

1 **Registered nurses' and medical doctors' experiences of patient safety in health information exchange in interorgani-**
2 **zational care transitions: Qualitative review.**

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40 **ABSTRACT**

41

42 **Research aim**

43 This systematic review aims to identify, critically appraise, and synthesize the best available literature on the experi-
44 ences of registered nurses and medical doctors of patient safety in health information exchange between inter-organi-
45 zational care transitions.

46 **Methods**

47 This review was conducted according the JBI methodology for systematic reviews of qualitative evidence. Five multidis-
48 ciplinary databases were systematically scanned from January 2010 to September 2020 to identify all qualitative or
49 mixed method studies exploring the registered nurses ‘and medical doctors’ experiences of patient safety in Health
50 Information exchange in interorganizational care transitions. JBI SUMARI with a meta-aggregation approach was used
51 to pool qualitative research findings.

52 **Results**

53 Six original studies were included in the final review. The total of 53 findings were aggregated into 9 categories and into
54 3 synthesized findings: 1) Efficiency and accuracy in health information exchange supports patient safety in interorgan-
55 izational care transitions, 2) the problems in content and structure as well as usability in health information exchange
56 jeopardize patient safety in interorganizational care transitions and 3) health care professionals’ actions in health infor-
57 mation exchange are associated with patient safety in interorganizational care transitions.

58 **Conclusions**

59 The results of this review demonstrated that health information exchange supports patient safety in interorganizational
60 care transitions, but development needs of health information exchange systems should be emphasized. Also, health
61 care professionals’ individual factors are associated with patient safety in health information exchange. The findings
62 show that in all stages of deployment of Health Information Exchange, health care professionals experiences should be
63 emphasized and there is still a need for qualitative research on the topic.

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65 Keywords:

66 **1. Introduction**

67

68 Patients' present care paths and care transitions in healthcare are unfunctional and discontinuous^{1, 2} due to deficiencies
69 in information transfer and inadequate written communication between hospitals and other healthcare organizations
70 ³⁻⁵. The Health Information Exchange (HIE), defined as "the electronic movement of health-related information among
71 organizations according to nationally recognized standards"⁶, can be used to reduce fatal treatment delays and improve
72 patient safety through safe and efficient data management ⁷⁻⁹. Poor usability and functionality of HIE, however, contrib-
73 utes adverse events and patient harm^{10,7}.

74 Inadequate documentation and information transfer are severe risk to the patient safety and a major cause or
75 contributor to the patient safety¹¹⁻¹⁴. Lack or overload of information of patient's situation and status can cause adverse
76 events, such as medication errors, lack of timely coordination of care and unwanted rehospitalizations¹⁵⁻¹⁸. Also, current
77 clinical information systems (CIS) have integration and functionality problems and the demands for functionality are
78 rising¹⁹.

79 Health care professionals (HCPs) have felt that HIE improves efficiency and quality of care and safety of information
80 transfer ²⁰⁻²². For example accurate documentation, computer-generated summaries and standardized formats in the
81 patient transfer record ensures the access to the patient data in a timely manner and that improves the quality of
82 interorganizational transitions^{23,2,24,7}. HIE improves also the quality of the clinical decisions²⁵ although HCPs have felt
83 that written patient data should be augmented with a verbal information so that HCP has an opportunity to discuss
84 about patients' status^{2,21}. In the study from Saranto et al.(2020)²², registered nurses (RNs) have been satisfied particu-
85 larly in intraorganizational information transfer whereas interorganizational information exchange has caused dissatis-
86 faction.

87 Perceived usefulness, threat, and ease of use as well as social influence have affected to the HCPs' attitudes and
88 acceptance to use HIE²⁶⁻²⁸, but in general the HCPs' attitudes towards the use of HIE have been positive^{29,8}. Poor HIE is
89 time-consuming, cause frustration and even burn out³⁰ and HCPs' motivation to use HIE has been reduced by list of
90 factors such as gaps in information, workflow interruptions and poor usability in general^{31,32}. HCPs have also been con-
91 cerned of the confidentiality and safety of information exchange and the reliability and quality of patient information²⁰.
92 Study by Hyppönen et al. (2018)³³ shows that especially medical doctors (MDs) have been critical in their evaluation of
93 HIE. There seems to be dissatisfaction with the information transfer and co-operation between different organizations,
94 even though the national patient data register is in use.

95 When using HIE, technological problems explain only part of the problems associated with patient data transfer.
96 The human impact on technology and the data input is significant. For example, data is manually entered into the HIE

97 and causing duplication of data and increasing the possibility of errors.^{34,35} In addition, there has been problems regard-
98 ing accurate medication documentation^{36,37,34} and patient identification³⁵.

99 Human factors approach can be used to support HCPs to deliver safe care by considering three domains of system
100 design: Physical, cognitive and organizational^{38,17}. The key principle of human factors approach is that the elements
101 functions within systems¹⁷. By implementing for example electronic health record without considering interactions
102 between the elements, patient safety will not be improved overall³⁹. Indeed, RNs have felt that in-service training have
103 supported the change in work processes related to digital services²² and organizational support is needed in HIE⁴⁰.

104 Previous systematic reviews on this topic have focused on the adoption of electronic systems by HCP, the role of
105 medical data in patient transfers, communication in healthcare in general, computer-assisted patient discharge and
106 networked health information technology (IT) improving patient safety^{41,5,8,7,28}. However, there is no previous qualita-
107 tive systematic review of factors affecting patient safety in HIE in interorganizational care transitions, which would be
108 particularly important for the development work of patient safety .

109 **2. Methods**

110

111 **2.1. Research aim**

112 This systematic review aims to identify, critically appraise, and synthesize the best available literature on the experi-
113 ences of RNs and MDs of patient safety in health information exchange in interorganizational care transitions. The re-
114 search question was: What are RN's and MD's experiences of patient safety in HIE in interorganizational care transi-
115 tions?

116

117 **2.2. Design**

118 This review was conducted according the JBI methodology for systematic reviews of qualitative evidence⁴², the Pre-
119 ferred Reporting Items for Systematic Reviews and Meta-Analyses (see Annex 1)⁴³ and a priori published protocol (PROS-
120 PERO 220631).

121

122 **2.3. Search methods**

123 A preliminary search for existing reviews on the topic was conducted in.... Five electronic databases (Cumulative Index
124 to Nursing and Allied Health Literature, Web of Science, PubMed, Scopus and Medic) were systematically reviewed from
125 January 2010 to September 2020. Search strategy was designed and conducted for each database separately by an
126 information specialist in cooperation with the corresponding author. The past decade was chosen because the devel-
127 opment of HIE processes and related technologies have been constantly evolving. The keywords with free-text and
128 MESH-terms used are presented in Table 1. The inclusion criteria were designed according to the PICO: participants=
129 RNs' and MDs', phenomena of interest= experiences of patient safety in HIE between interorganizational care transi-
130 tions, context=all health care settings,) review protocol⁴². All qualitative or mixed method studies were included, con-
131 sidering that the qualitative results of the mix method studies had been reported separately. Quantitative studies were
132 excluded due to the need to aggregate deeper meanings of experiences of RNs' and MDs' of HIE and uncover possible
133 new understandings^{44,42}. Only peer reviewed studies written in English, Finnish and Swedish were included to ensure
134 the scientific quality of information gathered. Lastly, the reference lists of the included studies were searched for rele-
135 vant studies⁴².

136

137 **2.4. Search outcomes**

138 In the selection process two independent reviewers evaluated the studies at each stage of the selection and inclusion
139 process. The search produced a total of 1932 hits. Identified studies' titles and abstracts (n=1283) and full texts (n=48)
140 were screened against predetermined inclusion and exclusion criteria. (Figure 1.) Disagreements among researchers on
141 the inclusion of studies were resolved through discussions/third reviewer.

142

143 **2.5. Quality appraisal**

144 The JBI Critical Appraisal Checklist for Qualitative Research was used to evaluate methodological quality of studies in-
145 cluded⁴². Two researchers evaluated independently the quality of the studies and consensus among evaluators were
146 ensured at the end of the process.

147

148 **2.6. Data extraction**

149 The JBI-SUMARI *standardized data extraction* tool was used to extract the data from the included studies by correspond-
150 ing author and extraction was confirmed by another researcher (see table 2). The data extracted included specific details
151 about the population, context, culture, geographical location, study methods and the phenomena of interest relevant
152 to the review question and specific objectives. Findings, and their illustrations, were extracted and assigned a level of
153 credibility⁴².

154

155 **2.7. Data synthesis**

156 Qualitative research findings were pooled using JBI SUMARI with the meta-aggregation approach and the findings were
157 synthesized by consensus from three authors. Findings from qualitative studies were gathered and grouped into cate-
158 gories of similar meanings. Unequivocal findings (presented with an illustration that is beyond reasonable doubt) and
159 credible findings (presented with an illustration lacking clear association with it) were considered as reliable and in-
160 cluded in the aggregation⁴². The illustrations were grouped into findings without researches interpretation (see Table
161 4). The ConQual approach for qualitative systematic reviews was used to downgrade synthesized findings based on their
162 dependability and credibility⁴⁵ (see Table 5).

163 **3. Results**

164

165 **3.1. Characteristics of included studies**

166 The included (N=6) original studies with total sample of 402 participants were conducted in Norway⁴⁶, United Kingdom
167 ⁴⁷, Scotland⁴⁸ and USA⁴⁹⁻⁵¹. Majority of participants were RNs and MDs with varying lengths of working experience (Table
168 2). The studies were conducted both in public and private care settings in primary (e.g., community, public health and
169 home care)^{48,46,49-51} and secondary (e.g., surgical hospitals, emergency care) care^{46,49,50,47,51} as well as in social ser-
170 vices^{46,47}. Data were collected using focus group-^{46,48} and individual semi-structured interviews^{48,46,49,47,51} as well as in-
171 depth observations⁴⁷.

172

173 **3.2 Methodological quality**

174 After quality appraisal, six original studies were included in the final review. Criteria 6 *"Is there a statement locating the*
175 *researcher culturally or theoretically?"* and 7 *"Is the influence of the researcher on the research, and vice-versa, ad-*
176 *dressed?"* were unclear in all the included studies (Table 3). The findings, presented in the included studies, were allo-
177 cated by the level of credibility based on the evaluators' perception of the support provided from illustration. Only
178 reliable findings were accepted.⁴²

179

180 **3.3 Review findings**

181 The total of 53 findings were aggregated into 9 categories and finally into 3 synthesized findings: 1) Efficiency and accu-
182 racy in HIE supports patient safety in interorganizational care transitions. 2) The problems in content and structure as
183 well as usability in HIE jeopardize patient safety in interorganizational care transitions. 3) HCPs' actions in HIE are asso-
184 ciated with patient safety in interorganizational care transitions. (see Table 4).

185

186 **3.2.1 Efficiency and accuracy in HIE supports patient safety in interorganizational care transitions.**

187 This synthesized observation was formed by combining four categories supported by 18 findings (Table 4). Seventeen
188 findings were rated as unequivocal and one as credible.

189 **The first category** (Direct, timeless and automated bidirectional HIE supports patient safety) was supported by 5
190 findings. HCPs felt that direct and written communication with automated data entry supports better access to relevant
191 and valued patient information and is considered efficient^{48,46,51}. One MD pointed out that *"I think one important*

192 *advantage is that it automatically populates the referral with past... with important past information, that we don't*
193 *need to edit and complete that, it does it automatically which is very helpful".*

194 **Second category** (Written and automatically documented HIE supports patient safety) was supported with 3 find-
195 ings. Written information is valued more than oral information strengthening patient safety and awareness committing
196 caregivers to patient work⁴⁶. One hospital nurse pointed out that *"The fact that things are written down, commits you.*
197 *You can see that we and community care are communicating."*

198 **Third category** (Improved and customized HIE supports patient safety) was supported by 8 findings. HIE improves
199 communication and safer patient transfers compared to previously used communication methods due to better access
200 to the relevant information and nursing staff in the care relationship with the patient^{48,46,51}. One community nurse stated
201 that *"When we called the hospital, you did not reach anyone who knew the patient, and you had to spend some time on*
202 *that. I think it is easier today."*

203 **Fourth category** (Guidance and protocols in HIE supports patient safety) was supported by 2 findings. Clinical advice
204 inbuilt in systems and improved use of standard protocols were considered as guidance and help to the professional's
205 work⁴⁸. One general practitioner said, *"Some of the stuff like might have specific form[...] so it kind of helps focus you to*
206 *what you should be doing on some of these forms, it's just really good"*.

207

208 **3.2.2 The problems in content and structure as well as usability in HIE jeopardize patient safety in interorganizational** 209 **care transitions.**

210 This synthesized observation was formed by combining three categories supported by 21 findings (Table4). Seventeen
211 findings were rated as unequivocal and 4 as credible.

212 The **first category** (Usability issues (e.g. interoperability, lack of coordination, double documentation, workflow
213 difficulties) causes challenges to patient safety) was supported by 11 findings. The lack of inter-operability of multiple
214 systems causes problems of coordination between health organizations as well as usability problems causes workflow
215 interruptions, inefficiencies and data loss^{48,50,47}. One focus group pointed out that *"Our referral information note [sum-*
216 *mary] doesn't always capture every nuance of the hospital stay... it's good, but it's not complete"*.

217 **The second category** (The content and structure of HIE jeopardize patient safety) was supported by 7 findings.
218 Content and structure of information should be more accurate in terms of patient functions, social determinants, and
219 the care process so HCPs' have sufficient information for continuous care^{50,51}. One focus group felt that *"Our referral*

220 *information note [summary] doesn't always capture every nuance of the hospital stay... it's good, but it's not complete.*
221 *(Focus Group C)*”.

222 The **third category** (Lack of patient’s or caregivers’ contribution to HIE jeopardizes patient safety) was supported
223 by three findings. Patient and informal caregiver participation in HIE still needs to be developed especially in the case
224 of safe medication by improving patient centered education⁵⁰. One focus group told that *“What happens in the hospital*
225 *they're handed a whole wad of papers [e.g. EHR-generated discharge documents] in a notebook, and it's like they don't*
226 *know what it is, or what they're supposed to do with it, so they're overwhelmed with information, particularly the older*
227 *population.”*

228

229 **3.2.3 HCPs’ actions in HIE are associated with patient safety in interorganizational care transitions**

230 This synthesized observation was formed by combining 2 categories supported by 14 findings (Table 4). All findings were
231 rated as unequivocal.

232 The **first category** (User-dependent inaccuracies, incompleteness, and inefficiencies in HIE jeopardize patient
233 safety) was supported by 6 findings. HCPs’ ways to use information systems cause inaccuracies in medication lists and
234 ambiguities and delays in patient information (e.g. description of patient’s functional level). However, HIE encourages
235 HCPs to think more carefully about the documentation of the patient information.^{46,50,49,51} One hospital nurse said *“I*
236 *think that we could be better to be concrete and describe (...) especially from our side—when we send a request [for*
237 *services], it has to appear [sic] relevant information. (Hospital, nurse 4).”*

238 The **second category** (Healthcare professional’s situation awareness is used in HIE) was supported by 8 findings. If
239 there are concerns of patient’s situation (e.g. complications, immediate follow up need or social determinants of health)
240 HCPs add e-messaging or oral information in addition with HIE to ensure the sufficient and safe information trans-
241 fer^{49,50,47,51}. “One primary care provider said *“...anything that like you might lose a little sleep over it at night. Whenever*
242 *you have a gut instinct, I think that’s when you should send a personal message.”.*”

243 **4. Discussion**

244

245 According to our understanding this is the first qualitative review focusing on HIE in interorganizational care transitions
246 form patient safety perspective. According to our findings 3 main synthesized findings for factors affecting patient safety
247 in HIE in interorganizational care transitions were identified.

248 According to the findings, efficiency and accuracy in HIE supports patient safety in interorganizational care transi-
249 tions. Previous studies have shown that patients care transitions are unfunctional and discontinuous^{1,2} due to the inad-
250 equate information transfer³⁻⁵. Use of HIE improves efficiency, timeliness and quality of care and improves collaborative
251 work with other HCP^{20,8,21}. Greatest benefits of HIE are in relation to medication information, especially when patients
252 aren't able to provide information themselves²⁸. Also, provided data supports quality of decision making^{25,28}. This re-
253 view points out also that the guidance and protocols in information systems are considered helpful and the written
254 information is valued more than oral information. However, HCP feel that written information should be augmented
255 with a verbal communication^{2,21}. In general, functional CIS can reduce adverse events (e.g. medication or diagnostic
256 errors), and support up-to-date patient information, and improve efficiency of care^{8,19}.

257 This review found that the problems in content and structure as well as usability in HIE jeopardize patient safety in
258 interorganizational care transitions. The study by Adene et al. (2019)⁷ agrees that usability issues of HIE cause problems
259 in patient safety. Lack or overload of data and scattered and erroneous patient information cause adverse events such
260 as medication errors, lack of timely coordination of care and rehospitalizations^{15-18,40}. Also, the format of information
261 delivered between organizations and interoperability issues needs development¹⁹. The demands for functionality are
262 rising¹⁹ and MDs are critical in their evaluations of HIE³³. Usability issues in HIE cause frustration and burn out to HCPs³⁰,
263 reduces the motivation to use HIE and causes gaps in information transfer.^{31,27} Again, in review by Motamedi (2011)⁸
264 physicians were satisfied with HIE at the time of patient discharge.

265 According to this review HCPs' actions in HIE are associated with patient safety in interorganizational care transi-
266 tions. Previous studies have shown that humans have major influence on patient information. Particularly problems
267 with accurate medication information and patient identification are present.^{34,35} Study from Kierkegaard et al. (2014)⁴⁰
268 indicates that there is a need for organizational support within the use of HIE. However, nurses have felt that their
269 information management skills are relatively high, although the level of education and age affect to the competence³³.
270 HCPs have felt uncertain of the confidentiality and safety of HIE as well as the reliability and quality of patient

271 information²⁰. Randell's et al. (2019)²⁸ review stated that the use of information depends on perceived accessibility and
272 quality of desired information

273 The results of this review show that HIE at its best supports patient safety by reducing the impact of human factors.
274 On the other hand, lack of usability and functionality of HIE systems emphasizes the effect of human factors increasing
275 the risk to adverse events. HCPs situational awareness or mental workload is rarely considered in health care, even
276 though in other high-risk areas (e.g. aviation) it's mandatory in information systems design.¹⁷ Furthermore, findings
277 show that the cognitive properties of HCPs are also related to the patient safety in the use of HIE. Information pro-
278 cessing, competence to use HIE and decision making are interacting with offered technological solutions. Organizational
279 support such as training reduces the impact of cognitive human factor.³⁸

280

281 **4.1 Limitations**

282 This review has limitations. Due to the inclusion criteria concerning languages of published studies , it is possible that
283 some relevant studies have been overlooked. Due to the lack of grey literature, some significant studies may have been
284 missed. Also, due to the relatively small amount of included studies, some perspectives are likely to remain undescribed.
285 However, the depth of findings produced by qualitative methods helps to answer the research question and reflect on
286 the patient safety perspectives of HIE. The reader should also notice that the experiences from the informants of in-
287 cluded studies concerns a variety of HIE systems with diverse characteristics in quality and functions.

288

289 **4.2 Implications for practice and research**

290 This review describes and synthesizes the factors affecting patient safety in the use of HIE between organizational care
291 transitions from HCPs perspective. The findings of this study can be used for development of HIE at all stages of deploy-
292 ment (e.g. design, implementation, HCPs training and continuous evaluation). In future studies the patient safety per-
293 spective should be highlighted, including a comprehensive perspective based on human factors. Relatively few qualita-
294 tive studies have been carried out of HCPs experiences of HIE so qualitative research on the topic is apparent.

295

296 **5. Conclusion**

297 The results of this review demonstrated that HIE supports patient safety in inter organizational care transitions, but
298 development needs of HIE systems should be emphasized. Also, the HIE users' individual factors are associated with

299 patient safety in use of HIE. The findings show that in all stages of deployment of HIE, HCPs experiences should be
300 emphasized and there is still a need for qualitative research on the topic.

301

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312 **Declaration of competing interest**

313 No conflict of interest has been declared by the authors.

314 **References:**

315

- 316 1. Grönroos E, Perälä M-L. Home care personnel's perspectives on successful discharge of elderly clients from hos-
317 pital to home setting. *Scand J Caring Sci* 2005;19:288-95.
- 318 2. Jeffs L, Lyons R, Merkley J, et al. Clinicians' views on improving inter-organizational care transitions. *BMC Health*
319 *Serv Res*. 2013;30:289.
- 320 3. Nagpal K, Vats A, Lamb B, et al. Information Transfer and Communication in Surgery: A Systematic Review. *An-*
321 *nals of Surgery*. 2010;252: 224–239.
- 322 4. Ong M, Coiera E. A systematic review of failures in handoff communication during intrahospital transfers. *Joint*
323 *Commission Journal on Quality and Patient Safety*. 2011;37:274–284.
- 324 5. Vermeir P, Vandijck D, Degroote S, et al. Communication in healthcare: a narrative review of the literature and
325 practical recommendations. *International Journal of Clinical Practice*. 2015;69:1257–1267.
- 326 6. N.A.f.H.I. Technology, Report to the Office of the National Coordinator for Health Information Technology on
327 defining key health information technology terms, in, Office of the National Coordinator for Health Information
328 Technology, US Department of Health and Human Services Washington, DC, 2008.
- 329 7. Adane K, Gizachew M, Kendie S. The role of medical data in efficient patient care delivery: A review. *Risk Manag*
330 *Healthc Policy*. 2019;12:67-73.
- 331 8. Motamedi SM, Posadas-Calleja J, Straus S, et al. The efficacy of computer-enabled discharge communication
332 interventions: a systematic review. *BMJ Qual Saf*. 2011;20:403-15.
- 333 9. Nunes S, Rego G, Nunes R. The experience of an information system of nursing practice: The importance of
334 nursing records in the management of a care plan. *CIN: Computers, Informatics, Nursing*. 2014;32: 322–332.
- 335 10. Howe JL, Adams KT, Hettinger AZ, et al. Electronic health record usability issues and potential contribution to
336 patient harm. *JAMA*. 2018;319:1276-1278.
- 337 11. Milch CE, Salem DN, Pauker SG, et al. Voluntary electronic reporting of medical errors and adverse events. An
338 analysis of 92,547 reports from 26 acute care hospitals. *J Gen Intern Med*. 2006;21:165-170.
- 339 12. Yeaman B, Ko K.J, Del Castillo, et al. Care transitions in long-term care and acute care: Health information ex-
340 change and readmission rates. *Online Journal of Issues in Nursing*. 2015;20:5.

- 341 13. Hohenstein C, Fleischmann T, Rupp P, et al. German critical incident reporting system database of prehospital
342 emergency medicine: Analysis of reported communication and medication errors between 2005–2015. *World J*
343 *Emerg Med.* 2016;7:90–96.
- 344 14. Sockolow P, Hellesø R, Ekstedt M. Digitalization of Patient Information Process from Hospital to Community
345 (Home) Care Nurses: International Perspectives. *Stud Health Technol Inform.* 2018;250:227-229.
- 346 15. Kessler C, Williams M. C, Moustoukas J. N, et al. Transitions of care for the geriatric patient in the emergency
347 department. *Clinics in Geriatric Medicine.* 2013;29:49-69.
- 348 16. King B, Gilmore-Bykovskiy A, Roiland R, et al. The Consequences of Poor Communication during Hospital to
349 Skilled Nursing Facility Transitions: A Qualitative Study. *J Am Geriatr Soc.* 2013;61:1095-102.
- 350 17. WHO. Human Factors: Technical Series on Safer Primary Care. Geneva: World Health Organization; 2016.
- 351 18. Manias E, Gerdtz M, Williams A, et al. Complexities of medicines safety: communicating about managing medi-
352 cines at transition points of care across emergency departments and medical wards. *Journal of Clinical Nursing.*
353 2015;24:69–80.
- 354 19. Islam MM, Poly TN, Li YJ. Recent advancement of clinical information systems: Opportunities and challenges.
355 *Yearb Med Inform.* 2018;27:83-90.
- 356 20. Zwaanswijk M, Verheij RA, Wiesman FJ, et al. Benefits and problems of electronic information exchange as per-
357 ceived by health care professionals: an interview study. *BMC Health Serv Res.* 2011;11:256.
- 358 21. Barrett J. Ambulance clinicians’ perspectives of sharing patient information electronically. *British Paramedic*
359 *Journal.* 2019;4:49-50.
- 360 22. Saranto K, Kinnunen U-M, Koponen S, et al. Sairaanhoidajien valmiudet tiedonhallintaan sekä kokemukset poti-
361 las- ja asiakastietojärjestelmien tuesta työtehtäviin. *Finnish Journal of EHealth and EWelfare.* 2020;12:212-228.
- 362 23. Kripalani S, LeFevre F, Phillips CO, et al. Deficits in Communication and Information Transfer Between Hospital-
363 Based and Primary Care Physicians. *J Am Med Inform Assoc* 2007;297:831–841
- 364 24. Tierney WM, Sidle JE, Diero LO. Assessing the impact of a primary care electronic medical record system in three
365 Kenyan rural health centers. *J Am Med Inform Assoc.* 2016;23:544–552.
- 366 25. Ben-Assuli O, Sagi D, Leshno M, et al. Improving diagnostic accuracy using EHR in emergency departments: a
367 simulation-based study. *J Biomed Inform.* 2015;55:31–40.
- 368 26. Davis, F. ‘Perceived usefulness, perceived ease of use and user acceptance of information technology’, *MIS*
369 *Quarterly.* 1989;13: 319–340.

- 370 27. Al-Adwan A.S, Berger H. 'Exploring physicians' behavioural intention toward the adoption of electronic health
371 records: an empirical study from Jordan', *Int. J. Healthcare Technology and Management*. 2015;15:89–111.
- 372 28. Randell R, Abdulwahid M, Greenhalgh J et al. How and in what contexts does networked health IT improve
373 patient safety? Elicitation of theories from the literature. *Stud Health Technol Inform*. 2019;264:753-757.
- 374 29. Secginli S, Semra E, Monsen Karen. Attitudes of health professionals towards electronic health records in pri-
375 mary health care settings: A questionnaire survey. *Informatics for health & social care*. 2014;39:15-32.
- 376 30. Gardner RL, Cooper E, Haskell J, et al. Physician stress and burnout: the impact of health information technology.
377 *J Am Med Inform Assoc*. 2018;26:106–114.
- 378 31. Rudin R., Volk L., Simon S, et al. What Affects Clinicians' Usage of Health Information Exchange? *Appl Clin Inf*.
379 2011;2:250–262.
- 380 32. Wawrzyniak C, Marcilly R, Baclet N, et al. EHR Usage Problems: A Preliminary Study. *Studies in health technology*
381 *and informatics*. 2019;257:484-488.
- 382 33. Hyppönen H, Vänskä J, Reponen J, et al. Ammattilainen – potilastietojärjestelmät työn tukena? In Tutkimuksesta
383 tiiviisti. Terveiden ja hyvinvoinnin laitos, Helsinki. 2018.
- 384 34. Jylhä V, Bates DW, Saranto K. Critical factors in the information management process: the analysis of hospital-
385 based patient safety incident reports. *Finnish Journal of EHealth and EWelfare*. 2016;8:164-176.
- 386 35. Palojoki S, Mäkelä M, Lehtonen L, et al. An analysis of electronic health record–related patient safety incidents.
387 *Health Informatics*. 2017;23:134–145.
- 388 36. Ruuhilehto K, Kaila M, Keistinen T, et al. HaiPro - millaisista vaaratapahtumista terveydenhuollon yksiköissä opit-
389 tiin vuosina 2007–2009? *LÄÄKETIETEELLINEN AIKAKAUSKIRJA DUODECIM*. 2011;127:1033-40.
- 390 37. Tupper JG, Gray C, Pearson K, et al. Safety of Rural Nursing Home-to-Emergency Department Transfers: Improv-
391 ing Communication and Patient Information Sharing Across Settings. *Journal for Healthcare Quality*. 2015;37:55-
392 65.
- 393 38. Karsh BT, Holden RJ, Alper SJ, et al. A human factors engineering paradigm for patient safety: designing to sup-
394 port the performance of the healthcare professional. *Qual Saf Health Care*. 2006;15:59-65.
- 395 39. Carayon P, Karsh BT, Gurses AP, et al. Macroergonomics in Healthcare Quality and Patient Safety. *Rev Hum*
396 *Factors Ergon*. 2013;8:4-54.
- 397 40. Kierkegaard P, Kaushal R, Vest JR. Information retrieval pathways for health information exchange in multiple
398 care settings. *Am J Manag Care*. 2014;20:494-501.

- 399 41. Dimitrovski T, Ketikidis P, Lazuras L, et al. 2013. Adoption of Electronic Health Records (EHRs): A Review of Tech-
400 nology Acceptance Studies. In: *Proceedings of the 16th International Symposium on Health Information Manage-*
401 *ment Research–ISHIMR 2013.*
- 402 42. Lockwood C, Porrit K, Munn Z, et al. Chapter 2: Systematic reviews of qualitative evidence. In: Aromataris E,
403 Munn Z (Editors). *JBIM Manual for Evidence Synthesis.* JBI, 2020. Available from [https://synthesisman-](https://synthesismanual.jbi.global)
404 [ual.jbi.global.](https://synthesismanual.jbi.global)
- 405 43. Moher D, Liberati A, Tetzlaff J, et al. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The
406 PRISMA Statement. *PLoS Med* 2009;6:e1000097.
- 407 44. Seers K. Qualitative systematic reviews: their importance for our understanding of research relevant to pain.
408 *British journal of pain*, 2015;9:36–40.
- 409 45. Munn Z, Porritt K, Lockwood C, et al. Establishing confidence in the output of qualitative research synthesis: the
410 ConQual approach. *BMC Med Res Methodol* 2014;14:108.
- 411 46. Melby L, Brattheim B, Hellesø R. Patients in transition - improving hospital-home care collaboration through
412 electronic messaging: Providers' perspectives. *Journal of Clinical Nursing.* 2015;24:3389-3399.
- 413 47. Waring J, Bishop S, Marshall F. An ethnographic study comparing approaches to inter-professional knowledge
414 sharing and learning in discharge planning and care transitions. *Journal of Health Organization and Management*
415 2019;33:677-694.
- 416 48. Bouamrane MM, Mair FS. A qualitative evaluation of general practitioners' views on protocol-driven eReferral
417 in Scotland. *BMC Medical Informatics and Decision Making.* 2014;14:30-43.
- 418 49. Slager S, Beckstrom J, Weir C, Del Fiol G, Brooke BS. Information Exchange Between Providers During Transitions
419 of Surgical Care: Communication, Documentation and Sometimes Both. *Stud Health Technol Inform.*
420 2017;234:303-308.
- 421 50. Sarzynski E, Ensberg M, Parkinson A, et al. Eliciting nurses' perspectives to improve health information exchange
422 between hospital and home health care. *Geriatric nursing.* 2019;40:277-283.
- 423 51. Munchhof A, Gruber R, Lane KA, et al. Beyond Discharge Summaries: Communication Preferences in Care Tran-
424 sitions Between Hospitalists and Primary Care Providers Using Electronic Medical Records. *J Gen Intern Med.*
425 2020;35:1789-1796.
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Identification

Screening

Eligibility

Included

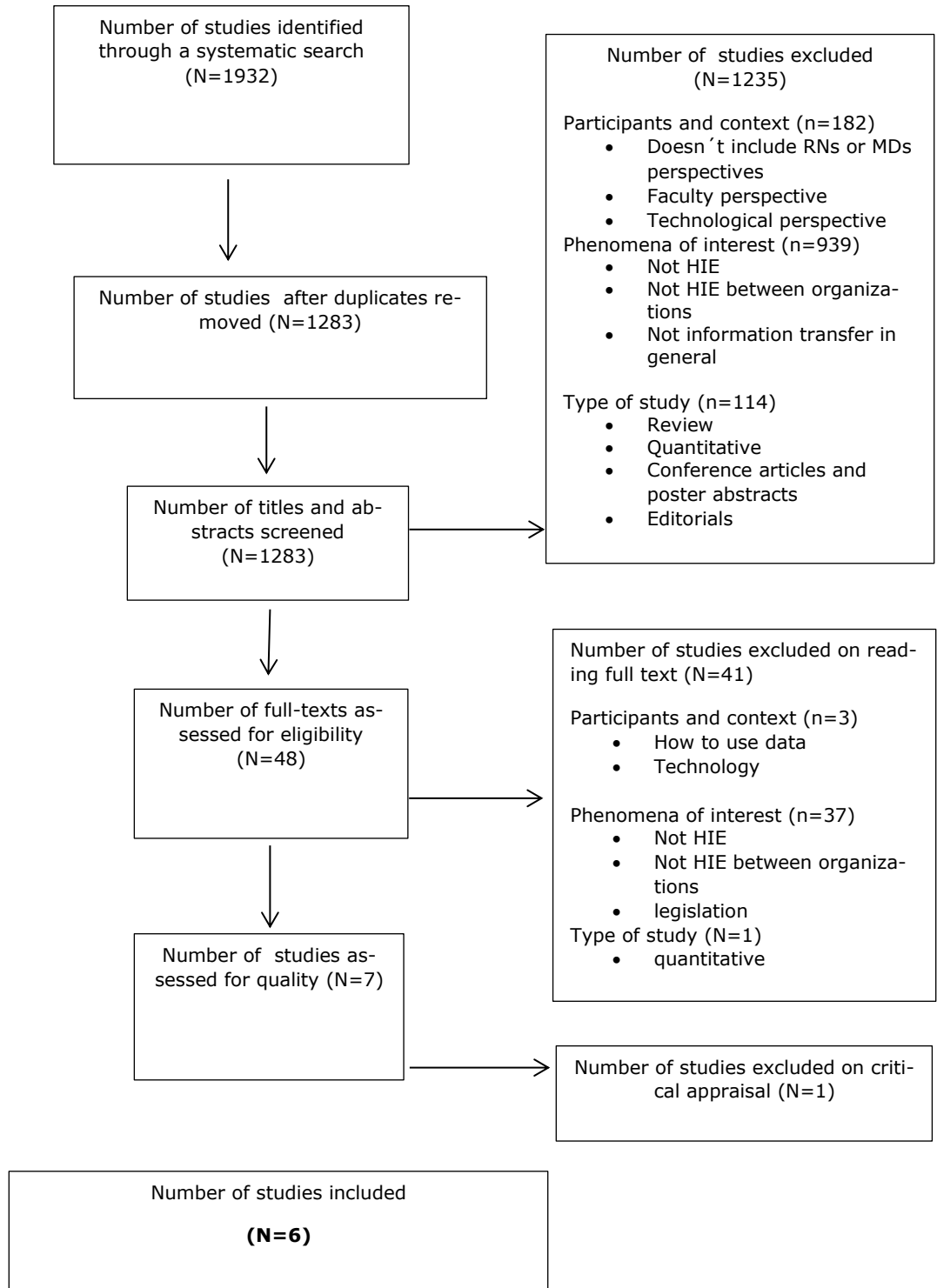


Fig. 1. Flowchart of study selection process (HIE = Health Information Exchange).

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Table 1. Keywords used in databases in the search strategy.

Database	
Web of science, Cinahl and Scopus	nurse* OR doctor* OR physician* OR personnel OR user* OR professional* AND "medical information" OR "medical data" OR "medical record*" OR "patient information" OR "health information" OR "patient data" OR "health data" OR "patient record*" OR "health record*" AND safety OR "adverse event*" OR "risk management" OR error* AND exchange OR transfer* OR handover
Pubmed, Medic	"Health Personnel"[Mesh] OR ((nurse*[Text Word] OR doctor*[Text Word] OR physician*[Text Word] OR personnel [Text Word] OR user*[Text Word] OR professional*[Text Word] AND medical information[Text Word] OR medical data[Text Word] OR medical record*[Text Word] OR patient information[Text Word] OR health information[Text Word] OR patient data[Text Word] OR health data[Text Word] OR patient record*[Text Word] OR health record*[Text Word])) OR ("Health Information Exchange"[Mesh] OR "Medical Records" AND "Patient Safety"[Mesh] OR "Risk Management"[Mesh] OR "Medical Errors"[Mesh])) OR ((safety[Text Word] OR adverse event*[Text Word] OR risk management[Text Word] OR error*[Text Word] AND "Patient Handoff"[Mesh] OR "Patient Transfer"[Mesh])) OR ((exchange [Text Word] OR transfer*[Text Word] OR handover [Text Word]

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Table 2. Assessment of methodological quality of included studies according to Joanna Briggs Institute’s critical appraisal checklist for qualitative research.

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Bouamrane & Mair 2014	Y	Y	Y	Y	Y	U	U	Y	Y	Y
Melby et al. 2015.	Y	Y	Y	Y	Y	U	U	Y	Y	Y
Sarzynski et al. 2019.	U	Y	Y	Y	Y	U	Y	Y	Y	Y
Slager et al. 2017.	U	Y	Y	Y	Y	U	U	Y	Y	Y
Waring et al. 2019.	Y	Y	Y	Y	Y	U	U	Y	Y	Y
Munchhof et al. 2020	Y	Y	Y	Y	Y	U	U	Y	Y	Y
%	33,33	100.0	100.0	100.0	100.0	0.0	16,67	100	100.0	100.0

Y = yes, N = no, U = unclear: Q1 = Is there congruity between the stated philosophical perspective and the research methodology; Q2 = Is there congruity between the research methodology and the research question or objectives?; Q3 = Is there congruity between the research methodology and the methods used to collect data?; Q4 = Is there congruity between the research methodology and the representation and analysis of data?; Q5 = Is there congruity between the research methodology and the interpretation of result?; Q6 = Is there a statement locating the researcher culturally or theoretically?; Q7 = Is the influence of the researcher on the research, and vice-versa, addressed?; Q8 = Are participants, and their voices, adequately represented?; Q9 = Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?; Q10 = Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?

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Table 3. Synthesized findings, presented as synthesized categories, the underlying categories and findings with illustrations supporting each category.

Synthesized finding	Categories	Findings	Illustration
Efficiency and accuracy in health information exchange supports patient safety in inter-organizational care transitions.	Direct, timeless and automated bidirectional health information exchange supports patient safety.	There was considerable agreement among the informants that e-messaging means more efficient communication in patient transitions (C) (Melby et al. 2015)	<i>It is perhaps the best [thing] that has happened!</i> (Hospital, nurse 7)
		Support during the patient consultation workflow (U) (Bouamrane & Mair 2014)	GP10: "...we can see the patient, see the patient and sometimes your... depending on if it's a protocol that I'm happy using on SCI, I can have the referral done with the patient in the room, press a button and know it's gone. You know, it may not be seen for a while, but I know that I've done it, and it's sent instantly which I think is very good".
		Immediate transfer of the referral request (U) (Bouamrane & Mair 2014)	GP22: "... Yes it's excellent, I mean if I'm putting someone through at 8 o'clock at night you know that this is going to be at least looked at first thing the next morning... and it's fabulous"
		The SCI Gateway system provides adequate support for automated data entry (U) (Bouamrane & Mair 2014)	GP8: "...I think one important advantage is that it automatically populates the referral with past... with important past information, that we don't need to edit and complete that, it does it automatically which is very helpful"
		Messaging within the EMR was also viewed as a facilitator of direct communication due to a direct link to patients' charts via medical record numbers, accessibility of messages at any time, and ease of bidirectional messaging. (U) (Munchhof et al. 2020)	"if we call [the PCP] or page them we're taking them away from another patient. It's also taking our time to page and wait for a call back. So, I think it's the EMR messaging that most important." (Hosp 1024)
Written and automatically documented health information exchange supports patient safety.	The automatic recording of information in each patient's EPR was viewed as strengthening patients' safety. (Melby et al. 2015)	Several informants argued that a written message has a stronger value than information communicated orally (U) (Melby et al. 2015)	<i>The communication is documented; it is proper quality assurance'. (Hospital, nurse 6).</i>
		The content of the patient information communicated across providers has changed with the introduction of e-messaging. (C) (Melby et al. 2015)	<i>You become more aware. [Because] what is written has a bit stronger value than what is just put in words. (Hospital, nurse 4).</i>

Improved and customized health information exchange supports patient safety	E-messaging makes it easier to get in contact with the right person, i.e. a person that has knowledge of a given patient (U) (Melby et al. 2015)	<i>When we called the hospital, you did not reach anyone who knew the patient, and you had to spend some time on that. I think it is easier today. (Community, nurse 13)</i>
	The positive experiences with e-messaging must be seen in contrast to previous practices, which were depicted as inefficient, cumbersome and unsafe (U) (Melby et al.2015)	<i>Not only did we take notes [from the telephone conversation], but we received an anonymized fax! We had to call the hospital to obtain the patient's name and number in order to identify him. And it was not easy to find the correct nurse. You just had a telephone number [to the ward]. It took some time. (Community, nurse 11)</i>
	They also think more carefully about what they want to communicate (U) (Melby et al. 2015)	<i>I can sit down and write and delete text if it turns out wrong. I think it is all right to have the possibility to formulate it in written text, and I think it is all right to give some thoughts [sic] to what I want to say. (Hospital, nurse 6)</i>
	Improved information sharing/systems integration across the health services (U) (Bouamrane & Mair 2014)	<i>GP9: "...I quite like the various features of it; that you can see that they've looked at your referral and they've acted upon it, so, yes I'm fairly happy with it".</i>
	Improved organisational work processes and performance (U) (Bouamrane & Mair 2014)	<i>GP12: "...Well if we suspect cancer, there is box on our SCI referral that you tick. You know: 'suspect cancer', that is, it's taken as an urgent referral and also the 'managed clinical network for cancer': they follow those guys up and make sure that things are, you know, that things are happening and everything. I mean... they have worked hard to work at their... reduce bottle necks where there have been, like you know, investigations or something where there was delays and stuff and things... they've tried hard to try and make sure that those, particularly for the cancer patients, are sorted out so those patients are investigated and sorted out as soon as".</i>
	Support for providing additional clinical information. (U) (Bouamrane & Mair 2014)	<i>GP23: "...you can cut and paste the consultation itself then, with a bit of tweaking then, that tends to, I think, give them a good background as to the reason for referral".</i>
	PCPs and hospitalists alike valued direct communication at discharge and noted that it allowed key parts of the discharge summary, including critical follow-up items, to be highlighted (U) (Munchhof et al. 2020)	<i>"If I'm concerned that the patient is not going to show up for their follow up and ... I want to make sure that they're not lost and make sure the PCP knows is somebody should actually call social work and get followed up rather than just letting them fall away from the system." (Hosp 1017).</i>
	eReferral is designed to suit the information needs of the recipient of the referrals (U) (Bouamrane & Mair 2014)	<i>GP3: "Some of it is O.K. I mean, I think – like you know... – the colorectal one's a pain. But it actually is not too bad, you know... It's really for them to be able to detect the urgent ones compared to the</i>

			<i>non-urgent: that's the idea and that's fair enough! I've no problems with that"</i>
	Guidance and protocols in health information exchange supports patient safety.	Clinical advice/referral guidance functionalities are helpful (U) (Bouamrane & Mair 2014)	<i>GP2: "... Some of the stuff like might have specific form [...] so it kind of helps focus you to what you should be doing on some of these forms, it's just really good".</i>
		Improved use of standard protocols and guidelines (U) (Bouamrane & Mair 2014)	<i>GP17: "...this SCI Gateway system that we use it links to guidance... So if we're making the referral it will have guidance about who's appropriate to refer and who's not appropriate to refer. And finally it can prompt for things, so it can prompt you to you know check a blood pressure or it can prompt you to, you know, put information about disabilities or past medical history or things that you might forget"</i>
The problems in content and structure as well as usability in health information exchange jeopardize patient safety in inter-organizational care transitions.	Usability issues (e.g. interoperability, lack of coordination, double documentation, workflow difficulties) causes challenges to patient safety.	The multiplicity of technological systems not only necessitated duplication of recording due to a lack of inter-operability, but also problems of coordination between systems that needed additional work to be resolved during day-to-day practice. (U) (Waring et al. 2019)	<i>There isn't a simple answer. There are just too many agencies out there, and each has their own system, and you have to know what they each need, and when they need it. (Nurse, S2, Orthopaedic)</i>
		In a number of instances, the use of electronic communications systems was supported through preliminary or parallel use of paper-based records or verbal communications. (U) (Waring et al. 2019)	<i>We still use fax. Can you believe it. Fax. Mostly when sending referrals to social services. It seems too old fashioned. (Ward Clerk, S2, Orthopaedic)</i>
		Inefficiencies (e.g., double documentation) (U) (Sarzynski et al. 2019)	<i>Our referral information note [summary] doesn't always capture every nuance of the hospital stay... it's good, but it's not complete.(Focus Group C)</i>
		Issues accessing relevant information (e.g. contacting multiple providers to clarify medication discrepancies) and resources (e.g. arranging oxygen or supplies), especially on weekends. (C) (Sarzynski et al. 2019)	<i>It's tougher on the weekends that's for sure... I mean, there's been times when on the weekend we don't get any information, and I go in and I'm totally punting when I go into a home... (Focus Group B)</i>
		Data loss and system breakdown (U) (Bouamrane & Mair 2014)	<i>GP21: "...very occasionally we had occasional instances were it's not worked well, were a referral is a...we thought it's been sent but it hasn't or it hasn't been received so but that's maybe once a year"</i>

Lack of coordination across the health services & lack of work practice coherence (U) (Bouamrane & Mair 2014)	GP2: <i>"The only confusing thing about is that some things, and more and more is on SCI Gateway now, but there's still some services that are not on SCI Gateway. It's sometimes difficult to remember what's on SCI Gateway and what still needs some other specific form on whatever. [...] Sometimes you have to look on it to see, you know, how do you refer these things..... [...] It can be quite difficult to find out. So that sort of thing</i>
Lack of feed-back on referrals (U) (Bouamrane & Mair 2014)	GP4: <i>"[...] I don't think you would need to receive a notification elect... through an e-mail or anything because I think you would just get a lot of them and you would end-up probably not... but it would be useful to be able to go in and check so if a patient says 'I've still not received the letter', it would be useful to be able to go in the system and say well you're in this stage so it won't be that long [...] they do sometimes say: 'I was referred months ago but I haven't hear anything'..." Interviewer: ...so what happens then? What do you do? "...you have to just phone up the secretary" (at the hospital)</i>
Information presentation & system status (U) (Bouamrane & Mair 2014)	<ul style="list-style-type: none"> • GP4: <i>"...one of the secretaries [...] does keep an eye on referrals so, because some doctors... what you can do is that you can complete it, half of it and not send it. Now, I never do that 'cause I'm only in practice just once a week and I always do the whole thing and send it off... It's a bit frustrating because you have to send it and then you have to go back into the journal part of the note and click another button to proceed it, which again I think is unnecessary but, umh... what I was talking about being a bit, you know clunky with all the different things you've got to click... some GPs will leave it half-finished and come back to it and the secretary keeps an eye on whether some of them are sitting on the system that haven't gone so she nags at people to tell them to get them sent..."</i>
Issues of system performance (U) (Bouamrane & Mair 2014)	GP1: <i>"...apart from the time taken to open up SCI Gateway, and then to log into the referral screen and then each referral takes 8 mouse clicks to actually send. Now that... whoever dreamed that up was not a busy GP."</i>
Administratively cumbersome (U) (Bouamrane & Mair 2014)	GP6: <i>"...What's frustrating is when they have um... what do you call them... mandatory boxes that you can't submit it unless you give the information but if you don't... sometimes you don't have it all and then that's a bit of a... you know... a bit of an issue"</i>

	Usefulness & usability of SCI gateway system. (C) (Bouamrane & Mair 2014)	GP24: “yeah, it’s quite intuitive, it’s quite good, it’s a bit on the slow side but I quite... I find it quite OK”
The content and structure of health information exchange jeopardize patient safety.	Limited health literacy (U) (Sarzynski et al. 2019)	The med they have in their home or they’re familiar with needs to be listed. If they take Lasix it needs to say Lasix, and I know they have both names there, but if they have furosemide, it needs to say furosemide. [confusion about drugs: Trade name versus generic name] (Focus Group A)
	Social determinants of health (e.g. financial, transportation, home environment, etc.). (C) (Sarzynski et al. 2019)	The hospital’s like going to the theater... Here [home health care] is like attending the circus! (Focus Group A)
	Poor electronic health record-generated documentation too much information, but lacking essential data (e.g. labs, dietary/fluid restrictions, target weight, ejection fraction, and code status) (U). (Sarzynski et al. 2019)	Our referral information note [summary] doesn’t always capture every nuance of the hospital stay... it’s good, but it’s not complete. (Focus Group C)
	Inaccurate medication lists (e.g. poor medication reconciliation). (U) (Sarzynski et al. 2019)	The list printed off in our packet when we go out to do the start [of care] is different than the list the patient brings home from the hospital, even though they both come off of Epic [EHR]. (Focus Group D)
	Issues clarifying patient’s medication regimens. (U) (Sarzynski et al. 2019)	It takes a very long time [medication reconciliation]. It can be an hour... and that’s only the in-home stuff, not calling their doctor to figure it out, then calling the patient back and telling ‘em what to take. (Focus Group C)
	PCPs recommended templates to help structure messages to keep them brief and not become a repeat of the discharge summary. (U) (Munchhof et al. 2020)	“you could make a template for it... might make it easier for people to do and to know specifically what information... but we don’t want it to turn into as long as discharge.” (PCP 1132)
	The primary system-level barrier described by both groups was incorrect identification of the PCPs in the EMR. (U) (Munchhof et al. 2020)	“They need to do a better job of making sure at least in the EMR it’s listed fairly correctly.... They’ve seen 4 different people in the past year and knowing who their PCP is, is not always easy.” (PCP 1116).
	Lack of patient’s or caregivers’ contribution to health information exchange jeopardizes patient safety.	Complexity of medication self-management tasks. (C) (Sarzynski et al. 2019)

		Ineffective informal caregiver (e.g. caregiver has own functional limitations, caregiver absent, etc.). (U) (Sarzynski et al. 2019)	<i>One family member fills the pillbox, and then takes the pills [bottles] home or something, and then you don't know what's in there... You don't know if they're getting the right dose of Lasix... (Focus Group C)</i>
		Ineffective clinician to patient communication e.g., Patients is overwhelmed, need to improve delivery of patient centred education (U). (Sarzynski et al. 2019)	<i>What happens in the hospital they're handed a whole wad of papers [e.g. EHR-generated discharge documents] in a notebook, and it's like they don't know what it is, or what they're supposed to do with it, so they're overwhelmed with information, particularly the older population. (Focus Group B)</i>
Health care professionals' actions in health information exchange are associated with patient safety in inter-organizational care transitions.	User-dependent inaccuracies, incompleteness, and inefficiencies in health information exchange jeopardize patient safety.	The medicine list was often incomplete, e.g. it did not always include the patient's regular medications that he or she used before hospitalisation. (U). (Melby et al. 2015)	<i>It happens that the list does not correspond [with community care's list], or that there are pills on the old medicine list that we think the patient shall continue to take. So, when it's a weekday we have to consult the GP. (Community, nurse 13)</i>
		Expressing oneself can also be a challenge for native speakers (U). (Melby et al. 2015)	<i>Sometimes a nursing assistant has been writing on my note, and I would never have expressed myself in such a non-medical way. The report must have a certain professional standard. (Hospital, nurse 19)</i>
		Transition situations demand extra attention to what kind of information the receiver needs to provide the best follow-up care to the patient (U) (Melby et al. 2015)	<i>I think that we could be better to be concrete and describe (...) especially from our side—when we send a request [for services], it has to appear [sic] relevant information. (Hospital, nurse 4)</i>
		Ineffective clinician-to-clinician communication (e.g. inconsistent messages regarding care plans). (U) (Sarzynski et al. 2019)	<i>[No indication of] Their target weight—what you want them to stay... in the discharge summary it'll say, "diuresed well," but did they lose 20 pounds of fluid? How much fluid did they gain [to prompt hospital admission]? (Focus Group C)</i>
		Information does not arrive in time for decision making. The lack of consistency with what comes in a referral or post-operative note was mentioned by several providers, and lack of information required more effort to determine what was missing. (U) (Slager et al. 2017)	<i>I mean, it varies. Referrals sometimes come with lots of information, sometimes with no information at all.</i>
		Hospitalists suggested that PCPs reply back to messages in the EMR acknowledging receipt as this makes it more likely they will send messages to the PCPs in the future. (U) (Munchhof et al. 2020)	<i>"... a message when you sign the discharge summary you know this patient was a 30-day readmission please strongly consider sending a message via EMR to their PCP Dr. X." (Hosp 1010).</i>

Healthcare professional's situation awareness is used in health information exchange.	When there was no urgent need for a surgeon to communicate with a PCP, a standard visit note was sufficient to document the patient's status and clinical course, particularly if no immediate follow up was required. (U) (Slager et al. 2017)	<i>I don't personally talk to primary care physicians after surgery. The only form of communication that I would have is through Epic if they're (the PCP) on Epic and if they're going to a skilled nursing facility or residence, we'll do a transfer phone call. So there would be discussion at that level if there was a very specific issue where we needed information or we needed to convey information to the PCP we would make a phone call.</i>
	Provider-provider communication is usually about the current situation or near future (including follow up requirements), and usually regarding patient care. (U) (Slager et al. 2017)	<i>I think our healthcare environment is really complicated so the more communication we can have the better but I also think that sometimes adding this - enforcing communication ... that doesn't help either like you are just adding some other bureaucratic thing to do.</i>
	If the patient experienced complications, many providers would attempt to contact the other directly. (U) (Slager et al. 2017)	<i>If all goes according to plan the PCP would receive a copy of my operative note and a copy of the discharge as long everything was smooth if there is any complications the PCP gets a phone call.</i>
	The importance of direct communication at time of hospital discharge about information that, if missed, could cause patient harm. (U) (Munchhof et al. 2020)	<i>"if you need to change more than one medication or if they're on 20 units of insulin [and] they go home on none, that's big... I guess it's bigger medication changes... stuff that if they went back to their old ways would kill them." (PCP1128).</i>
	Social factors including social determinants of health (living/home situation, access to healthcare, ability to obtain medications, homelessness, and substance or physical abuse) as high priority for direct communication, especially given the patient population at this safety net hospital.(U) (Munchhof et al. 2020)	<i>"...if there is some bad social thing going on... concern about substance use disorder... wasn't previously recognized... a victim of domestic violence... stuff like that" (PCP 1129)</i>
	Clinical judgment, a sense that something is "off" or a "gut instinct," was given high priority for direct communication at discharge (U) (Munchhof et al. 2020)	<i>"...anything that like you might lose a little sleep over it at night. Whenever you have a gut instinct, I think that's when you should send a personal message." (PCP 1163).</i>
	In contrast, paper-based records seemed to act as a more dynamic and evolving record that appeared to be "owned" by a professional group or team (U) (Waring et al. 2019)	<i>It might seem antiquated but with a patient file you can pick it up and give it to someone [...] when everything fails you can put the summary on the trolley with the patient as they get wheeled out. (Nurse, S2, Orthopaedic)</i>

	Issues with hardware and software. (e.g. old computers and multiple electronic health records) (U) (Sarzynski et al. 2019)	<i>I want the paper because if the computer fails I still got the paper... (Focus Group A)</i>
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- 482 PCP= Primary Care Practitioner
- 483 EMR= Electronic Medical Record
- 484 EPR= Electronic Patient Record
- 485 SCI-Gateway= Scottish Care Information - gateway

Table 4. ConQual Summary of Findings

Registered nurses' and medical doctors' experiences of patient safety in health information exchange in inter-organizational care transitions: Qualitative review.					
Population: RNs and MDs					
Phenomena of interest: patient safety in Health information exchange in interorganizational care transitions					
Context: healthcare settings					
Bibliography:					
Synthesized findings	Type of research	Dependability	Credibility	ConQual score	Comments
Efficiency and accuracy in health information exchange supports patient safety in inter-organizational care transitions.	qualitative	Moderate (downgraded one level)	Moderate (downgraded one (-1)) *	Moderate	*downgraded one level due to mix of unequivocal (U) and credible (C) findings 17 (U) 1(C)
The problems in content and structure as well as usability in health information exchange jeopardize patient safety in inter-organizational care transitions.	qualitative	Moderate (downgraded one level)	Moderate (downgraded one (-1)) *	Moderate	*downgraded one level due to mix of unequivocal (U) and credible (C) findings 17 (U) 4(C)
Health care professionals' actions in health information exchange are associated with patient safety in inter-organizational care transitions.	qualitative	Moderate (downgraded one level)	High	High	14 (U)

487 U: unequivocal; C: credible

488 The ConQual approach⁴⁵ was used to assess and report confidence in the results of this qualitative systematic review.

Section/topic	#	Checklist item	Reported on page
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	6
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	-
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	6

Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Table 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Figure 1
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6,13
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	7, Table 2, 4
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	-
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	7
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	8
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	-
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	8, Fig. 1

Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	8-10, Table 3
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	8, Table 2, 4
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	-
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	-
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	8, Table 2, 4
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	-
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11-12
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	13

490 From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement.
491 PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097