

**Supplemental Table 1: Factors influencing adoption of Information and Communication Technology by nurses**

| Reference & country                                                |                                                                                                                                                                                                                                                                                                                                                                  |                                                                                      |                                                                                                                                                                                                                                                            |                                | Factors that influence adoption                                                                                                                                                                                                                                                                                                                                                                                                                |                                             |              |                                                                  |
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|                                                                    | Focus / key findings                                                                                                                                                                                                                                                                                                                                             | Research Design/ Level of Evidence* / JBS**                                          | Data collection/ Sample Size                                                                                                                                                                                                                               | ICT in adoption (category)     | Collaboration factors                                                                                                                                                                                                                                                                                                                                                                                                                          | Leadership factors                          | Team factors | Individual factors                                               |
| Asiedu, Fang, Harris, Colby, & Carroll (2019)<br><br>United States | Focus: health professionals' perspectives (nurses included) on the use of tele-neonatology for newborn resuscitation.<br><br>Key findings: Successful implementation of teleneonatology is facilitated by strong interpersonal relationships among teams, training and education, communication about the value, opportunities and benefits of tele-neonatology. | Qualitative design<br><br>LOE: 4<br>Qualitative interviews<br><br>JBS: 8/10 (strong) | 9 Qualitative focus groups<br>4 Individual interviews<br><br>December 2015 – June 2016<br><br>6 health system sites<br>49 healthcare professionals at six affiliated health system hospitals: physicians (N= 18), nurses (N= 30), nurse practitioner (N=1) | Teleneonatology (telemedicine) | - Teleneonatology makes it possible to collaborate more actively<br>-Actively involving health professionals in the implementation process enhances acceptance<br>- Collaboration between local and remote care providers is necessary for success<br>- Training of staff should be performed collectively to promote awareness and understanding<br>-Shared understanding of benefits and mutual understanding of guidelines support adoption | -Leadership engagement promotes utilization | -            | -Past experiences with technology influence the adoption process |

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| Chow, Chin, Lee, Leung, & Tang (2012)<br><br>Hong Kong | Focus: nurses' perception of Hospital Information System (HIS) and the predictive factors that influence their attitudes and satisfaction with HIS.<br><br>Key findings: Nursing staff acceptance and satisfaction with the system have a positive influence on nursing staff attitudes. Successful implementation depends on nurses' attitudes and satisfaction with the system. | Cross-sectional survey design<br><br>LOE: 2<br>Cross-sectional survey design<br><br>JBS: 4/8 (weak) | Questionnaire<br><br>Sample size: 342 full time nurses working in a private hospital (Hong Kong) who have used HIS<br><br>(N= 204)<br>Return rate: 59,6% | Hospital Information System (EHR) | - Effective collaboration between nurses and the IT team (related to the implementation and use of the system) is key to success of implementation<br>- Having a voice in system improvements enhances nurses motivation to use the system | -A strong nurse leadership aids the implementation of technology | - | - Nurses' attitude and satisfaction with the system is related to motivation to use the system<br>-Improved computer knowledge and IT skills make the system more useful for nurses: HIS training leads to more user-friendliness of the system |
| Dennehy et al. (2011)<br><br>United States             | Focus: describing the experiences with the 'partnership model' (focus on collaborative relationship between Electronic health records (EHR) implementers and healthcare                                                                                                                                                                                                           | 2 case studies<br><br>LOE: 2<br>Cross-sectional survey design<br><br>JBS: 6/8 (moderate)            | End user surveys: before, after and post implementation stage<br><br>2 nurse-managed health centers (NMHC):<br>Case 1: The Glide Health Services:        | Electronic health records (EHR)   | - Collaborative relationship between EHR implementers and healthcare practitioners prevents adoption difficulties.<br>- Continuous support from the partnership after go-live helped in                                                    | -                                                                | - | - Initial negative experiences leads to adoption resistance<br>- Attitude and evaluation of quality of EHR determine if clinicians are self-motivated to integrate the system                                                                   |

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|                                           | <p>professionals) when implementing the EHR at two nurse-managed health centers (NMHC). Staff of NMHC is primarily nurse practitioners and midwives.</p> <p>Key findings: When implementing EHR, (unexpected) difficulties can influence the adoption by healthcare professionals. The partnership model can help in this process.</p> |                                                                                                 | <p>Primary care for the homeless, immigrants, and poor</p> <p>Survey: At baseline (T0, N=5); 3 months (T1, N=9); 6 months (T2, N=10); 9 months (T3, N=9)</p> <p>Case 2: The Campus Health Center, Detroit: Primary and behavioral care to urban university students</p> <p>Survey: At baseline (T0, N=4); 3 months (T1, N=3); 6 months (T2, N=6)</p> |                                 | implementation process |                                                                                                    |                                                                                                                     |                                                                                             |
| De Leeuw et al. (2020)<br>The Netherlands | <p>Focus: exploration of the experiences and needs of nurses who are digitally lagging behind.</p> <p>Key Findings: insufficient ineffective digital education is often the cause of nurses who are digitally lagging behind. A tailored digital</p>                                                                                   | <p>Qualitative design</p> <p>LOE: 4</p> <p>Qualitative interviews</p> <p>JBS: 8/10 (strong)</p> | <p>10 face-to-face semi-structured interviews with registered nurses (RN)</p> <p>(N=10)</p>                                                                                                                                                                                                                                                          | Electronic Health Records (EHR) | -                      | -Awareness among managers of the difficulties that nurses experience in developing digital skills. | -Encouragement of a team culture, collegial learning, helping each other in developing digital skills, peer support | -Formal training and training-on-the-job<br>-Having enough time to learn and repeat skills. |

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|                                                  | training would benefit these nurses.                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                          |                                                                                           |                              |                                                                                                                                                                   |                                                                                                                                                                                       |                                                                                |
| Dunford et al. (2017)<br><br>United States       | Focus: causes of the use of smart pump work-arounds by nurses and how work-arounds can be reduced.<br><br>Key findings: Although nurses reported having positive attitudes with smart pumps, they use workarounds (deliberately improvising) because of challenges they face. The reported causes were technical, organizational, cultural, and psychological. | Anonymous online survey: instrument with questions using a Likert scale and open-ended questions<br><br>LOE: 2<br>Cross-sectional design<br><br>JBS: 4/8 (weak) | Anonymous online survey with quantitative and qualitative (open-ended questions)<br><br>November 2012 to February 2013<br><br>Three hospitals (USA, Midwest): Nurses (N=818)<br><br>Iowa (N=311)<br>Response rate of 15.5%<br>Wisconsin (N= 346)<br>Response rate of 26.6%<br>Wishard-Eskenazi Health: (N=161)<br>Response rate of 21.8% | Smart Infusion Pumps (telemedicine)                                                       | -                            | -                                                                                                                                                                 | - Nurses go to nursing coworkers for assistance (instead of leaders)<br>-Lack of understanding by peers leads to workarounds.<br>-Resistance to change attitudes leads to workarounds | -Workload challenges contribute to workarounds                                 |
| Hogan-Murphy et al. (2021)<br><br>United Kingdom | Focus: the facilitators and barriers to implementing electronic systems for medicines management in hospitals.                                                                                                                                                                                                                                                 | Qualitative design<br><br>LOE4<br><br>JBS: 8/10 (strong)                                                                                                        | Semi-structured qualitative interviews<br><br>Three public hospitals<br>9 nurses;<br>4 pharmacists;<br>2 pharmacy technicians;<br>6 doctors;                                                                                                                                                                                             | Electronic prescribing (ePrescribing), robotic pharmacy systems, and automated medication | -Multi-disciplinary approach | -Clinical leadership, champions at ward level and selecting early adopters promotes engagement with the system<br>-Inadequate management support is a key barrier |                                                                                                                                                                                       | -Training sessions and sufficient time for training is beneficial for adoption |

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|                                                                            | Key findings: facilitators are perceived enhanced patient safety and efficiency, working with clinical champions and a multidisciplinary implementation team. Barriers are inadequate training and organizational support, the need for confidence and ease when working with the system. |                                                                                                                                 | 2 Information Technology managers                                                                        | storage and retrieval systems (EHR and BCMA)                            |                                                                                                                                                                           |   |   |                                                                                                                             |
|                                                                            |                                                                                                                                                                                                                                                                                           |                                                                                                                                 | Total (N=23)                                                                                             |                                                                         |                                                                                                                                                                           |   |   |                                                                                                                             |
| Johansson-Pajala, Gustafsson, Jorsäter Blomgren, Fastbom, & Martin, (2017) | Focus: Registered Nurses' (RNs) perceptions of using CDSS in drug monitoring.<br><br>Key findings: According to RNs, CDSS saves time and increases safety and provides standardized ways of working. This calls for teamwork and shared responsibilities.                                 | Explorative qualitative design with phenomenological approach<br><br>LOE: 4<br>Qualitative interviews<br><br>JBS: 9/10 (strong) | Interviews<br><br>Four nursing homes. In each nursing home work between 3 and 11 RNs<br><br>Total (N=16) | Computerised decision support systems (CDSS) for drug monitoring (BCMA) | - RNs' wished for increased collaboration and more involvement with physicians<br>- The standardized procedures require shared responsibilities, involvement and teamwork | - | - | - Use of the CDSS had impact on nurses' knowledge and awareness; nurses were better prepared to discuss with the physicians |
| Sweden                                                                     |                                                                                                                                                                                                                                                                                           |                                                                                                                                 |                                                                                                          |                                                                         |                                                                                                                                                                           |   |   |                                                                                                                             |
| Lee et al. (2017)                                                          | Focus: description of the development                                                                                                                                                                                                                                                     | Cross-sectional design                                                                                                          | Survey based on the TAM and UTAUT                                                                        | BESTBoard (Bundang                                                      | - BESTboard was useful for team                                                                                                                                           | - | - | - Positive attitude and expectations of work                                                                                |

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| South Korea                                                               | process and functions of BESTboard, analysis of factors that influence adoption by care professionals. Key findings: BESTboard was implemented successfully. The satisfaction rate of the system was high, especially among voluntary users. Positive intentions influenced real usage. | LOE: 2<br>Cross-sectional design<br><br>JBS: 5/8 (weak)                                                                      | April 2012 – October 2014<br><br>Seoul National University Bundang Hospital (SNUBH)<br><br>Physicians and nurses (N=383)                                                                                                                                               | Excellent & Smart Touch Board): digital dashboard with health information (EHR) | rounds and interdisciplinary collaboration                                  |   |   | performance are important factors for intention to use<br>- Voluntary users provided a greater amount of positive feedback<br>- Age: elderly users thought of BESTboard as not useful compared to younger users |
| Moreland, Gallagher, Bena, Morrison, & Albert (2012)<br><br>United States | Focus: determine if nurse perception of satisfaction with eMAR changed over time.<br><br>Key findings: Nurses' perceptions of eMAR improved over time. Age, length of work experience, and comfort with computers are associated with                                                   | Cross-sectional, comparative design with convenience sampling<br><br>LOE: 2<br>Cross-sectional design<br><br>JBS: 4/8 (weak) | Anonymous survey: immediately after implementation of eMAR, 3 months after implementation, 6 months after implementation<br><br>Tertiary care medical centre. Registered and licensed practical nurses (LPNs) with responsibility for administering medication by eMAR | Electronic Medication Administration Record (EHR)                               | - Interdisciplinary cooperation is critical for a successful implementation | - | - | - Higher satisfaction scores were associated with younger age, less time as a nurse, greater comfort with using computers                                                                                       |

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|                                      | improvement of scores.                                                                                                                                                                                                                                                                                                                    |                                                                                      | Total: N= 719 (N0 =398); (N1=213); (N2=117)                                                                                                                                                                                                                                                                                                                                              |                                  |                                                                                                                                                                                                                                                                                                      |                                                                                                |                                                                                                                                        |                                                                                      |
| Rasmussen et al. (2015)<br>Denmark   | Focus: organizational changes caused by implementation of telemedicine in wound care according to healthcare professionals.<br><br>Key findings: Telemedicine leads to changes in communication and between nurses and staff. Important factors are training in wound care and telemedicine, shortage of staff and supportive leadership. | Qualitative design<br><br>LOE: 4<br>Qualitative interviews<br><br>JBS: 8/10 (strong) | Qualitative survey (part of an RCT): Results from the organizational domain of the used framework<br><br>October 2010-November 2014<br>Region of Southern Denmark (22 municipalities, 5 hospitals)<br><br>Focus group interviews with healthcare staff Of ten nurses, two doctors<br><br>Semi-structured individual interviews with key individuals, clinical and administrative leaders | Telemedicine (telemedicine)      | -Willingness to cooperate between the hospitals and municipalities is a key factor for success<br>- Training enhanced collaboration due to mixture of participants<br>- Implementation of telemedicine caused a new type of communication between nurses and clinical staff that enhanced confidence | - Support from different levels of leadership is beneficial for adoption                       | - New work routines caused by telemedicine led to task shifting.<br>-Common ground is important when testing telemedicine              | - Sense of ownership is a key success factor                                         |
| Shah et al. (2019)<br>United Kingdom | Focus: Healthcare professionals' (HCPs) perspectives about using mobile technologies in hospital settings and                                                                                                                                                                                                                             | Qualitative design<br><br>LOE: 4<br>Qualitative interviews                           | Focus groups and semi-structured interviews<br>Six doctors, six senior nurses, 13 junior nurses, three healthcare assistants,                                                                                                                                                                                                                                                            | Mobile technology (telemedicine) | -                                                                                                                                                                                                                                                                                                    | -Strong organizational leadership is needed for successful implementation of mobile technology | - Organizational culture: innovative organizations support staff to be ready for changes<br>- Cultural change is required when the use | -Experience with information technology determines how participants perceive the use |

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|                                                 | <p>change to a mobile culture in work.</p> <p>Key findings:<br/>Three themes were identified:<br/>-integrating mobile working in hospital care<br/>-addressing issues of data governance and accountability<br/>-handling the pace of change to digital.</p> <p>Acceptance of mobile working determined whether it improves (rather than hinders) practice.<br/>Acceptance requires strong organizational leadership and positive end-user engagement.</p> | JBS: 7/10 (moderate)                                       | four allied health professionals, two administration staff, pharmacist, speech therapist, theatre coordinator (N=34) |                                                                             |                                                                                                                              | - Active communication from leaders is necessary for adoption | of mobile technology is normal practice | <p>-Positive attitude is necessary for implementation of technology<br/>- Patient views are important for professionals<br/>- Changes should be meaningful and introduced incrementally in order to be successful</p> |
| Sockolow, Rogers, Bowles, Hand, & George (2014) | Focus: the challenges and facilitators to Nursing Information System (NIS) adoption.                                                                                                                                                                                                                                                                                                                                                                       | Qualitative design<br><br>LOE: 4<br>Qualitative interviews | Scenario-based user testing: scenarios and interview questions, observations<br><br>March - May 2012                 | Nursing Information Systems (NISs): technology supporting collaboration and | - NIS improved communication and relations in the team<br>- NIS made it possible to follow actions done by other disciplines | -                                                             | -                                       | - Patient perspectives are important for nurses (impersonal due to NIS)<br>- Nurses need to understand the value                                                                                                      |

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| United States                                | Key findings:<br>Influencing factors are: communication with clinicians about hospitals' goals, perceived NIS value, constructive feedback about design and software functionality.                                                                                        | JBS: 5/10 (weak)                                                                           | Two hospitals; four units<br><br>Registered nurses (N=12)                                                                                                                                   | can be used as part of EHR (EHR)          | - All disciplines should use the system in the correct manner to ensure adoption<br>- All users should complete the training to be able to work together in the system |                                                                                            |                                                                                        | and goals of using the system                                                                                                                                                                                                 |
| Song, Park, & Oh (2015)<br><br>United States | Focus: evaluation of relationship between acceptance of BCMA and patient safety culture (PSC)<br><br>Key findings:<br>Predictors of use of BCMA are:<br>-Feedback and communication about errors<br>-Perceived usefulness<br>-Teamwork within units<br>-Age and experience | Cross –sectional design<br><br>LOE: 2<br>Cross-sectional design<br><br>JBS: 5/8 (moderate) | Cross-sectional quantitative survey: self-administered questionnaire<br><br>May - August 2012<br><br>Two hospitals (USA, Washington DC)<br>RN's using BCMA<br><br>N=163 (response rate 46%) | Bar Code Medication Administration (BCMA) | -Teamwork within hospital units (nurses assist each other) predicts behavioral intention to use BCMA                                                                   | - Feedback about medication errors predicts perceived usefulness and perceived ease of use | -                                                                                      | - Age: older nurses were less likely to use BCMA than younger nurses<br>-Nurses with more experience with BCMA have a positive effect on perceived ease of use<br>-Perceived usefulness of BCMA predicts behavioral intention |
| Spetz, Burgess, & Phibbs (2012)              | Focus: study of the implementation of CPRS and BCMA and the impact on nurses.                                                                                                                                                                                              | Qualitative design<br><br>LOE: 4                                                           | Semi-structured interviews<br><br>June 2006 – September 2007                                                                                                                                | Computerized Patient Record System (CPRS) | - Team that leads the implementation should have involvement from nurses and a                                                                                         | - Good leadership is necessary for successful implementation                               | -Culture of the facility: success depends on support for change from leaders and staff | - Nurses who are less computer-skilled have more struggles with adoption                                                                                                                                                      |

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| United States                                     | <p>Key findings:<br/>Influencers on the success of the process of implementation are:</p> <ul style="list-style-type: none"> <li>-Organizational stability and team leadership</li> <li>-Implementation timelines</li> <li>-Equipment availability and reliability</li> <li>-Staff training</li> <li>-Changes in workflow</li> </ul> | <p>Qualitative interviews</p> <p>JBS: 7/10 (moderate)</p>                                                  | <p>7 Veterans Affairs (VA) hospitals</p> <p>nurses, pharmacists, nurse managers, information technology staff, senior management (N=118)</p>                                                                                                               | <p>Bar Code Medication Administration (EHR and BCMA)</p> | <p>partnership with pharmacy and IT</p> <ul style="list-style-type: none"> <li>- Shared team responsibility and involvement of end users are necessary for implementation</li> </ul> | <ul style="list-style-type: none"> <li>- Flexibility in implementation and a gradual process helps staff in the adoption process</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>- Nurses need adequate training and support staff</li> </ul>                                                                                                                                                                                                                              |
| <p>Taylor et al. (2015)</p> <p>United Kingdom</p> | <p>Focus: use and acceptance of telehealth by frontline staff working in community nursing</p> <p>Key findings:<br/>Implementation of telehealth is a fragile process.</p> <p>Themes:<br/>-Changing environment (era of change) is a barrier</p>                                                                                     | <p>Qualitative case study design</p> <p>LOE: 4</p> <p>Qualitative interviews</p> <p>JBS: 9/10 (strong)</p> | <p>In-depth interviews and documentation</p> <p>4 community health services</p> <p>Advanced community nursing staff (N=49); other qualified nursing staff (N=9); clinical leads and nursing service managers (N=10); other (N=37)</p> <p>Total (N=105)</p> | <p>Telehealth (telemedicine)</p>                         | <ul style="list-style-type: none"> <li>- Shared learning helps participants gain insight and thus accept the technology</li> </ul>                                                   | <ul style="list-style-type: none"> <li>- Local champions were key enablers of adoption of telehealth</li> </ul>                             | <ul style="list-style-type: none"> <li>- Working in a changing environment (restructuring of teams, integration of health and social care) is a barrier</li> <li>-Sharing of knowledge and successes establish trust</li> <li>- Trust and confidence enable adoption</li> <li>- The adoption process is fragile; telehealth was viewed as new technology, not as integrated into practice</li> </ul> | <ul style="list-style-type: none"> <li>-Good training and experimenting with the technology are enablers for adoption</li> <li>-Early experiences (positive and negative) have an impact on adoption. Negative experiences are caused by uncertainty and lack of understanding about patient suitability and workload</li> </ul> |

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|                               | <ul style="list-style-type: none"> <li>-Uncertainty regarding the role of/why to use telehealth (motives)</li> <li>-Experiences with telehealth (positive and negative)</li> <li>-Gaining insight into service design and technology</li> <li>-Integrating telehealth in routine care</li> </ul>                |                                                                                                                           |                                                                                                                                                                                                                                |                                   |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                       | <ul style="list-style-type: none"> <li>- Knowledge increases confidence and acceptance</li> <li>- How telehealth is introduced has an effect on adoption; uncertainty about the role of the technology is a barrier</li> </ul>                                                                                                                                            |
| Vedel et al. (2012)<br>Canada | <p>Focus: understanding the dynamics of implementation of CIS in an interdisciplinary team in Primary Care.</p> <p>Key findings: Seven user profiles were defined with each different drivers/ barriers. Influencing factors in early phase: IT skills, expected ease of use, expected usefulness, concerns</p> | <p>Qualitative study with longitudinal approach</p> <p>LOE: 4</p> <p>Qualitative interviews</p> <p>JBS: 9/10 (strong)</p> | <p>Data-source triangulation: observations of meetings and training, documentation, interviews (main source)</p> <p>2 Family Medical Groups (Quebec)</p> <p>All primary care physicians: staff, nurses, pharmacists (N=31)</p> | Clinical Information System (EHR) | <ul style="list-style-type: none"> <li>- Collaborative nature of development of the system has a positive impact on adoption</li> <li>- System has a positive impact on interdisciplinary work and collaboration: more people need to use it to have positive impact</li> </ul> | <ul style="list-style-type: none"> <li>- Presence of 'go-to-expert' colleague is an important factor in adoption process</li> <li>- Leadership shared by the team is a factor in adoption process</li> <li>- Bottom-up approach is beneficial for adoption process: development of the system out of needs of the interdisciplinary team</li> </ul> | <ul style="list-style-type: none"> <li>- Positive feedback and support from colleagues contributes to the adoption process</li> </ul> | <ul style="list-style-type: none"> <li>- Lack of IT skills is a barrier</li> <li>- Positive expectations about ease of use and usefulness are key drivers</li> <li>- Perceived benefits of using the system help adoption</li> <li>- Different user profiles have different drivers and barriers</li> <li>- Gradual implementation process encourages adoption</li> </ul> |

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|                                                       | about doctor-patient relationship<br>Influencing factors after two months: IT skills, ease of use, comfort with system, support from colleagues, positive impact                                                                                                                                                                                                                                                            |                                                                                                                    |                                                                                                                                                                                                                                                                                   |                          |                                                                                                                                                                                                                                                                                                                                                  |   |                                                                                                                                                                                            |                                                                                                                     |
| Zadvinskis, Chipps, & Yen (2014)<br><br>United States | Focus: nurses' perspectives regarding health IT and the impact on workflow, satisfaction, and quality of care.<br><br>Key findings:<br>Nurses' confirmed expectations are:<br>- Interaction with computer facilitates organization and care planning<br>- EHR and BCMA influence nurses' task accomplishment<br>- Teamwork is important for implementation of EHR<br>- Improvement of interdisciplinary communication after | Qualitative study with phenomenological approach<br><br>LOE: 4<br>Qualitative interviews<br><br>JBS: 9/10 (strong) | Qualitative research with inductive approach<br><br>Academic center; medical-surgical unit<br><br>Registered nurses experienced with EHR and BCMA, minimum two years working experience<br><br>Semi-structured interviews three to four months after implementation of EHR (N=10) | Health IT (EHR and BCMA) | - Collaboration eases implementation of health IT<br>- EHR improved interdisciplinary communication because of the increased communication across departments<br>- Technical issues negatively influenced interdisciplinary teamwork (difficulty sharing information)<br>- EHR implementation may affect teamwork due to increased time pressure | - | - Team members assist each other with the IT<br>- Teamwork depends upon staffing: lack of assistance is due to nurses being too busy.<br>- Mood and work tempo in the unit affect teamwork | - Nurses are concerned how patients perceive them (spending more time on a computer and less time with the patient) |

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| EHR<br>implementation<br>- EHR and BCMA<br>reduced error<br>reduction and<br>improved patient<br>safety |  |  |  |  |  |  |  |
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\*Paans et al., 2010  
\*\*Joanna Briggs Institute, 2017