43 | Harricharan et al. | 2015 | UK | myPace for weight management | Systematic, iterative stages of engagement | Patients, HCPs | Heuristic evaluation | Background, testing | Not reported |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|-------------------|------|---|---|--|---|---|--|------------------------------|
| 44 | Harte et al. | 2017 | Ireland | Mobile phone app in an integrated falls risk detection system for use by older adult users | Human-centred design | Patients, research experts, technical experts | Not-protocolled meeting, usability test, think-aloud, interview, questionnaire, | Background, testing | Sample, method and analysis |
| 45 | Haynes et al. | 2016 | USA | A mobile platform for care coordination for complex, chronic heart disease | User-centred design | Patients, HCPs, informal care givers | Interview, questionnaire | Background, testing | Not reported |
| 46 | Haynes et al. | 2017 | USA | A mobile platform for care coordination for complex, chronic heart Disease | User-centred design | Patients, HCPs | Think-aloud, heuristic evaluation | Requirements | Sample, social dynamic |
| 47 | Heynsbergh et al. | 2019 | Australia | Smartphone app for informal carers of people with cancer: processes and learnings | User-centred design / co-design process | Relatives, informal care givers | Interview, focus group, usability test | Background, testing | Sample |
| 48 | Holtz et al. | 2017 | USA | mHealth app: a tool for adolescents with type 1 diabetes and their parents | Patient-centred research methods | Patients, parents, informal care givers, HCPs, research experts, advocacy group members | Focus group | Background, testing | Not reported |
| 49 | Honary et al. | 2018 | UK | Web-based intervention for relatives of people experiencing psychosis or bipolar disorder | User-centred approach and heuristic evaluation | Relatives, informal care givers | Workshop, think-aloud, not-protocolled meeting | Background, requirements, designing, testing | Sample |
| 50 | Howarth et al. | 2019 | UK, United States, Spain, China and India | e-Health intervention for the workplace developed | Person-based approach | Citizens | Focus group, interview, think-aloud, workshop | Background, requirements, designing | Not reported |
| 51 | Hu et al. | 2019 | Canada | Mobile phone app for the self-management of pediatric concussion | User-centred design approach and agile development methods | Patients, HCPs | Interview, think-aloud | Testing | Sample |
| 52 | Huberty et al. | 2016 | USA | Text4baby is a free, mobile health information service for pregnant and post-partum women | User-centred and an iterative design process | Patients, HCPs | Interview | Background, testing | Sample |
| 53 | Jalil et al. | 2019 | Australia | Telehealth in-home monitoring device to manage type 2 diabetes mellitus from home | Clinical user-experience evaluation from a human computer interaction perspective | Patients | Interview, think-aloud | Background, testing | Not reported |
| 54 | Jibb et al. | 2017 | Canada | A mHealth Real-Time Pain Self-Management App for Adolescents With Cancer | User-centered design approach, iterative cycles of usability testing and interviews | Patients | Think-aloud, heuristic evaluation | Requirements, design, testing | Sample, method and analysis, |
| 55 | Jie et al. | 2019 | The Netherlands | “Stappy”, a sensorfeedback system to facilitate walking in people after stroke | User-centred approach | Patients | Usability test | Testing | Sample |
| 56 | Joshi et al. | 2019 | USA | A diet app that would assist in management of patients with metabolic syndrome | Human centered approach | HCPs | Interview | Background | Not reported |
| 57 | Kip et al. | 2019 | The Netherlands | A VR application for treatment in forensic mental healthcare | CeHRes Roadmap | Patients, HCPs, technical experts, managers | Interview | Background, requirements, testing | Sample, feasibility, topic |
| 58 | Lau et al. | 2018 | Singapore | Healthy lifestyle mobile app for overweight pregnant women | User-centred approach | Patients | Interview | Background, requirements, testing | Sample, feasibility |
| 59 | Madrigal-Cadavid | 2019 | Colombia | Mobile app of drug information for people with visual impairment | User-centred design | Patients | Interview | Requirements | Not reported |
| 60 | Maher et al. | 2015 | USA | The BMT Roadmap, a portable, tablet-based platform | User-centred design | Patients, informal care givers | Workshop, questionnaire | Requirements, testing | Sample, social |
| 61 | Marien et al. | 2019 | Belgium | Web-based medication reconciliation application integrated in an eHealth network | User-centred study | HCPs | Interview, focus group, observation | Testing | Sample, feasibility |
| 62 | Martinez et al. | 2016 | Costa Rica | A software platform for the support of personalized cancer treatment | User-centred design | Patients, HCPs, technical experts, research experts | Not-protocolled meeting | Requirements, designing | Feasibility |
| 63 | Mateo et al. | 2018 | USA | Technology-assisted intervention designed to provide primary care-based 5As counseling within patient-centred medical homes | User-centred design | Patients, HCPs | Focus group, interview, think-aloud | Requirements, designing, testing | Sample |
| 64 | Mawson et al. | 2014 | UK, United States, Spain, China and India | Personalised self-managed rehabilitation system (PSMrS) | Hybrid of health and social sciences research methods and user-centred design methods and realist evaluation | Patients, relatives, informal care givers, HCPs | Focus group, think-aloud, workshop, interview | Background, requirements, testing | Not reported |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|--------------------|------|----------------------|--|--|---|---|--|--|
| 65 | McGrath et al. | 2017 | USA | Concussion assessment mHealth app for certified Athletic Trainers | CeHRes Roadmap | Citizens | Focus group, delphi study | Requirements, designing, testing | Feasibility |
| 66 | Milward et al. | 2016 | UK | App to reduce harmful drinking in young adults | User-centred design | Patients | Focus group | Requirements, testing | Sample, topics |
| 67 | Mortenson et al. | 2019 | Canada | Self-management app for people with spinal cord injury | User-centred design | Patients, relatives, HCPs | Focus group, interview, questionnaire | Requirements, designing, testing | Method and analysis, feasibility |
| 68 | Neubeck et al. | 2015 | Australia | e-Health tool for people with, or at high risk of, cardiovascular disease | Iterative process incorporating user-centred design | Patients | Focus group, usability test | Background, designing, testing | Sample |
| 69 | Nkoy et al. | 2019 | USA | Home monitoring system for children with medical complexity | User-centred design | Informal care givers | Focus group | Background, requirements | Sample, method and analysis |
| 70 | Olney et al. | 2019 | USA | Comprehensive mobile assessment of pressure (CMAP) system for pressure injury prevention for veterans with spinal cord injury | Experience based design | Patients | Focus group, interview | Requirements, testing | Sample |
| 71 | Oulton et al. | 2018 | UK | Informative game for preparing children for blood tests | User-experience design | Patients | Workshop, sketching | Requirements | Sample, social dynamics, feasibility, topics |
| 72 | Paay et al. | 2018 | Denmark | Interactive technologies supporting young adults in managing low self-esteem | User-centred study | Patients | Interview, focus group, workshop | Testing | Social dynamics, topics |
| 73 | Paulino et al. | 2019 | Portugal | An integrative system for Exergaming targeting the senior population | Human-centred design | HCPs | Interview, questionnaire | Testing | Method and analysis, topics |
| 74 | Pazart et al. | 2017 | France | A new medical device, the VEDIAS system, Device to Assist Manual Ventilation | User-centred design | HCPs | Heuristic evaluation | Background, testing | Method and analysis, topics |
| 75 | Prince et al. | 2019 | Canada | Web-based tool to support management of chemotherapy-related toxicities in cancer patients | User-centred participatory design methodology | Patients, informal care givers, HCPs | Interview, focus group, observation | Background, requirements, procedure | Sample, method and analysis |
| 76 | Rogers et al. | 2019 | USA | Composer, a visual analysis tool for orthopedic surgeons to compare changes in physical functions of a patient cohort following various spinal procedure | User-centred design | HCPs, Student HCPs, technical experts | Not-protocolled meeting | Requirements | Not reported |
| 77 | Rothangel et al. | 2017 | Netherlands, Germany | Telerehabilitation platform for patients with phantom limb pain | Iterative user-centred design | Patients, HCPs, Student HCPs, technical experts | Questionnaire, interview, not-protocolled meeting, usability test | Requirements, testing | Sample, topics |
| 78 | Runaas et al. | 2017 | USA | "BMT Roadmap" is a web-based application that integrates patient-specific information | User-centred design / patient-centred design | Informal care givers | Interview, observation | Background, requirements, testing | Sample |
| 79 | Schnall et al. | 2016 | USA | A mHealth app for persons living with HIV | User-centred design | Patients, technical experts | Heuristic evaluation | Background, requirements, designing, testing | Not reported |
| 80 | Schneider et al. | 2016 | USA | Mobile app to aid disease self-management | Patient-centred design/user-centred design | Patients | Interview | Testing | Not reported |
| 81 | Schwartz et al. | 2019 | USA | A Tailored mHealth Intervention for Adolescent and Young Adult Survivors of Childhood Cancer | Agile development | Patients, HCPs, citizens, technical experts | Focus group, not-protocolled meeting | Requirements | Sample, method and analysis |
| 82 | Sedlmayr et al. | 2019 | Germany | Mobile interface concept to support the management of medication information | Human-centred design process for interactive systems | Patients, research experts, technical experts | Interview, observation, usability test, think-aloud, interview | Background, requirements, testing | Topics |
| 83 | Sewitch et al. | 2019 | Canada | A Smartphone App That Supports Colonoscopy Preparation | User-centred approach | Patients | Focus group, observation | Testing | Sample |
| 84 | Schellmer et al. | 2017 | USA | Teen Pocket PATH, a mobile health application to improve medication adherence in adolescent solid organ recipients | User-centred design | Patients, informal care givers | Heuristic evaluation | Testing | Sample, social dynamic, feasibility |
| 85 | Sivan et al. | 2016 | UK | Home-based Computer Assisted Arm Rehabilitation (hCAAR), a home-based robotic device | User-centred design | Patients, HCPs | Interview | Testing | Sample, method and analysis, topic |
| 86 | Smaradottir et al. | 2015 | Norway | Information system for a Norwegian telemedicine service | User-centred design | Patients, HCPs, technical experts, advocacy group members | Interview, think-aloud, workshop | Requirements, testing | Not reported |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|---|-------------------|------|---------------|--|---|---|--|-------------------------------------|--|
| 87 | Sobrinho et al. | 2018 | Brazil | Mobile application to assist the self-monitoring of the chronic kidney disease | User-centred design | Patients, HCPs | Interview | Requirements, designing, testing | Not reported |
| 88 | Srinivas et al. | 2017 | USA/Singapore | Consumer health IT application for geriatric heart failure selfcare | User-centred design | Patients, relatives, informal care givers | Interview, think-aloud | Background, testing | Not reported |
| 89 | Tamblyn | 2017 | Canada | Computer-assisted tool with automated electronic integration of population-based community drug data: the RightRx project | User-centred design and agile development processes | HCPs | Workshop | Requirements | Not reported |
| 90 | Thirumalai et al. | 2018 | USA | Telerehabilitation mHealth app | User (participant)-centred design | Patients | Focus group, think-aloud | Requirements, testing | Sample, topics |
| 91 | Timmerman et al. | 2016 | Netherlands | ICT-supported cancer rehabilitation application for resected lung cancer survivors | User-centred approach | Patients, HCPs | Interview, focus group, not-protocolled meeting, | Requirements, testing | Sample, topics |
| 92 | Tonkin et al. | 2017 | Australia | Smartphone app to reduce sugar-sweetened beverage consumption among young adults in Australian remote indigenous communities | Consultative user-centred approach | Citizens | Interview, think-aloud, questionnaire, workshop | Background, requirements, designing | Sample, method and analysis, feasibility |
| 93 | Wachtler et al. | 2018 | Australia | Mobile clinical prediction tool to estimate future depression severity and guide treatment in primary care | User-centred design | Patients | Interview, focus group | Requirements, testing | Sample |
| 94 | Wilcox et al. | 2016 | USA | myNYP Inpatient a custom personal health record application | User-centred approach | Patients, HCPs | Interview | Requirements, testing | Sample |
| 95 | Willard et al. | 2018 | Netherlands | Online community care platform for frail older adults in the Netherlands | User-centred design | Patients | Interview, observation | Background, requirements, testing | Not reported |
| 96 | Williamson et al. | 2014 | USA | A Mobile/Web App for Long Distance Caregivers of Older Adults | User-centred design | Patients | Interview, think-aloud | Testing | Sample, social dynamic, topics |
| 97 | Wozney et al. | 2015 | Canada | Breathe - An Internet-based, CBT treatment program for anxious adolescents with mild to moderate distress and impairment | Lean user experience design | Patients, HCPs | Interview, heuristic evaluation | Background, requirements, designing | Sample |
| 98 | Yoo et al. | 2015 | South Korea | The Smart Bedside Station (SBS) is a screen that is installed on the bedside for the personal use and provides a variety of convenient services for the patients | User experience design | Patients, HCPs, research experts | Interview, workshop | Background, requirements, testing | Sample |
| Abbreviations: USA = United States of America, UK = United Kingdom, HCPs = healthcare professionals, app = application | | | | | | | | | |

Table D3: Papers grouped in the consultation approach

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|--------------------|------|--------------|--|---|---------------------|-------------------------|----------------------------------|--|
| 1 | Abrams et al. | 2018 | USA | he Bridge Mobile Application (App) for Burn Patients | Qualitative inquiry: three focus groups | Patients, HCPs | Focus group | Background, requirements | Sample |
| 2 | Acharya and Sarraf | 2017 | USA | A novel Android application (Pro-Care) that provides a real-time, multi-way communication between patients and providers | Practical evaluation | Patients, relatives | Not-protocolled meeting | Requirements, testing | Not reported |
| 3 | Ahmadi et al. | 2015 | Iran | A Software for Teaching Health Related Topics to Deaf Students | Descriptive study using interviews | Hygiene instructors | Interview | Problem, requirements, procedure | Feasibility, topics |
| 4 | Ahmed et al. | 2015 | Malawi | The Knowledge for Health (K4Health) Project | A needs assessment | Patients, HCPs | Interview, focus group | Testing | Method and analysis, social dynamic, feasibility, topics |
| 5 | Aliabadi et al. | 2016 | USA | An HIV Prevention Smartphone Application for High-Risk MSM | Focus group sessions | Patients | Focus group | Background, requirements | Sample, method and analysis, feasibility, topic |
| 6 | Alnasser et al. | 2015 | Saudi Arabia | Weight loss application | Focus group | Patients | Focus group | Background | Not reported |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|---------------------------|------|-------------|---|---|--|--|--|--|
| 7 | Alnosayan et al. | 2017 | USA | mHealth system that could effectively support heart failure | Design science research | Patients, HCPs, technical experts | Interview, observation, focus group, questionnaire | Requirements, testing | Sample, method and analysis |
| 8 | Angula and Dlodlo | 2016 | Nambia | A Mobile Application for Health Information Dissemination | Qualitative approach | HCPs, citizens | Interview, questionnaire | Background, requirements | Not reported |
| 9 | Anshari et al. | 2015 | Brunei | Clinic 2.0 - facilitate interactions between healthcare providers and customers | Mixed methods, qualitative | Patients, HCPs | Interview, questionnaire | Background, requirements, designing, procedure | Not reported |
| 10 | Armin et al. | 2017 | USA | The See Me Smoke-Free™ (SMSF) mobile health application | Focus groups | Patients | Focus group | Requirements | Sample, topics |
| 11 | Athilingam et al. | 2018 | USA | An Interactive Mobile Health Application to Improve Self-care in Heart Failure (HeartMapp) | Intervention Mapping Approach / Needs assessment | Patients, HCPs | Interviews | Background, requirements | Not reported |
| 12 | Baier et al. | 2015 | USA | Web-based customizable report platform | Multiphased approach | Patients, relatives, HCPs | Interview, focus group | Background, requirements, testing | Sample |
| 13 | Biedinger-Friedman et al. | 2016 | USA | Smartphone app designed to improve health behaviors among participants in the special supplemental nutrition program for women, infants, and children | Focus group | Patients | Focus group | Background | Sample, method and analysis |
| 14 | Bishop et al. | 2016 | UK | A new evidence-based website about acupuncture for back pain | Qualitative “think aloud” audio-recorded interviews | Patients | Think-aloud | Background, requirements, testing | Sample, topics |
| 15 | Bobin et al. | 2018 | France | A self-contained smart cup that can be used to perform exercises that are similar to everyday tasks such as drinking | Semi-structured interviews | Patients, HCPs, technical experts | Interview | Background, requirements, testing, procedure | Method and analysis |
| 16 | Casida et al. | 2018 | USA | A mobile phone application (VAD Care App) to organize and simplify the left-ventricular assist device self-management process | Interviews | Patients, HCPs | Interview | Background, requirements, testing | Sample, method and analysis |
| 17 | Compagna and Kohlbacher | 2015 | Germany | Service robots in care facilities for older people | Scenario-based design (SBD) method - interviews and focus groups | Patients, HCPs, managers | Interview, focus group | Background, requirements, procedure | Sample, method and analysis, social dynamic |
| 18 | Deighan et al. | 2017 | UK | Digital version of the heart manual: cardiac rehabilitation programme | Mixed method design | Patients, HCPs, research experts, technical experts | Interview, not-protocolled meeting, questionnaire | Testing | Not reported |
| 19 | Den Bakker et al. | 2019 | Netherlands | Electronic health program to empower patients in returning to normal activities after general surgical and gynecological procedures | Intervention mapping framework | Patients | Focus group, questionnaire | Requirements | Sample |
| 20 | Doarn et al. | 2019 | USA | iPad app for smoking cessation counseling and shared decision making in primary care | Conceptual framework grounded in system development methodology and behavioral theories | Patients, HCPs, research experts, advocacy group members | Focus group, interview | Requirements | Not reported |
| 21 | Domanska et al. | 2017 | UK | Certolizumab pegol electromechanical selfinjection device | Human factors studies | Patients, citizens, informal care givers, HCPs | Interview | Designing, testing | Method and analysis |
| 22 | Dworkin et al. | 2018 | USA | Realistic talking human embodied agent mobile phone intervention to promote HIV medication adherence and retention in care in young HIV-positive African American men who have sex with men | Focus group | Citizens | Focus group | Requirements | Sample |
| 23 | Edwards et al. | 2018 | UK | Cigbreak smoking cessation mobile phone game | Agile development | Patients | Focus group | Background, requirements, testing | Method and analysis, social dynamic, feasibility |
| 24 | Ehrler et al. | 2019 | Switzerland | Mobile phone app for bedside nursing care | Software development life cycle model | HCPs | Focus group, usability test | Background, requirements, testing | Sample |
| 25 | Escalada-Hern et al. | 2019 | Spain | Prototype of augmented reality applied to medical devices | Rapid application development methodology | HCPs | Focus group, questionnaire, think-aloud | Requirements, testing | Not reported |
| 26 | Fager et al. | 2017 | USA | Sensor access system for environmental control for people with disabilities | Focus group | Patients, HCPs | Focus group | Testing | Not reported |
| 27 | Gilbert et al. | 2016 | Canada | Internet-based testing program for sexually transmitted and blood-borne infections | Holistic approach developing ehealth technologies | Patients, citizens | Focus group, interview, questionnaire | Requirements, testing | Feasibility |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|---------------------------|------|-----------|---|---|----------------------------------|---|--|---|
| 28 | Ginsburg et al. | 2016 | Ghana | Mpneumonia, an innovative mHealth application for diagnosing and treating childhood pneumonia | Field usability testing | HCPs | Think-aloud | Testing | Not reported |
| 29 | Gogovor et al. | 2016 | Canada | Internet-based chronic pain self-management program | Focus group | Patients, HCPs | Focus group | Background, requirements | Sample |
| 30 | Goodwin et al. | 2016 | Ireland | Mental health smartphone app | Qualitative descriptive design | Patients | Interview | Requirements | Sample, social dynamic |
| 31 | Gordon et al. | 2017 | USA | mHealth app to increase tobacco cessation medication adherence | Focus groups (think aloud) | Patients | Focus group | Designing, testing | Sample |
| 32 | Grasaas et al. | 2019 | Norway | Self-management app for adolescents with persistent pain in Norway | Usability test in laboratory setting and field usability test | Patients | Usability test, think-aloud, interview | Testing | Sample, method and analysis, feasibility |
| 33 | Gray et al. | 2019 | UK | Electronic personal assessment questionnaire for menstrual, pelvic pain and gynaecological hormonal disorders | Interviews and panel review | Patients | Interview, | Background, requirements, testing | Sample |
| 34 | Grindell et al. | 2018 | UK | Online programme to promote walking | Pragmatic, iterative process of qualitative data collection and analysis with distinct phases and differing user groups | Patients, teachers | Focus group, interview | Testing | Sample, method and analysis |
| 35 | Hardinge et al. | 2015 | UK | An internet-linked tablet computer based mobile health (mHealth) system in improving quality of life in patients with moderate to severe COPD | Participant informant group | Patients, HCPs | Focus group, workshop | Background, requirements, designing, testing | Not reported |
| 36 | Hasin et al. | 2014 | USA | HealthCall for the smartphone: intervention in HIV alcohol dependent patients | Focus group and multidisciplinary team | Patients | Interview | Background, requirements | Sample, topic |
| 37 | Hill et al. | 2016 | Australia | eSALT, an asynchronous telerehabilitation platform for speech-language pathology | Mixed methods | Patients, HCPs | Heuristic evaluation | Testing | Sample |
| 38 | Hohenstein et al. | 2017 | USA | Optical reader system to support point-of-care rapid diagnostic testing | Iterative design methodology | Citizens | Interview, think-aloud | Testing | Sample, social dynamic, feasibility, topics |
| 39 | Houze de l'Aulnoit et al. | 2018 | France | A Smart Mobile Data Module for Fetal Monitoring in E-Healthcare | Interviews | Patients, HCPs | Interview | Background, requirements | Not reported |
| 40 | Hsieh et al. | 2018 | USA | A Fall Risk mHealth App for Older Adults | Iterative design-evaluation process of semistructured interviews | Citizens | Interview | Requirements, designing, testing | Sample, method |
| 41 | Joe et al. | 2017 | USA | IT-based wellness tools for older adults | 6-8-5 design method | Patients | Focus group | Requirements, designing | Sample, method and analysis, topics |
| 42 | Kabeza et al. | 2019 | Rwanda | Diabetes self-management smartphone application (Kir'App) | Qualitative study design | Patients | Interview | Requirements | Sample, method and analysis, topics |
| 43 | Kim et al. | 2015 | USA | Tablet Device App for Parkinson's Disease Patients' Continuous Self-Monitoring and Management | Interviews | Patients, HCPs | Interview | Requirements | Not reported |
| 44 | Knight-Agarwal et al. | 2015 | Australia | Eating4two mobile phone app to monitor gestational weight gain | Qualitative investigation supported by an evidence-based approach | Patients, HCPs, research experts | Focus group, interview, not-protocolled meeting | Background, requirements, testing | Sample, method and analysis |
| 45 | Kohlstadt et al. | 2015 | USA | Online, peer leader component to an existing in-person preventive nutrition intervention called NutriBee | Focus group | Patients, parents, HCPs | Focus group | Requirements | Not reported |
| 46 | Krishnamurti et al. | 2017 | USA | MyHealthyPregnancy App: a behavioral decision research-based tool for assessing and communicating pregnancy risk | Interview | Patients, HCPs, research experts | Interview | Background, testing | Sample |
| 47 | Kristiansen et al. | 2017 | Denmark | An educational website for patients with heart failure | A two-step qualitative study | Patients | Focus group, workshop, diary writing | Requirements, designing | Sample |
| 48 | Lui et al. | 2017 | China | "Information Assistant": A Smartphone Application to Meet the Personalized Information Needs of Women with Breast Cancer | Interviews, experts group discussion, and e-Delphi studies | Patients | Interview, focus group, delphi study | Requirements | Sample, method and analysis |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|---------------------------|------|-------------------|--|---|---|---|--------------------------|---|
| 49 | Lwin et al. | 2016 | Singapore | Social media mhealth solution to address the needs of dengue prevention and management in Sri Lanka | Interview | Inspectors | Interview | Background, requirements | Not reported |
| 50 | Marsac et al. | 2015 | USA and Australia | Innovative, preventive web-based game for children exposed to acute trauma | Interview | Patients, parents | Interview | Testing | Sample, method and analysis, topics |
| 51 | Martinez et al. | 2018 | USA | Patient-facing diabetes dashboard embedded in a patient web portal | Interview and meeting | Patients, HCPs, research experts | Not-protocolled meeting, questionnaire | Requirements, testing | Sample, method and analysis, social dynamic |
| 52 | Materia | 2018 | USA | Smartphone intervention for women with overweight and obesity | Interview and focus group | Patients | Focus group, interview | Background, requirements | Sample, method and analysis |
| 53 | Mattie et al. | 2019 | Canada | Kneeling wheelchair with "on the fly" adjustable seating functions | Open ended questions in questionnaire | Patients | Questionnaire | Testing | Sample, method and analysis, feasibility |
| 54 | McClelland and Fitzgerald | 2018 | UK | A mobile app for mental health service users and clinicians | Qualitative design using four focus groups | Patients, HCPs | Focus group | Requirements, designing | Sample, feasibility |
| 55 | McDonald et al. | 2017 | UK | A Web-Based Diary Tool for Self-Monitoring Symptoms in Glaucoma | Prospective mixed-method feasibility study | Patients | Diary writing | Testing | Sample |
| 56 | Middelweerd | 2018 | Netherlands | App-based Intervention to promote physical activity among young adults | Pilot testing | Citizens | Usability test | Testing | Not reported |
| 57 | Milward et al. | 2017 | UK | The app "BRANCH" targets harmful drinking in young adults (18-30 year olds) | Usability Testing / Focus groups | Citizens | Focus group | Testing | Sample, social dynamic |
| 58 | Mohamad Marzuki et al. | 2019 | Malaysia | Usable mobile app for community education on colorectal cancer | Nominal group technique | HCPs | Nominal group technique | Requirements | Not reported |
| 59 | Morrison et al. | 2019 | Malaysia | A mobile application is being developed to help reduce stress and uncertainty for families who have a child newly diagnosed with cancer | A 2-phase qualitative study using the design thinking approach of product ethnography | Patients | Interview | Background, requirements | Sample, topics |
| 60 | Nguyen et al. | 2018 | Australia | mHealth app patient testing and review of educational materials designed for self-management of gout patients | Interview and focus group | Patients | Focus group, interview | Testing | Sample, feasibility, topics |
| 61 | Ning et al. | 2019 | China | Parenting app to prevent unintentional injury in newborn babies and toddlers | 2-step sequential mixed-method study | Relatives, teachers | Focus group | Background, requirements | Sample, social dynamic |
| 62 | Nitsch et al. | 2016 | Austria | Guided online and mobile self-help program for individuals with eating disorders | Iterative usability study design approach | Patients | Interview, think-aloud | Testing | Method and analysis, social dynamic, topics |
| 63 | O'Reilly et al. | 2018 | Australia | Smartphone app design for diabetes prevention in women with previous gestational diabetes | Focus group | Patients | Focus group | Testing | Social dynamic |
| 64 | Ogden et al. | 2019 | UK | App (Ladle)for weight loss and behaviour change | Needs assessment, experts reviews, focus groups, ongoing feedback | Patients, HCPs, research experts, advocacy group members, consultants | Focus group, interview, not-protocolled meeting | Requirements, testing | Not reported |
| 65 | Pearon et al. | 2016 | UK | Web-based version of an exercise-based rehabilitation program for people with chronic knee and hip pain | Focus groups and semistructured think aloud interviews | Patients | Focus group, interview, think-aloud | Testing | Sample, feasibility |
| 66 | Piau et al. | 2015 | France | Smart insole to promote healthy aging for frail elderly individuals | Focus group | Patients, HCPs | Focus group | Requirements, testing | Not reported |
| 67 | Pilco et al. | 2019 | Equador | The ePHoRT platform allows hip arthroplasty patients recovering from fracture or joint replacement to carry out part of the rehabilitation treatment at home | Usability evaluation | Technical experts | Heuristic evaluation | Testing | Not reported |
| 68 | Possemato et al. | 2017 | USA | PTSD Coach app - a self-management mobile app | Qualitative interviews | HCPs | Interview | Testing | Sample |
| 69 | Pramana et al. | 2014 | USA | The SmartCAT: An m-Health Platform for Ecological Momentary Intervention in Child Anxiety Treatment | Feasibility study | Patients, HCPs, technical experts | Heuristic evaluation | Testing | Sample |
| 70 | Prapkree et al. | 2019 | USA | Snackability smartphone application to identify healthy and unhealthy snacks | Analysis, design, development, implementation, and evaluation model | Citizens | Focus group | Background, testing | Sample |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|----|----------------------|------|--|---|---|--|--|-------------------------------------|--|
| 71 | Prokhorov | 2017 | USA | Mobile phone text messaging program for tobacco risk communication among college students | Focus group, mixed methods | Citizens | Focus group | Testing | Sample, method and analysis |
| 72 | Puijk-Hekman et al. | 2017 | Netherlands | Self-management web-based support program for patients with cardiovascular diseases | Intervention mapping framework | HCPs | Not-protocolled meeting | Requirements, designing, procedure | Sample, social dynamic |
| 73 | Reese et al. | 2017 | USA | Text messages to promote physical activity among African American women attending college | Focus groups/nominal group technique | Patients | Focus group | Requirements, testing | Sample, social dynamic |
| 74 | Ribigan et al. | 2018 | Romania and Belgium | Follow.Me system | Multi-structured approach / user needs and requirements analysis | Patients, HCPs | Interview, questionnaire | Testing | Not reported |
| 75 | Rivera et al. | 2018 | Canada | Mobile app for weight and health management in adolescents with complex health needs | Descriptive qualitative research design | Citizens, relatives, informal care givers, HCPs | Focus group | Background, requirements, procedure | Sample |
| 76 | Rohde et al. | 2019 | Germany | Mobile app intervention to improve eating habits of adolescents and young adults | Behavior change wheel | Patients, citizens, HCPs, research experts, technical experts, marketing experts | Interview | Background, requirements | Sample, feasibility, topics |
| 77 | Salgado et al. | 2018 | USA | Interactive Mobile Health and Rehabilitation (iMHere), Medication Management Smartphone App | The Delphi method | HCPs, informal care givers | Delphi | Design | Sample, method and analysis, topic |
| 78 | Sauer et al. | 2018 | USA, France, Germany, Brazil and South Korea | New pen device for injection of recombinant human growth hormone | Interview | HCPs | Interview | Testing | Sample |
| 79 | Shepherd et al. | 2015 | New Zealand | Computerized gamified depression therapy program for indigenous Māori adolescents | Focus groups using kaupapa Māori methodology | Citizens | Focus group | Testing | Sample, topics |
| 80 | Smith-Turchyn et al. | 2017 | Canada | TAPESTRY-CM healthy lifestyle app, an online self-management application for older adults with diabetes and hypertension | Cognitive interviewing techniques | Patients | Interview, workshop | Testing | Sample, method |
| 81 | Soomro et al. | 2019 | Australia | Injury Surveillance App for Cricket: TeamDoc is the first complementary, standalone mobile app that records cricket injuries through a smartphone | Survey with open answers | Citizens | Questionnaire | Designing, testing | Not reported |
| 82 | Stinson et al. | 2014 | Canada | Web- and mobile-based self-management program for youth with chronic pain | Descriptive exploratory qualitative design | Patients, HCPs | Focus group, interview | Background, requirements, testing | Sample, method and analysis |
| 83 | Teh et al. | 2018 | Australia | Handheld health information technology tool to support the timely update of bedside visual cues to prevent falls in hospitals | Focus group | HCPs | Focus group | Testing | Sample, method and analysis, social dynamic, feasibility |
| 84 | Thilo et al. | 2019 | Switzerland | Wearable fall detection device | Real field testing approach underpinned by the theoretical framework "medical device technology development process" | Patients | Focus group, not-protocolled meeting | Testing, procedure | Sample, feasibility |
| 85 | Thomas et al. | 2019 | UK | Digital group fatigue management program | Interviews and consultation groups | Patients, HCPs, research experts, technical experts | Interview, not-protocolled meeting | Requirements, testing | Sample |
| 86 | Threatt et al. | 2017 | USA | Assistive robotic table (ART) for stroke patients | Iterative design and evaluation study using both qualitative and quantitative components in a mixed-methods research design | HCPs, research experts, technical experts | Delphi study, focus group, think-aloud, usability test | Requirements, designing | Sample, method and analysis |
| 87 | Timmons et al. | 2017 | USA | SmartphSmartphone app to support adolescents' use of long-acting reversible contraception | Interview | Patients | Interview | Testing | Sample, method and analysis, social dynamic |
| 88 | Tonheim and Babic | 2019 | Norway | A mobile application for patient self-management within the field of Multiple Sclerosis (MS) | Semi-structured interview | HCPs | Interview | Designing, testing | Not reported |
| 89 | Vanoh et al. | 2018 | Malaysia | An education tool that is web-based, called WESIAT 2.0, had been created to educate elderly people about precautionary strategies against mild cognitive impairment | Survey with open answers | HCPs, technical experts | Questionnaire | Testing | Not reported |
| 90 | Villegas et al. | 2014 | Chile | Internet-based STI-HIV prevention intervention for young Chilean women | Panels and questionnaire | Citizens, research experts, technical experts | Not-protocolled meeting, questionnaire | Requirements, design | Sample, method and analysis |

| Nr | Authors | Year | Country | Technology | Approach | Stakeholders | Data collection methods | Topics | Challenges |
|-----|-----------------------|------|-----------------------|---|--|---|--------------------------------------|-----------------------------------|---|
| 91 | Vorrink | 2016 | Netherlands | Mobile phone app to stimulate daily physical activity in patients with chronic obstructive pulmonary disease | Group consultation sessions | Patients, citizens | Focus group | Testing | Sample |
| 92 | Walker et al. | 2017 | Australia | Colorectal cancer RiSk Prediction tool ('CRISP') for use in primary care. | Simulated consultations / interviews | HCPs | Interview | Designing, testing | Sample, method and analysis, social dynamic |
| 93 | Wang et al. | 2016 | China | 'Care Assistant': A smartphone application to support caregivers of children with acute lymphoblastic leukaemia | Key informant interviews and focus group studies | Informal care givers | Interview | Background, requirements | Sample, feasibility |
| 94 | Ward et al. | 2016 | Canada | Smartphone app as a patient education tool for the management of thalassemia and iron overload syndromes | Delphi method | Patients | Delphi method | Requirements | Not reported |
| 95 | Ward et al. | 2017 | UK | FallCheck is a web app that supports identification of home-hazards and directs users towards self-management strategies to reduce risk of falling | Qualitative survey | HCPs | Questionnaire | Requirements, design | Sample, topic |
| 96 | Warren et al. | 2018 | New Zealand | Smartphone-based app for behavior change for youth drivers | Semistructured phone interviews or less formal discussion-based sessions | Patients, parents, advocacy group members | Interview | Background, requirements | Not reported |
| 97 | Webster et al. | 2016 | UK | Intervention to increase condom use in heterosexual men (the MenSS website) | The Behaviour Change Wheel | Patients, HCPs | Interview, workshop | Requirements | Sample, method and analysis, topics |
| 98 | Weichtelt et al. | 2019 | USA | Application designed to assist clinicians in returning injured farmworkers to light-duty job assignments | Interview and focus group | Citizens | Focus group, interview | Background, requirements, testing | Sample, method and analysis |
| 99 | Werner-Seidler et al. | 2019 | Australia | The Sleep Ninja is a fully-automated app that delivers CBT-I to young people cognitive behavioral therapy for insomnia | This qualitative study involved 3 focus groups | Patients | Focus group | Background, requirements, design | Sample, method and analysis, topics |
| 100 | Whiteley et al. | 2019 | USA | Gaming app to increase adherence to pre-exposure prophylaxis | Interviews, iterative and collaborative procedures | Patients | Interview | Testing | Sample, feasibility |
| 101 | Wilson et al. | 2019 | USA | Multi-Component Mobile-enhanced Treatment for Smoking Cessation | Qualitative methodology | Patients | Interview, think aloud | Requirements, design, testing | Sample, method and analysis |
| 102 | Zafeiridi et al. | 2018 | Italy/Spain/France/UK | Web-based platform for people with memory problems and their caregivers (CAREGIVERSPRO-MMD) | Mixed method design | Patients, relatives, informal care givers, HCPs | Questionnaire | Testing | Feasibility, topics |
| 103 | Zieve et al. | 2017 | USA | Personalized feedback for multiple health risk behaviors and reinforcement for health promoting behaviors from an electronic health screening tool for primary care setting | Interview | Patients | Interview | Testing | Sample, method and analysis |
| 104 | Zuidema et al. | 2015 | Netherlands | Online tailored self-management program for patients with rheumatoid arthritis | Intervention mapping framework | Patients, HCPs, research experts | Focus group, not-protocolled meeting | Requirements, testing | Sample |

Abbreviations: USA = United States of America, UK = United Kingdom, HCPs = healthcare professionals, app = application