

## Supplementary Material

**Supplementary Table 1. Detailed report of articles included in the review**

Number	Authors: Year	Country	Aim	Sample Size	type of study	Target group	Application Usage	Application Descriptions	Factors affecting the use of applications	Reported criteria	Results from application usage
1	Danielle M. Vossebel d et al. 2019	Netherlands	“To analyse the development of a mobile input device for electronic medical records (MEMR)”.	16 nurses, six nurse managers, and seven other involved parties were contacted	case study	nurses	mobile electronic medical record	A workflow application supported by nurses	supportive technology, functionality of the app and input device, nurses’ workflow	“The mismatches with the most impact were found to be: (1) suboptimal supportive technology, (2) limited functionality of the app and input device, and (3) disruption of nurses’ workflow”.	“Choices for design parameters made during the development of labor-saving technology for nurses, may conflict with the customer needs of nurses. Even though the causes of mismatches were mentioned by the IT department, the nurse managers acquired the MEMR based on the idea behind the app”.
2	Caleb Ferguson et al. 2019	Australia	“To evaluate the efficacy of EVICOAG - a novel mHealth, smartphone-based, spaced-learning intervention on nurses’ knowledge of AF and anticoagulation”.	Seventy-four participants recruited to T1, 40 completed T2. There was a 54% mean improvement in knowledge levels post-intervention	pilot study	nurses	To improve nurses’ atrial fibrillation and anticoagulation knowledge and practice QStream™ type modules.	“EVICOAG, an QStream™-based online learning module, comprises 12 case-based atrial fibrillation (AF) and anticoagulation learning scenarios”.	High quality, credibility	“The EVICOAG intervention improved nurses’ knowledge of atrial fibrillation (AF) and anticoagulation, and influenced their uptake and use of stroke and bleeding risk assessment tools in clinical practice”.	

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3	Bree Holtz et al. 2019	USA	“To determine primary care physicians’ and advanced practice registered nurses’ perceptions of consumer-grade sensor devices and Web- or mobile phone-based apps that allow patients to track physical activity, diet, and sleep”.	300 primary care physicians and 300 advanced practice registered nurses	Pilot Study	Physicians, nurses	Health indicators of patients to track physical activity, diet, and sleep.	Tracking health care and improving their overall lifestyle	Usefulness, helpfulness, reliable data, privacy, security and liability, perceived patient barriers	Usefulness, Provider’s trust of data, Patient’s interest in technologies, Security and liability, Perceived patient barriers	“Providers perceived benefits for their patients to use these technologies, including improved communication. Providers’ concerns included their patients’ access and the usability of these technologies”.
4	Frederic Ehrler et al. 2018	Swiss	“To assess the usability of the BEDSide Mobility app in terms of the navigation and interaction design through usability testing”.	10 nurses	Usability Study	Nurses	Support nurses in their daily workflow and to facilitate documentation at the bedside.	“The tool supports the entire nurse workflow. Nurses start by selecting the rooms and patients under their responsibility during their shift and access their patient’s charts”.	navigation, layout, and interaction design of the app, lack of clarity of some icons, User’s Interface, App’s Usability and suitability	App’s usability and suitability	“The participants’ results do indicate good usability, high acceptance, and high satisfaction with the developed app”.
5	Frederic EHRLER a et al. 2018	Swiss	Supporting caregivers’ workflow with mobile applications (apps) is a growing trend.	27 nurses	Pilot Study	Nurses	“The bedside mobility app to support documentation of nurses at the bedside using a user-centered approach”.	The app provides an integrated view of all the daily tasks that need to be performed by nurses during their shifts.	“Perceiving an increase of productivity, social influence dimension, performance, effort expectancy, facilitating conditions”	Technology Acceptance, UTAUT Model	“Perceiving an increase of productivity is a critical point in fostering the adoption of a new tool. The variability of the amount and type of collected patient information adds a challenge to the design of the entry interface, which needs to be adapted to each context and each patient.”

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6	Alvaro Sobrinho et al. 2018		“In this article, a native mHealth app targeting the Android platform is presented as an approach to assist the early diagnosis and self-monitoring of the chronic kidney disease (CKD)”.	one nurse and four nephrologists	Qualitative, Mixed Methods	Patients, nurse , nephrologists	A mobile health (mHealth) application (app) that aims at assisting the early diagnosis and self-monitoring of the disease progression.	“The main functionalities of the app are providing access control; management of medications, allergies, and examinations; monitoring of risk factors for CKD; history for CKD risk analyses; and CKD risk evaluation”.	ease-of-use, safety, effectiveness, and usability	Effectiveness and usability.	“A mHealth app for risk evaluation and stratification of CKD can benefit both patients and physicians in managing and monitoring the disease, and in identifying a possible risk before critical health stages”.
7	Devraj Jindal et al. 2018	India	“To describe the steps and processes in the development of mWellcare, a complex intervention based on mobile health (mHealth) technology”.	631 patients diagnosed with hypertension and/ or diabetes were registered	Intervention	primary care nurses , doctors, patients	“mHealth system with important components, i.e. integrated management of chronic conditions, evidence-based clinical decision support (CDS), longitudinal health data and automated short-messaging service to reinforce compliance to drug intake and follow-up visit, which will be used by nurses at primary health care settings”.	“Integrated management of blood pressure, diabetes and other patient conditions, to store and integrate health records; to provide automated guideline-recommended treatment plan, prompt referral; to generate lifestyle intervention; to allow patient monitoring with alerts; to send out automatic SMS reminders and alerts to patients; to serve as a data collection tool for remote quality assurance (QA) of (NCD) programs”.	Customization, feasibility	utility, acceptability, and feasibility	“The mWellcare CDSS for hypertension and diabetes can successfully handle over 1000 permutations of clinical profiles to generate personalized mWellcare decision support output”.

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8	Liliana Giraldo et al. 2018	Italian	“To know the perceptions and expectations of nurses regarding the implementation of Codes scanning Drug Administration System (BCMA)”.	groups of nurses from different inpatient wards of the Hospital Italiano de Buenos Aires	Qualitative	nurses	The BCMA system includes a mobile station with an incorporated tablet, together with an App Mobile that interacts with the Hospital electronic health record (EHR), and data recording is done at the bedside.	“The process begins with the preparation of the medication, the label to identify medication with 2D code (QR) is printed, the nurse accesses the Mobile App through his username and password, displays the list of patients and scans the 2D code (QR) of the patient's bracelet, to verify patient identification, it visualizes the medications of the patient, by scheduled hours for administration, continues with the scan of each of the medications”.	Ease of use, usefulness, functionalities of the tool, impact on the workflow, confidentiality	“The ease of use of the mobile station, the device, the nursing application and its usefulness, and high expectations about the new process”.	“The incorporation of mobile technology must be consistent with the workflow, the multiplicity of tasks and the care plan around patient care. Perceptions about the implementation of information technology (IT) vary according to the level of expectation”.
9	Rebecca H et al. 2018	USA	“To evaluate perceived benefits, challenges, and recommendations following participation in a workplace mobile application– and email-based meditation research program”.	11 healthcare providers	Qualitative	Healthcare staff	“The app-based meditations were grounded in Krishnamacharya -Desikacharya yoga therapy, a personalized, guided approach for promoting health and healing, incorporating yoga principles and practices”.	“A personalized, guided approach for promoting health and healing, incorporating yoga principles and practices. These meditations integrate breathing, postures, and mental focus to regulate attention, reduce stress, and promote interceptive awareness”.	Perceived benefits, Convenience, Flexibility, Guided instruction, Time	perceived benefits, perceived stress	“The focus group findings provide important insights into the personal experiences of participants engaged in an app-based meditation program that aimed to build capacity to adaptively respond to work-related stressors, combat compassion fatigue, and improve professional quality of life”.

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10	Jisan Lee et al. 2018	Korea	“To create an effective method of identifying applications that address user needs”.	Among 2784 applications found, 369 were analyzed quantitatively	intervention mapping approach	Users and clinical experts	-	-	Convenience, design, customization, suitability, easy to use, trustworthy, Fun feature	Method of App Selection based on User Needs	“This study suggests how to find and use the best among existing apps and demonstrates the need for nurses. Furthermore, the Method of App Selection based on User Needs (MASUN) can be used by consumers who want to find apps to manage many other health problems”.
11	Thoma-Lürken et al., 2018		“To gain insight into the perceived added value of a decision support App for district nurses and case managers intended to support a problem assessment and the provision of advices on possible solutions to facilitate ageing in place of people with dementia, and to investigate how they would implement the App in daily practice”.	33 participants	qualitative study	nurses and case managers	“(a) providing a broader/better overview of possible solutions; (b) providing a guideline/checklist for problem assessment and advice on solutions; (c) Supporting an in-depth problem assessment; (d) being a support tool for inexperienced case managers/district nurses; and (e) providing up-to-date information”.	“The decision support App was perceived as a valuable tool to support the process of problem assessment and providing advice on possible solutions for people with dementia (PwD) who want to age in place”.	Update content, effectiveness, familiarity	effectiveness	“The participants valued both parts, the problem assessment and the overview of possible solutions. An important requisite for the usage would be that the content is continuously updated. Before the App is recommended, an evaluation of its effectiveness regarding decision-making should be conducted”.

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12	Spindler et al., 2017	India	“Assessed changes in skill and knowledge related to the use of evidence-based practices associated with quality of maternal and neonatal care during a nurse midwife mentoring intervention at primary health clinics (PHCs) in Bihar, India”.	5,799 births	Intervention	Deliveries and infant	Birth tracking and data analysis	“The NMMs completed questions in the App after every live birth witnessed. The App consisted of questions around three main themes, “What went well?”, “What needed improvement?” and “What can be done differently next time?”	Perceived usefulness	mobile tools can help to improve the quality of care provided	“Mobile App is an acceptable job aid in a nurse-mentoring program that can be used to monitor changes in medical management, teamwork and supply availability over time”.
13	Aude Motulsky et al., 2017	Canada	“To describe the usage of a novel application (The FLOW) that allows mobile devices to be used for rounding and handoffs”.	253 health professionals	Descriptive analytics	Nurses and doctors	a handoff and rounding tool, data entry, indicating collaborative documentation practices	“It allows care team members to enter and share short free-text notes, hereafter referred to as flows, for admitted patients”.	Quality of information, Quality of patient care, Usability, Productivity of work processes	Quality of information, Quality of patient care, Usability of the tool, Overall satisfaction, Productivity of work processes	“The FLOW was perceived as having improved patient care by 57% of respondents, compared to usual care. Most respondents (86%) wished to continue using The FLOW”.
14	Johan N Siebert et al., 2017	Swiss	“To determine whether the use of PedAMINES in both university and smaller hospitals reduces medication dosage errors (primary outcome), time to drug preparation (TDP), and time to drug delivery (TDD)”.	120 certified nurses	Randomized Controlled Crossover Trial	nurses	Reduce Medication Errors and Time to Drug Delivery During Pediatric Cardiopulmonary Resuscitation	“To support nurses and physicians step-by-step from order to delivery of a wide range of drugs in real time, including those requiring continuous infusion. PedAMINES also dramatically reduced time to drug preparation (TDP) and time to drug delivery (TDD)”.	stress perceived	“The study is formatted according to the Consolidated Standards of Reporting Trials Statement for Randomized Controlled Trials of Electronic and Mobile Health Applications and Online TeleHealth (CONSORT-EHEALTH).”	“This paper describes the protocol used for a clinical trial assessing the impact of a mobile device app to reduce the rate of medication errors, time to drug preparation, and time to drug delivery during pediatric resuscitation”.

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15	Karen Jean Day et al., 2017	New Zealand	“To examine the acceptability of doctors and nurses of a translation application (app) used on a tablet, in brief interactions with Korean patients”.	Fifteen clinicians	Technology Acceptance Model 2	doctors and nurses	“An app was developed to facilitate brief conversations between patients and clinicians as part of clinical care”.	“The app, available on an iPad, provides interpretations of standard medical information, from the clinician’s and patient’s points of view. Patients can also express aspects of daily life dialogue”.	Perceived ease of use, Perceived usefulness, Social norm, managerial support	Technology Acceptance Model 2	“It was considered useful for everyday brief interactions and urgent situations where there is no time to call an interpreter and, after hours, to augment the work of interpreters”.
16	Mona Choia et al. 2017	Korea	“To examine the effect of an experiment that introduced a mobile AEMR application for undergraduate nursing students in their practicum”.	75 third-year nursing students	quasi-experimental	nurses	“The application was modified to solve problems in the PC based EMR application and was equipped with features based on the educational goals and practicum course”.	“To enabling the clinical practice of the hospital staff, such as doctors and nurses. EMR application presents real-time patient information, the AEMR application was set to read-only to prevent students from accidentally altering patient records”.	perceived usefulness, perceived ease of use, user satisfaction	usability scale, perceived usefulness, perceived ease of use, user satisfaction	“The AEMR application was an effective educational method for practicing the immediate documentation of students’ observations and interventions and was available at the patients’ bedsides”.
17	Kalyani Ankem et al. 2017	USA	“The usability of a medication safety app was tested with nurses to reveal their perceptions of the graphical user interface and to discover problems they encountered in using the app”.	18 participants	Pilot study	patients and by patients caregivers and physicians	Medication safety, decreasing medication errors, increasing medication safety.	“The app gives patients and their caregivers and physicians the information they need to manage or administer safe, error-free medications and integrates patients’ medical care”.	Design, easy to understand, usability	usability testing guidelines formulated in an elaborate protocol in Qualtrics	“To successfully integrate mobile devices in healthcare, developers must address the problems that nurses encountered in use of the app”.

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18	Devraj Jindal et al. 2017	India	“The objectives were to develop a multifaceted, mobile clinical decision support system (CDSS) for Cardiovascular disease (CVD) management and evaluate it for use by public non physician health care workers (NPHWs) and physicians in a rural Indian setting”.	ASHAs (n=227) and doctors (n=65).	feasibility study	non physician health care workers (NPHWs)	to improve Cardiovascular disease (CVD) detection, prevention, and management	“The app takes the user through a 4-step process (patient registration, past medical history and medications, risk factor measurements, and treatment advice)”.	User interface, design (proper language font installation, and greater emphasis on the use of color for communicating risk),	Acceptability, effectiveness	“A tablet-based CDSS implemented within primary health care systems has the potential to help improve CVD outcomes in India. However, system-level barriers to accessing medical care limit its full impact”.
19	Jessica D. Rothstein et al., 2016	Ghana	“To assessed the feasibility, usability, and acceptability of a mobile Client Data App for maternal, neonatal, and child client data management by community health nurses (CHNs) in rural Ghana”.	14 individuals, representing one CHN and one midwife per health center, one CHN each from three community health posts in each district, and the district health director and information officer in each district.	qualitative	maternal, neonatal, and child	Managing data for the care of mothers, infants and children, improve the quality of care	Managing data for the care of mothers, infants and children, improve the quality of care	Feasibility, Usability, and Acceptability, ease of use, low-cost, Easily integrated into routine care, poor network connectivity	Feasibility, Usability, and Acceptability	“MOTTECH’s Client Data App is a promising tool to aid health workers in collecting and tracking data across the health care continuum”.



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20	Kuo-Hui Yeh 2016	Taiwan	“Propose a robust IoT-based healthcare system, called BSNCare+, in which body sensor networks (BSNs) are adopted as the underlying communication architecture”.		Fundamental research	doctors , nurses, patients	Monitor patients bio-features, assess the personal health status of patients, avoid medical errors	“The patient’s bio-features can be monitored in real time via bodily equipped or embedded bio-sensors. The physicians (or nurses) can thus assess the personal health status of their patients more effectively. Medical errors can be avoided, and the treatments provided by the hospital will be more on-demand in nature.”	Practicability, feasibility, performance efficiency	Practicability, feasibility, performance efficiency	“The nurse/doctor can utilize his/her mobile gateway for real-time data collection and provide better-quality healthcare services to the patient with further data analysis and mining of patient’s needs”.
21	Ruth A. Crowley 2016	USA	“To identify and evaluate icons for the Verbal Care tablet application, and examine the use and satisfaction with this tablet application in a pediatric post-acute hospital”.	five patients	structured interview	children	The Verbal Care application was used most frequently to communicate the need to use the bathroom and the need to get something	“The Verbal Care tablet application allows a patient to indicate a specific need to nursing staff not present in the hospital room by selecting an icon on an iPad (e.g., need for a drink represented by a cup)”.		evaluate icons for the Verbal Care tablet application, patient use and satisfaction	“Children using the tablet application for bedside to nurse communication reported satisfaction with the experience and would recommend it to other patients”.

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22	Rocio de la Vega et al., 2014	Spain	“To introduce Painometer, a smartphone app that helps users to assess pain intensity, and report on its usability (i.e., user performance and satisfaction) and acceptability (i.e., the willingness to use it)”.	19 health care professionals and 30 non-professionals	qualitative, semi structured interview	Patient, Clinical staff	Painometer, a smartphone app that helps users to assess pain intensity	“Painometer is a smartphone app that contains 4 pain intensity scales: the Faces Pain Scale-Revised (FPS-R), the numerical rating scale-11 (NRS-11), the Coloured Analogue Scale (De La Vega et al.), and visual analog scale (VAS)”.	easy to use, having guided tour, simplicity, versatility	Usability, user performance and satisfaction, acceptability	“Painometer easy to use and preferred it to paper-and-pencil scales, so it might encourage health care professionals to use psychometrically sound scales to assess pain intensity”.
23	Luciane Mandia Grossi et al. 2014	Brazil	“To develop a web and mobile device application to search for chemotherapy drugs to support nursing audits of hospital bills and to evaluate user satisfaction and tool usability”.	29 nurse auditors	development applied research	nurses	search for chemotherapy drugs	“The application stored all information of the pharmaceutical guide, including PDFs, in order to enable use even when the mobile device was not connected to the Internet”.	Satisfaction, usability	user satisfaction and usability	“This tool was evaluated with regard to user satisfaction and usability. Even with the limited number of evaluators, it was clear that Oncoaudit can be used in practice for drug audit. This application can make the auditing process faster and complete”.
24	Pauline E et al. 2012	Sweden	“To exploring nursing students' experience of using a PDA in clinical practice”.	120 nursing students	intervention study	nurses	support nursing students	“The PDA was found to support nursing students in clinical practice and to have the potential to be a useful tool with benefits for both the patients and for the students”.	Useful, increased confidence, time savings, patient safety, quality of care	Usefulness, confidence, quality of care, time management	“PDA has the potential to be a useful tool in clinical practice, with benefits for both the patients and for the NSs”.

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25	Jinwook Choia et al. 2003	South Korea	“Study the feasibility of hand-held information system for point of nursing care”	six volunteered nurses	Clinical trials	nurses	“MobileNurse has four modules each of which performs: (1)Patient information management; (2) medical order check; (3) nursing recording; and (4) nursing care plan. MobileNurse provides easy input interface and various outputs for nursing records”.	“The system consists of PDAs and a mobile support system (MSS) which supports clinical data exchange between PDAs and the hospital information system”.	ease-to-use interface, easily portable, efficient, useful, reduces workload, conducive menu, easy to learn	ease-to-use interface, easily portable, efficient, useful, reduced my workload, conducive menu, easy to learn	“Ease-of-use aspect of the system is the most important factor for success among the other technical issues. The system can reduce duplicated works, and the improvement of care quality through the sharing of patient information all around the care units”.