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Independent and system-wide safety investigation in healthcare, establishing and testing a curriculum – a qualitative study

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3 1 **Title page**
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6 2 **Title:** Independent and system-wide safety investigation in healthcare, establishing and testing a
7 3 curriculum – a qualitative study
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4 27 Independent and system-wide safety investigation in healthcare,
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8 28 establishing and testing a curriculum – a qualitative study
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14 29 **Abstract:**
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18 30 **Objective and Setting:** National, system-wide safety investigation represents a new approach to safety
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20 31 improvement in healthcare. In 2019 a new master's level course in *Safety Investigation in Healthcare*
21
22 32 was established to support the training and development of a new team of national investigators from
23
24 33 an independent investigatory body. A total of 19 participants were enrolled and completed the course.
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26 34 The objective of this study was to qualitatively evaluate the course and explore the participants' needs
27
28 35 and expectations prior to the course conduct, and their experiences and suggestions for improvements
29
30 36 after course completion.
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33
34 37 **Design:** The study design was a qualitative explorative study with interviews before and after course
35
36 38 participation. Data collection included 5 individual interviews and 2 focus group interviews with a total
37
38 39 of 13 informants. Data were analysed according to thematic content analysis.
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41
42 40 **Results:** The results showed a need for a common conceptual foundation for the multidisciplinary team
43
44 41 of safety investigators who were all employed in the same investigatory body. Course participation
45
46 42 contributed to create reflexive spaces for the participants and generated new knowledge about the
47
48 43 need for a broad range of investigatory tools and approaches. This contrasted with the initial aspiration
49
50 44 among the participants to have a recipe for how to conduct safety investigations.
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53
54 45 **Conclusions:** Course participation contributed to a common language among a highly multidisciplinary
55
56 46 group of safety investigators and supported building a culture of collaborative learning. The need for
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58 47 additional activities to further develop a safety investigation curriculum in healthcare was identified.
59
60 48 We conclude that this should be co-created with independent investigators, safety scientists, patients

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3 49 and users, and healthcare professionals to ensure a strong methods repertoire and a sound theoretical
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5 50 backdrop for investigatory practice.
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9 51 Article Summary

12 52 Strengths and limitations of this study

- 17 53 • A new master level training course for national, system-wide patient safety investigations was
18 54 established, tested, and evaluated.
- 21 55 • The participants represent independent national investigators who works for learning
22 56 purposes only to improve patient safety in Norway.
- 26 57 • The course was developed based on input from the national investigatory body to ensure
27 58 relevance.
- 30 59 • The study evaluated the first round of running the new investigation course and the sample
31 60 size is therefore somewhat small.

35
36 61 **Word count: 3770**

39 62 Introduction

43 63 One of the most fundamental aspects of safety in healthcare is to learn from adverse events in order
44 64 to improve future healthcare services¹⁻⁶. Every year a large number of patients across the world are
45 65 harmed by adverse events such as late diagnosis, wrong diagnosis, wrong treatment, technical failure,
46 66 medication errors and infections. In order to learn from these events, safety investigation is key^{4 7-10}.
47 67 Investigating and learning from serious adverse events is a complex process that confronts many
48 68 challenges¹¹⁻¹³. These challenges relate to establishing multidisciplinary competence to address the
49 69 complex nonlinear phenomenon of adverse events, the independence of the investigatory body,
50 70 patient and user involvement in investigations, and trust and system understanding^{4 9 10 12-14}.

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3 71 Different types of courses exist to train and support accident investigators in different sectors such as
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5 72 transport, industrial accidents, and healthcare. Despite this, there are few university courses at higher
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7 73 educational levels to support competence development in safety investigations in healthcare—
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9 74 particularly for the specialist knowledge and skills required for independent, system-wide national
10
11 75 safety investigators. Hence, upon a collaboration request from the new independent national
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13 76 healthcare safety investigation body in Norway, the University of Stavanger designed a Master of
14
15 77 Science level course that could support future safety investigators in competence development to
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17 78 achieve high quality safety investigations in healthcare. Specifically, the course was designed to give
18
19 79 insight into the required knowledge, skills, and analytical capacity to understand how safety
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21 80 investigations in healthcare can be approached to foster patient safety and learning processes from a
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23 81 system-wide perspective. During 2019, 19 participants from a Norwegian independent safety
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25 82 investigatory body were enrolled and completed the course.
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31 Description of safety investigation course

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34 84 The safety investigation course was designed as a 5 ECTS course as requested by the investigatory
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36 85 body. The course was given in English, over a period of three one-day sessions, with individual reading
37
38 86 and group tasks to be completed in between sessions. During the course, the participants were
39
40 87 introduced to six main topics and took part in different student-active collaborative learning methods
41
42 88 such as group work and a table-top simulation of a safety investigation (see table 1). In addition, the
43
44 89 participants applied their skills to real reported events as cases for testing and practicing theoretical
45
46 90 perspectives and methods. The exam was a group term paper on a self-selected research problem with
47
48 91 a word limit of 5000, marked approved/not approved. All aids were allowed. The learning outcomes
49
50 92 of the course were set according to knowledge, skills and general competence (see overview in table
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52 93 2). The content was based on recent research into accident and safety investigations in healthcare,
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54 94 with examples from other relevant industries.
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3 96 PLEASE INCERT HERE Table 1: Overview of main topics
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7 98 PLEASE INCERT HERE Table 2: Learning outcomes in the safety investigation in healthcare course
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11 100 Objective and research question

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15 101 The objective of this study was to qualitatively evaluate the Safety Investigation in Healthcare course
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17 102 and explore the participants' needs and expectations prior to the course, and their experiences and
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19 103 suggestions for improvements after course completion.
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22 104 The study was guided by the following research questions:
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25 105 a) What are the expectations from healthcare safety investigators for a system-wide safety
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27 106 investigation course?
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29 107 b) How did national safety investigators experience attending the course and what are their
30
31 108 suggestions for improvement?
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34 35 109 Methods

36 37 38 39 40 110 Design

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42
43 111 The study was designed as a qualitative explorative study using individual and focus group interviews
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45 112 ¹⁵ in order to provide information concerning the participants' needs, expectations and experiences
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47
48 113 related to the safety investigation in healthcare course.
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50 51 114 Data collection and analysis

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55 115 Data collection was conducted in two phases. First, five individual interviews were undertaken prior to
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57 116 the course starting, followed by two focus group interviews after course completion. A total of 13
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59 117 participants contributed to both data collection methods. Safety investigators and managers of the
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3 118 investigatory body participated in both phases. All participants were affiliated with the same
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5 119 investigatory body.
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8 120 The individual interviews were conducted using a semi structured interview guide aimed to answer
9
10 121 research question a). The interviews were focused on mapping current work task, needs and practices
11
12 122 as well as needs and expectations related to investigation methods, investigatory principles,
13
14 123 theoretical knowledge, investigation methods, user involvement, interdisciplinary teamwork,
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16 124 simulation experience, and competence related to setting criteria for investigation initiation.
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20 125 The focus group interviews were conducted a while after the participants had completed the course.
21

22 126 The rationale for this was to give the participants the chance to include the knowledge and experiences
23
24 127 from the course in their everyday work. Safety investigators and managers were divided into two
25
26 128 separate groups during the focus group interviews to enable all participants to speak more freely ¹⁶.
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29 129 Both groups consisted of four participants, safety investigators in group one (three male, one female)
30
31 130 and managers in group two (three female, one male). The semi structured interview guide for these
32
33 131 interviews aimed to answer research question b). The guide covered themes related to experiences
34
35 132 and suggestions for improvement regarding course structure, relevance to current work tasks, theory,
36
37 133 investigation methods, different pedagogical approaches, user involvement, and interdisciplinary
38
39 134 teamwork. In group one all the participants were eager to contribute, had a friendly tone and waited
40
41 135 for their turn to speak. In group two, three out of the four participants mainly spoke, while the fourth
42
43 136 took a more confirmatory role, nodding in response to the other participants' contributions.
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47 137 All interviews took place at the participants' current workplace. The interviews lasted approximately
48
49 138 between 40-60 minutes and were conducted by three researchers (LS, JGA, CHD) who had limited
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51 139 involvement in the course delivery. All interviews were tape recorded and transcribed shortly after the
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53 140 interviews took place.
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3 141 The transcribed data material from both individual interviews and focus group interviews were
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5 142 analyzed using thematic content analysis¹⁷. Authors, CHD, SW, VG, AR and JGA contributed to the data
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7 143 analysis through an iterative process of reading and discussions.
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10 144 Patient and Public Involvement

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14 145 The course was developed with input on collaboration with the interdependent national investigatory
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16 146 body, where different parts of the course such as content, layout and design were discussed.
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19 20 147 Results

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23
24 148 The analysis resulted in two main themes, which correspond to the study's two research questions.
25
26 149 These themes are: 1) Needs and Expectations and 2) Experiences. Each of the themes are described in
27
28 150 turn below. Table 3 and 4 provides an overview of themes and subthemes illustrated by direct quotes
29
30 151 from the interviews.
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34 152 35 36 37 153 Needs and Expectations

38 39 40 41 154 Feeling open, curious and excited

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44 155 The participants expressed largely positive expectations towards the course, regardless of their
45
46 156 professional backgrounds and prior knowledge and experience. They were open and curious about the
47
48 157 potential for gaining new knowledge and learning new hands-on approaches. Several felt that the
49
50 158 course was to cover themes that they already had knowledge of, but they expressed that the course
51
52 159 content would likely complement their existing competencies as well. The participants highlighted that
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54 160 they welcomed all kinds of new knowledge, and that they valued the opportunity for further education.
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161 Need for a common conceptual foundation

162 The safety investigators were a highly interdisciplinary group from a wide variety of professional
163 backgrounds (nurses, doctors, human factors, philosophy, psychology, political science, etc.). They
164 therefore represented a variety of different perspectives and starting points before attending the
165 course. This also included varying prior knowledge and experience of safety theories and safety
166 investigation methods. The participants noted that the highly interdisciplinary nature of the group was
167 first and foremost a strength that had a mostly positive impact on their investigations. But conversely,
168 it was clear that the group's significant heterogeneity could challenge their investigative work and
169 collaborative practices. This was often expressed as being due to a lack of a common conceptual
170 foundation or common language with which to approach and discuss cases.

171 Need for in-depth theoretical knowledge and a common investigative approach

172 Several participants expressed a need for broader theoretical knowledge and a more in-depth
173 understanding of the safety science field. Many were vocal about their concern that the focus here
174 ought to be on learning about complex systems theories rather than approaches that are built around
175 simple causal explanations. Adopting a systems perspective was also seen as vital to facilitate learning
176 across levels and organizations. Gaining the theoretical knowledge necessary to develop a common
177 conceptual apparatus was therefore high on the list of the participants' educational needs prior to
178 attending the course.

179 Participants expressed a definite need for a common investigative approach, including a common set
180 of analytical methods and tools to use in investigations. This was referred to within the group as a
181 'methodological hunger'. With a lack of hands-on experience of investigative methods and tools, there
182 was a sense of uncertainty regarding how to best approach the analytical phase of investigations. They
183 therefore talked about the importance of being able to familiarize themselves with and test different
184 tools and approaches in an effort to gain the insight necessary to make informed decisions about the

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3 185 usefulness or not of the various options available. Again, participants were concerned that simplistic
4
5 186 causal approaches would be too narrow in scope for the purposes of their investigations, which aim to
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7 187 facilitate cross-level learning. There was therefore a need for investigative methods and tools with a
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10 188 complex systems focus.

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13 189 PLEASE INCERT HERETable 3: Overview of themes, subthemes and direct quotes from individual
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15 190 interviews

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19 20 21 192 Experiences

22 23 24 25 193 Joint experiences provide common ground

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28 194 The participants highlighted that the most important effect of the course was that it had provided
29
30 195 them with common ground. This related to getting a better understanding of each other's background
31
32 196 and knowledge, in addition to a joint vocabulary, and a common language. Due in part to participating
33
34 197 in the course, they now had a similar understanding of the underlying meaning of different safety
35
36 198 related terms. The participants believed that this was also partly due to the fact that they now had
37
38 199 longer experience working with each other. The managers emphasized that building a common culture
39
40 200 was what they considered as the most positive outcome of course participation. The managers
41
42 201 believed that this aspect was particularly important for the investigators working part-time since
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44 202 course participation made them more included in the team of investigators. The investigators
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46 203 themselves believed that it was getting to know each other through the course's practical learning
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48 204 tasks that was of most importance.

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3 206 Collaborative working requires collaborative learning
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6 207 In relation to learning and the pedagogical approaches encountered during the course, the participants
7
8 208 highly appreciated the sessions with group work. Both managers and safety investigators believed that
9
10 209 the table-top simulation and group work were the most fruitful approaches, since they reflected their
11
12 210 everyday investigatory work practices. Learning together therefore became important since it
13
14 211 resembled how they usually worked. It was important for the participants that the cases they were
15
16 212 going to discuss were highly authentic and recognizable for them. They believed that the more 'real'
17
18 213 the cases felt, the easier it was to get engaged and learn. Some of the participants believed that lack
19
20 214 of authenticity was the reason why they found other pedagogical approaches such as tabletop
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22 215 exercises with movies less useful. The participants also preferred pedagogical approaches where they
23
24 216 got to engage with each other and take an active role in their own learning.
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30 217 Create arena for reflection and discussion
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33 218 Although it was difficult for the participants to pinpoint practical contributions which could specifically
34
35 219 be dated back to their course participation, both groups made a range of reflections related to the
36
37 220 course subjects. They had become more aware of the implications of a systems perspective, the
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39 221 difficulties of engaging in systematic methods, the need for case specific adjustments, that there is no
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41 222 single recipe for conducting investigations, the demanding task of giving attention to details as well as
42
43 223 seeing the whole picture, and the need for a combination of different approaches. They also reflected
44
45 224 on their data gathering practices and that different narratives will provide different information, as
46
47 225 well as how to conduct valid data collection, what data is, and issues concerning how to set criteria for
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49 226 case selection. One of the most valuable contributions from course participation therefore seemed to
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51 227 be the fact that it created an arena for reflection and discussions, allowing the participants to become
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53 228 more aware of the strengths and weaknesses related to their work.
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4 230 Extensive subject - limited time
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6 231 Participants from both groups stressed that the course had proved demanding, with a high number of
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8 232 different subjects and highly advanced literature to be covered in a short amount of time. Although
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10 233 they valued and respected the English-speaking lecturer, and the English curriculum, it was demanding
11
12 234 for Norwegian speakers to navigate new territory with a large amount of new subject specific
13
14 235 terminologies in a different language to their own. The participants believed that the short
15
16 236 introduction to several new subjects, instead of more in-depth studies of fewer subjects, was the
17
18 237 reason they found the course material to be somewhat fragmented. Although both groups wanted
19
20 238 more in-depth knowledge of the subjects, they all acknowledged that there was a discrepancy between
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22 239 their needs and expectations and the amount of in-depth study that it is possible to offer with a 5 ECT
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24 240 course.
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29 241 Based on their experiences from participating in the course, the participants suggested that future
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31 242 classes be taught in the participants' native language. They also suggested taking time to present an
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33 243 overview of the material at the beginning of the course, and to include some 'lighter' items on the
34
35 244 curriculum to ease access to complex and difficult material. The participants also encouraged
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37 245 authenticity and that the course developer should strive to make all case studies and group work highly
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39 246 recognizable and authentic to real life cases. All participants suggested a longer and more extensive
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41 247 course that gave the opportunity for more in-depth understanding of each of the safety investigation
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43 248 theories presented throughout the course.
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48 249 PLEASE INCERT HERE Table 4: Overview of themes, subthemes and direct quotes from focus group
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50 250 interviews
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253 Discussion

254 This paper explored the participants needs, expectations, and experiences related to a system-wide,
255 learning focused safety investigation in healthcare course. The findings showed that a heterogenous
256 group of multidisciplinary healthcare investigators shared a need for collective understanding of safety
257 investigatory concepts, tools, and practice. In the following we discuss the findings and reflect on
258 implications for further curriculum development to contribute to enhanced system-wide and learning
259 focused investigatory practice in healthcare.

260 The complexity of safety investigations in healthcare

261 Prior to course participation, the participants described both needs and expectations related to a
262 common conceptual apparatus and investigative approach. More specifically, they had expectations
263 of receiving detailed information regarding how to investigate different types of cases. At that time,
264 the participants had limited experience of working together, they all came from different backgrounds,
265 and had different levels of experience with safety investigation in healthcare. Within learning
266 processes, the difference between a novice and an expert level is the ability to extract key principles
267 and transfer them to similar situations¹⁸. With such a high degree of difference and uncertainty among
268 them, it is to be expected that the participants at this particular point in time, and in a novel situation,
269 acted much like novices wanting stability and a recipe of how to approach their new task. However,
270 although this was what the participants initially craved, only a short time after the completion of the
271 course the participants acknowledged that there was a need for a more nuanced approach than that
272 provided by a standard recipe. The need to have a methods repertoire and insight into the varying
273 options available and their limitations, contributed to a better understanding of their role and position
274 in approaching the investigative task. Our results are in line with recent research arguing for the need
275 for a large toolbox to fit the exact case and context of adverse events investigations¹⁴. This

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3 276 furthermore demonstrates the participants' ability to advance to a higher level of reflection in a short
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5 277 period of time, on their way towards becoming experts.
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8 278 Reflexive spaces as a mean to promote system learning

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12 279 Previous research ¹⁹ argues that creating and supporting reflexive spaces, such as what was done at
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14 280 the safety investigation course, is key in learning processes in the sense that it brings people together
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16 281 and bridges tacit and explicit knowledge. Learning from adverse events is important to improve future
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18 282 healthcare services. However, safety investigation in healthcare is complex and multifaceted with
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20 283 context specific aspects that investigations need to consider to understand the sum of causal factors ⁹
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22 284 ^{14 20}. This has similarities to how other sectors with longer traditions for independent investigations,
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24 285 such as the aviation or nuclear fields, need to investigate their specific contexts. However, to transfer
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26 286 methods and approaches directly from one sector to another could be challenging ^{21 22}. Healthcare in
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28 287 general has, in line with the course described in this paper, adopted investigation methods developed
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30 288 in other sectors. We argue that the ability to reflect on how different approaches, methods and
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32 289 narratives of what happened likely will provide different answers is of central importance for safety
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34 290 investigators in healthcare.
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39 291 Creating reflexive spaces and making use of simulation-based activities ^{19 23} allow for such critical
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41 292 reflections to take place. Our findings indicate that this should be a significant part of a healthcare
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43 293 safety investigation course, as well as in everyday investigatory practice to ensure continuous learning
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45 294 processes in the team and within the investigation body itself, and to share findings and
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47 295 recommendations with the field. Learning from investigation reports published by different
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49 296 investigatory bodies has proved challenging for the practice field as similar adverse events reoccur
50
51 297 within and across organizations. In Norway, for example, around 1000 of the most severe types of
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53 298 adverse events, which are mandatory to report to the Norwegian Board of Health Supervision, were
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55 299 reported in 2020. This number includes underreporting, and a high proportion of deaths or severe
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57 300 patient harm ²⁴. Being able to create reflection among stakeholders involved in adverse events within
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3 301 and across system levels, and to share experiences of how to approach safety investigations in
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5 302 healthcare might be a key step to system learning and improvement. We argue that creation of
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7 303 reflexive spaces is a fundamental aspect that international healthcare systems should nurture for
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9
10 304 future safety investigation bodies.

13 305 **Developing a culture for multidisciplinary investigatory practice**

16 306 There was a clear tension between the desire to on the one hand have an interdisciplinary group of
17
18 307 investigators and an organizational culture that gives room for diverse perspectives, and on the other
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20 308 hand, the need for a common conceptual apparatus or framework from which the staff can find some
21
22 309 common ground in approaching investigations. Interdisciplinary teamwork is said to be paramount in
23
24 310 order to develop collaborative and effective teams^{25 26} and for accident investigation to succeed in
25
26 311 understanding complex causal relations^{9 14 27-29}. However, for interdisciplinary teamwork to be efficient
27
28 312 it is dependent on shared knowledge and skills, mutual trust and respect³⁰. The course allowed the
29
30 313 participants to engage in group work and simulated work tasks, enabling them to get to know each
31
32 314 other and build trust and understanding of each other's views in a safe environment. As such, the joint
33
34 315 experience of developing interdisciplinary teamwork skills through course participation could in itself
35
36 316 be seen as equally important as the theoretical knowledge gained. Although a longer and more
37
38 317 extensive course would have been beneficial in providing participants with more in-depth theoretical
39
40 318 knowledge, participation in this relatively short course gave them valuable teamworking skills which
41
42 319 are particularly appreciated in investigations in complex healthcare systems. Future research and
43
44 320 testing of modules in safety investigation in healthcare should focus more on user involvement in
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46 321 investigatory practice, while further enriching the investigatory toolbox with diverse system models
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48 322 and investigation methods adapted to the healthcare context by involving multidisciplinary
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50 323 investigation teams to ensure relevance to the field¹⁴.

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325 Limitations

326 This study has some limitations that should be acknowledged. The study evaluated the first round of a
327 new safety investigation in healthcare course and the sample size is therefore somewhat small.
328 However, we conducted interviews both before and after the course, in addition to including both
329 investigators and managers. This gives the study a high information richness, from different
330 perspectives³¹. The course was developed based on collaboration with the investigatory body, and the
331 responses could be biased due to that. It was voluntary to participate in all parts of the study which
332 could result in some of the participants not attending both prior to and after the course completion.
333 To ensure trustworthiness in the research process, the data collection and the analysis process were
334 strengthened through group collaboration featuring a team of researchers with various backgrounds
335 such as safety investigation, pedagogy, healthcare, psychology, and risk management³².

336 Conclusion

337 Developing competence in system-wide and learning-based safety investigation is fundamental for
338 investigating severe adverse events, trends, and system failure in healthcare⁴. Our study found that
339 a university master's level course designed to establish competence in different theoretical
340 perspectives of safety and investigatory approaches contributed to create reflexive spaces where
341 participants discussed systemic safety investigations, opportunities, limits, and identified knowledge
342 gaps in this new field of practice. Course participation helped establish a common language among a
343 highly multidisciplinary group and build a culture of collaborative learning. Further course and practice
344 activities are needed to create a full curriculum for safety investigation in healthcare. This should be
345 co-created with independent investigators, safety scientists, patients and users, and healthcare
346 professionals to ensure a strong methods repertoire and a sound theoretical backdrop for
347 investigatory practice that may contribute to system-wide learning and improvement.

348 Ethical approval

349 The study was approved by the Norwegian Centre for Research Data (ref.nr 217643). All participants
350 signed informed consent forms prior to participation in the study.

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353 Conflict of interest statement

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362 or interpretation of the data.

363 Author contributions

364 Authors CHD, CM and SW advanced the initial idea for the study. CHD, LS and JGA contributed in data
365 collection, while all authors contributed in data analysis. CHD, VG and SW drafted the manuscript with

366 major contribution from JGA and AR. All authors have commented on the draft, read and approved
367 the final version.

368 Consent for Publication

369 Not required

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Table 1: Overview of main topics

Overall main topics of the Safety Investigation in Healthcare course	
1	Accident models and theoretical foundation for safety investigations
2	Complexity of healthcare systems, technology and people
3	Methods of safety investigations
4	Patient and stakeholder involvement in safety investigations
5	Just culture, safety investigation and organizational learning
6	Rapid table-top simulation of a safety investigation

Table 2: Learning outcomes in the safety investigation in healthcare course

Learning outcomes for the Safety Investigation in Healthcare course		
Knowledge	Skills	General competence
<ul style="list-style-type: none"> - About the foundation of different types of safety investigations - About existing accident models and theories explaining causality - About principles, practices and processes of safety investigations - About safety investigation methods in healthcare and other industries - About how different stakeholders' (e.g. patients, next of kin, healthcare professionals, managers, regulators) perspectives and experiences can be incorporated into safety investigations - About strengths and limitations in safety investigations 	<ul style="list-style-type: none"> - To apply accident theories and investigation methods in practice - To evaluate scientific publications in safety investigation 	<ul style="list-style-type: none"> -To critically analyze different theoretical, methodological and practical approaches to safety investigations in healthcare.

Table 3: Overview of themes, subthemes and direct quotes from individual interviews

Theme	Subtheme	Quote
Needs and expectations	Feeling open, curious and excited	I think it will be good. I'm looking forward to it. Getting to do some study is only positive, really. It's a privilege to be allowed to attend school. (Informant 1)
		I am really excited. I think one of the most important things is perhaps "hands-on" tools and training in how to use them. (Informant 2)
	I don't think I will get a very revolutionary new view of things, of why things happen. But, maybe something to do with analysis. So, we'll see. I'll go in openly, with interest. I look forward to it. (Informant 4)	
Need for a common conceptual foundation		It's this conceptual framework, to be able to talk to colleagues. ... Having common ground, that is very important. ... The reason we are employed here is that we have different perspectives. But we also have that common knowledge. It's that common knowledge which needs increasing. (Informant 3)
		We have decided that we are going to be very interdisciplinary. ... There are very many perspectives. ... And then it becomes very difficult to find something that we can agree on. ... As everyone has a very different perspective on what it means to investigate. ... We have all these discussions, where people professionally speaking are living on their own planets. (Informant 2)
		If [the managers] had made it easy for themselves, they would have hired 20 lawyers or something like that. Or whatever. Nurses. Something or other. But they have been very clear that here we recruit people who represent different perspectives. ... And that is good. But it is also very demanding' (Informant 5)
Need for in-depth theoretical knowledge and a common investigative approach		We have some ideas about what, who we are and how we should work. But, in a way, it is only the broad outlines that have been drawn, and not so much the minor lines and the minor methods. And, maybe that's why method, in particular, is something we do not have much of. ... And when I say method, I'm thinking of method of analysis. So that's the 'methodological hunger' we've been joking about. (Informant 1)
		We're really in the middle of it now. In the first investigation. Because we have collected a lot of data. And we agree that we have a lot of data. And we agree that we have a lot of interesting findings, in the data. ... But we have no idea how to select those findings and present them in a meaningful way. That is what we are discussing. ... How to systemize what we have found? (Informant 2)
		I need to know more about different, concrete tools actually. Investigative, or maybe methods of analysis. ... To gain knowledge of different analysis methods because that makes me better able to choose [between them]. And use them, or have an opinion on them. (Informant 5)

Table 4: Overview of themes, subthemes and direct quotes from focus group interviews

Theme	Subtheme	Quote
Experiences	Joint experiences provide common ground	<p>In the beginning, I felt it was really noticeable (the differences). But this has subsided after we have gotten the chance to test out our ideas on each other. I believe we have seen that there is a lot of common ground, that it is okay to be different. (...) And the course gave us some experiences with each other (Informant 7).</p> <p>After the course at the University, I believe that we became more similar, I mean, maybe we kind of see things through the same lenses. It provided us with more similar ways of thinking. Maybe on both a conscious and unconscious level (Informant 1)</p>
	Create arena for reflection and discussion	<p>The course created an arena where we got to know each other better through working together and reflecting on issues such as investigative tools and theory (Informant 5)</p> <p>The course created an opportunity for building on our common culture in addition to building competence among staff (Informant 7).</p>
	Collaborative working requires collaborative learning	<p>Working in smaller groups was a good way to learn (...) combined with the exam paper we had to write, this forced you to get more involved in the topics, learn more about the course themes (Informant 4)</p> <p>The lecturer gave us quite explicit advice: To test out different analytical tools for different investigations. And, in fact, that is what we do (Informant 7)</p> <p>The group work combined with the exam paper felt like an engaging way to learn and the group dynamics felt engaging...one got to go "deeper" in a sense...I believe this was what we learnt the most from(Informant 6)</p>
	Extensive subject-limited time	<p>It was a quite small course, quite limited. So, I guess I'm left with a feeling of missing something, I missed going in-depth into both safety theories and analytical tools (Informant 7)</p> <p>The idea of having a whole day designated to learning is great, but you need time to process, think. So, it was too much, and too little time' (Informant 4)</p> <p>In retrospect I believe that there should have been selected a few themes, which we could have studied in greater depth-or had longer time (Informant 8)</p> <p>The safety investigation methods need to be adapted right...so more time spent on discussing possible adaptations of methods faced with real time investigations would have been helpful...how far can one go in adapting safety investigation methods for example? (Informant 5)</p>

BMJ Open

Independent and system-wide safety investigation in healthcare, establishing and testing a curriculum – a qualitative study

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3 1 **Title page**
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6 2 **Title:** Independent and system-wide safety investigation in healthcare, establishing and testing a
7 3 curriculum – a qualitative study
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4 27 Independent and system-wide safety investigation in healthcare,
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8 28 establishing and testing a curriculum – a qualitative study
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14 29 **Abstract:**
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18 30 **Objective and Setting:** National, system-wide safety investigation represents a new approach to safety
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20 31 improvement in healthcare. In 2019 a new master's level course in *Safety Investigation in Healthcare*
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22 32 was established to support the training and development of a new team of investigators from an
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24 33 independent investigatory body. The course was established at one Norwegian university and a total
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26 34 of 19 students were enrolled and completed the course. The aim of this study was to qualitatively
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28 35 evaluate the course, and the objectives were to explore the students' needs and expectations prior to
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30 36 the course conduct, and their experiences and suggestions for improvements after course completion.
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34 37 **Design:** The study design was a qualitative explorative study with individual- and focus group
35
36 38 interviews. Data collection included five individual interviews prior to course participation and two
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38 39 focus group interviews, after course participation, with a total sample size of 13 participants Data were
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40 40 analysed according to thematic analysis.
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44 41 **Results:** The results showed a need for a common conceptual foundation for the multidisciplinary team
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46 42 of safety investigators who were all employed in the same investigatory body. Course participation
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48 43 contributed to create reflexive spaces for the participants and generated new knowledge about the
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50 44 need for a broad range of investigatory tools and approaches. This contrasted with the initial aspiration
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52 45 among the participants to have a recipe for how to conduct safety investigations.
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56 46 **Conclusions:** Course participation contributed to a common language among a highly multidisciplinary
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58 47 group of safety investigators and supported building a culture of collaborative learning. The need for
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60 48 additional activities to further develop a safety investigation curriculum in healthcare was identified.

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3 49 It is recommended that such a curriculum be co-created with independent investigators, safety
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5 50 scientists, patients and users, and healthcare professionals to ensure a strong methods repertoire and
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7 51 a sound theoretical backdrop for investigatory practice.
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10 11 52 Article Summary

12 13 14 15 16 53 Strengths and limitations of this study

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19 54 • A new master level training course for national, system-wide patient safety investigations was
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21 55 established, tested, and evaluated.
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24 56 • The participants represent independent national investigators who work for learning purposes
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26 57 only, to improve patient safety in Norway.
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29 58 • The course was developed based on input from the national investigatory body to ensure
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31 59 relevance.
- 32
33 60 • The study evaluated the first round of running the new investigation course where 13 out of
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35 61 19 students participated. A higher number of participants could have provided additional
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37 62 information and perspectives.

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45 64 One of the most fundamental aspects of safety in healthcare is to learn from adverse events to improve
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47 65 future healthcare services¹⁻⁶. Every year a large number of patients across the world are harmed by
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49 66 adverse events such as late diagnosis, wrong diagnosis, wrong treatment, technical failure, medication
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51 67 errors and infections. It is estimated that unsafe care most likely is one of the 10 leading causes of
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53 68 death and disability in the world⁷. Nearly 50 % of the harmed caused by adverse events in hospitals,
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55 69 could be prevented in high income countries⁸. To learn from these events, safety investigation is key⁴
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57 70⁹⁻¹². Investigating and learning from serious adverse events is a complex process that confronts many
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3 71 challenges¹³⁻¹⁵. These challenges relate to establishing multidisciplinary competence to address the
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5 72 complex nonlinear phenomenon of adverse events, the independence of the investigatory body,
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7 73 patient and user involvement in investigations, and trust and system understanding^{4 11 12 14-16}.
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10 74 Different types of courses exist to train and support accident investigators in different sectors such as
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12 75 aviation (Airports Council International, Canada), transport, (Cranfield University, UK) industrial
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14 76 accidents (and National Safety Council, USA), and healthcare (Norwegian Directorate of Health,
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16 77 Norway). Although accident investigation courses exist within the healthcare sector, few university
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18 78 level courses hold a systems perspective that supports competence development and specialist
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20 79 knowledge and skills required for independent, system-wide national safety investigation. Hence, upon
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22 80 a collaboration request from a new independent national healthcare safety investigation body in
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24 81 Norway, the University of Stavanger designed a Master of Science level course that could support
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26 82 future safety investigators in competence development to achieve high quality safety investigations in
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28 83 healthcare. Specifically, the course was designed to give insight into the required knowledge, skills,
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30 84 and analytical capacity to understand how safety investigations in healthcare can be approached to
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32 85 foster patient safety and learning processes from a system-wide perspective. During 2019, 19 students
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34 86 from a Norwegian independent safety investigatory body were enrolled and completed the course.
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41 Description of safety investigation course

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44 88 The safety investigation course was designed as a 5 ECTS (European Credit and Accumulation System-
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46 89 ECTS) course. This means that the course is expected to demand between 125- 150 work hours¹⁷. The
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48 90 course was given in English, over a period of three one-day sessions, with individual reading and group
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50 91 tasks to be completed in between sessions. Every course day lasted seven hours from 9am to 4pm,
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52 92 with four weeks between day one and day two, and three weeks between day two and day three.
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54 93 During the course, the students were introduced to six main topics and took part in different student-
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56 94 active collaborative learning methods such as group work and a table-top simulation of a safety
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58 95 investigation (see table 1). In addition, the students applied their skills to real reported events as cases
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3 96 for testing and practicing theoretical perspectives and methods. The learning outcomes of the course
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5 97 were set according to knowledge, skills, and general competence (see overview in table 2). The content
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7 98 of the course was based on recent research into accident and safety investigations in healthcare, with
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9 99 examples from other relevant industries. The course was finalized with a take-home exam, based on a
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11 group approach. This entails that the students were given the exam task at the beginning of the course.
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14 101 They were grouped in groups of four to five students and worked on the group exam before submitting
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16 102 a paper at the end of the term. In the exam paper students describe, investigate, and discuss a self-
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18 103 selected research problem with a word limit of 5000. A take-home exam is often preferred when the
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20 104 main aim is to foster higher-order thinking skills and allow time for reflection¹⁸ The exam papers were
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22 105 marked 'approved'/'not approved', in accordance with The Norwegian Association of Higher
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24 106 Educations Institutions guidelines for group exams. During a take-home exam the students have access
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26 107 to, and are free to use, all course material, databases, and internet resources to solve the exam task.
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109 Table 1: Overview of main topics and content covered in each topic

	Overall main topics of the Safety Investigation in Healthcare course	Content covered in each topic
1	Accident models and theoretical foundation for safety investigations	Understanding risk and failure in healthcare systems and how to investigate risk across system levels and time
2	Complexity of healthcare systems, technology, and people	Exploring the nature and implications for safety of complex interactions and sociotechnical adaptive systems
3	Methods of safety investigations	Understanding and comparing different methodological approaches and analytical tools for safety investigation and the relative strengths and limitations of each
4	Patient and stakeholder involvement in safety investigations	Understanding strategies and practices for integrating different perspectives and stakeholders into investigations - the harmed, the involved, the managers, the regulators
5	Just culture, safety investigation and organizational learning	-Taking care of and involving the healthcare professionals – Experiences from the field - Approaches to investigate and contribute to system learning
6	Rapid table-top simulation of a safety investigation	-Developing practical skills by applying the models, methods, and tools of investigation to a simulated incident

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112 Table 2: Learning outcomes in the safety investigation in healthcare course

Learning outcomes for the Safety Investigation in Healthcare course
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Knowledge	Skills	General competence
- About the foundation of different types of safety investigations - About existing accident models and theories explaining causality - About principles, practices and processes of safety investigations - About safety investigation methods in healthcare and other industries - About how different stakeholders' (e.g. patients, next of kin, healthcare professionals, managers, regulators) perspectives and experiences can be incorporated into safety investigations - About strengths and limitations in safety investigations	- To apply accident theories and investigation methods in practice - To evaluate scientific publications in safety investigation	-To critically analyze different theoretical, methodological and practical approaches to safety investigations in healthcare.

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115 Aim and research questions

116 The aim of this study was to qualitatively evaluate the Safety Investigation in Healthcare course and
 117 explore the students' needs and expectations prior to the course, and their experiences and
 118 suggestions for improvements after course completion.

119 The study was guided by the following research questions:

- 120 a) What are the expectations from healthcare safety investigators for a system-wide safety
 121 investigation course?
- 122 b) How did healthcare safety investigators experience attending the course and what are their
 123 suggestions for improvement?

124 Methods

125 Design

126 The study was designed as a qualitative explorative study using individual and focus group interviews
127 ¹⁹ in order to provide information concerning the students' needs, expectations and experiences
128 related to the safety investigation in healthcare course.

129 Data collection and analysis

130 Data collection was conducted in two phases. First, five individual interviews were undertaken prior to
131 the course starting, followed by two focus group interviews after course completion. Individual
132 interviews were chosen to give the participants, who had a range of different backgrounds, the
133 opportunity to provide in depth descriptions of expectations and knowledge gaps, prior to course
134 participation²⁰. After course participation, focus group interviews were chosen since the topics of
135 interest here were related to the joint experience of participating at the course. A total of 13 students
136 took part in the study. Five of them participated in both an individual interview as well as a focus group
137 interview, while eight of them only took part in focus group interviews. Safety investigators and
138 managers of the investigatory body participated in both phases. All participants were affiliated with
139 the same investigatory body and were recruited through an invitation by e-mail to the contact person
140 in the management team. The participants had a various of backgrounds such as nurses, doctors,
141 human factors, safety, philosophy, psychology, political science, etc.

142 All interviews took place at the participants' current workplace. The interviews lasted approximately
143 between 40-60 minutes and were conducted by three researchers (LS, JGA, CHD) who had no
144 involvement in the course delivery, only in the design and administrative tasks. Voice from all individual
145 and focus groups interviews were tape recorded and verbatim transcribed by authors LS and JGA
146 shortly after the interviews took place. The recordings only contained voice and no video.

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3 147 The transcribed data material from both individual interviews and focus group interviews were
4
5 148 analyzed using thematic analysis²¹. The analysis process followed an inductive six step process, guided
6
7 149 by the research questions although not following a specific framework in the analysis process. During
8
9
10 150 step one, authors LS and JGA transcribed and anonymized the data material, before authors CHD, VG,
11
12 151 JGA, LS, AR and SW familiarized themselves with the data and noting down initial ideas such as
13
14 152 'expectations', 'experiences' and 'suggestions for improvement'. In step two of the analysis, initial
15
16 153 codes were generated before step three, where the authors discussed initial themes and gathered all
17
18 154 relevant data to each potential theme. In step four, authors reviewed the themes and agreed on the
19
20 155 final version of the themes in a second workshop, in step five. In step six the authors produced the
21
22 156 final text with the results. Author CHD led the analytical process with support from SW.

23 24 25 26 157 *Individual interviews*

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28
29 158 The individual interviews were conducted using a semi structured interview guide aimed to answer
30
31 159 research question a). The interviews were focused on mapping current work task, needs and practices
32
33 160 as well as needs and expectations related to investigation methods, investigatory principles,
34
35 161 theoretical knowledge, investigation methods, user involvement, interdisciplinary teamwork,
36
37 162 simulation experience, and competence related to setting criteria for investigation initiation.

38 39 40 41 163 *Focus group interviews*

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43
44 164 The focus group interviews were conducted three to four months after the participants had completed
45
46 165 the course. The rationale for this was to give the participants the chance to include the knowledge and
47
48 166 experiences from the course in their everyday work. Safety investigators and managers were divided
49
50 167 into two separate groups during the focus group interviews to enable all participants to speak more
51
52 168 freely²². Both groups consisted of four participants, safety investigators in group one (three male, one
53
54 169 female) and managers in group two (three female, one male). The semi structured interview guide for
55
56 170 these interviews aimed to answer research question b). The guide covered themes related to
57
58 171 experiences and suggestions for improvement regarding course structure, relevance to current work
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3 172 tasks, theory, investigation methods, different pedagogical approaches, user involvement, and
4
5 173 interdisciplinary teamwork. In group one all the participants were eager to contribute, had a friendly
6
7 174 tone and waited for their turn to speak. In group two, it was mainly three of the four participants that
8
9 175 spoke, while the fourth took a more confirmatory role, nodding in response to the other participants'
10
11 176 contributions.

15 177 Patient and Public Involvement

17 178 The course was developed with input on collaboration with the interdependent national investigatory
18
19 179 body, where different parts of the course such as content, layout and design were discussed.

24 180 Results

25 181 The analysis resulted in two main themes. These themes are: 1) Needs and Expectations and 2)
26
27 182 Experiences. Each of the themes are described in turn below.

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36 184 Needs and Expectations

37 185 The participants particularly highlighted that they were open, curious, and excited about the course,
38
39 186 they were eager to learn more and widen their perspectives. Due to their multidisciplinary
40
41 187 backgrounds the participants initially lacked a common conceptual foundation, and a common
42
43 188 investigative approach and expressed a need for more in-depth theoretical knowledge.

44 189 Feeling open, curious and excited

45 190 The participants expressed largely positive expectations towards the course, regardless of their
46
47 191 professional backgrounds and prior knowledge and experience. They were open and curious about the
48
49 192 potential for gaining new knowledge and learning new hands-on approaches. *'I think it will be good.*

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3 193 *I'm looking forward to it. Getting to do some study is only positive, really. It's a privilege to be allowed*
4
5 194 *to attend school'* (Participant 1). Several felt that the course would cover themes that they already had
6
7 195 knowledge of, but they expressed that the course content would likely complement their existing
8
9 196 competencies as well. *'I am really excited. I think one of the most important things is perhaps "hands-*
10
11 *on" tools and training in how to use them'* (Participant 2). The participants highlighted that they
12
13 197 welcomed all kinds of new knowledge, and that they valued the opportunity for further education. *'I*
14
15 198 *don't think I will get a very revolutionary new view of things, of why things happen. But maybe*
16
17 199 *something to do with analysis. So, we'll see. I'll go in openly, with interest. I look forward to it'*
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19 200 (Participant 4).
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21 201

202 Need for a common conceptual foundation

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27 203 The safety investigators were a highly interdisciplinary group from a wide variety of professional
28
29 204 backgrounds (nurses, doctors, human factors, philosophy, psychology, political science, etc.). They
30
31 205 therefore represented a variety of different perspectives and starting points before attending the
32
33 206 course. *'If [the managers] had made it easy for themselves, they would have hired 20 lawyers or*
34
35 207 *something like that. Or whatever. Nurses. Something or other. But they have been very clear that here*
36
37 208 *we recruit people who represent different perspectives. ... And that is good. But it is also very*
38
39 209 *demanding'* (Participant 5). This also included varying prior knowledge and experience of safety
40
41 210 theories and safety investigation methods. *'We have decided that we are going to be very*
42
43 211 *interdisciplinary... everyone has a very different perspective on what it means to investigate. ... We have*
44
45 212 *all these discussions, where people professionally speaking are living on their own planets'* (Participant
46
47 213 2). The participants noted that the highly interdisciplinary nature of the group was first and foremost
48
49 214 a strength that had a mostly positive impact on their investigations. But conversely, it was clear that
50
51 215 the group's significant heterogeneity could challenge their investigative work and collaborative
52
53 216 practices. This was often expressed as being due to a lack of a common conceptual foundation or
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55 217 common language with which to approach and discuss cases. *'It's this conceptual framework, to be*
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3 218 *able to talk to colleagues. ... Having common ground, that is very important. ... The reason we are*
4
5 219 *employed here is that we have different perspectives. But we also have that common knowledge. It's*
6
7 220 *that common knowledge which needs increasing'* (Participant 3).
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221 Need for in-depth theoretical knowledge and a common investigative approach

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14 222 Several participants expressed a need for broader theoretical knowledge and a more in-depth
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16 223 understanding of the safety science field. Many were vocal about their concern that the focus here
17
18 224 ought to be on learning about complex systems theories rather than approaches that are built around
19
20 225 simple causal explanations. Adopting a systems perspective was also seen as vital to facilitate learning
21
22 226 across levels and organizations. Gaining the theoretical knowledge necessary to develop a common
23
24 227 conceptual apparatus was therefore high on the list of the participants' educational needs prior to
25
26 228 attending the course. *'We're really in the middle of it now. In the first investigation. Because we have*
27
28 229 *collected a lot of data. And we agree that we have a lot of data. And we agree that we have a lot of*
29
30 230 *interesting findings, in the data. ... But we have no idea how to select those findings and present them*
31
32 231 *in a meaningful way. That is what we are discussing. ... How to systemize what we have found?'*
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34 232 (Participant 2).
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39 233 Participants expressed a definite need for a common investigative approach, including a common set
40
41 234 of analytical methods and tools to use in investigations. This was referred to within the group as a
42
43 235 'methodological hunger'. *'We have some ideas about what, who we are and how we should work. But,*
44
45 236 *in a way, it is only the broad outlines that have been drawn, and not so much the minor lines and the*
46
47 237 *minor methods. And, maybe that's why method, in particular, is something we do not have much of. ...*
48
49 238 *And when I say method, I'm thinking of method of analysis. So that's the 'methodological hunger' we've*
50
51 239 *been joking about'* (Participant 1). With a lack of hands-on experience of investigative methods and
52
53 240 tools, there was a sense of uncertainty regarding how to best approach the analytical phase of
54
55 241 investigations. They therefore talked about the importance of being able to familiarize themselves with
56
57 242 and test different tools and approaches in an effort to gain the insight necessary to make informed
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3 243 decisions about the usefulness or not of the various options available. *'I need to know more about*
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5 244 *different, concrete tools actually. Investigative, or maybe methods of analysis. ... To gain knowledge of*
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7 245 *different analysis methods because that makes me better able to choose [between them]. And use them*
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10 246 *or have an opinion on them'* (Participant 5). Again, participants were concerned that simplistic causal
11
12 247 approaches would be too narrow in scope for the purposes of their investigations, which aim to
13
14 248 facilitate cross-level learning. There was therefore a need for investigative methods and tools with a
15
16 249 complex system focus.

20 250

23 251 Experiences

26 252 The safety investigation course gave the participants a more common ground to work from, making it
27
28 253 easier to collaborate and to understand each other's perspectives. They also appreciated the
29
30 254 collaborative learning experiences which reflected their every-day work practice and that the course
31
32 255 provided them with an arena for reflection and discussion. However, they felt that the course provided
33
34 256 insufficient time to go through such an extensive subject.

38 257 Joint experiences provide common ground

41 258 The participants highlighted that the most important effect of the course was that it had provided
42
43 259 them with common ground. *'In the beginning, I felt it was really noticeable (the differences). But this*
44
45 260 *has subsided after we have gotten the chance to test out our ideas on each other. I believe we have*
46
47 261 *seen that there is a lot of common ground, that it is okey to be different. (...). And the course gave us*
48
49 262 *some experiences with each other'* (Participant 7). The participants believed that course participation
50
51 263 along with a longer work experience had given them a similar understanding of the underlying meaning
52
53 264 of different safety related terms. The managers emphasized that they considered the building of a
54
55 265 common culture as the most positive outcome of course participation. This aspect was particularly
56
57 266 important for the investigators working part-time since course participation made them more included
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3 267 in the team of investigators. The investigators themselves believed that it getting to know each other
4
5 268 through the course's practical learning tasks was of most importance. *'After the course at the*
6
7 269 *University, I believe that we became more similar, I mean, maybe we kind of see things through the*
8
9 270 *same lenses. It provided us with more similar ways of thinking. Maybe on both a conscious and*
10
11 271 *unconscious level'* (Participant 1).
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18 273 Collaborative working requires collaborative learning

21 274 The participants highly appreciated the sessions with group work. *'Working in smaller groups was a*
22
23 275 *good way to learn (...) combined with the exam paper we had to write, this forced you to get more*
24
25 276 *involved in the topics, learn more about the course themes'* (Participant 4). Both managers and safety
26
27 277 investigators believed that the table-top simulation and group work were the most fruitful approaches,
28
29 278 since it reflected their everyday investigatory work practices. Learning together therefore became
30
31 279 important since it resembled how they usually worked. The participants emphasized that the cases
32
33 280 they were going to discuss needed to be highly authentic and recognizable for them. They believed
34
35 281 that the more 'real' the cases felt, the easier it was to get engaged and learn. Some of the participants
36
37 282 believed that lack of authenticity was the reason why they found other pedagogical approaches such
38
39 283 as tabletop exercises with movies less useful. The participants also preferred pedagogical approaches
40
41 284 where they got to engage with each other and take an active role in their own learning. *'The group*
42
43 285 *work combined with the exam paper felt like an engaging way to learn and the group dynamics felt*
44
45 286 *engaging...one got to go "deeper" in a sense.... I believe this was what we learnt the most from'*(
46
47 287 Participant 6).
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54 288 Create arena for reflection and discussion

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57 289 Participants made a range of reflections related to the course subjects. They had become more aware
58
59 290 of the implications of a systems perspective, the difficulties of engaging in systematic methods, the
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3 291 need for case specific adjustments, that there is no single recipe for conducting investigations, the
4
5 292 demanding task of giving attention to details as well as seeing the whole picture, and the need for a
6
7 293 combination of different approaches. *'The lecturer gave us quite explicit advice: To test out different*
8
9 294 *analytical tools for different investigations. And, in fact, that is what we do'* (Participant 7). They also
10
11 295 reflected on their data gathering practices and that different narratives will provide different
12
13 296 information, as well as how to conduct valid data collection, what data is, and issues concerning how
14
15 297 to set criteria for case selection. *'The course created an arena where we got to know each other better*
16
17 298 *through working together and reflecting on issues such as investigative tools and theory'* (Participant
18
19 299 5) One of the contributions from course participation therefore seemed to be that it created an arena
20
21 300 for reflection and discussions, allowing the participants to become more aware of the strengths and
22
23 301 weaknesses related to their work.
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303 Extensive subject - limited time

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34 304 Participants from both focus groups stressed that the course had proved demanding, with a high
35
36 305 number of different subjects and highly advanced literature to be covered in a short amount of time:
37
38 306 *'The idea of having a whole day designated to learning is great, but you need time to process, think.*
39
40 307 *So, it was too much, and too little time'* (Participant 4). Although they valued and respected the English-
41
42 308 speaking lecturer, and the English curriculum, it was demanding for Norwegian speakers to navigate
43
44 309 new territory with a large amount of new subject specific terminologies in a different language. The
45
46 310 participants believed that the short introduction to several new subjects, instead of more in-depth
47
48 311 studies of fewer subjects, was the reason they found the course material to be somewhat fragmented.
49
50 312 *'It was a quite small course, quite limited. So, I guess I'm left with a feeling of missing something, I*
51
52 313 *missed going in-depth into both safety theories and analytical tools* (Participant 7). Although both
53
54 314 groups wanted more in-depth knowledge of the subjects, they all acknowledged that there was a
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3 315 discrepancy between their needs and expectations and the amount of in-depth study that it is possible
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5 316 to offer with a 5 ECT course.
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8 317 The participants suggested that future classes should be taught in the participants' native language.
9
10 318 They also suggested taking time to present an overview of the material at the beginning of the course,
11
12 319 and to include some 'lighter' items on the curriculum to ease access to complex and difficult material.
13
14 320 The participants valued authenticity and that the course developer should strive to make all case
15
16 321 studies and group work highly recognizable and authentic to real life cases. All participants suggested
17
18 322 a longer and more extensive course that gave the opportunity for more in-depth understanding of
19
20 323 each of the safety investigation theories presented throughout the course: *'In retrospect I believe that*
21
22 324 *there should have been selected a few themes, which we could have studied in greater depth-or had*
23
24 325 *longer time' (Participant 8).*
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327 Discussion

328 This paper explored the participants needs, expectations, and experiences related to a system-wide,
329 learning focused safety investigation in healthcare course. The findings showed that a heterogenous
330 group of multidisciplinary healthcare investigators shared a need for collective understanding of safety
331 investigatory concepts, tools, and practice. In the following, the findings and implications for further
332 curriculum development are discussed with the purpose of contributing to enhanced system-wide and
333 learning focused investigatory practice in healthcare. The complexity of safety investigations in
334 healthcare

335 Prior to course participation, the participants described both needs and expectations related to a
336 common conceptual apparatus and investigative approach. More specifically, they had expectations
337 of receiving detailed information regarding how to investigate different types of cases. At that time,
338 the participants had limited experience of working together, they all came from different backgrounds,

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3 339 and had different levels of experience with safety investigation in healthcare. Within learning
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5 340 processes, the difference between a novice and an expert level is the ability to extract key principles
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7 341 and transfer them to similar situations²³. With such a high degree of difference and uncertainty among
8
9
10 342 them, it is to be expected that the participants at this particular point in time, and in a novel situation,
11
12 343 acted much like novices wanting stability and a recipe of how to approach their new task. However,
13
14 344 although this was what the participants initially craved, only a short time after the completion of the
15
16 345 course the participants acknowledged that there was a need for a more nuanced approach than that
17
18 346 provided by a standard recipe. The need to have a methods repertoire and insight into the varying
19
20 347 options available and their limitations, contributed to a better understanding of their role and position
21
22
23 348 in approaching the investigative task. Our results are in line with recent research arguing for the need
24
25 349 for a large toolbox to fit the exact case and context of adverse events investigations¹⁶. This
26
27 350 furthermore demonstrates the participants' ability to advance to a higher level of reflection in a short
28
29 351 period of time, on their way towards becoming experts.

352 Reflexive spaces as a mean to promote system learning

353 Previous research²⁴ argues that creating and supporting reflexive spaces, such as what was done at
354 the safety investigation course, is key in learning processes in the sense that it brings people together
355 and bridges tacit and explicit knowledge. Learning from adverse events is important to improve future
356 healthcare services. However, purely knowledge is not enough to make a change in behavior²⁵.
357 Changing investigation methods within the healthcare setting requires that the investigators have
358 knowledge, skills and education regarding both why and how a change is to be made²⁵. The reflexive
359 spaces created during the safety investigation course could potentially help the participants to gain
360 not only the knowledge needed, but also the skillset and the education concerning why and how
361 changes in the investigation methods could occur.

362 Safety investigation in healthcare is complex and multifaceted with context specific aspects that
363 investigations need to consider for better understanding the sum of causal factors^{11 16 26}. This has

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3 364 similarities to how other sectors with longer traditions for independent investigations, such as the
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5 365 aviation or nuclear fields, need to investigate their specific contexts. However, to transfer methods
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7 366 and approaches directly from one sector to another could be challenging ^{27 28}. Healthcare in general
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10 367 has, in line with the course described in this paper, adopted investigation methods developed in other
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12 368 sectors. We argue that the ability to reflect on how different approaches, methods, and narratives of
13
14 369 what happened likely will provide different answers is of central importance for safety investigators in
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16 370 healthcare.

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18
19 371 Creating reflexive spaces and making use of simulation-based activities ^{24 29} allow for such critical
20
21 372 reflections to take place. Our findings indicate that this should be a significant part of a healthcare
22
23 373 safety investigation course, as well as in everyday investigatory practice to ensure continuous learning
24
25 374 processes in the team and within the investigation body itself, and to share findings and
26
27 375 recommendations with the field. Learning from investigation reports published by different
28
29 376 investigatory bodies has proved challenging for the practice field as similar adverse events reoccur
30
31 377 within and across organizations. In Norway, for example, around 1000 of the most severe types of
32
33 378 adverse events, which are mandatory to report to the Norwegian Board of Health Supervision, were
34
35 379 reported in 2020. This number includes underreporting, and a high proportion of deaths or severe
36
37 380 patient harm ³⁰. Being able to create reflection among stakeholders involved in adverse events within
38
39 381 and across system levels, and to share experiences of how to approach safety investigations in
40
41 382 healthcare might be a key step to system learning and improvement. We argue that creation of
42
43 383 reflexive spaces is a fundamental aspect that international healthcare systems should nurture for
44
45 384 future safety investigation bodies.

51 385 Developing a culture for multidisciplinary investigatory practice

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55 386 There was a clear tension between the desire to on the one hand have an interdisciplinary group of
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57 387 investigators and an organizational culture that gives room for diverse perspectives, and on the other
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59 388 hand, the need for a common conceptual apparatus or framework from which the staff can find some

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3 389 common ground in approaching investigations. Interdisciplinary teamwork is said to be paramount in
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5 390 order to develop collaborative and effective teams^{31 32} and for accident investigation to succeed in
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7 391 understanding complex causal relations^{11 16 33-35}. However, for interdisciplinary teamwork to be efficient
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10 392 it is dependent on shared knowledge and skills, mutual trust and respect³⁶. The course allowed the
11
12 393 participants to engage in group work and simulated work tasks, enabling them to get to know each
13
14 394 other and build trust and understanding of each other's views in a safe environment. As such, the joint
15
16 395 experience of developing interdisciplinary teamwork skills through course participation could in itself
17
18 396 be seen as equally important as the theoretical knowledge gained. Although a longer and more
19
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21 397 extensive course would have been beneficial in providing participants with more in-depth theoretical
22
23 398 knowledge, participation in this relatively short course gave them valuable teamworking skills which
24
25 399 are particularly appreciated in investigations in complex healthcare systems. Future research and
26
27 400 testing of modules in safety investigation in healthcare should focus more on user involvement in
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29 401 investigatory practice, while further enriching the investigatory toolbox with diverse system models
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31 402 and investigation methods adapted to the healthcare context by involving multidisciplinary
32
33 403 investigation teams to ensure relevance to the field¹⁶.

404

405 Strengths and limitations

406 This study has some strengths and limitations that should be acknowledged. The study evaluated the
407 first round of a new safety investigation in healthcare course. . We conducted interviews both before
408 and after the course and included both investigators and managers as participants. This gives the study
409 a high information richness, from different perspectives³⁷ although a higher number of study
410 participants could have provided additional information and perspectives. The course was developed
411 in collaboration with the investigatory body, and the responses could be biased due to that. At the
412 same time, however, a collaborative approach to course development likely also contributes to its
413 increased relevance to the original training needs. It was voluntary to participate in all parts of the

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3 414 study which could have resulted in some of the students not participating in the study, either prior to
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5 415 and/or after the course completion. Participating in focus group interviews could potentially restrict
6
7 416 the participants from speaking their minds freely. There is also a risk that the participants in the group
8
9 417 do not entirely represent the broader target group. Potential bias due to this must therefore be
10
11 418 considered. However, different representatives participated in different stages of the data collection
12
13 419 and two different data gathering techniques were used to give them the opportunity to both speak
14
15 420 freely as well as get a consensus from a group. The study could have benefited from the use of
16
17 421 behavioural change theory, to further investigate how attending such courses might influence
18
19 422 behaviour. However, this would have required a somewhat different methodological approach
20
21 423 focusing on changes in investigatory practice which was out of scope of this study. To ensure
22
23 424 trustworthiness in the research process, the data collection and the analysis process were
24
25 425 strengthened through group collaboration featuring a team of researchers with various backgrounds
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27 426 such as safety investigation, pedagogy, healthcare, psychology, and risk management ³⁸.

33 34 427 Conclusion

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38 428 Developing competence in system-wide and learning-based safety investigation is fundamental for
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40 429 investigating severe adverse events, trends, and system failure in healthcare ⁴. Our study found that
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42 430 a university master's level course designed to establish competence in different theoretical
43
44 431 perspectives of safety and investigatory approaches contributed to create reflexive spaces where
45
46 432 participants discussed systemic safety investigations, opportunities, limits, and identified knowledge
47
48 433 gaps in this new field of practice. Course participation helped establish a common language among a
49
50 434 highly multidisciplinary group and build a culture of collaborative learning. Further course and practice
51
52 435 activities are needed to create a full curriculum for safety investigation in healthcare.

436 Implications for practice

437 It is recommended that such a future curriculum is co-created with independent investigators, safety
438 scientists, patients and users, and healthcare professionals to ensure a strong methods repertoire and
439 a sound theoretical backdrop for investigatory practice that may contribute to system-wide learning
440 and improvement.

441 Ethical approval

442 The study was approved by the Norwegian Centre for Research Data (ref.nr 217643). All participants
443 signed informed consent forms prior to participation in the study.

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446 Author contributions

447 Authors CHD, CM and SW advanced the initial idea for the study. CHD, LS and JGA contributed to data
448 collection, while all authors contributed in data analysis. CHD, VG and SW drafted the manuscript with
449 contribution from JGA and AR. All authors have commented on the initial drafts and read and approved
450 the final version.

451 Conflict of interest statement

452 Author SW, CHD, VG and CM was involved in the course development and course coordination at the
453 University of Stavanger. Beyond this the authors declare no conflict of interest.

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458 Data sharing statement

459 Data are available upon reasonable request.

460 Consent for Publication

461 Not required

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SRQR Checklist for paper 'Independent and system-wide safety investigation in healthcare, establishing and testing a curriculum – a qualitative study'

No.	Topic	Where found in article
S1	Title	p.2, line 27-28
S2	Abstract	p.2 & 3, line 29-53
S3	Problem formulation	P. 3, line 66-91
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S5	Qualitative approach and research paradigm	p.7, line 135-138
S6	Researcher characteristics and reflexivity	p.18, line 444-447
S7	Context	p.4-5, line 93-114
S8	Sampling strategy	p.7, line 148-150
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S10	Data collection methods	p.7, line 140-149
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S12	Units of study	p.7, line 140-149
S13	Data processing	p.7, line 150-154
S14	Data analysis	p.7, line 155-166
S15	Techniques to ensure trustworthiness	p.19, line 444-447
S16	Synthesis and interpretation	p.9-15, line 192-349
S17	Links to empirical data	Can be provided up on request.
S18	Integration with prior work, implications, transferability and contribution to the field.	p.15-18, line 353-428
S19	Limitations	p.19, line 431-447
S20	Conflicts of interest	p. 20, line 467-469
S21	Funding	P 20, line 470-475

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Evaluating a system-wide, safety investigation in healthcare course in Norway: A qualitative study

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2
3 1 **Title page**
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4 26 Evaluating a system-wide, safety investigation in healthcare
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9 27 course in Norway: A qualitative study.
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14 28 **Abstract:**
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18 29 **Objective and Setting:** National, system-wide safety investigation represents a new approach to safety
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20 30 improvement in healthcare. In 2019 a new master's level course in *Safety Investigation in Healthcare*
21
22 31 was established to support the training and development of a new team of investigators from an
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24 32 independent investigatory body. The course was established at one Norwegian university and a total
25
26 33 of 19 students were enrolled and completed the course. The aim of this study was to qualitatively
27
28 34 evaluate the course, and the objectives were to explore the students' needs and expectations prior to
29
30 35 the course conduct, and their experiences and suggestions for improvements after course completion.
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34 36 **Design:** The study design was a qualitative explorative study with individual- and focus group
35
36 37 interviews. Data collection included five individual interviews prior to course participation and two
37
38 38 focus group interviews, after course participation, with a total sample size of 13 participants. Data
39
40 39 were analysed according to thematic analysis.
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44 40 **Results:** The results showed a need for a common conceptual foundation for the multidisciplinary team
45
46 41 of safety investigators who were all employed in the same investigatory body. Course participation
47
48 42 contributed to create reflexive spaces for the participants and generated new knowledge about the
49
50 43 need for a broad range of investigatory tools and approaches. This contrasted with the initial aspiration
51
52 44 among the participants to have a recipe for how to conduct safety investigations.
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56 45 **Conclusions:** Course participation contributed to a common language among a highly multidisciplinary
57
58 46 group of safety investigators and supported building a culture of collaborative learning. The need for
59
60 47 additional activities to further develop a safety investigation curriculum in healthcare was identified.

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3 48 It is recommended that such a curriculum be co-created with independent investigators, safety
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5 49 scientists, patients and users, and healthcare professionals to ensure a strong methods repertoire and
6
7 50 a sound theoretical backdrop for investigatory practice.
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10 11 51 Article Summary

12 13 14 15 16 52 Strengths and limitations of this study

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19 53 • The participants represent independent national investigators who work for learning purposes
20
21 54 only, to improve patient safety in Norway.
- 22
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24 55 • The course was developed based on input from the national investigatory body to ensure
25
26 56 relevance.
- 27
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29 57 • The study evaluated the first round of running the new investigation course where 13 out of
30
31 58 19 students participated. A higher number of participants could have provided additional
32
33 59 information and perspectives.
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36 37 60 Introduction

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41 61 One of the most fundamental aspects of safety in healthcare is to learn from adverse events to improve
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43 62 future healthcare services¹⁻⁶. Every year a large number of patients across the world are harmed by
44
45 63 adverse events such as late diagnosis, wrong diagnosis, wrong treatment, technical failure, medication
46
47 64 errors and infections. It is estimated that unsafe care most likely is one of the 10 leading causes of
48
49 65 death and disability in the world⁷. Nearly 50 % of the harmed caused by adverse events in hospitals,
50
51 66 could be prevented in high income countries⁸. To learn from these events, safety investigation is key⁴
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53 67⁹⁻¹². Investigating and learning from serious adverse events is a complex process that confronts many
54
55 68 challenges¹³⁻¹⁵. These challenges relate to establishing multidisciplinary competence to address the
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3 69 complex nonlinear phenomenon of adverse events, the independence of the investigatory body,
4
5 70 patient and user involvement in investigations, and trust and system understanding ^{4 11 12 14-16}.
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8 71 Different types of courses exist to train and support accident investigators in different sectors such as
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10 72 aviation (Airports Council International, Canada), transport, (Cranfield University, UK) industrial
11
12 73 accidents (and National Safety Council, USA), and healthcare (Norwegian Directorate of Health,
13
14 74 Norway). Although accident investigation courses exist within the healthcare sector, few university
15
16 75 level courses hold a systems perspective that supports competence development and specialist
17
18 76 knowledge and skills required for independent, system-wide national safety investigation. Hence, upon
19
20 77 a collaboration request from a new independent national healthcare safety investigation body in
21
22 78 Norway, the University of Stavanger designed a Master of Science level course that could support
23
24 79 future safety investigators in competence development to achieve high quality safety investigations in
25
26 80 healthcare. Specifically, the course was designed to give insight into the required knowledge, skills,
27
28 81 and analytical capacity to understand how safety investigations in healthcare can be approached to
29
30 82 foster patient safety and learning processes from a system-wide perspective. During 2019, 19 students
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32 83 from a Norwegian independent safety investigatory body were enrolled and completed the course.
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39 84 Description of safety investigation course

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41
42 85 The safety investigation course was designed as a five ECTS (European Credit and Accumulation
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44 86 System- ECTS) course. This means that the course is expected to demand between 125- 150 work hours
45
46 87 ¹⁷. The course was given in English, over a period of three one-day sessions, with individual reading
47
48 88 and group tasks to be completed in between sessions. Every course day lasted seven hours from 9am
49
50 89 to 4pm, with four weeks between day one and day two, and three weeks between day two and day
51
52 90 three. During the course, the students were introduced to six main topics and took part in different
53
54 91 student-active collaborative learning methods such as group work and a table-top simulation of a
55
56 92 safety investigation (see table 1). In addition, the students applied their skills to real reported events
57
58 93 as cases for testing and practicing theoretical perspectives and methods. The learning outcomes of the
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60

94 course were set according to knowledge, skills, and general competence (see overview in table 2). The
 95 content of the course was based on recent research into accident and safety investigations in
 96 healthcare, with examples from other relevant industries. The course was finalized with a take-home
 97 exam, based on a group approach. This entails that the students were given the exam task at the
 98 beginning of the course. They were grouped in groups of four to five students and worked on the group
 99 exam before submitting a paper at the end of the term. In the exam paper students describe,
 100 investigate, and discuss a self-selected research problem with a word limit of 5000. A take-home exam
 101 is often preferred when the main aim is to foster higher-order thinking skills and allow time for
 102 reflection¹⁸ The exam papers were marked 'approved'/'not approved', in accordance with The
 103 Norwegian Association of Higher Educations Institutions guidelines for group exams. During a take-
 104 home exam the students have access to, and are free to use, all course material, databases, and
 105 internet resources to solve the exam task.

106
 107 Table 1: Overview of main topics and content covered in each topic

	Overall main topics of the Safety Investigation in Healthcare course	Content covered in each topic
1	Accident models and theoretical foundation for safety investigations	Understanding risk and failure in healthcare systems and how to investigate risk across system levels and time
2	Complexity of healthcare systems, technology, and people	Exploring the nature and implications for safety of complex interactions and sociotechnical adaptive systems
3	Methods of safety investigations	Understanding and comparing different methodological approaches and analytical tools for safety investigation and the relative strengths and limitations of each
4	Patient and stakeholder involvement in safety investigations	Understanding strategies and practices for integrating different perspectives and stakeholders into investigations - the harmed, the involved, the managers, the regulators
5	Just culture, safety investigation and organizational learning	-Taking care of and involving the healthcare professionals – Experiences from the field - Approaches to investigate and contribute to system learning
6	Rapid table-top simulation of a safety investigation	-Developing practical skills by applying the models, methods, and tools of investigation to a simulated incident

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 110 Table 2: Learning outcomes in the safety investigation in healthcare course

Learning outcomes for the Safety Investigation in Healthcare course
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Knowledge	Skills	General competence
- About the foundation of different types of safety investigations - About existing accident models and theories explaining causality - About principles, practices and processes of safety investigations - About safety investigation methods in healthcare and other industries - About how different stakeholders' (e.g. patients, next of kin, healthcare professionals, managers, regulators) perspectives and experiences can be incorporated into safety investigations - About strengths and limitations in safety investigations	- To apply accident theories and investigation methods in practice - To evaluate scientific publications in safety investigation	-To critically analyze different theoretical, methodological and practical approaches to safety investigations in healthcare

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113 Aim and research questions

114 The aim of this study was to qualitatively evaluate the Safety Investigation in Healthcare course and
 115 explore the students' needs and expectations prior to the course, and their experiences and
 116 suggestions for improvements after course completion.

117 The study was guided by the following research questions:

- 118 a) What are the expectations from healthcare safety investigators for a system-wide safety
 119 investigation course?
- 120 b) How did healthcare safety investigators experience attending the course and what are their
 121 suggestions for improvement?

122 Methods

123 Design

124 The study was designed as a qualitative explorative study using individual and focus group interviews
125 ¹⁹ in order to provide information concerning the students' needs, expectations and experiences
126 related to the safety investigation in healthcare course.

127 Data collection and analysis

128 Data collection was conducted in two phases. First, five individual interviews were undertaken prior to
129 the course starting, followed by two focus group interviews after course completion. Individual
130 interviews were chosen to give the participants, who had a range of different backgrounds, the
131 opportunity to provide in depth descriptions of expectations and knowledge gaps, prior to course
132 participation²⁰. After course participation, focus group interviews were chosen since the topics of
133 interest here were related to the joint experience of participating at the course. A total of 13 students
134 took part in the study. Five of them participated in both an individual interview as well as a focus group
135 interview, while eight of them only took part in focus group interviews. Safety investigators and
136 managers of the investigatory body participated in both phases. All participants were affiliated with
137 the same investigatory body and were recruited through an invitation by e-mail to the contact person
138 in the management team. The participants had a various of backgrounds such as, nursing, medicine,
139 human factors, safety, philosophy, psychology, political science, etc.

140 All interviews took place at the participants' current workplace. The interviews lasted approximately
141 between 40-60 minutes and were conducted by three researchers (LS, JGA, CHD) who had no
142 involvement in the course delivery, only in the design and administrative tasks. Voice from all individual
143 and focus groups interviews were tape recorded and verbatim transcribed by authors LS and JGA
144 shortly after the interviews took place. The recordings only contained voice and no video.

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3 145 The transcribed data material from both individual interviews and focus group interviews were
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5 146 analyzed using thematic analysis²¹. The analysis process followed an inductive six step process, guided
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7 147 by the research questions although not following a specific framework in the analysis process. During
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10 148 step one, authors LS and JGA transcribed and anonymized the data material, before authors CHD, VG,
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12 149 JGA, LS, AR and SW familiarized themselves with the data and noting down initial ideas such as
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14 150 'expectations', 'experiences' and 'suggestions for improvement'. In step two of the analysis, initial
15
16 151 codes were generated before step three, where the authors discussed initial themes and gathered all
17
18 152 relevant data to each potential theme. In step four, authors reviewed the themes and agreed on the
19
20 153 final version of the themes in a second workshop, in step five. In step six the authors produced the
21
22 154 final text with the results. Author CHD led the analytical process with support from SW.

23 24 25 26 155 *Individual interviews*

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29 156 The individual interviews were conducted using a semi structured interview guide aimed to answer
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31 157 research question a). The interviews were focused on mapping current work task, needs and practices
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33 158 as well as needs and expectations related to investigation methods, investigatory principles,
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35 159 theoretical knowledge, investigation methods, user involvement, interdisciplinary teamwork,
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37 160 simulation experience, and competence related to setting criteria for investigation initiation.

38 39 40 41 161 *Focus group interviews*

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44 162 The focus group interviews were conducted three to four months after the participants had completed
45
46 163 the course. The rationale for this was to give the participants the chance to include the knowledge and
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48 164 experiences from the course in their everyday work. Safety investigators and managers were divided
49
50 165 into two separate groups during the focus group interviews to enable all participants to speak more
51
52 166 freely²². Both groups consisted of four participants, safety investigators in group one (three male, one
53
54 167 female) and managers in group two (three female, one male). The semi structured interview guide for
55
56 168 these interviews aimed to answer research question b). The guide covered themes related to
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58 169 experiences and suggestions for improvement regarding course structure, relevance to current work

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3 170 tasks, theory, investigation methods, different pedagogical approaches, user involvement, and
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5 171 interdisciplinary teamwork. In group one all the participants were eager to contribute, had a friendly
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7 172 tone and waited for their turn to speak. In group two, it was mainly three of the four participants that
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9 173 spoke, while the fourth took a more confirmatory role, nodding in response to the other participants'
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11 174 contributions.
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15 175 Patient and Public Involvement

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19 176 The course was developed with input on collaboration with the interdependent national investigatory
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21 177 body, where different parts of the course such as content, layout and design were discussed.
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25 178 Results

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29 179 The analysis resulted in two main themes. These themes are: 1) Needs and Expectations and 2)
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31 180 Experiences. Each of the themes are described in turn below.
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35 181

37 182 Needs and Expectations

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40 183 This main theme holds the following three sub themes; 1) Feeling open, curious, and excited, 2) Need
41
42 184 for a common conceptual foundation, and 3) Need for in-depth theoretical knowledge and a common
43
44 185 investigative approach. The participants particularly highlighted that they were open, curious, and
45
46 186 excited about the course, they were eager to learn more and widen their perspectives. Due to their
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48 187 multidisciplinary backgrounds the participants initially lacked a common conceptual foundation, and a
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50 188 common investigative approach and expressed a need for more in-depth theoretical knowledge.
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189 Feeling open, curious and excited

190 The participants expressed largely positive expectations towards the course, regardless of their
191 professional backgrounds and prior knowledge and experience. They were open and curious about the
192 potential for gaining new knowledge and learning new hands-on approaches. *'I think it will be good.
193 I'm looking forward to it. Getting to do some study is only positive, really. It's a privilege to be allowed
194 to attend school'* (Participant 1). Several felt that the course would cover themes that they already had
195 knowledge of, but they expressed that the course content would likely complement their existing
196 competencies as well. *'I am really excited. I think one of the most important things is perhaps "hands-
197 on" tools and training in how to use them'* (Participant 2). The participants highlighted that they
198 welcomed all kinds of new knowledge, and that they valued the opportunity for further education. *'I
199 don't think I will get a very revolutionary new view of things, of why things happen. But maybe
200 something to do with analysis. So, we'll see. I'll go in openly, with interest. I look forward to it'
201* (Participant 4).

202 Need for a common conceptual foundation

203 The safety investigators were a highly interdisciplinary group from a wide variety of professional
204 backgrounds (nursing, medicine, human factors, philosophy, psychology, political science, etc.). They
205 therefore represented a variety of different perspectives and starting points before attending the
206 course. *'If [the managers] had made it easy for themselves, they would have hired 20 lawyers or
207 something like that. Or whatever. Nurses. Something or other. But they have been very clear that here
208 we recruit people who represent different perspectives. ... And that is good. But it is also very
209 demanding'* (Participant 5). This also included varying prior knowledge and experience of safety
210 theories and safety investigation methods. *'We have decided that we are going to be very
211 interdisciplinary... everyone has a very different perspective on what it means to investigate. ... We have
212 all these discussions, where people professionally speaking are living on their own planets'* (Participant
213 2). The participants noted that the highly interdisciplinary nature of the group was first and foremost

1
2
3 214 a strength that had a mostly positive impact on their investigations. But conversely, it was clear that
4
5 215 the group's significant heterogeneity could challenge their investigative work and collaborative
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7 216 practices. This was often expressed as being due to a lack of a common conceptual foundation or
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9
10 217 common language with which to approach and discuss cases. *'It's this conceptual framework, to be*
11
12 218 *able to talk to colleagues. ... Having common ground, that is very important. ... The reason we are*
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14 219 *employed here is that we have different perspectives. But we also have that common knowledge. It's*
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16 220 *that common knowledge which needs increasing'* (Participant 3).

20 221 Need for in-depth theoretical knowledge and a common investigative approach

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23 222 Several participants expressed a need for broader theoretical knowledge and a more in-depth
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25 223 understanding of the safety science field. Many were vocal about their concern that the focus here
26
27 224 ought to be on learning about complex systems theories rather than approaches that are built around
28
29 225 simple causal explanations. Adopting a systems perspective was also seen as vital to facilitate learning
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31 226 across levels and organizations. Gaining the theoretical knowledge necessary to develop a common
32
33 227 conceptual apparatus was therefore high on the list of the participants' educational needs prior to
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35 228 attending the course. *'We're really in the middle of it now. In the first investigation. Because we have*
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37 229 *collected a lot of data. And we agree that we have a lot of data. And we agree that we have a lot of*
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39 230 *interesting findings, in the data. ... But we have no idea how to select those findings and present them*
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41 231 *in a meaningful way. That is what we are discussing. ... How to systemize what we have found?'*
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43 232 (Participant 2).

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48 233 Participants expressed a definite need for a common investigative approach, including a common set
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50 234 of analytical methods and tools to use in investigations. This was referred to within the group as a
51
52 235 'methodological hunger'. *'We have some ideas about what, who we are and how we should work. But,*
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54 236 *in a way, it is only the broad outlines that have been drawn, and not so much the minor lines and the*
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56 237 *minor methods. And, maybe that's why method, in particular, is something we do not have much of. ...*
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58 238 *And when I say method, I'm thinking of method of analysis. So that's the 'methodological hunger' we've*
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3 239 *been joking about'* (Participant 1). With a lack of hands-on experience of investigative methods and
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5 240 tools, there was a sense of uncertainty regarding how to best approach the analytical phase of
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7 241 investigations. They therefore talked about the importance of being able to familiarize themselves with
8
9 242 and test different tools and approaches in an effort to gain the insight necessary to make informed
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11 243 decisions about the usefulness or not of the various options available. *'I need to know more about*
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13 244 *different, concrete tools actually. Investigative, or maybe methods of analysis. ... To gain knowledge of*
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15 245 *different analysis methods because that makes me better able to choose [between them]. And use them*
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17 246 *or have an opinion on them'* (Participant 5). Again, participants were concerned that simplistic causal
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19 247 approaches would be too narrow in scope for the purposes of their investigations, which aim to
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21 248 facilitate cross-level learning. There was therefore a need for investigative methods and tools with a
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23 249 complex system focus.
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32 Experiences

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35 252 This main theme holds the four following sub themes; 1) Joint experiences provide common ground,
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37 253 2) Collaborative working requires collaborative learning, 3) Create arena for reflection and discussion,
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39 254 4) Extensive subject-limited time. The safety investigation course gave the participants a more
40
41 255 common ground to work from, making it easier to collaborate and to understand each other's
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43 256 perspectives. They also appreciated the collaborative learning experiences which reflected their every-
44
45 257 day work practice and that the course provided them with an arena for reflection and discussion.
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47 258 However, they felt that the course provided insufficient time to go through such an extensive subject.
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51 Joint experiences provide common ground

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55 260 The participants highlighted that the most important effect of the course was that it had provided
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57 261 them with common ground. *'In the beginning, I felt it was really noticeable (the differences). But this*
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59 262 *has subsided after we have gotten the chance to test out our ideas on each other. I believe we have*
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3 263 *seen that there is a lot of common ground, that it is okey to be different. (...) And the course gave us*
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5 264 *some experiences with each other'* (Participant 7). The participants believed that course participation
6
7 265 along with a longer work experience had given them a similar understanding of the underlying meaning
8
9 266 of different safety related terms. The managers emphasized that they considered the building of a
10
11 267 common culture as the most positive outcome of course participation. This aspect was particularly
12
13 268 important for the investigators working part-time since course participation made them more included
14
15 269 in the team of investigators. The investigators themselves believed that it getting to know each other
16
17 270 through the course's practical learning tasks was of most importance. *'After the course at the*
18
19 271 *University, I believe that we became more similar, I mean, maybe we kind of see things through the*
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21 272 *same lenses. It provided us with more similar ways of thinking. Maybe on both a conscious and*
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23 273 *unconscious level'* (Participant 1).
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275 Collaborative working requires collaborative learning

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34 276 The participants highly appreciated the sessions with group work. *'Working in smaller groups was a*
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36 277 *good way to learn (...) combined with the exam paper we had to write, this forced you to get more*
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38 278 *involved in the topics, learn more about the course themes'* (Participant 4). Both managers and safety
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40 279 investigators believed that the table-top simulation and group work were the most fruitful approaches,
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42 280 since it reflected their everyday investigatory work practices. Learning together therefore became
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44 281 important since it resembled how they usually worked. The participants emphasized that the cases
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46 282 they were going to discuss needed to be highly authentic and recognizable for them. They believed
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48 283 that the more 'real' the cases felt, the easier it was to get engaged and learn. Some of the participants
49
50 284 believed that lack of authenticity was the reason why they found other pedagogical approaches such
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52 285 as tabletop exercises with movies less useful. The participants also preferred pedagogical approaches
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54 286 where they got to engage with each other and take an active role in their own learning. *'The group*
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56 287 *work combined with the exam paper felt like an engaging way to learn and the group dynamics felt*
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3 288 *engaging...one got to go “deeper” in a sense.... I believe this was what we learnt the most from*
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5 289 *....’(Participant 6).*
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8 290 **Create arena for reflection and discussion**

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11 291 Participants made a range of reflections related to the course subjects. They had become more aware
12
13 292 of the implications of a systems perspective, the difficulties of engaging in systematic methods, the
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15 293 need for case specific adjustments, that there is no single recipe for conducting investigations, the
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17 294 demanding task of giving attention to details as well as seeing the whole picture, and the need for a
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19 295 combination of different approaches. *‘The lecturer gave us quite explicit advice: To test out different*
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21 296 *analytical tools for different investigations. And, in fact, that is what we do’* (Participant 7). They also
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23 297 reflected on their data gathering practices and that different narratives will provide different
24
25 298 information, as well as how to conduct valid data collection, what data is, and issues concerning how
26
27 299 to set criteria for case selection. *‘The course created an arena where we got to know each other better*
30
31 300 *through working together and reflecting on issues such as investigative tools and theory’* (Participant
32
33 301 5). One of the contributions from course participation therefore seemed to be that it created an arena
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35 302 for reflection and discussions, allowing the participants to become more aware of the strengths and
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37 303 weaknesses related to their work.
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42 43 44 305 **Extensive subject - limited time**

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47 306 Participants from both focus groups stressed that the course had proved demanding, with a high
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49 307 number of different subjects and highly advanced literature to be covered in a short amount of time:
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51 308 *‘The idea of having a whole day designated to learning is great, but you need time to process, think.*
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53 309 *So, it was too much, and too little time’* (Participant 4). Although they valued and respected the English-
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55 310 speaking lecturer, and the English curriculum, it was demanding for Norwegian speakers to navigate
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57 311 new territory with a large amount of new subject specific terminologies in a different language. The
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3 312 participants believed that the short introduction to several new subjects, instead of more in-depth
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5 313 studies of fewer subjects, was the reason they found the course material to be somewhat fragmented.
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7 314 *'It was a quite small course, quite limited. So, I guess I'm left with a feeling of missing something, I*
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9 315 *missed going in-depth into both safety theories and analytical tools (Participant 7).* Although both
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11 316 groups wanted more in-depth knowledge of the subjects, they all acknowledged that there was a
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13 317 discrepancy between their needs and expectations and the amount of in-depth study that it is possible
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15 318 to offer with a five ECTS course.

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19 319 The participants suggested that future classes should be taught in the participants' native language.
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21 320 They also suggested taking time to present an overview of the material at the beginning of the course,
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23 321 and to include some 'lighter' items on the curriculum to ease access to complex and difficult material.
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25 322 The participants valued authenticity and that the course developer should strive to make all case
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27 323 studies and group work highly recognizable and authentic to real life cases. All participants suggested
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29 324 a longer and more extensive course that gave the opportunity for more in-depth understanding of
30
31 325 each of the safety investigation theories presented throughout the course: *'In retrospect I believe that*
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33 326 *there should have been selected a few themes, which we could have studied in greater depth-or had*
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35 327 *longer time' (Participant 8).*

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48 330 This paper explored the participants needs, expectations, and experiences related to a system-wide,
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50 331 learning focused safety investigation in healthcare course. The findings showed that a heterogenous
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52 332 group of multidisciplinary healthcare investigators shared a need for collective understanding of safety
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54 333 investigatory concepts, tools, and practice. In the following, the findings and implications for further
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56 334 curriculum development are discussed with the purpose of contributing to enhanced system-wide and
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3 335 learning focused investigatory practice in healthcare. The complexity of safety investigations in
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5 336 healthcare
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8 337 Prior to course participation, the participants described both needs and expectations related to a
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10 338 common conceptual apparatus and investigative approach. More specifically, they had expectations
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12 339 of receiving detailed information regarding how to investigate different types of cases. At that time,
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14 340 the participants had limited experience of working together, they all came from different backgrounds,
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16 341 and had different levels of experience with safety investigation in healthcare. Within learning
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18 342 processes, the difference between a novice and an expert level is the ability to extract key principles
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20 343 and transfer them to similar situations²³. With such a high degree of difference and uncertainty among
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22 344 them, it is to be expected that the participants at this particular point in time, and in a novel situation,
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24 345 acted much like novices wanting stability and a recipe of how to approach their new task. However,
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26 346 although this was what the participants initially craved, only a short time after the completion of the
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28 347 course the participants acknowledged that there was a need for a more nuanced approach than that
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30 348 provided by a standard recipe. The need to have a methods repertoire and insight into the varying
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32 349 options available and their limitations, contributed to a better understanding of their role and position
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34 350 in approaching the investigative task. Our results are in line with recent research arguing for the need
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36 351 for a large toolbox to fit the exact case and context of adverse events investigations¹⁶. This
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38 352 furthermore demonstrates the participants' ability to advance to a higher level of reflection in a short
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40 353 period of time, on their way towards becoming experts.
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51 354 Reflexive spaces as a mean to promote system learning

52 355 Previous research²⁴ argues that creating and supporting reflexive spaces, such as what was done at
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54 356 the safety investigation course, is key in learning processes in the sense that it brings people together
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56 357 and bridges tacit and explicit knowledge. Learning from adverse events is important to improve future
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58 358 healthcare services. However, purely knowledge is not enough to make a change in behavior²⁵.
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60 359 Changing investigation methods within the healthcare setting requires that the investigators have

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3 360 knowledge, skills and education regarding both why and how a change is to be made²⁵. The reflexive
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5 361 spaces created during the safety investigation course could potentially help the participants to gain
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7 362 not only the knowledge needed, but also the skillset and the education concerning why and how
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9 363 changes in the investigation methods could occur.

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12 364 Safety investigation in healthcare is complex and multifaceted with context specific aspects that
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14 365 investigations need to consider for better understanding the sum of causal factors ^{11 16 26}. This has
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16 366 similarities to how other sectors with longer traditions for independent investigations, such as the
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18 367 aviation or nuclear fields, need to investigate their specific contexts. However, to transfer methods
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20 368 and approaches directly from one sector to another could be challenging ^{27 28}. Healthcare in general
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22 369 has, in line with the course described in this paper, adopted investigation methods developed in other
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24 370 sectors. We argue that the ability to reflect on how different approaches, methods, and narratives of
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26 371 what happened likely will provide different answers is of central importance for safety investigators in
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28 372 healthcare.

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33 373 Creating reflexive spaces and making use of simulation-based activities ^{24 29} allow for such critical
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35 374 reflections to take place. Our findings indicate that this should be a significant part of a healthcare
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37 375 safety investigation course, as well as in everyday investigatory practice to ensure continuous learning
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39 376 processes in the team and within the investigation body itself, and to share findings and
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41 377 recommendations with the field. Learning from investigation reports published by different
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43 378 investigatory bodies has proved challenging for the practice field as similar adverse events reoccur
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45 379 within and across organizations. In Norway, for example, around 1000 of the most severe types of
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47 380 adverse events, which are mandatory to report to the Norwegian Board of Health Supervision, were
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49 381 reported in 2020. This number includes underreporting, and a high proportion of deaths or severe
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51 382 patient harm ³⁰. Being able to create reflection among stakeholders involved in adverse events within
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53 383 and across system levels, and to share experiences of how to approach safety investigations in
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55 384 healthcare might be a key step to system learning and improvement. We argue that creation of
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3 385 reflexive spaces is a fundamental aspect that international healthcare systems should nurture for
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5 386 future safety investigation bodies.
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8 387 Developing a culture for multidisciplinary investigatory practice

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12 388 There was a clear tension between the desire to on the one hand have an interdisciplinary group of
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14 389 investigators and an organizational culture that gives room for diverse perspectives, and on the other
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16 390 hand, the need for a common conceptual apparatus or framework from which the staff can find some
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18 391 common ground in approaching investigations. Interdisciplinary teamwork is said to be paramount in
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20 392 order to develop collaborative and effective teams^{31 32} and for accident investigation to succeed in
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22 393 understanding complex causal relations^{11 16 33-35}. However, for interdisciplinary teamwork to be efficient
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24 394 it is dependent on shared knowledge and skills, mutual trust and respect³⁶. The course allowed the
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26 395 participants to engage in group work and simulated work tasks, enabling them to get to know each
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28 396 other and build trust and understanding of each other's views in a safe environment. As such, the joint
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30 397 experience of developing interdisciplinary teamwork skills through course participation could in itself
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32 398 be seen as equally important as the theoretical knowledge gained. Although a longer and more
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34 399 extensive course would have been beneficial in providing participants with more in-depth theoretical
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36 400 knowledge, participation in this relatively short course gave them valuable teamworking skills which
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38 401 are particularly appreciated in investigations in complex healthcare systems. Future research and
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40 402 testing of modules in safety investigation in healthcare should focus more on user involvement in
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42 403 investigatory practice, while further enriching the investigatory toolbox with diverse system models
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44 404 and investigation methods adapted to the healthcare context by involving multidisciplinary
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46 405 investigation teams to ensure relevance to the field¹⁶.
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407 Strengths and limitations

408 This study has some strengths and limitations that should be acknowledged. The study evaluated the
409 first round of a new safety investigation in healthcare course. We conducted interviews both before
410 and after the course and included both investigators and managers as participants. This gives the study
411 a high information richness, from different perspectives ³⁷ although a higher number of study
412 participants could have provided additional information and perspectives. The course was developed
413 in collaboration with the investigatory body, and the responses could be biased due to that. At the
414 same time, however, a collaborative approach to course development likely also contributes to its
415 increased relevance to the original training needs. It was voluntary to participate in all parts of the
416 study which could have resulted in some of the students not participating in the study, either prior to
417 and/or after the course completion. Participating in focus group interviews could potentially restrict
418 the participants from speaking their minds freely. There is also a risk that the participants in the group
419 do not entirely represent the broader target group. Potential bias due to this must therefore be
420 considered. However, different representatives participated in different stages of the data collection
421 and two different data gathering techniques were used to give them the opportunity to both speak
422 freely as well as get a consensus from a group. The study could have benefited from the use of
423 behavioural change theory, to further investigate how attending such courses might influence
424 behaviour. However, this would have required a somewhat different methodological approach
425 focusing on changes in investigatory practice which was out of scope of this study. To ensure
426 trustworthiness in the research process, the data collection and the analysis process were
427 strengthened through group collaboration featuring a team of researchers with various backgrounds
428 such as safety investigation, pedagogy, healthcare, psychology, and risk management ³⁸.

429 Conclusion

430 Developing competence in system-wide and learning-based safety investigation is fundamental for
431 investigating severe adverse events, trends, and system failure in healthcare ⁴. Our study found that
432 a university master's level course designed to establish competence in different theoretical
433 perspectives of safety and investigatory approaches contributed to create reflexive spaces where
434 participants discussed systemic safety investigations, opportunities, limits, and identified knowledge
435 gaps in this new field of practice. Course participation helped establish a common language among a
436 highly multidisciplinary group and build a culture of collaborative learning. Further course and practice
437 activities are needed to create a full curriculum for safety investigation in healthcare.

438 Implications for practice

439 It is recommended that such a future curriculum is co-created with independent investigators, safety
440 scientists, patients and users, and healthcare professionals to ensure a strong methods repertoire and
441 a sound theoretical backdrop for investigatory practice that may contribute to system-wide learning
442 and improvement.

443 Ethical approval

444 The study was approved by the Norwegian Centre for Research Data (ref.nr 217643). All participants
445 signed informed consent forms prior to participation in the study.

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448 Author contributions

449 Authors CHD, CM and SW advanced the initial idea for the study. CHD, LS and JGA contributed to data
450 collection, while all authors contributed to data analysis. CHD, VG and SW drafted the manuscript with
451 contribution from JGA and AR. All authors have commented on the initial drafts and read and approved
452 the final version.

453 Conflict of interest statement

454 Author SW, CHD, VG and CM was involved in the course development and course coordination at the
455 University of Stavanger. Beyond this the authors declare no conflict of interest.

456 Funding statement

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460 Data sharing statement

461 Data are available upon reasonable request.

462 Consent for Publication

463 Not required.

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SRQR Checklist for paper 'Independent and system-wide safety investigation in healthcare, establishing and testing a curriculum – a qualitative study'

No.	Topic	Where found in article
S1	Title	p.2, line 27-28
S2	Abstract	p.2 & 3, line 29-53
S3	Problem formulation	P. 3, line 66-91
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S5	Qualitative approach and research paradigm	p.7, line 135-138
S6	Researcher characteristics and reflexivity	p.18, line 444-447
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S14	Data analysis	p.7, line 155-166
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S16	Synthesis and interpretation	p.9-15, line 192-349
S17	Links to empirical data	Can be provided up on request.
S18	Integration with prior work, implications, transferability and contribution to the field.	p.15-18, line 353-428
S19	Limitations	p.19, line 431-447
S20	Conflicts of interest	p. 20, line 467-469
S21	Funding	P 20, line 470-475