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A FIRST LINE MANAGEMENT TEAM´S STRATEGIES FOR SUSTAINING RESILIENCE IN A SPECIALISED INTENSIVE CARE UNIT – AN OBSERVATIONAL STUDY

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1 **A FIRST LINE MANAGEMENT TEAM´S STRATEGIES FOR SUSTAINING RESILIENCE IN A**
2 **SPECIALISED INTENSIVE CARE UNIT – AN OBSERVATIONAL STUDY**
3

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ABSTRACT

Objectives

Acute care units manage high risk patients at the limits of scientifically established treatments and organisational constraints aiming to balance reliability to standards with the needs of situational adaptation (resilience). First line managers have a central role of coordinating clinical care. Any systemic brittleness will be evident only in retrospect through for example care quality measures and accident statistics, which poses a challenge to understanding what successful managerial strategies for adaptation are and how they could be improved. The managerial work of balancing reliability and adaptation is only partially understood. This study aims to explore and describe how system resilience is sustained by naturally occurring coordination performed in situ by a management team under variable circumstances.

Design

An explorative observational study using shadowing observations of coordination analysed with inductive-deductive content analysis from a perspective of resilience engineering (RE).

Participants

A team of managers in a neonatal intensive care unit (i.e. clinical coordinators, head nurses, senior medical doctors).

Results

Managers focused on maintaining coherence in escalating problematic situations by facilitating teamwork through goalsetting, problem-solving and circumventing the technical systems' limitations in creating situational awareness. The results describe a functional relationship between the units' level of manoeuvrability and a progression of strategies for enabling adaptations for safe performance, expressed through recurring patterns of adaptation when the unit were subjected to pressure.

2

45 **Conclusions**

46 Coordination supports a coherent goal setting by increased team collaboration and is supported by team

47 members ability to predict the behavior of each other. Our findings suggest that resilience is possible to

48 engineer by supporting and training managers to maintain cohesion, manage system boundaries,

49 adapting the structure and roles of the coordinating management team and shifting between

50 information sources in response to the variability of the systems operating point (how tightly coupled

51 the system is).

52 **Keywords**

53 Qualitative research, Health services administration & management, Health policy, Organisation of

54 health services, Risk management

55 **Wordcount**

56 4417

57 **Strengths and limitations of this study**

58 • Several iterations of data collection and analysis allowed for an initially wide and later more

59 focused data collection that opened opportunities for the researchers to follow up on specific

60 findings.

61 • The explorative ethnographic design allowed for a deeper understanding of the underspecified

62 (hidden) work of first line managers.

63 • This is a single center study of a specialised unit with a specific patient clientele that cannot be

64 cared for by any other type of unit which might affect the generalizability and transferability of

65 results.

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66   • The first author (KH) who conducted the fieldwork is an experienced intensive care nurse. The

67   familiarity with the specific type of work may have affected the interpretations drawn in this

68   study.

4

BACKGROUND

69

70   The Neonatal Intensive Care Unit (NICU) continuously evolves by incorporating new care practises,

71   organisational models and patient groups (1). It is a complex adaptive system (CAS) because of its many

72   interrelated parts, goals and relationships where highly specialised care is fragmented over many places,

73   purposes and teams of professionals (2). Work is done at the frontiers of scientifically established

74   treatments, frequently pushing the organization to its limits (3). The difficulty of maintaining quality and

75   safety is a persistent problem for everyday clinical work (ECW) in this high risk environment that is

76   continuously exposed to acute admissions, staff shortage and rapidly deteriorating patients with life-

77   threatening conditions (4,5).

78   Patient safety is often defined as an absence of certain outcomes such as 'the absence of preventable

79   harm to a patient during the process of health care' (6) or 'the absence of the potential for, or the

80   occurrence of, health care associated injury to patients, created by avoiding medical errors and taking

81   action to prevent errors from causing injury' (7,8). However, during the last decades of patient safety

82   research a movement have emerged towards an inclusive view of supporting the healthcare systems´

83   ability to sustain required (normal) operations complimentary to traditional error reduction and fault-

84   finding, the resilience engineering (RE) perspective (9).

85   Resilience in healthcare is defined as 'the ability of the health care system (a clinic, a ward, a hospital, a

86   country) to adjust its functioning prior to, during, or following events (changes, disturbances and

87   opportunities), and thereby sustain required operations under both expected and unexpected

88   conditions' [7, p. xvii]. An important point made within the RE perspective is that safety in ECW can be

89   managed by a combination of structure and control on one hand (i.e. Safety -1) and adaptive behaviour

90   on the other (Safety −2) (10).

5

91   Research on resilience in healthcare provides two important insights for how to enhance its capacity for

92   resilient adaptations. Firstly, by making early investments in staff´s expertise, deep domain knowledge,

93   clinical training and the maintenance of a good workplace culture and thus creating preconditions for

94   teams to manoeuvre the system even under unexpected situations (11). Secondly is the understanding

95   that successful as well as unsuccessful outcomes emerge from the fluid arrangement of system

96   components (coordination) (12). Coordination is defined as "*…the deliberate and orderly alignment or*

97   *adjustment of partners' actions to achieve jointly determined goals* (13). People who perform

98   coordinative work are a part of a "*process by which team resources, activities, and responses are*

99   *organized to ensure that tasks are integrated, synchronized, and completed within established temporal*

100   *constraints"* (14)

101   Although coordinating functions are an integral part of everyday healthcare management in domains

102   such as surgery, anesthesia, emergency and pediatric intensive care at the level of small multi-

103   professional clinical teams (15–18), we know very little about how *managers* learn the strategies they

104   use and which of the work practices they develop that are successful (19,20). Specifically multiteam

105   coordination (i.e coordination within and between multiple teams) is not as empirically supported in

106   highly specialised acute- or intensive care as in primary care with chronic patients (21) or teams in other

107   high-risk domains such as aviation, military and maritime safety (22).

108   Therefore, it is important to further explore the performance of coordination within and between

109   multiple teams in the acute care domain to allow for development of tools and training for supporting

110   its managers.

111   This study aims to explore how system resilience is sustained by naturally occurring coordination

112   performed in situ by a management team (i.e. clinical coordinators, head nurses, senior medical doctors)

113   under variable circumstances.

6

114 METHODS

115 **Design and setting**

116 This explorative ethnographic study used participatory observations and an abductive approach to

117 capture and analyse naturally occurring coordination in situ (23). The observations were conducted in a

118 Swedish tertiary level NICU with an approximate capacity of 70 cots divided over three wards located in

119 separate hospitals. The patient mix of the three wards is dependent on local factors such as the size and

120 risk profile of adjacent delivery wards and the availability of paediatric surgical capacity. Staffing for the

121 high acuity patients is normally one nursing team per two patients (one nurse and one assistant nurse).

122 Paediatricians and neonatologists are allocated over the tree wards depending on availability and

123 competence.

124 ECW in each of the three wards is managed by a clinical coordinator, a head nurse and an operations

125 manager during daytime (Figure 1). The clinical coordinator performs tasks such as rostering, planning

126 for patient flows (admissions, discharges and transports) and clinical work when needed. The head

127 nurse is formally responsible for the work environment and quality of care. The operations manager is a

128 senior neonatologist with an overall responsibility for the medical quality and patient flow. A strategic

129 operations manager has mandate to move patients between hospitals within the own organisation or to

130 hospitals outside. All managers are clinical specialists (nurses and neonatologists). Hereafter we will

131 refer to this team as the coordinating management team (CMT).

132   [Insert figure 1 here]

133 **Data collection**

7

134 Data collection employed blended observational techniques including participatory observation of

135 'places', shadowing managers, ad-hoc interviews, collection of artefacts, field notes and memo writing

136 (24). Observation of 'places' was primarily conducted in areas where the coordination of work was

137 apparent, at the open office area where the head nurses and secretaries work and at the CMTs´ office at

138 the center of the ward. Collected artefacts included coordinators own notes on patients´ statuses,

139 occupancy- and rostering charts. All relevant aspects of the environment were captured in field notes

140 during or after the observations, along with researchers' memo-writing over personal reflections and

141 thoughts about what was happening. The observer performed informal interviews with staff and

142 managers during or after the shadowing. Clarifying questions were posed to get a broader picture of the

143 observed situations. The reason for focusing on action-interaction was to capture a deep understanding

144 of the varying conditions under which decisions and coordination happened (25).

145 Participant observations were conducted over the course of a year between 2016 and 2017. Beginning

146 with a broad descriptive phase that later became focused (26). The focused observations took place

147 during weekdays from 7 AM to 4 PM in January and February 2017. Starting with 50 hours of initial

148 observations for the researcher to get familiar with the environment, staff and relevant aspects of the

149 work for the subsequent observations. Four clinical coordinators were shadowed in their daily work for

150 a total of six full shifts, meaning that the observer followed the clinical coordinator wherever he/she

151 went (27,28). The observer attended both scheduled and ad hoc meetings between the managers

152 and/or clinical staff (29), unless explicitly asked not to by any of the participants (30).

153 **Data analysis**

154 All meetings and interviews were audio recorded and transcribed verbatim. Transcriptions from tape-

155 recorded dialogue were placed in a correct temporal order along with the field notes, so that the mix of

156 field notes and transcription chronologically represented the full workday. The transcripts were read

8

157 through several times, followed by discussions in the research group about the level of detail in the data

158 and reflections the observer had regarding the observed work shift (31). The initial inductive analysis

159 went through a two-step process (columns two and three in Table 1). First, a conversation or a situation

160 of relevance for the study's´ aim (a meaning unit) was selected and the question "What is happening

161 here?" was directed to data. Next, the selected conversation or situation was analysed in the context of

162 the entire scene where it took place, with the question "Why or how is it happening here?" The

163 interpretation was condensed and labelled with one or several codes (Table 1). The initial inductive

164 analysis generated a total of 86 codes. The codes and their relations were frequently discussed in the

165 research team and sorted into tentative sub- and main categories. The movement back and forth

166 between induction and deduction was a way to discover meaningful underlying patterns that made it

167 possible to integrate concrete behaviour and deep contextual structures. The last iteration of analysis

168 was a deductive comparison of interdependencies between the categories and sub-categories in

169 relation to the theoretical concepts or resilience (25). Categories and subcategories were refined, and

170 the researchers agreed upon six subcategories and two main categories that unified them.

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Table 1 Example of the analysis in two-steps: going from *raw data* to *interpretation of incident* and to *analytical interpretation in context*, *code* and *memo*.

Raw data	Interpretation of incident	Analytical interpretation in context	Code	Memo
The observation begins in the flow room. The flow room is a small room with two workstations where the coordinator has her seat. There are several information sources hanging on the walls and post-it notes on the computers. The coordinator meets the observer in the flow room after having walked around the ward to check all the patient rooms.	In the physical environment, several different communication tools are gathered within a small area, i.e., tools used to summarize, remember, and disseminate important information. Information exchange occurs on paper notes stuck to computers, through software, and when the coordinator herself walks around the ward.	Information exchange is one part of coordination and can be performed through predefined channels and tools, but also more intuitively through physical meetings within the ward while the manager compares notes to what is experienced. The environment has been adapted for having several different information channels intersecting in one place.	Adapting environment – cluster tools for facilitating information exchange	The coordinator has gathered information about the current situation in the patient rooms by walking around and taking a look. She then looks at the system level, occupancy lists, and information from the other coordinators. If coordination means exercising control, real life information gathering is probably an important step.
The coordinator sits down at a computer and begins counting patients on her paper copy of the occupancy list and in TakeCare [a patient journal system]. She reports the occupancy in Belport and talks a bit about this.	Counting patients and manually entering the number into the national occupancy report is one of the first things the coordinator does in the morning.	The coordinator gets an idea of the status and distributes it to the rest of the country as information. This is proactive management, as future coordination may become easier if reference can be made to Belport, or if you know that the other units in the country your information.	Information handling	Reporting your status is a way of exercising control by impacting others perception regarding the degrees of freedom at your end.

172 **PATIENT AND PUBLIC INVOLVMENT**

10

173 Patients or the public were not directly involved in the development of this research. The researcher's

174 involvement with clinical experts ensured that the patient perspective were in focus.

175 **RESULTS**

176 The NICU serves as its own emergency department, intensive care unit and a pre- and postoperative

177 ward, requiring a wide array of interrelated multi-professional teams to operate in a coordinated

178 fashion. The many roles of the unit are coupled with the pressures of maintaining high-quality and

179 individualized care, family support and safe care practices. Some situations are manageable by

180 reorganizing teams internally while others require the cooperation of external units (see Figure 1).

181 The ´how´ and ´when´ of coordination is presented in Table 2 that illustrate the functional relationship

182 between the two main categories *adaptations for enabling safe performance* and *maneuverability* with

183 their respective sub-categories. The sub-categories *Supporting system cohesion* and *Extending system*

184 *boundaries* describe the joint work of managers and clinical staff. *Adapting the structure and roles of the*

185 *coordinating management team* and *Shifting between information sources for better sensemaking*

186 describe the management teams internal work.

187 *Extracts from the field notes and conversations during the participatory observations are presented to*

188 *clarify the findings. More comprehensive material is attached in the appendix 1*

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189

<table>
<tr><td colspan="4">Table 2 The main categories are on the y-axis adaptations for enabling safe performance and on the x-axis; maneuverability. Four sub-categories on the y-axis describe strategies (i.e. the work that managers do); and the three sub-categories on the x-axis describe a progression of the strategies in relation to a perceived level of manoeuvrability.</td></tr>
<tr><td colspan="4" align="center">Manoeuvrability</td></tr>
<tr>
<td></td>
<td>Losing control – reorganisation</td>
<td>Stretching the system to work outside ordinary conditions</td>
<td>Everyday work under ordinary conditions</td>
</tr>
<tr>
<td>Supporting system cohesion</td>
<td>Delay work and evaluate the situation
Isolate problems and focus on re-creating manoeuvrability (creating systemic degrees of freedom)
Exploit possibilities of extraordinary individual achievements (trade-off individual resilience for systemic control)</td>
<td>Goalsetting towards protecting manoeuvrability (protecting systemic degrees of freedom)
Goalsetting for promoting basic safe care practices at the clinical level through minimal staff allocation and skill mix
Sacrificing continuity in patient assignments</td>
<td>Goalsetting towards family-centred care
Goalsetting of individualised care
Managing optimal staff allocation for maintaining professional development and education
Controlling occupancy and redundant capacity through predefined strategies
Monitoring state of the ward at the clinical level by regular walkarounds in the clinical work environment</td>
</tr>
<tr>
<td>Extending system boundaries</td>
<td>Identifying novel use of any existing external resources (i.e. use of PETS transport team and other wards)
Shedding managerial tasks for participating in clinical emergency work (trade-off management system for clinical system)</td>
<td>Managing occupancy trade-offs between facilities and staffing (higher occupancy in fewer rooms lowers staff requirements).
Utilising individual managers social networks within predefined limits for proactive problem-solving</td>
<td>System working within normal boundaries</td>
</tr>
<tr>
<td>Adapting the structure and roles of the coordinating management team</td>
<td>Make loss of control explicit in the CMT.
Moving from understanding the situation to making rapid decisions close to the clinical level</td>
<td>Relaying information on the patients' clinical situation to mid- and upper-level managers (information priority bottom-up)</td>
<td>Relaying high level plans to clinical level workers through regular briefings (information priority top-down)
Participate in regular medical discussions on patients' status´</td>
</tr>
<tr>
<td>Shifting between information sources for better sensemaking</td>
<td>Dropping computerised aides, rostering systems and staffing charts for handwritten notes and memos
Using face-to-face communication with people in close vicinity (shedding electronic communication)</td>
<td>Seeking ad-hoc meetings within the CMT for calibrating information of the situation and possible workarounds
Verbally explaining situations to other managers</td>
<td>Regular use of computerised systems and manual cognitive aides</td>
</tr>
</table>

(Left margin, rotated: **Adaptations for enabling safe performance**)

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191   **Manoeuvrability**

192   The CMT work with limited staffing to achieve high occupancy while supporting clinical teams in their

193   care of patients. They use clinical expertise to understand the overall situation and their management

194   expertise to find a way forward as illustrated in the following quote.

195   *"We have put those two [patients] together in 9:1 to get an emergency cot in 9:2 for the twins [9 refers*

196   *to a room divided in two sections equipped for one patient per section 9:1 and 9:2], I told the father that*

12

197   *they may have to move out. But then we'll be in the situation where they maybe… They may need… That*

198   *father is very new. So, I think that in that case they'll have to be two [staff] in there too (Clinical*

199   *coordinator). [Q1 – appendix 1]*

200   When several managers meet, they discuss the fit of different situations across the unit and adjust their

201   strategies accordingly. Some priorities are accepted while others are discarded as unacceptable. This is

202   described in x-axis of Table 2 as a progression of the sub-categories *Everyday work under ordinary*

203   *conditions, Stretching the system to work outside ordinary conditions and Losing control –*

204   *reorganisation.*

205   **Everyday work under ordinary conditions**

206   Coordination under ordinary conditions is largely based on preparations and routine. Even if one of the

207   clinical teams are under heavy stress the situation is contained. The CMT have planned meetings,

208   managers sweep the ward to collect up to date information on the state of things and relay high level

209   plans to workers.

210   *The coordinator begins her shift by conducting a walkaround of the ward, saying hello to the nurses and*

211   *doctors as she is asking if everything is all right. After the walkaround she sits down to begin exploring*

212   *her staff roster and patient occupancy charts (Observers notes).*

213   Under ordinary conditions there is a minimal observable need for managers to manually adapt any

214   information they extract from technical systems, regarding for example occupancy, patient acuity levels

215   and staffing. Managers recognise weaknesses in the technical systems but can ignore them as they are

216   not causing problems.

217   **Stretching the system to work outside ordinary conditions**

13

218 Some goals are not achievable as there is a lack of manoeuvrability for action to pursue them all.

219 However, some can be sacrificed or be put on hold.

220 The following situation is a typical example of how the CMT must re-organize and adapt to out of

221 ordinary conditions.

222 *The coordinator calls for an ad-hoc on-site face-to-face discussion with the strategic operations*

223 *manager. This happens when the CMT experience that basic safe care practices at the clinical level*

224 *consume every opportunity for maintaining overarching quality goals, the unit stop lending help to*

225 *others and start sacrificing continuity of care for individual patients. The plan for this day is to admit one*

226 *intermediary level patient that were born during the night and is waiting for a room at the NICU. One*

227 *patient has been diagnosed with a multi-resistant bacterium and will need increased hygiene standards*

228 *(Observers notes) […] "We are plenty of people today, which is nice. But when NN [strategic operations*

229 *manager] asked if we had a lot of capacity, I had to say no" (Clinical coordinator) […] "...one important*

230 *thing. This baby that needed eye surgery is now acute and will arrive soon. They will land directly in the*

231 *operating room and the transport team will take care of the baby until it can go back home its own*

232 *hospital (Operations manager).* [Q2 – Appendix 1]

233 The normal plan for postoperative care after acute eye-surgery is to be assigned a cot and a nursing

234 team on the ward. The constrained situation is managed by using the transport team to temporarily care

235 for the baby inside the NICU until the situation is stable enough for transport to another hospital. This

236 decision has possible implications for the whole CMT. The clinical coordinator wants to know about the

237 utilisation of staff and facilities. The head nurse about workplace safety, quality of care and economy.

238 The operations manager has responsibility for the medical quality and strategic operations manager for

239 the possibility of helping the other ward in trouble.

14

240 The ad-hoc meeting in this example illustrate that strategic goals of family centred care and optimal staff

241 allocation can be traded for immediate medical priorities, basic safe care practises and protection of the

242 wider system. Other patients on the ward can be safely tended to by their respective teams, unaware of

243 this emerging crisis because it is handled by the transport team.

244 **_Losing control - reorganisation_**

245 The state of losing control is characterised by strategies for _sacrificing coordinative work tasks_ and

246 _focusing on re-creating manoeuvrability_. Now the focus shift to protecting clinical teams from being

247 exposed to the rapidly shifting plans and priorities at the managerial level. Strategies for regaining

248 control can be to sacrifice the goal of continuity by transferring at-risk mothers to other hospitals, or to

249 temporarily transfer additional weight of medical care to neighbouring sub-systems or the CMT itself

250 (the double headed arrows in Figure 1).

251 When the managers start shedding managerial tasks for doing operative work at the bedside, they will

252 lose the ability to meet other managers and keep up to date with the ward. Management decisions in

253 these situations are based on a narrower understanding of the bigger picture. Technical aides are less

254 used (or not at all) because of their inability to present rapidly changing borderline conditions.

255 The following situation illustrates a reorganisation at the verge of losing control. The situation is that the

256 coordinator tries to conserve an empty cot for possible acute emergency admissions.

257 _"This is not good, its full [the ward]. We have no space when this eye baby arrives" (Clinical coordinator)._

258 _The clinical coordinator walks to the room where a nurse oversees the twins that were supposed to be_

259 _transported out the next day but are now showing symptoms of infection (Observers notes). "Do you_

260 _think these twins could be together in a twin cot?" (Clinical coordinator) […] "Well, I don´t know. This one_

261 _is just on the margin of managing without incubator" (Nurse) […] "The problem is that I don't have staff_

262 _to open another room." (Clinical coordinator). [Q3 – Appendix 1]_

15

263 The way to manage this situation is to concentrate available resources by putting twins together in one

264 cot, using one nurse to care for three babies which is more than the goal of two babies per nurse. This

265 manoeuvre creates an opportunity to temporarily have the capacity for five patients (including one

266 empty emergency cot) in a room for four- and staffing for two patients. The nurse's expresses concern

267 for her patient but remain focused on finding a solution.

268 **_Adaptations for enabling safe performance_**

269 **_Supporting system cohesion_**

270 Members of the CMT primarily communicate through ad-hoc meetings were verbal information is

271 compared to lists of patients, patient conditions, staffing and workload indicators. All members of the

272 CMT work close to the clinical context and use their up to date knowledge of the current goals'

273 attainment for individual clinical teams and what the trade-offs are. With their experience of how things

274 usually are, the managers compare computer- and paper-based cognitive aids, as well as the

275 information provided at start-up meetings to update their understanding of the status of the ward and

276 were it is heading (the umbrella perspective presented below in Figure 2). The CMT is constantly

277 negotiating situations that need simultaneous attention, like prioritizing readiness and clinical capacity

278 in some parts of the ward while maintaining family centered care and staff education in others.

279 **_Extending system boundaries_**

280 The need for extending the systems´ boundaries emerge as the pressure of prioritizing decisions

281 increase. This allows for the CMT to make use of other units' facilities or staff, like delaying patients in

282 the operating theatre or letting a transport team care for the patient for some time before handing it

283 over to the units' regular staff. The CMT can use auxiliary staff and overlapping competencies of

284 different professional groups, even managers can double as clinical staff within their vocation.

16

285 *Adapting the structure and roles of the coordinating management team*

286 The CMT express a range of strategies to fluently adapt its own structure in situations where there are

287 not enough resources to manage within everyday routines, when there is urgency or when some of the

288 CMT are not available with their specific expertise and mandate. Structural adaptation means that

289 individuals in the CMT shift from relaying plans from top-down to working and gathering information

290 from bottom-up.

291 *Shifting between information sources for better sensemaking*

292 Shifting information sources was observed when the CMT increased their reliance towards handwritten

293 notes rather than the standard computer-generated lists for staffing and patient acuity information.

294 Computer-generated aides work under normal conditions but does no longer serve their purposes as the

295 situation on the ward become more complex.

296 Handwritten notes are normally used as memory aides in team discussions. The notes are mainly short

297 phrases or single words in the margins like "discharge planned" or "need antibiotics". These phrases

298 carry specific meaning to the managers. The limitations of computer-generated lists to convey this type

299 of information on real world complexities are expressed by members of the CMT. The national

300 occupancy chart for example is only able to classify patients as high or low acuity. When there is a need

301 to work outside the binary world of two patient groups, the team quit using this computer-generated

302 aide and instead relied on their own domain knowledge, personal network and the stability of the CMT´s

303 understanding of the big picture (Figure 2).

304   [Insert figure 2 here]

17

305 **DISCUSSION**

306   Our findings describe a link between adaptations for enabling safe performance and the available

307   manoeuvrability. The CMT in this study exhibited a range of mindful adaptations for sustaining the units´

308   capacity for expressing resilience like sacrificing low level goals based on up-to date information and a

309   continuous assessment of what would be minimally intrusive for the overall performance of the system

310   (figure 2).

311   **Supporting coherence**

312   The CMT need to balance the demands and capacity of multiple teams that operate in separate rooms

313   tending to patients with a wide variety of problems and acuity. Teams that for practical reasons not

314   always meet to communicate with each other. A defining characteristic of a multiteam system is the

315   ability of component teams to modify individual goal hierarchies while sharing a common distal goal or

316   set of goals (20). Still, the CMT and the clinical staff consequently agree on making provision of acute

317   care to rapidly deteriorating patients a top priority, allowing us to identify it as a core mission (i.e.

318   purpose of the system) (32). Other priorities where more likely to be put on hold and resumed later or

319   to be permanently dropped.

320   When the care teams are unable to communicate, an important factor for maintaining coherence was

321   the managers maintenance of an umbrella perspective i.e. what was needed in order to understand how

322   the bigger picture of their interventions fit together (33). At this point, it is possible to say two things

323   about coherence that has implications for the trainability of managers as adaptive teams (34). First, that

324   coordination supports a coherent goal setting with increased team collaboration and second, that it is

325   enhanced by team members ability to predict the behaviour of each other.

18

Reorganising to support manoeuvrability

Everyday work of the CMT is characterised by seamlessly and actively organising and reorganising. The observations show how the CMT make use of early investments in for example staff´s expertise, deep domain knowledge and the workplace culture to maintain a unit wide focus on the core mission (11). Allowing the care teams to adapt their goal hierarchies individually exemplifies that being resilient is to be part of a process of identifying conflicting goals in a complex, intractable environment using *"numerous indicators in a proactive fashion to probe a system's adaptive capacity before system-wide collapse results in disaster"* (34). A realisation of studying the CMT was the shapelessness of the organisation. We could not observe a formal agenda for how and why the CMT was supposed to prioritize in terms of goal achievement below the core mission. Our study suggests that it is up to the CMT to support the system by using experience, professional ethos and domain knowledge to negotiate the way forward. Figure two illustrate one instantiation of this balancing act.

Important for the application of resilience in ECW is the link between adaptation and outcome (successful or unsuccessful) as described in for example the CARE model for researching resilience in healthcare (35). An adaptation is a deviation from work as planned, and it is not always clear beforehand whether the outcome of an adaptation constitutes success or failure in terms of quality and safety (a.a). Our study describe coordinating managers' adaptive responses to the conflicting demands of acute patient care on one hand and the long-term demands for quality and safety on the other (measured as for example respirator days, patient throughput and hospital acquired bloodstream infections). Assessment and subsequent learning from adaptive managerial responses to situations where the system is "stretched" or "needs reorganization" (table 2), should be about whether the actions were able to achieve the short-term goals while preserving the long-term goals of safe, high quality patient care.

19

349 **Balancing between long- and short-term goals**

350 Resilience is dependent on the use of earlier investments in potential opportunities for action described

351 as systemic degrees of freedom (SDOF) (11). However, low-level goal-sacrifices represent a potential

352 loss of future investments in SDOF if they are overexploited. For example, families will be less prepared

353 to go home if they are not trained, staff might receive less time learning from experienced colleagues

354 and formal routines might erode if they are not employed.

355 The balancing act of seemingly irreconcilable goals makes it impossible to decide in retrospect whether

356 coordination has been good or bad for the total outcome of the system. Each decision to suspend or

357 sacrifice a low-level goal has implications for the organisations future capacity for expressing resilience.

358 All teams are working towards the core mission of providing acute care. But the maintenance of long-

359 term investments is achieved by managing a diversity of low-level goal-sacrifices between many clinical

360 teams (i.e. sacrificing patient education in one and staff education in another). For example, in Figure 2

361 the teams 1 and 2 can achieve parent education and family centred care because the third team can be

362 isolated and focus on acute care.

363 # CONCLUSIONS

364 We are only beginning to understand teams of managers strategies for prioritising and acting on the

365 variability of SDOF (36). Task management, for example during medical resuscitation have well

366 established decision support based on understanding of the human body. There is also a well-

367 established body of knowledge around non-technical skills for clinical teams´ efficient teamwork during

368 stabilisation of a critically ill patient (37). Our findings suggest that managers at the clinical level, while

369 being central to the system's capacity for expressing resilience, do not have a similar explicit model or

20

370   training for how they approach their work. Furthermore, managers lack the aid of tailored decision

371   support systems. This could depend on well described challenges for design of such interventions (36). It

372   is important that healthcare policy and organisational redesign initiated by a higher system level are well

373   calibrated with the nature of managerial work on the clinical level before interventions can be

374   developed.

375   Seeing that many healthcare systems are facing increasing resource constraints, resilience and

376   sustainability becomes increasingly important. Our recommendations for future research and policy is to

377   prioritise the study and operationalisation of successful coordination in a wide variety of contexts. For

378   example, of how managers in the clinical context continually adapt instances of optimal staff allocation

379   for maintaining professional development and education with promoting basic safe care practices at the

380   clinical level (Figure 2).

381   **ARTICLE SUMMARY**

382   **Limitations**

383   This is a single centre study of a specialised unit with a specific patient clientele that cannot be cared for

384   by any other type of unit available. It was expected that the unit´s high tempo and specialisation would

385   promote a particularly observable coordinative work although it might introduce the argument of

386   limited transferability to other areas of healthcare. Although the specific unit for study enabled us to

387   capture and understand the subtleties of everyday work of first line managers, further studies are

388   needed to investigate how much of this work that may be specific to organizations of both similar and

389   contrasting types.

390   The first author (KH) who conducted the fieldwork is an experienced intensive care nurse. The familiarity

391   with the specific type work may have affected the interpretations drawn in this study. Table 1 of the

21

392 methodological section provide a trail of how interpretations of data where made. Trustworthiness

393 during data analysis was addressed by regular peer-check and in seminars with the wider research group

394 (38). The iterative process of data collection and analysis was intended to secure that the analysis

395 included more than one researcher's interpretation. Transferability were addressed by leaving an audit

396 trail of extracts from the raw data in the report so that readers from other fields can evaluate if the

397 results are transferable to their respective contexts (39).

LIST OF ABBREVIATIONS
398

399 RE: Resilience Engineering; NICU: Neonatal Intensive Care Unit; CAS: Complex Adaptive System; ECW:

400 Everyday Clinical Work; CMT: Coordination Management Team; SDOF: Systemic Degrees of Freedom

DECLARATIONS
401

402 **Ethics approval**

403 This study was approved by the regional ethical review board of Stockholm (2016/1832-32).

404 **Consent for publication**

405 Not applicable.

406 **Availability of data and material**

407 Given that the data is in Swedish and phrasing of the consent obtained from participants, complete raw

408 data are not available for sharing. Partial datasets used and/or analysed during the current study are

409 available from the corresponding author on reasonable request. A selection of translated quotes is

410 supplied in the results and methods sections and in appendix 1.

22

411 **Competing interests**

412 The authors declare that they have no competing interests.

413 **Funding**

414 The authors received no specific funding for this work.

415 **Author Contributions**

416 The study was initiated by KH. The study design was developed in collaboration within the research

417 team. KH performed the data collection. The analysis and interpretation of data was conducted in close

418 collaboration between KH, ME and KPH. KH wrote the first draft of the paper. All authors were involved

419 in writing, critical revisions and approval of the final version.

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423 phase of the study. Thanks also to the participating Neonatal clinic.

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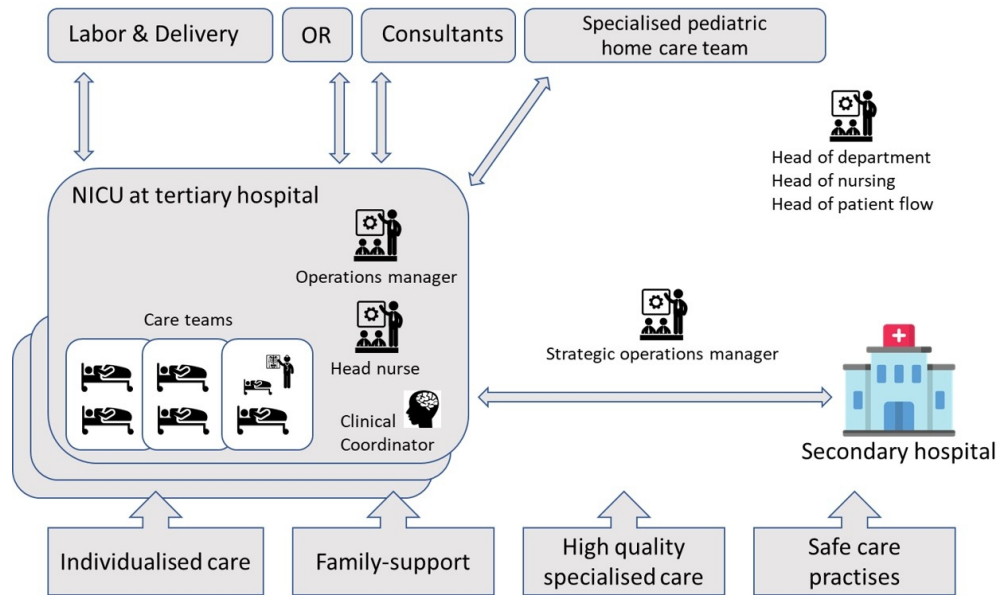
Fig. 1 The studied NICU in a tertiary level hospital with surgical capacity. Managers are located to illustrate their vicinity to the clinical care teams. Overarching goals are presented at the base of the figure. A selection of peripheral wards and units are illustrated in the surrounding area. The arrows are double headed to symbolise a two-way relationship of demands and possibilities for negotiation of for example patient transfers.

214x129mm (149 x 149 DPI)
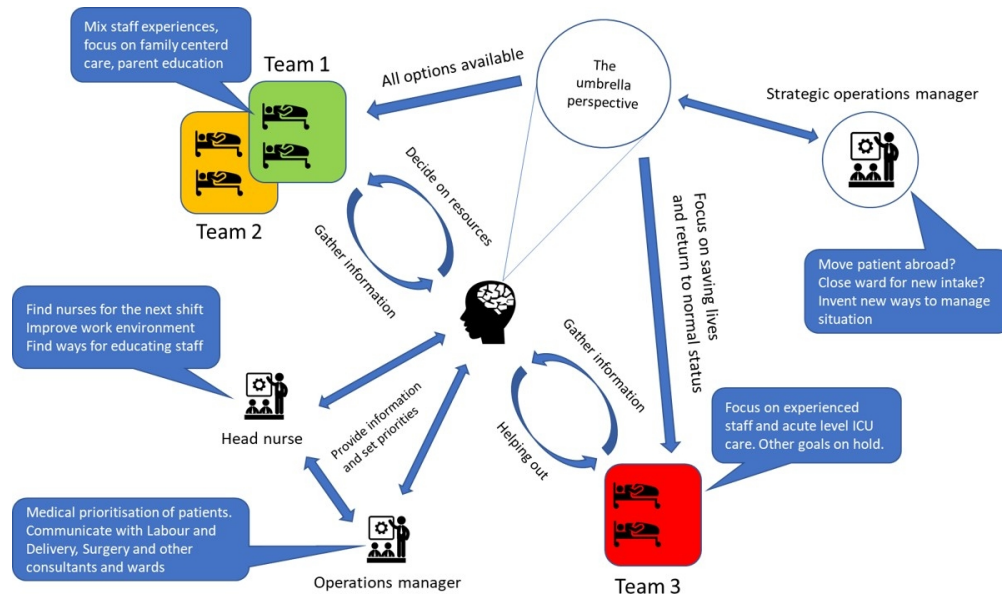
Fig. 2 The clinical coordinator at the centre of the CMT. The work of balancing goal-settings for system wide coherence, maintaining the umbrella perspective and adapting the CMTs´ work to meet rapidly changing demands.

204x124mm (149 x 149 DPI)

Appendix 1

Q1

(Clinical coordinator) We have put those two [patients] together in 9:1 to get an emergency cot in 9:2 for the twins [9 refers to a room divided in two sections equipped for one patient per section 9:1 and 9:2], I told the father that they may have to move out. But then we'll be in the situation where they maybe… They may need… That father is very new. So, I think that in that case they'll have to be two [staff] out there too.
(Operations manager) The [NN] twins?
(Head nurse) Right. Now there are two kids there, so one person can take care of them. But if you add those two [twins] then there'll be four babies, so then you need another person out there [on the ward] and there'll only be two staff left in there [room 9].
(Operations manager) Mm, it's tricky.
(Head nurse) Oh... so there are three of them who can help each other and... in [room] 7 and 8?
(Operations manager) Okay... I understand that to mean that we have a bit of leeway here if we need it in an emergency... but nothing that we can give to anyone else. Okay. [previously wanted to lend a nurse to another ward in need]
(Head nurse) Yeah, that's too bad. We'd love to be able to.
(Operations manager) Take over week 36 twins who need it, say. And then send them back, that's no fun.
(Clinical coordinator) And then we'd have to open like [rooms] 13 and 14.

Q2

The coordinator calls for an ad-hoc on-site face-to-face discussion with the strategic operations manager. This happens when the CMT experience that basic safe care practices at the clinical level consume every opportunity for maintaining overarching quality goals, the unit stop lending help to others and start sacrificing continuity of care for individual patients. The plan for today is to admit one intermediary level patient that were born during the night and is waiting for a room at the NICU. One patient has been diagnosed with a multi-resistant bacterium and will need increased hygiene standards. One baby currently in another hospital are being assessed by a surgeon for the need of possible transport and surgery, one will possibly arrive by helicopter for eye surgery today. Three babies are planned for being transported back to their respective local hospitals, one by helicopter today and twins tomorrow (Observers notes after the coordinating management team's morning huddle).

- *(Clinical coordinator) We are plenty of people today, that is nice. But when NN [strategic operations manager] asked if we had a lot of capacity, I had to say no.*

The clinical coordinator checks the antenatal list of at-risk mothers who are under observation.

- *(Clinical coordinator) Oh, there is a lot here, induction, ich... a lot of bleedings. There is a lot waiting... but you don't know when... It could be calm... I will not read all their charts.*
- *(Operations manager) ...one important thing. This baby that needed eye surgery is now acute and will arrive soon. They will land directly in the operating room and the transport team will take care of the baby until it can go back home its own hospital.*
- *(Strategic operations manager) Can we lend out some staff to [a neonatal ward in a neighbouring hospital].*
- *(Head nurse) I can check, we have plenty of staff, but they are all in use.*

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- *(Strategic operations manager) I ask because they are not doing so well [the other unit]. Twins are being born and they are asking for allowance and resources to move them to another region.*

Q3

- *(Clinical coordinator) This is not good, its full [the ward]. We have no space when this eye baby arrives.*

The clinical coordinator walks to the room where a nurse oversees the twins that were supposed to be transported out the next day but are now showing symptoms of infection.

- *(Clinical coordinator) Lets´ see when [Strategic operations manager] gets back, maybe we can send someone else.*
- *(Nurse) But they went to fetch the week 31 from delivery to there [points to an empty cot].*
- *(Clinical coordinator) Yes, and the eye baby is coming [points toward the 2ⁿᵈ empty place for a cot. Then its full here. Do you think these twins could be together in a twin cot?*
- *(Nurse) Well, I don´t know. This one is just on the margin of managing without incubator, and that one is getting treatment for bilirubin [treatment includes being exposed to light from a special lamp].*
- *(Clinical coordinator) The problem is that I don't have staff to open another room.*
- *(Nurse) Maybe if we reconsider the lamp-treatment...*
- *(Clinical coordinator) Exactly, and then we hope that the eye baby can go back to his own hospital later in the evening.*

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A FIRST LINE MANAGEMENT TEAM´S STRATEGIES FOR SUSTAINING RESILIENCE IN A SPECIALISED INTENSIVE CARE UNIT – A QUALITATIVE OBSERVATIONAL STUDY

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1 **A FIRST LINE MANAGEMENT TEAM´S STRATEGIES FOR SUSTAINING RESILIENCE IN A**
2 **SPECIALISED INTENSIVE CARE UNIT – A QUALITATIVE OBSERVATIONAL STUDY**
3

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1

ABSTRACT

Objectives

Acute care units manage high risk patients at the edge of scientifically established treatments and organisational constraints while aiming to balance reliability to standards with the needs of situational adaptation (resilience). First line managers are central in coordinating clinical care. Any systemic brittleness will be evident only in retrospect through for example care quality measures and accident statistics. This challenges us to understand what successful managerial strategies for adaptation are and how they could be improved. The managerial work of balancing reliability and adaptation is only partially understood. This study aims to explore and describe how system resilience is enhanced by naturally occurring coordination performed in situ by a management team under variable circumstances.

Design

An explorative observational study of a tertiary Neonatal Intensive Care Unit (NICU) in Sweden. One year of broad preparatory work followed by focused shadowing observations of coordination analysed through inductive-deductive content analysis from a perspective of resilience engineering.

Participants

A team of managers (i.e. clinical coordinators, head nurses, senior medical doctors).

Results

The results describe a functional relationship between the NICU´s level of manoeuvrability and a progression of adjustments in the actual situation, expressed through recurring patterns of adaptation. Managers focused on maintaining coherence in escalating problematic situations by facilitating teamwork through goalsetting, problem-solving and circumventing the technical systems' limitations.

Conclusions

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44 Coordination supports a coherent goal setting by increased team collaboration and is supported by team

45 members´ abilities to predict the behavior of each other. Our findings suggest that in design of future

46 research or training for coordination, the focus of assessment and reflection on adaptive managerial

47 responses may lie on situations where the system was "stretched" or "needed reorganization" and that

48 learning should be about whether the actions were able to achieve the short-term goals while

49 preserving the long-term goals.

50 **Keywords**

51 Qualitative research, Health services administration & management, Health policy, Organisation of

52 health services, Risk management

53 **Wordcount**

54 4877

55 **Strengths and limitations of this study**

56 • The explorative ethnographic design allowed for a deeper understanding of the underspecified

57   (hidden) work of first line managers.

58 • Several iterations of data collection and analysis allowed for an initially wide and later more

59   focused data collection that opened opportunities for the researchers to follow up on specific

60   findings.

61 • The inductive-deductive analysis allowed the researchers to follow and describe patterns of

62   recurring codes within the whole dataset.

63 • The first author (KH) who conducted the fieldwork is an experienced neonatal intensive care

64   nurse which may have affected the interpretations drawn in this study.

65 • The explorative study design was suitable for describing a complex process without measurable

66   clinical outcomes.

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67 **BACKGROUND**

68 The neonatal intensive care unit (NICU) is a specialized intensive care unit that serves as its own

69 emergency department, intensive care unit and a pre- and postoperative ward, requiring a wide array of

70 interrelated multi-professional teams to operate in a coordinated fashion. The many roles of the unit are

71 coupled with the pressures of maintaining high-quality and individualized care, family support and safe

72 care practices. Some situations are manageable by reorganizing teams internally while others require

73 cooperation with external units.

74 The NICU is distributed over three hospitals in an integrated network of independent units organized

75 under one head of department. Daily operations are overseen by the strategic operations manager to

76 ensure collaboration for overall performance across the three units. The overarching goals as

77 understood by the authors are individualized care, family support, high quality care and safe care

78 practices (Figure 1).

79   [Insert figure 1 here]

80 Maintaining quality and safety is a persistent problem considering acute admissions, staff shortage and

81 rapidly deteriorating patients with life-threatening conditions (1,2). Safety is often defined as one of

82 many variations of 'the absence of preventable harm to a patient during the process of health care' (3).

83 During the last decades of patient safety research a movement towards an inclusive view of supporting

84 the healthcare systems´ ability to sustain required (normal) operations has emerged, the resilience

85 engineering (RE) perspective (4). An important point made within the RE perspective is that safety can

86 be enhanced by a combination of structure and control on one hand and adaptations on the other (5).

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87   Healthcare is to be understood as a complex sociotechnical system (6). It is not only defined by the

88   boundaries of physical locations (7). People with their skills and relationships, rules, regulations and

89   even work place culture may impact system performance (6). Research on resilience in healthcare

90   suggest that successful as well as unsuccessful outcomes emerge from the fluid arrangement of system

91   components (coordination) (8). Coordination is defined as "*…the deliberate and orderly alignment or*

92   *adjustment of partners' actions to achieve jointly determined goals"* (9). 'Partners' in the healthcare

93   setting are those who share a common goal of delivering care to patients. People who perform

94   coordinative work are a part of a "*process by which team resources, activities, and responses are*

95   *organized to ensure that tasks are integrated, synchronized, and completed within established temporal*

96   *constraints"* (10).

97   Although coordination is an integral part of everyday healthcare management we know very little about

98   how *managers* learn the strategies they use and which of the work practices they develop that are

99   successful (11,12).

100   This study aims to explore how system resilience is enhanced by naturally occurring coordination

101   performed in situ by a management team (i.e. clinical coordinators, head nurses, senior medical doctors)

102   under variable circumstances.

103   **METHODS**

104   **Design and setting**

105   This study uses an explorative ethnographic design using participatory observations and an abductive

106   approach to capture and analyse naturally occurring coordination in situ (13). The reason for focusing

107   on action-interaction was to capture a deep understanding of the varying conditions under which

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108   decisions and coordination took place (14). The Standards for Reporting Qualitative Research (SRQR)

109   checklist was used to improve the transparency of research (15).

110   The study took place in a tertiary level NICU with an approximate capacity of 70 cots divided over three

111   wards located in separate hospitals. The patient mix of the three wards is dependent on local factors

112   such as the size and risk profile of adjacent delivery wards and the availability of paediatric surgical

113   capacity. Staffing for the high acuity patients is normally one nursing team per two patients (one nurse

114   and one assistant nurse). Paediatricians and neonatologists are allocated over the three wards

115   depending on availability and competence.

116   Each of the three wards is managed by a clinical coordinator, a head nurse and an operations manager

117   during daytime (Figure 1). The clinical coordinator performs tasks such as rostering, planning for patient

118   flows (admissions, discharges and transports) and does clinical work when needed. The head nurse is

119   formally responsible for the work environment and quality of care. The operations manager is a senior

120   neonatologist with an overall responsibility for the medical quality and patient flow. A strategic

121   operations manager has mandate to move patients between hospitals within the own organisation or to

122   hospitals outside the region. All managers are clinical specialists (nurses and neonatologists). Hereafter

123   we will refer to this team as the management team.

124   **Data collection**

125   Data was collected between January and February 2017. The head of the department gave permission

126   to conduct participant observations at the unit. All staff was informed about the procedures in a staff

127   meeting and they were informed that they could decline from being observed at any time according to

128   the ethics approval. The clinical coordinators (four individuals) gave written consent to being shadowed

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129   after receiving written and oral information. The coordinators were all women, experienced nurses with

130   more than 10 years of NICU experience.

131   Data collection was structured in iterative cycles of collection and analysis, starting with descriptive

132   observations to get familiar with the work environment and relevant aspects of the managers' work

133   (16). The descriptive observations focused primarily on ´places´ were the coordination of work was

134   apparent, for example at the head nurses and secretaries open office area and at the management

135   teams´ office at the center of the ward. The intermittent recording and analysis of field notes during

136   initial observations yielded research questions that were in focus during the following observations.

137   The focused observations targeted selected situations such as rostering for the next shift, start-up

138   meetings and handovers between shifts in addition to shadowing of coordinators. Data was collected

139   through ad-hoc interviews with staff and managers during or after the shadowing (16). Shadowing

140   meaning "following people, wherever they are, whatever they are doing" (17). Artefacts, including

141   coordinators' notes on patients' medical status, occupancy- and rostering charts were copied and

142   collected. All relevant aspects of the environment were captured in field notes during or after the

143   observations, along with researcher's memo-writing over personal reflections and thoughts about what

144   was happening.

145   **Analysis**

146   All meetings and interviews were audio recorded and transcribed verbatim. Transcriptions from tape-

147   recorded dialogues were placed in a correct temporal order along with the field notes, so that the mix of

148   field notes and transcription chronologically represented the full workday. Transcripts were read

149   through several times, followed by discussions in the research group about the level of detail in the data

150   and reflections KH had regarding the observed work shift (18). The initial inductive analysis went

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151   through a two-step process (columns two and three in Table 1). First, a conversation or a situation of

152   relevance for the study's aim (a meaning unit) was selected and the question "What is happening here?"

153   was directed to the data. Next, the selected conversation or situation was analysed in the context of the

154   entire scene where it took place, with the question "Why or how is it happening here?". The

155   interpretation was condensed and labelled with one or several codes (Table 1). The codes and their

156   relations were frequently discussed in the research team and sorted into tentative sub- and main

157   categories. Field notes were included in the analysis as means to reflect on the researchers' pre-

158   understanding of the context. Moving back and forth between induction and deduction was a way to

159   discover meaningful underlying patterns that made it possible to integrate concrete behaviour and deep

160   contextual structures. Lastly, a deductive comparison of interdependencies between the main

161   categories and sub-categories in relation to the theoretical concept of resilience was performed (14).

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Table 1 Example of the analysis in two-steps: going from *raw data* to *interpretation of incident* and to *analytical interpretation in context*, *code* and *memo*.

Raw data	Interpretation of incident	Analytical interpretation in context	Code	Memo
The observation begins in the flow room. The flow room is a small room with two workstations where the coordinator has her seat. There are several information sources hanging on the walls and post-it notes on the computers. The coordinator meets the observer in the flow room after having walked around the ward to check all the patient rooms.	In the physical environment, several different communication tools are gathered within a small area, i.e., tools used to summarize, remember, and disseminate important information. Information exchange occurs on paper notes stuck to computers, through software, and when the coordinator herself walks around the ward.	Information exchange is one part of coordination and can be performed through predefined channels and tools, but also more intuitively through physical meetings within the ward while the manager compares notes to what is experienced. The environment has been adapted for having several different information channels intersecting in one place.	Adapting environment – cluster tools for facilitating information exchange	The coordinator has gathered information about the current situation in the patient rooms by walking around and taking a look. She then looks at the system level, occupancy lists, and information from the other coordinators. If coordination means exercising control, real life information gathering is probably an important step.
The coordinator sits down at a computer and begins counting patients on her paper copy of the occupancy list and in TakeCare [electronic health record]. She reports the occupancy in Belport [national occupancy chart] and talks a bit about this.	Counting patients and manually entering the number into the national occupancy report is one of the first things the coordinator does in the morning.	The coordinator gets an idea of the status and distributes it to the rest of the country as information. This is proactive management, as future coordination may become easier if reference can be made to Belport, or if you know that the other units in the country your information.	Information handling	Reporting your status is a way of exercising control by impacting others perception regarding the degrees of freedom at your end.

163 **PATIENT AND PUBLIC INVOLVMENT**

164 Public and patient involvement was not applicable in this research.

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165 **RESULTS**

166 The analysis resulted in six subcategories and two unifying main categories (table 2).

167 The ´how´ and ´when´ of coordination is presented in Table 2 that illustrate the functional relationship

168 between the two main categories *adjustments to meet the actual situation* and *maneuverability* with

169 their respective sub-categories. The sub-categories *Supporting system cohesion* and *Extending system*

170 *boundaries* describe the joint work of managers and clinical staff. *Adapting the structure and roles of the*

171 *coordinating management team* and *Shifting between information sources for better sensemaking*

172 describe the management team's internal work.

173 Extracts from the field notes and conversations are presented to clarify the findings. More

174 comprehensive material is provided in Appendix 1.

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Table 2 The main category on the y-axis are *adjustments to meet the actual situation* and on the x-axis; *maneuverability.* Four sub-categories on the y-axis describe strategies (i.e. the work that managers do); and the three sub-categories on the x-axis describe a progression of a perceived level of manoeuvrability based on the expressed availability of *degrees of freedom* with illustrative quotes.

<table>
<tr><td colspan="5" align="center">Manoeuvrability</td></tr>
<tr>
<td colspan="2" rowspan="2"></td>
<td align="center">Losing control – reorganisation</td>
<td align="center">Stretching the system to work outside ordinary conditions</td>
<td align="center">Everyday work under ordinary conditions</td>
</tr>
<tr>
<td></td><td></td><td></td>
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<tr>
<td rowspan="9">Adjustments to meet the actual situation</td>
<td></td>
<td>"So [the other hospital] have 20 babies now, seven acute. They have opened a temporary room but have no staff for it. We have no transport team [to use as staff] because they are on their way to [another city] […] I still won't send babies to other counties, which we can't because we have no transport team available […] either we find some staff here that can go there or we have to order two on overtime. How do we usually do?" (Operations manager).</td>
<td>"We have put those two [patients] together in 9:1 to get an emergency cot in 9:2 for the twins [9 refers to a room divided in two sections equipped for one patient per section 9:1 and 9:2], I told the father that they may have to move out. But then we will be in the situation where they maybe… They may need… That father is very new. So, I think that in that case they will have to be two [staff] in there too." (Clinical coordinator). [Q1 – appendix 1]</td>
<td>"Oh, so we are only at eight intensive care babies and three in family rooms. So, it's a pretty good situation. And we have nothing acute in the delivery- or antenatal wards. I just checked." (Operations manager).</td>
</tr>
<tr>
<td>Supporting system cohesion</td>
<td>
• Delay work and evaluate the situation
• Isolate problems and focus on re-creating manoeuvrability.
• Exploit possibilities of extraordinary individual achievements (trade-off individual resilience for system control).
</td>
<td>
• Goalsetting towards protecting manoeuvrability.
• Goalsetting for promoting basic safe care practices at the clinical level through minimal staff allocation and skill mix.
• Sacrificing continuity in patient assignments for saving lives.
</td>
<td>
• Goalsetting towards family-centred care
• Goalsetting of individualised care.
• Managing optimal staff allocation for maintaining professional development and education.
• Controlling occupancy and redundant capacity through predefined strategies.
• Monitoring state of the ward at the clinical level by regular walkarounds in the clinical work environment.
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<tr>
<td>Extending system boundaries</td>
<td>
• Identifying novel use of any existing external resources (i.e. use of paediatric emergency transport team and other wards).
• Shedding managerial tasks for participating in clinical emergency work (trade-off management for clinical work).
</td>
<td>
• Managing occupancy trade-offs between facilities and staffing (higher occupancy in fewer rooms lowers staff requirements).
• Utilising individual managers social networks within predefined limits for proactive problem-solving.
</td>
<td>
• System working within normal boundaries.
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</tr>
<tr>
<td>Adapting the structure and roles of the coordinating management team</td>
<td>
• Make *loss of control* explicit in the management team.
• Moving from understanding the situation to making rapid decisions close to the clinical level.
</td>
<td>
• Relaying information on the patients' clinical situation to mid- and upper-level managers (information priority bottom-up).
</td>
<td>
• Relaying high level plans to clinical level workers through regular briefings (information priority top-down).
• Participate in regular medical discussions on patients' status´.
</td>
</tr>
<tr>
<td>Shifting between information sources for better sensemaking</td>
<td>
• Dropping computerised aides, rostering systems and staffing charts for handwritten notes and memos.
• Using face-to-face communication with people in close vicinity (shedding electronic communication).
</td>
<td>
• Seeking ad-hoc meetings within the management team for calibrating information of the situation and possible workarounds.
• Verbally explaining situations to other managers.
</td>
<td>
• Regular use of computerised systems and handwritten notes.
</td>
</tr>
</table>

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177 **Manoeuvrability**

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178 Managers face situations where they must balance a limited number of staff and demands for high

179 occupancy with the task of supporting clinical teams in their care of patients. Unpredictable factors such

180 as acute admissions, staff availability and the medical progression of patients put managers in situations

181 where they might quickly have to re-adjust and re-plan, often ad-hoc with scarce information of the

182 overall situation. Part of the observed dialogue relate to the management team's efforts to identify

183 alternative ways forward. See quotes at the head of Table 2. Further examples of the choices made

184 under each sub-category of manoeuvrability is presented in table 3.

185 In the quote below, the head nurse acknowledges that the inflow of emergency patients is sometimes

186 impossible to avoid.

187 *"The patient flow, do you participate in that?" (Observer). "No, no more than that I can say ´stop´,*

188 *because I don't have the staffing." (Head nurse). "Ok, so you can say that too?" (Observer). "Mm, I can*

189 *say that I have five or six teams. But…" (Head nurse). "But you cannot say stop today." (Coordinator).*

190 *"No, but it is like that. Even if we say stop the babies are being born. And we have to take care of them."*

191 *(Head nurse).*

Table 3 Examples of ´situations´ and ´choices made´ sorted under each sub-category of manoeuvrability.

Losing control – reorganisation	Stretching the system to work outside ordinary conditions	Everyday work under ordinary conditions
Situation with several problematic trade-offs. The coordinator approaches the head nurse when she cannot find a suitable cot for a new patient (Field-notes). "We have another problem." (Coordinator). "Right, what?" (Head nurse). "This new week 28 [patient], I cannot put in room 10 [a room with four cots, one is available], the other baby in there is terminal and about to die." (Coordinator). "But if we place him in room 16 or 15?" (Head nurse). "No, I can't put it in 15 because I have two cots in there for the twins and they must be together [also incoming patients]." (Coordinator). […] "We cannot have the twins remaining at the stabilisation unit at delivery, there might be another patient coming in." (Coordinator). "Okay, because I thought it	**Exploring options to avoid patient transfers because of staff shortage.** "NN [strategic operations manager] think that we can conserve personnel by moving ´K´ [a patient] to ´Ts´ room [another patients]." (Head nurse). "Okay." (Observer). "But I am not so sure we conserve personnel by that; and the family have already moved several times, you know that they are the ones that was supposed to be moved to [another hospital]." (Coordinator). "Okay" (Observer). "It [the patient] started to have breathing problems and came back. And now after moving back here they will have to move again ´sigh´." (Coordinator).	**The deliberate adaptation of an administrative routine.** "I have talked to NN [a nurse currently placed at the emergency stabilisation unit in the delivery ward] because there is a week 35 baby there that the doctor did not want to take it up to the ward during the nightshift." (Coordinator). "No?" (Observer). "Yes, then he has of course been there a little longer that his allowed six hours." (Coordinator).

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would be a better idea to move the twins directly from delivery [to another hospital] if they need to move anyway at some point." (Head nurse). "Mm, but where should they move. All hospitals are full [in the county]. We would have to move them out of county." (Coordinator). "Yes, we will never be allowed to do that." (Head nurse).		

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Everyday work under ordinary conditions

194 The management team have planned meetings; they sweep the ward to collect information on the state

195 of things and relay high level plans to workers.

196 *The coordinator begins her shift by conducting a walkaround of the ward, saying hello to the nurses and*

197 *doctors as she is asking if everything is all right. After the walkaround she sits down to begin exploring*

198 *her staff roster and patient occupancy charts (Field-notes).*

199 Under ordinary conditions there is a minimal observable need for managers to manually adapt

200 information they extract from technical systems, regarding for example occupancy, patient acuity levels

201 and staffing. Managers describe how their experience of the technical systems' limitations are learned

202 on the job and how workarounds are taught between individuals.

203 *The coordinator makes a note of something on her occupancy chart (Field-notes). "What did you write on*

204 *that chart?" (Observer). "CT 11:15 [Computer Tomography at 11:15]." (Coordinator). "And it is used for*

205 *that kind of information?" (Observer). "I print one of these charts because there is more space to write*

206 *on. I think… I think many… I think NN and NN [two other coordinators] use this too. And NN [another*

207 *coordinator] use it because I taught her. And I use it because NN [a coordinator who quit earlier] taught*

208 *me." (Coordinator). "Okay, that is nice. But is it the same information you all use it for?" (Observer).*

209 *"Well, I don't know?" (Coordinator). "Not important?" (Observer). "Well, I don't think so, I use it for…*

210 *those that are planned for other hospitals, delivery ward, antenatal… Oh! I forgot to write that today*

211 *[makes another note on the chart] and stuff that I need to do." (Coordinator).*

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212 ***Stretching the system to work outside ordinary conditions***

213 The following situation is a typical example of how the management team must re-organize and adapt

214 to stretched conditions. The ad-hoc meeting in the example illustrates that strategic goals of family

215 centred care and optimal staff allocation are traded for immediate medical priorities, basic safe care

216 practises and protection of the wider system. Other patients on the ward are cared for by their

217 respective teams, avoiding exposure of this emerging crisis because it is handled by the paediatric

218 emergency transport team.

219 *The plan for this day is to admit one intermediary level patient that was born during the night and is*

220 *waiting for a cot at the NICU. One patient has been diagnosed with a multi-resistant bacterium and will*

221 *need increased hygiene standards (Field- notes) […] "We are plenty of people today, which is nice. But*

222 *when NN [strategic operations manager] asked if we had a lot of capacity, I had to say no." (Clinical*

223 *coordinator). […] "...one important thing. This baby that needed eye surgery is now acute and will arrive*

224 *soon. They will land directly in the operating room and the transport team will take care of the baby until*

225 *it can go back home to its own hospital. (Operations manager).* [Q2 – Appendix 1]

226 The plan for postoperative care after acute eye-surgery was for the patient to be assigned a cot and a

227 nursing team on the ward. The situation was managed by using the transport team to temporarily care

228 for the baby inside the operating room until it was stable enough for transport to another hospital. This

229 decision had possible implications for the whole management team. The clinical coordinator wanted to

230 know about the utilisation of staff and facilities. The head nurse about workplace safety, quality of care

231 and economy. The operations manager had responsibility for the medical quality and the strategic

232 operations manager for the possibility of helping one of the other wards with staffing.

233 ***Losing control – reorganisation***

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234   The category of ´losing control´ was characterised by managers shedding managerial tasks for

235   participating in clinical emergency work, isolating problems and focusing on re-creating manoeuvrability.

236   The focus was to protect clinical teams from being exposed to the rapidly shifting plans and priorities at

237   the managerial level. Strategies for regaining control can be to sacrifice the goal of continuity by

238   transferring at-risk mothers to other hospitals (deferral), or to temporarily transfer additional weight of

239   medical care to neighbouring sub-systems such as the paediatric emergency transport team or the

240   managers themselves.

241   The following situation illustrates a reorganisation at the verge of losing control. The coordinator tried to

242   reserve an empty cot for possible additional acute emergency admissions.

243   *"This is not good, its full [the ward]. We have no space when this eye baby arrives." (Clinical*

244   *coordinator). The clinical coordinator walks to the room where a nurse oversees the twins that were*

245   *supposed to be transported out the next day but are now showing symptoms of infection. (Field- notes).*

246   *"Do you think these twins could be together in a twin cot?" (Clinical coordinator) […] "Well, I don´t know.*

247   *This one is just on the margin of managing without incubator." (Nurse) […] "The problem is that I don't*

248   *have staff to open another room." (Clinical coordinator). [Q3 – Appendix 1]*

249   The manager handled the situation by putting twins together in one cot, thereby utilising one nurse to

250   care for three babies which is more than the goal of two babies per nurse. This manoeuvre created an

251   opportunity to temporarily handle five patients (with one empty emergency cot) in a room with staffing

252   for four. The nurse expressed concern for her patient but remained focused on finding a solution.

253   When the managers started shedding managerial tasks for bedside operative work, they risked losing

254   the ability to meet other managers and keep up to date with the ward. Management decisions in these

255   situations were then based on a narrower understanding of the bigger picture. Computer aides were

256   less used (or not at all) because of their inability to present rapidly changing borderline conditions.

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257 **Adjustments to meet the actual situation**

258 It was observed how the mandate for making decisions was distributed across the management team

259 and clinical nursing teams (speech bubbles in figure 2). The clinical coordinator moved freely across the

260 unit and made independent decisions regarding resource allocation, rostering and whether to shed her

261 own managerial work to help the clinical teams. The clinical coordinator also provided the other

262 managers with information when they needed to adjust their plans.

263   [Insert figure 2 here]

264 *Supporting system cohesion*

265 Members of the management team were observed to often communicate through ad-hoc meetings

266 where verbal information was compared to patient rosters, patient conditions, staffing and workload

267 indicators. They worked close to the clinical context and discussed the current goals' attainment for

268 individual clinical teams and what the current trade-offs were. The managers compared computer- and

269 paper-based notes, as well as information provided at start-up meetings to update themselves of the

270 status of the ward and where the situation was heading (umbrella perspective in Figure 2).

271 *The coordinator is back in room nine to alleviate the staff for lunch. She checks in on the baby that has*

272 *been in acute surgery for intestinal obstruction. There are lots of beeping sounds, but no one seems*

273 *alarmed. The head nurse enters the room and seeks the coordinators attention, but initially fails as the*

274 *coordinator is tending to a patient. Eventually the coordinator looks up (Field-notes). "Didn't they [the*

275 *surgeons] say already this morning that this patient was up for re-operation?" (Coordinator). "After*

276 *lunch apparently. Then what do we do with NN [another patient]?" (Head nurse).*

277 In the example above the managers discussed how two patients' trajectories were affected by the

278 surgeons rescheduling. The management team negotiated situations that needed simultaneous

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279 attention, like prioritizing readiness and clinical capacity in some parts of the ward while maintaining

280 family centered care and staff education in others (Illustrated as the three clinical teams in Figure 2).

Extending system boundaries

282 The need for extending the system's boundaries emerged as the pressure of prioritizing decisions

283 increased. The management team made use of other units' facilities or staff, like delaying patients in the

284 operating theatre or letting a transport team care for the patient for some time before handing it over

285 to the regular staff. The management team utilised auxiliary staff and overlapping competencies of

286 different professional groups. Sometimes the managers themselves doubled as clinical staff within their

287 vocation.

288 *"It is already a little tight if it arrives [the surgery baby], right now we have low workload in room nine*

289 *and ten with four patients and the other goes back to [another hospital out in another region] at five [in*

290 *the afternoon]. We hope. But it is also, I mean, if there is an acute admission and he... I do not think NN*

291 *[a nurse] can have four patients by himself out there. Since the father needs quite a lot of help."*

292 *(Coordinator). "They are really good patients those babies" (Operations manager). "What about the*

293 *midwives then? [that belongs to the adjacent delivery ward]" (Coordinator). "There are four of them*

294 *[turns to face the operations manager]?" (Head nurse). "Yesterday someone said that you can have four*

295 *patients by yourself." (Operations manager). "Not by yourself" (Coordinator). "With an assistant nurse."*

296 *(Head nurse). "Yes with an assistant yes, that is okay but." (Coordinator). "So there are three patients*

297 *left?" (Head nurse). "And then we have put two in the same cot at 9:1 [bed one in room nine]." (Head*

298 *nurse 2). "Okay." (Head nurse).*

Adapting the structure and roles of the coordinating management team

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300 The management team fluently adapted its own structure in situations where there were not enough

301 resources to manage within everyday routines, when there was urgency or when some of the

302 management team members were not available with their specific expertise and mandate. This

303 structural adaptation was observed when individuals in the management team shifted from relaying

304 plans from top-down to working with patients and gathering information from bottom-up.

305 *"In room nine is that week 22 baby that came in yesterday. They are intubating now so they use a lot of*

306 *people. There were no head nurses here at seven, so I decided myself that NN [nurse] got to be alone at*

307 *the stabilisation room [at the delivery ward]. The doctors there have to work a little harder now."*

308 *(Clinical coordinator).*

309 ***Shifting between information sources for better sensemaking***

310 As the situation on the ward became more complex the management team increased their reliance on

311 handwritten notes rather than the standard computer-generated lists for staffing and patient acuity

312 information.

313 The coordinator used handwritten notes as memory aides in team discussions. The notes were mainly

314 short markings, phrases, or single words in the margins like "discharge planned" or "need antibiotics".

315 The limitations of computer-generated patient rosters to convey this type of information on real world

316 complexities were expressed by members of the management team.

317 The national occupancy chart for example was only able to classify patients as high or low acuity without

318 regards of other factors. When there was a need to work outside the binary world of two patient

319 groups, the team stopped using this computer-generated aide and instead relied on their own domain

320 knowledge, personal network and the stability of the management teams' understanding of the bigger

321 picture.

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322 *"Well and this is actually look correct [number of beds in the national occupancy chart] 14 in total. But*

323 *with the stabilisation beds. That makes it 12 here plus two there… But it is also a little [inaccurate].*

324 *Because then you calculate [all of them as intensive care beds]. The stabilisation beds are supposed to be*

325 *low acuity". (Clinical coordinator)*

326 The following quote illustrates what happens when the computerised information indicated normal

327 occupancy when the off-going night nurse reported understaffing for the same shift.

328 *"How did this happen?" (Clinical coordinator).*

329 *"Well, because NN [one of the nurses] who is work-training after sick leave was included in the staffing.*

330 *The parenthesis was probably put there later [points at the handwritten parenthesis in the rostering*

331 *folder, indicating that NN should not be included in the staffing]". (Night nurse)*

DISCUSSION

333 The management team in this study exhibited a range of mindful adaptations for sustaining the units´

334 capacity for expressing resilience. Such as sacrificing low level goals based on up-to date information

335 and continuous assessments of what would be minimally intrusive for the overall performance of the

336 system (figure 2). Our findings elucidate a link between adjustments to meet the actual situation and the

337 available manoeuvrability of the system.

Supporting coherence

339 The management team aimed to balance the demands and capacity of multiple teams that operate in

340 separate rooms while tending to patients with a wide variety of problems and acuity. For practical

341 reasons the teams could not always meet to communicate with each other. A defining characteristic of a

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342   multiteam system is the ability of component teams to modify individual goal hierarchies while sharing a

343   common distal goal or set of goals (12). During the observations the management team and the clinical

344   staff consequently agreed on making provision of acute care to rapidly deteriorating patients a top

345   priority, allowing us to identify it as a core mission (i.e. purpose of the system) (19). Other priorities

346   were more likely to be put on hold and resumed later or to be permanently dropped.

347   When the care teams were unable to communicate, maintaining coherence was an important factor for

348   the managers´ maintenance of an umbrella perspective i.e. what they needed in order to understand

349   how the bigger picture of their interventions fit together (20). At this point, we can say two things about

350   coherence, with implications for the training of managers as adaptive teams (21). First, that

351   coordination supported a coherent goal setting with increased team collaboration and second, that it

352   was enhanced by team members' ability to predict the most likely priorities of each other.

353   **Reorganising to support manoeuvrability**

354   Everyday work of the management team was characterised by seamlessly and actively organising and

355   reorganising. Our observations illustrate how the management team made use of early investments in

356   for example staff´s expertise, deep domain knowledge and the workplace culture to maintain a unit

357   wide focus on the core mission (22). Allowing the care teams to adapt their goals individually

358   exemplifies that being resilient is to be part of a process of identifying conflicting goals in a complex,

359   intractable environment using *"numerous indicators in a proactive fashion to probe a system's adaptive*

360   *capacity before system-wide collapse results in disaster"* (21). A realisation from studying the

361   management team was the shapelessness of the organisation. We could not observe a formal agenda

362   for how and why the management team was supposed to prioritize in terms of goal achievement below

363   the core mission. Our study suggests that it is up to the management team to support the system by

364   using experience, professional ethos and domain knowledge to negotiate the way forward in a manner

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365   that resembles the fifth principle of managing the unexpected, as described by Weick and Sutcliffe (23).

366   Specifically, because the flexible decision structures enabled resilient performance when expertise and

367   experience outranked formal hierarchical positions.

368   Important for the application of resilience in everyday clinical work was the link between adaptation and

369   outcome (successful or unsuccessful) as described in for example the CARE model for researching

370   resilience in healthcare (24). An adaptation is a deviation from work as planned, and it is not always

371   clear beforehand whether the outcome of an adaptation constitutes success or failure in terms of

372   quality and safety. Our study describes managers' adaptive responses to the conflicting demands of

373   acute patient care on one hand and long-term strategic demands on the other (measured as for

374   example respirator days, patient throughput and hospital acquired bloodstream infections).

375   **Balancing between long- and short-term goals**

376   Resilience depended on the use of earlier investments in 'potential opportunities for action' previously

377   described as degrees of freedom. However, low-level goal-sacrifices do represent a loss of potential

378   future degrees of freedom if it is overexploited. In the context of the NICU, families are less prepared for

379   discharge if they are not trained, staff might receive less time learning from experienced colleagues if

380   they do not work together and formal routines might erode if they are not employed.

381   The balancing act between seemingly irreconcilable goals makes it impossible to decide in retrospect

382   whether coordination was good or bad for the total outcome of the system. Each decision to suspend or

383   sacrifice a low-level goal has implications for the organisation's future capacity for expressing resilience.

384   All teams worked towards the core mission of providing acute care. However, the maintenance of long-

385   term investments was achieved by managing a diversity of low-level goal-sacrifices between many

386   clinical teams (i.e. sacrificing patient education in one and staff education in another). Our findings

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387   suggest that in design of future research or training for coordination, the focus of assessment and

388   reflection should be on adaptive managerial responses in situations where the system is 'stretched' or

389   'in need of reorganization' (table 2). Furthermore, learning should be about whether the actions lead to

390   achievement of short-term goals while preserving the long-term goals.

391   **Limitations**

392   This was a single centre study of a specialised unit with a specific patient clientele that cannot be cared

393   for by any other type of unit available. It was expected that the unit´s high tempo and specialisation

394   would promote a particularly observable coordinative work with the risk that it might introduce the

395   argument of limited transferability to other areas of healthcare. We believe however that the

396   networked structure of three wards is not unique. The specific unit for study enabled us to capture and

397   understand the subtleties of everyday work of first line managers. Further studies are needed to

398   investigate how much of this work may be specific to organizations of both similar and contrasting

399   types.

400   Using a qualitative cross-sectional design, this study does not allow us to define successful or

401   unsuccessful outcomes. Resilience is described based on the actions taken and further studies are

402   required to operationalise and test our results.

403   The first author (KH) who conducted the fieldwork is an experienced neonatal intensive care nurse with

404   experience from the studied NICU. The familiarity with the specific type of work may have affected the

405   interpretations drawn in this study.

406   Trustworthiness during data analysis was addressed by regular peer-check and in seminars with the

407   wider research group and member check. The final analysis was individually validated with the

408   coordinators (25). The iterative process of data collection and analysis was intended to ensure that the

22

409 analysis included more than one researcher's interpretation. Transferability was addressed by leaving an

410 audit trail of extracts from the data in the report so that readers from other fields can evaluate if the

411 results are transferable to their respective contexts (26). Table 1 of the methodological section provides

412 a trail of how interpretations of data were made.

413 The use of voice recordings of meetings and conversations was limited to situations where verbal

414 consent could be obtained from all participants, unless explicitly asked not to by any of the participants

415 (27). In larger groups, where participants attended only partially this was not a feasible option and

416 handwritten notes were taken, video recordings were not possible because of difficulties with assuring

417 patient anonymity in the clinical context.

418 **CONCLUSIONS**

419 We are only beginning to understand managers' strategies for prioritising and acting on the variability of

420 degrees of freedom. Our findings suggest that managers at the clinical level, while being central to the

421 system's capacity for expressing resilience, do not have an explicit model or training for how they

422 approach their work. Furthermore, managers lack the aid of tailored decision support systems. This

423 could depend on well described challenges for design of such interventions (28). It is important that

424 healthcare policy and organisational redesign initiated at higher levels are well calibrated with the

425 nature of managerial work on the clinical level before interventions can be developed. Our

426 recommendations for future research and policy making is to prioritise definition and operationalisation

427 of successful coordination in a wide variety of contexts.

23

428 ## LIST OF ABBREVIATIONS

429 RE: Resilience Engineering;

430 NICU: Neonatal Intensive Care Unit

431 ## DECLARATIONS

432 **Ethics approval**

433 This study was approved by the regional ethical review board of Stockholm (2016/1832-32).

434 **Consent for publication**

435 Not applicable.

436 **Availability of data and material**

437 Given that the data is in Swedish and the phrasing of the consent obtained from participants, complete

438 raw data are not available for public sharing. Partial datasets used and/or analysed during the current

439 study are available from the corresponding author on reasonable request. A selection of translated

440 quotes is supplied in the results and methods sections and in appendix 1.

441 **Competing interests**

442 The authors declare that they have no competing interests.

443 **Funding**

444 The authors received no specific funding for this work.

445 **Author Contributions**

24

446 The study was initiated by KH. The study design was developed in collaboration within the research

447 team. KH performed the data collection. The analysis and interpretation of data was conducted in close

448 collaboration between KH, ME and KPH. KH wrote the first draft of the paper. All authors contributed

449 with writing, critical revisions and approval of the final version.

450 **Acknowledgement**

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523 **Figure legends**

524 **Fig. 1** The studied NICU in a tertiary level hospital with surgical capacity. Managers are visually located to illustrate

525 their vicinity to the clinical care teams. Overarching goals are presented at the base of the figure with examples of

526 how they are expressed in daily work. A selection of peripheral wards and units are illustrated in the surrounding

527 area. The arrows are double headed to symbolise a two-way relationship of demands and possibilities for

528 negotiation of for example patient transfers.

529 **Fig. 2** Illustration of the work of balancing goal-settings for system wide coherence, maintaining the umbrella

530 perspective and streamlining communication to meet rapidly changing demands with the shadowed clinical

531 coordinator at the centre. The width of double headed arrows visualises an estimation of the most frequently

532 observed communication for the respective manager.

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Fig. 1 The studied NICU in a tertiary level hospital with surgical capacity. Managers are visually located to illustrate their vicinity to the clinical care teams. Overarching goals are presented at the base of the figure with examples of how they are expressed in daily work. A selection of peripheral wards and units are illustrated in the surrounding area. The arrows are double headed to symbolise a two-way relationship of demands and possibilities for negotiation of for example patient transfers.

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Fig. 2 Illustration of the work of balancing goal-settings for system wide coherence, maintaining the umbrella perspective and streamlining communication to meet rapidly changing demands with the shadowed clinical coordinator at the centre. The width of double headed arrows visualises an estimation of the most frequently observed communication for the respective manager.
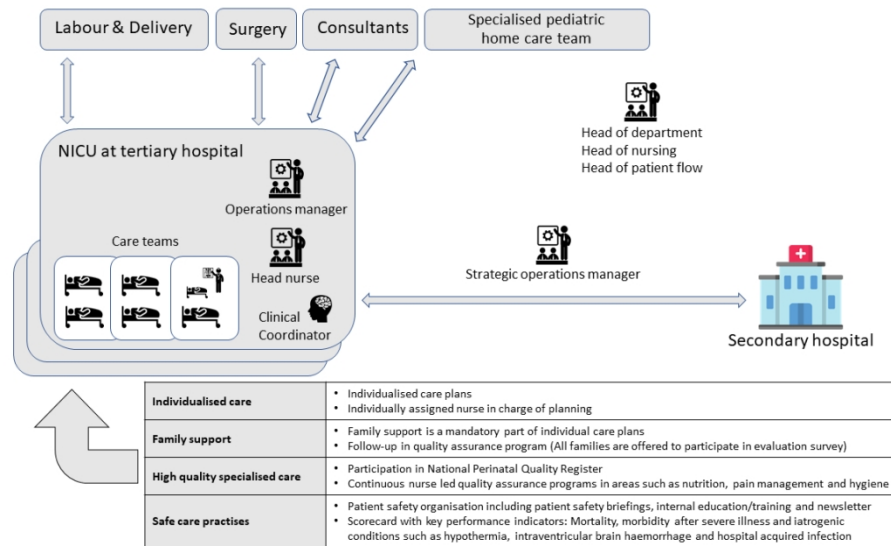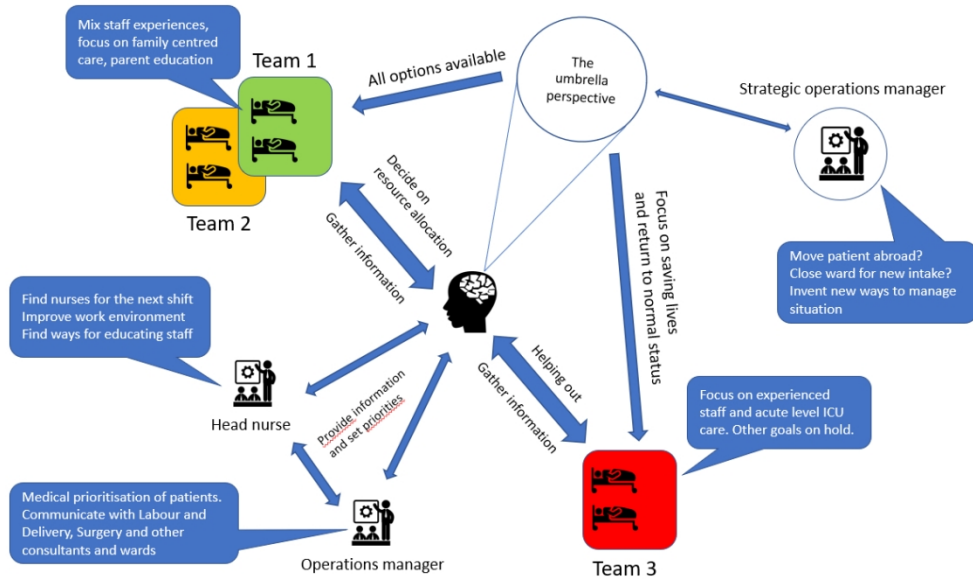
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Appendix 1

Q1

(Clinical coordinator) We have put those two [patients] together in 9:1 to get an emergency cot in 9:2 for the twins [9 refers to a room divided in two sections equipped for one patient per section 9:1 and 9:2], I told the father that they may have to move out. But then we'll be in the situation where they maybe… They may need… That father is very new. So, I think that in that case they'll have to be two [staff] out there too.
(Operations manager) The [NN] twins?
(Head nurse) Right. Now there are two kids there, so one person can take care of them. But if you add those two [twins] then there'll be four babies, so then you need another person out there [on the ward] and there'll only be two staff left in there [room 9].
(Operations manager) Mm, it's tricky.
(Head nurse) Oh… so there are three of them who can help each other and… in [room] 7 and 8?
(Operations manager) Okay… I understand that to mean that we have a bit of leeway here if we need it in an emergency… but nothing that we can give to anyone else. Okay. [previously wanted to lend a nurse to another ward in need]
(Head nurse) Yeah, that's too bad. We'd love to be able to.
(Operations manager) Take over week 36 twins who need it, say. And then send them back, that's no fun.
(Clinical coordinator) And then we'd have to open like [rooms] 13 and 14.

Q2

The coordinator calls for an ad-hoc on-site face-to-face discussion with the strategic operations manager. This happens when the CMT experience that basic safe care practices at the clinical level consume every opportunity for maintaining overarching quality goals, the unit stop lending help to others and start sacrificing continuity of care for individual patients. The plan for today is to admit one intermediary level patient that were born during the night and is waiting for a room at the NICU. One patient has been diagnosed with a multi-resistant bacterium and will need increased hygiene standards. One baby currently in another hospital are being assessed by a surgeon for the need of possible transport and surgery, one will possibly arrive by helicopter for eye surgery today. Three babies are planned for being transported back to their respective local hospitals, one by helicopter today and twins tomorrow (Observers notes after the coordinating management team's morning huddle).

- *(Clinical coordinator) We are plenty of people today, that is nice. But when NN [strategic operations manager] asked if we had a lot of capacity, I had to say no.*

The clinical coordinator checks the antenatal list of at-risk mothers who are under observation.

- *(Clinical coordinator) Oh, there is a lot here, induction, ich… a lot of bleedings. There is a lot waiting… but you don't know when… It could be calm… I will not read all their charts.*
- *(Operations manager) …one important thing. This baby that needed eye surgery is now acute and will arrive soon. They will land directly in the operating room and the transport team will take care of the baby until it can go back home its own hospital.*
- *(Strategic operations manager) Can we lend out some staff to [a neonatal ward in a neighbouring hospital].*
- *(Head nurse) I can check, we have plenty of staff, but they are all in use.*

- *(Strategic operations manager) I ask because they are not doing so well [the other unit]. Twins are being born and they are asking for allowance and resources to move them to another region.*

Q3

- *(Clinical coordinator) This is not good, its full [the ward]. We have no space when this eye baby arrives.*

The clinical coordinator walks to the room where a nurse oversees the twins that were supposed to be transported out the next day but are now showing symptoms of infection.

- *(Clinical coordinator) Lets´ see when [Strategic operations manager] gets back, maybe we can send someone else.*
- *(Nurse) But they went to fetch the week 31 from delivery to there [points to an empty cot].*
- *(Clinical coordinator) Yes, and the eye baby is coming [points toward the 2nd empty place for a cot. Then its full here. Do you think these twins could be together in a twin cot?*
- *(Nurse) Well, I don´t know. This one is just on the margin of managing without incubator, and that one is getting treatment for bilirubin [treatment includes being exposed to light from a special lamp].*
- *(Clinical coordinator) The problem is that I don't have staff to open another room.*
- *(Nurse) Maybe if we reconsider the lamp-treatment...*
- *(Clinical coordinator) Exactly, and then we hope that the eye baby can go back to his own hospital later in the evening.*

Standards for Reporting Qualitative Research (SRQR)

O'Brien B.C., Harris, I.B., Beckman, T.J., Reed, D.A., & Cook, D.A. (2014). Standards for reporting qualitative research: a synthesis of recommendations. *Academic Medicine, 89(9)*, 1245-1251.

No.	Topic	Item
Title and abstract		
S1	Title	Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended **Qualitative descriptive study is part of the title.**
S2	Abstract	Summary of key elements of the study using the abstract format of the intended publication; typically includes objective, methods, results, and conclusions **The 300 words abstract contain objectives, design, participants, results and conclusions**
Introduction		
S3	Problem formulation	Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement **Problem statement on line 84 followed by relevant theory. Study Aim is located at line 100-102.**
S4	Purpose or research question	Purpose of the study and specific objectives or questions **The explorative qualitative design is guided by the study aim. A specific area for improvement in indicated on line 97-99**
Methods		
S5	Qualitative approach and research paradigm	Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., positivist, constructivist/interpretivist) is also recommended **The ethnographic design and participatory observations are described in the methods section, sub headline "Design" line 105-109.**
S6	Researcher characteristics and reflexivity	Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, or transferability

		The researchers characteristics is mentioned in the methodological bulletpoint on page 3 line 63-64 and further discussed in "Limitations" line 403-405. Trustworthiness is discussed in the last paragraph in "Limitations"
S7	Context	Setting/site and salient contextual factors; rationale[a]
		Setting is presented in the *introductions first paragraph* and a subheading under methods "Design and setting" Line 105-109. 110-115.
S8	Sampling strategy	How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale[a]
		The sample of data are mentioned in line 131-144. Saturation is not specifically discussed.
S9	Ethical issues pertaining to human subjects	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues.
		Ethics approval information on line 433.
S10	Data collection methods	Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale[a]
		Data collection and data sources are presented in the methods section, sub-headline "Data collection" line 131-144.
S11	Data collection instruments and technologies	Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study
		Audio recording presented on line 147. Other instruments are not applicable in the ethnographic design.
S12	Units of study	Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)
		Not applicable in the ethnographic design, ample data is presented through quotes and appendix 1.
S13	Data processing	Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/deidentification of excerpts
		Analysis and collection of data were iterated according to the study design.
S14	Data analysis	Process by which inferences, themes, etc., were identified and developed, including researchers involved in data analysis; usually references a specific paradigm or approach; rationale[a]
		Analysis method presented in line 146-161 and "table 1" for further transparency.
S15	Techniques to enhance trustworthiness	Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale[a]

		Trustworthiness discussed in line 406-412
Results/Findings		
S16	Synthesis and interpretation	Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory **Results is based on an interpretation through a lens of the theoretical concept of resilience. Integration with theory is found in the discussion.**
S17	Links to empirical data	Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings **Extensive quotes and field notes presented in results and appendix 1.**
Discussion		
S18	Integration with prior work, implications, transferability, and contribution(s) to the field	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field **Integration with existing management theory for example in line 341-343, 363-367, 369.**
S19	Limitations	Trustworthiness and limitations of findings **Trustworthiness and limitations are discussed in lines 392-412**
Other		
S20	Conflicts of interest	Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed **No competing interests line 442**
S21	Funding	Sources of funding and other support; role of funders in data collection, interpretation, and reporting **No specific funding line 444.**

aThe rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together

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A FIRST LINE MANAGEMENT TEAM´S STRATEGIES FOR SUSTAINING RESILIENCE IN A SPECIALISED INTENSIVE CARE UNIT – A QUALITATIVE OBSERVATIONAL STUDY

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1   **A FIRST LINE MANAGEMENT TEAM´S STRATEGIES FOR SUSTAINING RESILIENCE IN A**
2   **SPECIALISED INTENSIVE CARE UNIT – A QUALITATIVE OBSERVATIONAL STUDY**
3

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21   ABSTRACT

22   **Objectives**

23   Acute care units manage high risk patients at the edge of scientifically established treatments and

24   organisational constraints while aiming to balance reliability to standards with the needs of situational

25   adaptation (resilience). First line managers are central in coordinating clinical care. Any systemic

26   brittleness will be evident only in retrospect through for example care quality measures and accident

27   statistics. This challenges us to understand what successful managerial strategies for adaptation are and

28   how they could be improved. The managerial work of balancing reliability and adaptation is only

29   partially understood. This study aims to explore and describe how system resilience is enhanced by

30   naturally occurring coordination performed in situ by a management team under variable

31   circumstances.

32   **Design**

33   An explorative observational study of a tertiary Neonatal Intensive Care Unit (NICU) in Sweden. One year

34   of broad preparatory work followed by focused shadowing observations of coordination analysed

35   through inductive-deductive content analysis from a perspective of resilience engineering.

36   **Participants**

37   A team of managers (i.e. clinical coordinators, head nurses, senior medical doctors).

38   **Results**

39   The results describe a functional relationship between the NICU´s level of manoeuvrability and a

40   progression of adjustments in the actual situation, expressed through recurring patterns of adaptation.

41   Managers focused on maintaining coherence in escalating problematic situations by facilitating

42   teamwork through goalsetting, problem-solving and circumventing the technical systems' limitations.

43   **Conclusions**

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44 Coordination supports a coherent goal setting by increased team collaboration and is supported by team

45 members´ abilities to predict the behavior of each other. Our findings suggest that in design of future

46 research or training for coordination, the focus of assessment and reflection on adaptive managerial

47 responses may lie on situations where the system was "stretched" or "needed reorganization" and that

48 learning should be about whether the actions were able to achieve the short-term goals while

49 preserving the long-term goals.

50 **Keywords**

51 Qualitative research, Health services administration & management, Health policy, Organisation of

52 health services, Risk management

53 **Wordcount**

54 4877

55 **Strengths and limitations of this study**

56 • The explorative ethnographic design allowed for a deeper understanding of the underspecified

57 (hidden) work of first line managers.

58 • Several iterations of data collection and analysis allowed for an initially wide and later more

59 focused data collection that opened opportunities for the researchers to follow up on specific

60 findings.

61 • The inductive-deductive analysis allowed the researchers to follow and describe patterns of

62 recurring codes within the whole dataset.

63 • The first author (KH) who conducted the fieldwork is an experienced neonatal intensive care

64 nurse which may have affected the interpretations drawn in this study.

65 • The explorative study design was suitable for describing a complex process without measurable

66 clinical outcomes.

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67   ## BACKGROUND

68   The neonatal intensive care unit (NICU) is a specialized intensive care unit that serves as its own

69   emergency department, intensive care unit and a pre- and postoperative ward, requiring a wide array of

70   interrelated multi-professional teams to operate in a coordinated fashion. The many roles of the unit are

71   coupled with the pressures of maintaining high-quality and individualized care, family support and safe

72   care practices. Some situations are manageable by reorganizing teams internally while others require

73   cooperation with external units.

74   The NICU is distributed over three hospitals in an integrated network of independent units organized

75   under one head of department. Daily operations are overseen by the strategic operations manager to

76   ensure collaboration for overall performance across the three units. The overarching goals as

77   understood by the authors are individualized care, family support, high quality care and safe care

78   practices (Figure 1).

79   [Insert figure 1 here]

80   Maintaining quality and safety is a persistent problem considering acute admissions, staff shortage and

81   rapidly deteriorating patients with life-threatening conditions (1,2). Safety is often defined as one of

82   many variations of 'the absence of preventable harm to a patient during the process of health care' (3).

83   During the last decades of patient safety research a movement towards an inclusive view of supporting

84   the healthcare systems´ ability to sustain required (normal) operations has emerged, the resilience

85   engineering (RE) perspective (4). An important point made within the RE perspective is that safety can

86   be enhanced by a combination of structure and control on one hand and adaptations on the other (5).

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87 Healthcare is to be understood as a complex sociotechnical system (6). It is not only defined by the

88 boundaries of physical locations (7). People with their skills and relationships, rules, regulations and

89 even work place culture may impact system performance (6). Research on resilience in healthcare

90 suggest that successful as well as unsuccessful outcomes emerge from the fluid arrangement of system

91 components (coordination) (8). Coordination is defined as "*…the deliberate and orderly alignment or*

92 *adjustment of partners' actions to achieve jointly determined goals"* (9). 'Partners' in the healthcare

93 setting are those who share a common goal of delivering care to patients. People who perform

94 coordinative work are a part of a "*process by which team resources, activities, and responses are*

95 *organized to ensure that tasks are integrated, synchronized, and completed within established temporal*

96 *constraints"* (10).

97 Although coordination is an integral part of everyday healthcare management we know very little about

98 how *managers* learn the strategies they use and which of the work practices they develop that are

99 successful (11,12).

100 This study aims to explore how system resilience is enhanced by naturally occurring coordination

101 performed in situ by a management team (i.e. clinical coordinators, head nurses, senior medical doctors)

102 under variable circumstances.

103 **METHODS**

104 **Design and setting**

105 This study uses an explorative ethnographic design using participatory observations and an abductive

106 approach to capture and analyse naturally occurring coordination in situ (13). The reason for focusing

107 on action-interaction was to capture a deep understanding of the varying conditions under which

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108   decisions and coordination took place (14). The Standards for Reporting Qualitative Research (SRQR)

109   checklist was used to improve the transparency of research (15).

110   The study took place in a tertiary level NICU with an approximate capacity of 70 cots divided over three

111   wards located in separate hospitals. The patient mix of the three wards is dependent on local factors

112   such as the size and risk profile of adjacent delivery wards and the availability of paediatric surgical

113   capacity. Staffing for the high acuity patients is normally one nursing team per two patients (one nurse

114   and one assistant nurse). Paediatricians and neonatologists are allocated over the three wards

115   depending on availability and competence.

116   Each of the three wards is managed by a clinical coordinator, a head nurse and an operations manager

117   during daytime (Figure 1). The clinical coordinator performs tasks such as rostering, planning for patient

118   flows (admissions, discharges and transports) and does clinical work when needed. The head nurse is

119   formally responsible for the work environment and quality of care. The operations manager is a senior

120   neonatologist with an overall responsibility for the medical quality and patient flow. A strategic

121   operations manager has mandate to move patients between hospitals within the own organisation or to

122   hospitals outside the region. All managers are clinical specialists (nurses and neonatologists). Hereafter

123   we will refer to this team as the management team.

124   **Data collection**

125   Data was collected between January and February 2017. The head of the department gave permission

126   to conduct participant observations at the unit. All staff was informed about the procedures in a staff

127   meeting and they were informed that they could decline from being observed at any time according to

128   the ethics approval. The clinical coordinators (four individuals) gave written consent to being shadowed

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129   after receiving written and oral information. The coordinators were all women, experienced nurses with

130   more than 10 years of NICU experience.

131   Data collection was structured in iterative cycles of collection and analysis, starting with descriptive

132   observations to get familiar with the work environment and relevant aspects of the managers' work

133   (16). The descriptive observations focused primarily on ´places´ were the coordination of work was

134   apparent, for example at the head nurses and secretaries open office area and at the management

135   teams´ office at the center of the ward. The intermittent recording and analysis of field notes during

136   initial observations yielded research questions that were in focus during the following observations.

137   The focused observations targeted selected situations such as rostering for the next shift, start-up

138   meetings and handovers between shifts in addition to shadowing of coordinators. Data was collected

139   through ad-hoc interviews with staff and managers during or after the shadowing (16). Shadowing

140   meaning "following people, wherever they are, whatever they are doing" (17). Artefacts, including

141   coordinators' notes on patients' medical status, occupancy- and rostering charts were copied and

142   collected. All relevant aspects of the environment were captured in field notes during or after the

143   observations, along with researcher's memo-writing over personal reflections and thoughts about what

144   was happening.

145   **Analysis**

146   All meetings and interviews were audio recorded and transcribed verbatim. Transcriptions from tape-

147   recorded dialogues were placed in a correct temporal order along with the field notes, so that the mix of

148   field notes and transcription chronologically represented the full workday. Transcripts were read

149   through several times, followed by discussions in the research group about the level of detail in the data

150   and reflections KH had regarding the observed work shift (18). The initial inductive analysis went

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151   through a two-step process (columns two and three in Table 1). First, a conversation or a situation of

152   relevance for the study's aim (a meaning unit) was selected and the question "What is happening here?"

153   was directed to the data. Next, the selected conversation or situation was analysed in the context of the

154   entire scene where it took place, with the question "Why or how is it happening here?". The

155   interpretation was condensed and labelled with one or several codes (Table 1). The codes and their

156   relations were frequently discussed in the research team and sorted into tentative sub- and main

157   categories. Field notes were included in the analysis as means to reflect on the researchers' pre-

158   understanding of the context. Moving back and forth between induction and deduction was a way to

159   discover meaningful underlying patterns that made it possible to integrate concrete behaviour and deep

160   contextual structures. Lastly, a deductive comparison of interdependencies between the main

161   categories and sub-categories in relation to the theoretical concept of resilience was performed (14).

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Table 1 Example of the analysis in two-steps: going from *raw data* to *interpretation of incident* and to *analytical interpretation in context*, *code* and *memo*.

Raw data	Interpretation of incident	Analytical interpretation in context	Code	Memo
The observation begins in the flow room. The flow room is a small room with two workstations where the coordinator has her seat. There are several information sources hanging on the walls and post-it notes on the computers. The coordinator meets the observer in the flow room after having walked around the ward to check all the patient rooms.	In the physical environment, several different communication tools are gathered within a small area, i.e., tools used to summarize, remember, and disseminate important information. Information exchange occurs on paper notes stuck to computers, through software, and when the coordinator herself walks around the ward.	Information exchange is one part of coordination and can be performed through predefined channels and tools, but also more intuitively through physical meetings within the ward while the manager compares notes to what is experienced. The environment has been adapted for having several different information channels intersecting in one place.	Adapting environment – cluster tools for facilitating information exchange	The coordinator has gathered information about the current situation in the patient rooms by walking around and taking a look. She then looks at the system level, occupancy lists, and information from the other coordinators. If coordination means exercising control, real life information gathering is probably an important step.
The coordinator sits down at a computer and begins counting patients on her paper copy of the occupancy list and in TakeCare [electronic health record]. She reports the occupancy in Belport [national occupancy chart] and talks a bit about this.	Counting patients and manually entering the number into the national occupancy report is one of the first things the coordinator does in the morning.	The coordinator gets an idea of the status and distributes it to the rest of the country as information. This is proactive management, as future coordination may become easier if reference can be made to Belport, or if you know that the other units in the country your information.	Information handling	Reporting your status is a way of exercising control by impacting others perception regarding the degrees of freedom at your end.

163 **PATIENT AND PUBLIC INVOLVMENT**

164 Public and patient involvement was not applicable in this research.

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3   165   **RESULTS**
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7   166   The analysis resulted in six subcategories and two unifying main categories (table 2).
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11   167   The ´how´ and ´when´ of coordination is presented in Table 2 that illustrate the functional relationship
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13   168   between the two main categories *adjustments to meet the actual situation* and *maneuverability* with
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15   169   their respective sub-categories. The sub-categories *Supporting system cohesion* and *Extending system*
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17   170   *boundaries* describe the joint work of managers and clinical staff. *Adapting the structure and roles of the*
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19   171   *coordinating management team* and *Shifting between information sources for better sensemaking*
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21   172   describe the management team's internal work.
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24   173   Extracts from the field notes and conversations are presented to clarify the findings. More
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26   174   comprehensive material is provided in Appendix 1.
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Table 2 The main category on the y-axis are *adjustments to meet the actual situation* and on the x-axis; *maneuverability.* Four sub-categories on the y-axis describe strategies (i.e. the work that managers do); and the three sub-categories on the x-axis describe a progression of a perceived level of manoeuvrability based on the expressed availability of *degrees of freedom* with illustrative quotes.

		Manoeuvrability		
		Losing control – reorganisation	**Stretching the system to work outside ordinary conditions**	**Everyday work under ordinary conditions**
Adjustments to meet the actual situation		"So [the other hospital] have 20 babies now, seven acute. They have opened a temporary room but have no staff for it. We have no transport team [to use as staff] because they are on their way to [another city] […] I still won't send babies to other counties, which we can't because we have no transport team available […] either we find some staff here that can go there or we have to order two on overtime. How do we usually do?" (Operations manager).	"We have put those two [patients] together in 9:1 to get an emergency cot in 9:2 for the twins [9 refers to a room divided in two sections equipped for one patient per section 9:1 and 9:2], I told the father that they may have to move out. But then we will be in the situation where they maybe… They may need… That father is very new. So, I think that in that case they will have to be two [staff] in there too." (Clinical coordinator). [Q1 – appendix 1]	"Oh, so we are only at eight intensive care babies and three in family rooms. So, it's a pretty good situation. And we have nothing acute in the delivery- or antenatal wards. I just checked." (Operations manager).
	Supporting system cohesion	• Delay work and evaluate the situation • Isolate problems and focus on re-creating manoeuvrability. • Exploit possibilities of extraordinary individual achievements (trade-off individual resilience for system control).	• Goalsetting towards protecting manoeuvrability. • Goalsetting for promoting basic safe care practices at the clinical level through minimal staff allocation and skill mix. • Sacrificing continuity in patient assignments for saving lives.	• Goalsetting towards family-centred care • Goalsetting of individualised care. • Managing optimal staff allocation for maintaining professional development and education. • Controlling occupancy and redundant capacity through predefined strategies. • Monitoring state of the ward at the clinical level by regular walkarounds in the clinical work environment.
	Extending system boundaries	• Identifying novel use of any existing external resources (i.e. use of paediatric emergency transport team and other wards). • Shedding managerial tasks for participating in clinical emergency work (trade-off management for clinical work).	• Managing occupancy trade-offs between facilities and staffing (higher occupancy in fewer rooms lowers staff requirements). • Utilising individual managers social networks within predefined limits for proactive problem-solving.	• System working within normal boundaries.
	Adapting the structure and roles of the coordinating management team	• Make *loss of control* explicit in the management team. • Moving from understanding the situation to making rapid decisions close to the clinical level.	• Relaying information on the patients' clinical situation to mid- and upper-level managers (information priority bottom-up).	• Relaying high level plans to clinical level workers through regular briefings (information priority top-down). • Participate in regular medical discussions on patients' status´.
	Shifting between information sources for better sensemaking	• Dropping computerised aides, rostering systems and staffing charts for handwritten notes and memos. • Using face-to-face communication with people in close vicinity (shedding electronic communication).	• Seeking ad-hoc meetings within the management team for calibrating information of the situation and possible workarounds. • Verbally explaining situations to other managers.	• Regular use of computerised systems and handwritten notes.

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177   **Manoeuvrability**

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178 Managers face situations where they must balance a limited number of staff and demands for high

179 occupancy with the task of supporting clinical teams in their care of patients. Unpredictable factors such

180 as acute admissions, staff availability and the medical progression of patients put managers in situations

181 where they might quickly have to re-adjust and re-plan, often ad-hoc with scarce information of the

182 overall situation. Part of the observed dialogue relate to the management team's efforts to identify

183 alternative ways forward. See quotes at the head of Table 2. Further examples of the choices made

184 under each sub-category of manoeuvrability is presented in table 3.

185 In the quote below, the head nurse acknowledges that the inflow of emergency patients is sometimes

186 impossible to avoid.

187 *"The patient flow, do you participate in that?" (Observer). "No, no more than that I can say ´stop´,*

188 *because I don't have the staffing." (Head nurse). "Ok, so you can say that too?" (Observer). "Mm, I can*

189 *say that I have five or six teams. But…" (Head nurse). "But you cannot say stop today." (Coordinator).*

190 *"No, but it is like that. Even if we say stop the babies are being born. And we have to take care of them."*

191 *(Head nurse).*

Table 3 Examples of ´situations´ and ´choices made´ sorted under each sub-category of manoeuvrability.

Losing control – reorganisation	Stretching the system to work outside ordinary conditions	Everyday work under ordinary conditions
Situation with several problematic trade-offs. The coordinator approaches the head nurse when she cannot find a suitable cot for a new patient (Field-notes). "We have another problem." (Coordinator). "Right, what?" (Head nurse). "This new week 28 [patient], I cannot put in room 10 [a room with four cots, one is available], the other baby in there is terminal and about to die." (Coordinator). "But if we place him in room 16 or 15?" (Head nurse). "No, I can't put it in 15 because I have two cots in there for the twins and they must be together [also incoming patients]." (Coordinator). […] "We cannot have the twins remaining at the stabilisation unit at delivery, there might be another patient coming in." (Coordinator). "Okay, because I thought it	**Exploring options to avoid patient transfers because of staff shortage.** "NN [strategic operations manager] think that we can conserve personnel by moving ´K´ [a patient] to ´Ts´ room [another patients]." (Head nurse). "Okay." (Observer). "But I am not so sure we conserve personnel by that; and the family have already moved several times, you know that they are the ones that was supposed to be moved to [another hospital]." (Coordinator). "Okay" (Observer). "It [the patient] started to have breathing problems and came back. And now after moving back here they will have to move again ´sigh´." (Coordinator).	**The deliberate adaptation of an administrative routine.** "I have talked to NN [a nurse currently placed at the emergency stabilisation unit in the delivery ward] because there is a week 35 baby there that the doctor did not want to take it up to the ward during the nightshift." (Coordinator). "No?" (Observer). "Yes, then he has of course been there a little longer that his allowed six hours." (Coordinator).

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would be a better idea to move the twins directly from delivery [to another hospital] if they need to move anyway at some point." (Head nurse). "Mm, but where should they move. All hospitals are full [in the county]. We would have to move them out of county." (Coordinator). "Yes, we will never be allowed to do that." (Head nurse).		

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Everyday work under ordinary conditions

194 The management team have planned meetings; they sweep the ward to collect information on the state

195 of things and relay high level plans to workers.

196 *The coordinator begins her shift by conducting a walkaround of the ward, saying hello to the nurses and*

197 *doctors as she is asking if everything is all right. After the walkaround she sits down to begin exploring*

198 *her staff roster and patient occupancy charts (Field-notes).*

199 Under ordinary conditions there is a minimal observable need for managers to manually adapt

200 information they extract from technical systems, regarding for example occupancy, patient acuity levels

201 and staffing. Managers describe how their experience of the technical systems' limitations are learned

202 on the job and how workarounds are taught between individuals.

203 *The coordinator makes a note of something on her occupancy chart (Field-notes). "What did you write on*

204 *that chart?" (Observer). "CT 11:15 [Computer Tomography at 11:15]." (Coordinator). "And it is used for*

205 *that kind of information?" (Observer). "I print one of these charts because there is more space to write*

206 *on. I think… I think many… I think NN and NN [two other coordinators] use this too. And NN [another*

207 *coordinator] use it because I taught her. And I use it because NN [a coordinator who quit earlier] taught*

208 *me." (Coordinator). "Okay, that is nice. But is it the same information you all use it for?" (Observer).*

209 *"Well, I don't know?" (Coordinator). "Not important?" (Observer). "Well, I don't think so, I use it for…*

210 *those that are planned for other hospitals, delivery ward, antenatal… Oh! I forgot to write that today*

211 *[makes another note on the chart] and stuff that I need to do." (Coordinator).*

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212 **_Stretching the system to work outside ordinary conditions_**

213 The following situation is a typical example of how the management team must re-organize and adapt

214 to stretched conditions. The ad-hoc meeting in the example illustrates that strategic goals of family

215 centred care and optimal staff allocation are traded for immediate medical priorities, basic safe care

216 practises and protection of the wider system. Other patients on the ward are cared for by their

217 respective teams, avoiding exposure of this emerging crisis because it is handled by the paediatric

218 emergency transport team.

219 _The plan for this day is to admit one intermediary level patient that was born during the night and is_

220 _waiting for a cot at the NICU. One patient has been diagnosed with a multi-resistant bacterium and will_

221 _need increased hygiene standards (Field- notes) […] "We are plenty of people today, which is nice. But_

222 _when NN [strategic operations manager] asked if we had a lot of capacity, I had to say no." (Clinical_

223 _coordinator). […] "…one important thing. This baby that needed eye surgery is now acute and will arrive_

224 _soon. They will land directly in the operating room and the transport team will take care of the baby until_

225 _it can go back home to its own hospital. (Operations manager)._ [Q2 – Appendix 1]

226 The plan for postoperative care after acute eye-surgery was for the patient to be assigned a cot and a

227 nursing team on the ward. The situation was managed by using the transport team to temporarily care

228 for the baby inside the operating room until it was stable enough for transport to another hospital. This

229 decision had possible implications for the whole management team. The clinical coordinator wanted to

230 know about the utilisation of staff and facilities. The head nurse about workplace safety, quality of care

231 and economy. The operations manager had responsibility for the medical quality and the strategic

232 operations manager for the possibility of helping one of the other wards with staffing.

233 **_Losing control – reorganisation_**

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234 The category of ´losing control´ was characterised by managers shedding managerial tasks for

235 participating in clinical emergency work, isolating problems and focusing on re-creating manoeuvrability.

236 The focus was to protect clinical teams from being exposed to the rapidly shifting plans and priorities at

237 the managerial level. Strategies for regaining control can be to sacrifice the goal of continuity by

238 transferring at-risk mothers to other hospitals (deferral), or to temporarily transfer additional weight of

239 medical care to neighbouring sub-systems such as the paediatric emergency transport team or the

240 managers themselves.

241 The following situation illustrates a reorganisation at the verge of losing control. The coordinator tried to

242 reserve an empty cot for possible additional acute emergency admissions.

243 *"This is not good, its full [the ward]. We have no space when this eye baby arrives." (Clinical*

244 *coordinator). The clinical coordinator walks to the room where a nurse oversees the twins that were*

245 *supposed to be transported out the next day but are now showing symptoms of infection. (Field- notes).*

246 *"Do you think these twins could be together in a twin cot?" (Clinical coordinator) […] "Well, I don´t know.*

247 *This one is just on the margin of managing without incubator." (Nurse) […] "The problem is that I don't*

248 *have staff to open another room." (Clinical coordinator). [Q3 – Appendix 1]*

249 The manager handled the situation by putting twins together in one cot, thereby utilising one nurse to

250 care for three babies which is more than the goal of two babies per nurse. This manoeuvre created an

251 opportunity to temporarily handle five patients (with one empty emergency cot) in a room with staffing

252 for four. The nurse expressed concern for her patient but remained focused on finding a solution.

253 When the managers started shedding managerial tasks for bedside operative work, they risked losing

254 the ability to meet other managers and keep up to date with the ward. Management decisions in these

255 situations were then based on a narrower understanding of the bigger picture. Computer aides were

256 less used (or not at all) because of their inability to present rapidly changing borderline conditions.

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257   **Adjustments to meet the actual situation**

258   It was observed how the mandate for making decisions was distributed across the management team

259   and clinical nursing teams (speech bubbles in figure 2). The clinical coordinator moved freely across the

260   unit and made independent decisions regarding resource allocation, rostering and whether to shed her

261   own managerial work to help the clinical teams. The clinical coordinator also provided the other

262   managers with information when they needed to adjust their plans.

263   [Insert figure 2 here]

264   *Supporting system cohesion*

265   Members of the management team were observed to often communicate through ad-hoc meetings

266   where verbal information was compared to patient rosters, patient conditions, staffing and workload

267   indicators. They worked close to the clinical context and discussed the current goals' attainment for

268   individual clinical teams and what the current trade-offs were. The managers compared computer- and

269   paper-based notes, as well as information provided at start-up meetings to update themselves of the

270   status of the ward and where the situation was heading (umbrella perspective in Figure 2).

271   *The coordinator is back in room nine to alleviate the staff for lunch. She checks in on the baby that has*

272   *been in acute surgery for intestinal obstruction. There are lots of beeping sounds, but no one seems*

273   *alarmed. The head nurse enters the room and seeks the coordinators attention, but initially fails as the*

274   *coordinator is tending to a patient. Eventually the coordinator looks up (Field-notes). "Didn't they [the*

275   *surgeons] say already this morning that this patient was up for re-operation?" (Coordinator). "After*

276   *lunch apparently. Then what do we do with NN [another patient]?" (Head nurse).*

277   In the example above the managers discussed how two patients' trajectories were affected by the

278   surgeons rescheduling. The management team negotiated situations that needed simultaneous

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279   attention, like prioritizing readiness and clinical capacity in some parts of the ward while maintaining

280   family centered care and staff education in others (Illustrated as the three clinical teams in Figure 2).

281   ***Extending system boundaries***

282   The need for extending the system's boundaries emerged as the pressure of prioritizing decisions

283   increased. The management team made use of other units' facilities or staff, like delaying patients in the

284   operating theatre or letting a transport team care for the patient for some time before handing it over

285   to the regular staff. The management team utilised auxiliary staff and overlapping competencies of

286   different professional groups. Sometimes the managers themselves doubled as clinical staff within their

287   vocation.

288   *"It is already a little tight if it arrives [the surgery baby], right now we have low workload in room nine*

289   *and ten with four patients and the other goes back to [another hospital out in another region] at five [in*

290   *the afternoon]. We hope. But it is also, I mean, if there is an acute admission and he... I do not think NN*

291   *[a nurse] can have four patients by himself out there. Since the father needs quite a lot of help."*

292   *(Coordinator). "They are really good patients those babies" (Operations manager). "What about the*

293   *midwives then? [that belongs to the adjacent delivery ward]" (Coordinator). "There are four of them*

294   *[turns to face the operations manager]?" (Head nurse). "Yesterday someone said that you can have four*

295   *patients by yourself." (Operations manager). "Not by yourself" (Coordinator). "With an assistant nurse."*

296   *(Head nurse). "Yes with an assistant yes, that is okay but." (Coordinator). "So there are three patients*

297   *left?" (Head nurse). "And then we have put two in the same cot at 9:1 [bed one in room nine]." (Head*

298   *nurse 2). "Okay." (Head nurse).*

299   ***Adapting the structure and roles of the coordinating management team***

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300   The management team fluently adapted its own structure in situations where there were not enough

301   resources to manage within everyday routines, when there was urgency or when some of the

302   management team members were not available with their specific expertise and mandate. This

303   structural adaptation was observed when individuals in the management team shifted from relaying

304   plans from top-down to working with patients and gathering information from bottom-up.

305   *"In room nine is that week 22 baby that came in yesterday. They are intubating now so they use a lot of*

306   *people. There were no head nurses here at seven, so I decided myself that NN [nurse] got to be alone at*

307   *the stabilisation room [at the delivery ward]. The doctors there have to work a little harder now."*

308   *(Clinical coordinator).*

309   ***Shifting between information sources for better sensemaking***

310   As the situation on the ward became more complex the management team increased their reliance on

311   handwritten notes rather than the standard computer-generated lists for staffing and patient acuity

312   information.

313   The coordinator used handwritten notes as memory aides in team discussions. The notes were mainly

314   short markings, phrases, or single words in the margins like "discharge planned" or "need antibiotics".

315   The limitations of computer-generated patient rosters to convey this type of information on real world

316   complexities were expressed by members of the management team.

317   The national occupancy chart for example was only able to classify patients as high or low acuity without

318   regards of other factors. When there was a need to work outside the binary world of two patient

319   groups, the team stopped using this computer-generated aide and instead relied on their own domain

320   knowledge, personal network and the stability of the management teams' understanding of the bigger

321   picture.

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322 *"Well and this is actually look correct [number of beds in the national occupancy chart] 14 in total. But*

323 *with the stabilisation beds. That makes it 12 here plus two there… But it is also a little [inaccurate].*

324 *Because then you calculate [all of them as intensive care beds]. The stabilisation beds are supposed to be*

325 *low acuity". (Clinical coordinator)*

326 The following quote illustrates what happens when the computerised information indicated normal

327 occupancy when the off-going night nurse reported understaffing for the same shift.

328 *"How did this happen?" (Clinical coordinator).*

329 *"Well, because NN [one of the nurses] who is work-training after sick leave was included in the staffing.*

330 *The parenthesis was probably put there later [points at the handwritten parenthesis in the rostering*

331 *folder, indicating that NN should not be included in the staffing]". (Night nurse)*

332 ## DISCUSSION

333 The management team in this study exhibited a range of mindful adaptations for sustaining the units´

334 capacity for expressing resilience. Such as sacrificing low level goals based on up-to date information

335 and continuous assessments of what would be minimally intrusive for the overall performance of the

336 system (figure 2). Our findings elucidate a link between adjustments to meet the actual situation and the

337 available manoeuvrability of the system.

338 **Supporting coherence**

339 The management team aimed to balance the demands and capacity of multiple teams that operate in

340 separate rooms while tending to patients with a wide variety of problems and acuity. For practical

341 reasons the teams could not always meet to communicate with each other. A defining characteristic of a

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342   multiteam system is the ability of component teams to modify individual goal hierarchies while sharing a

343   common distal goal or set of goals (12). During the observations the management team and the clinical

344   staff consequently agreed on making provision of acute care to rapidly deteriorating patients a top

345   priority, allowing us to identify it as a core mission (i.e. purpose of the system) (19). Other priorities

346   were more likely to be put on hold and resumed later or to be permanently dropped.

347   When the care teams were unable to communicate, maintaining coherence was an important factor for

348   the managers´ maintenance of an umbrella perspective i.e. what they needed in order to understand

349   how the bigger picture of their interventions fit together (20). At this point, we can say two things about

350   coherence, with implications for the training of managers as adaptive teams (21). First, that

351   coordination supported a coherent goal setting with increased team collaboration and second, that it

352   was enhanced by team members' ability to predict the most likely priorities of each other.

353   **Reorganising to support manoeuvrability**

354   Everyday work of the management team was characterised by seamlessly and actively organising and

355   reorganising. Our observations illustrate how the management team made use of early investments in

356   for example staff´s expertise, deep domain knowledge and the workplace culture to maintain a unit

357   wide focus on the core mission (22). Allowing the care teams to adapt their goals individually

358   exemplifies that being resilient is to be part of a process of identifying conflicting goals in a complex,

359   intractable environment using *"numerous indicators in a proactive fashion to probe a system's adaptive*

360   *capacity before system-wide collapse results in disaster"* (21). A realisation from studying the

361   management team was the shapelessness of the organisation. We could not observe a formal agenda

362   for how and why the management team was supposed to prioritize in terms of goal achievement below

363   the core mission. Our study suggests that it is up to the management team to support the system by

364   using experience, professional ethos and domain knowledge to negotiate the way forward in a manner

20

365 that resembles the fifth principle of managing the unexpected, as described by Weick and Sutcliffe (23).

366 Specifically, because the flexible decision structures enabled resilient performance when expertise and

367 experience outranked formal hierarchical positions.

368 Important for the application of resilience in everyday clinical work was the link between adaptation and

369 outcome (successful or unsuccessful) as described in for example the CARE model for researching

370 resilience in healthcare (24). An adaptation is a deviation from work as planned, and it is not always

371 clear beforehand whether the outcome of an adaptation constitutes success or failure in terms of

372 quality and safety. Our study describes managers' adaptive responses to the conflicting demands of

373 acute patient care on one hand and long-term strategic demands on the other (measured as for

374 example respirator days, patient throughput and hospital acquired bloodstream infections).

375 Balancing between long- and short-term goals

376 Resilience depended on the use of earlier investments in 'potential opportunities for action' previously

377 described as degrees of freedom. However, low-level goal-sacrifices do represent a loss of potential

378 future degrees of freedom if it is overexploited. In the context of the NICU, families are less prepared for

379 discharge if they are not trained, staff might receive less time learning from experienced colleagues if

380 they do not work together and formal routines might erode if they are not employed.

381 The balancing act between seemingly irreconcilable goals makes it impossible to decide in retrospect

382 whether coordination was good or bad for the total outcome of the system. Each decision to suspend or

383 sacrifice a low-level goal has implications for the organisation's future capacity for expressing resilience.

384 All teams worked towards the core mission of providing acute care. However, the maintenance of long-

385 term investments was achieved by managing a diversity of low-level goal-sacrifices between many

386 clinical teams (i.e. sacrificing patient education in one and staff education in another). Our findings

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387   suggest that in design of future research or training for coordination, the focus of assessment and

388   reflection should be on adaptive managerial responses in situations where the system is 'stretched' or

389   'in need of reorganization' (table 2). Furthermore, learning should be about whether the actions lead to

390   achievement of short-term goals while preserving the long-term goals.

391   **Limitations**

392   This was a single centre study of a specialised unit with a specific patient clientele that cannot be cared

393   for by any other type of unit available. It was expected that the unit´s high tempo and specialisation

394   would promote a particularly observable coordinative work with the risk that it might introduce the

395   argument of limited transferability to other areas of healthcare. We believe however that the

396   networked structure of three wards is not unique. The specific unit for study enabled us to capture and

397   understand the subtleties of everyday work of first line managers. Further studies are needed to

398   investigate how much of this work may be specific to organizations of both similar and contrasting

399   types.

400   Using a qualitative cross-sectional design, this study does not allow us to define successful or

401   unsuccessful outcomes. Resilience is described based on the actions taken and further studies are

402   required to operationalise and test our results.

403   The first author (KH) who conducted the fieldwork is an experienced neonatal intensive care nurse with

404   experience from the studied NICU. The familiarity with the specific type of work may have affected the

405   interpretations drawn in this study.

406   Trustworthiness during data analysis was addressed by regular peer-check and in seminars with the

407   wider research group and member check. The final analysis was individually validated with the

408   coordinators (25). The iterative process of data collection and analysis was intended to ensure that the

22

409 analysis included more than one researcher's interpretation. Transferability was addressed by leaving an

410 audit trail of extracts from the data in the report so that readers from other fields can evaluate if the

411 results are transferable to their respective contexts (26). Table 1 of the methodological section provides

412 a trail of how interpretations of data were made.

413 The use of voice recordings of meetings and conversations was limited to situations where verbal

414 consent could be obtained from all participants, unless explicitly asked not to by any of the participants

415 (27). In larger groups, where participants attended only partially this was not a feasible option and

416 handwritten notes were taken, video recordings were not possible because of difficulties with assuring

417 patient anonymity in the clinical context.

418 **CONCLUSIONS**

419 We are only beginning to understand managers' strategies for prioritising and acting on the variability of

420 degrees of freedom. Our findings suggest that managers at the clinical level, while being central to the

421 system's capacity for expressing resilience, do not have an explicit model or training for how they

422 approach their work. Furthermore, managers lack the aid of tailored decision support systems. This

423 could depend on well described challenges for design of such interventions (28). It is important that

424 healthcare policy and organisational redesign initiated at higher levels are well calibrated with the

425 nature of managerial work on the clinical level before interventions can be developed. Our

426 recommendations for future research and policy making is to prioritise definition and operationalisation

427 of successful coordination in a wide variety of contexts.

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428   LIST OF ABBREVIATIONS

429   RE: Resilience Engineering;

430   NICU: Neonatal Intensive Care Unit

431   DECLARATIONS

432   **Ethics approval**

433   This study was approved by the regional ethical review board of Stockholm (2016/1832-32).

434   **Consent for publication**

435   Not applicable.

436   **Availability of data and material**

437   Given that the data is in Swedish and the phrasing of the consent obtained from participants, complete

438   raw data are not available for public sharing. Partial datasets used and/or analysed during the current

439   study are available from the corresponding author on reasonable request. A selection of translated

440   quotes is supplied in the results and methods sections and in appendix 1.

441   **Competing interests**

442   The authors declare that they have no competing interests.

443   **Funding**

444   The authors received no specific funding for this work.

445   **Author Contributions**

24

446 The study was initiated by KH. The study design was developed in collaboration within the research

447 team. KH performed the data collection. The analysis and interpretation of data was conducted in close

448 collaboration between KH, ME and KPH. KH wrote the first draft of the paper. All authors contributed

449 with writing, critical revisions and approval of the final version.

450 **Acknowledgement**

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452 data; Professor Richard Cook for valuable discussions about system safety and methodology in the early

453 phase of the study. Thanks also to the participating Neonatal unit.

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523 **Figure legends**

524 **Fig. 1** The studied NICU in a tertiary level hospital with surgical capacity. Managers are visually located to illustrate

525 their vicinity to the clinical care teams. Overarching goals are presented at the base of the figure with examples of

526 how they are expressed in daily work. A selection of peripheral wards and units are illustrated in the surrounding

527 area. The arrows are double headed to symbolise a two-way relationship of demands and possibilities for

528 negotiation of for example patient transfers.

529 **Fig. 2** Illustration of the work of balancing goal-settings for system wide coherence, maintaining the umbrella

530 perspective and streamlining communication to meet rapidly changing demands with the shadowed clinical

531 coordinator at the centre. The width of double headed arrows visualises an estimation of the most frequently

532 observed communication for the respective manager.

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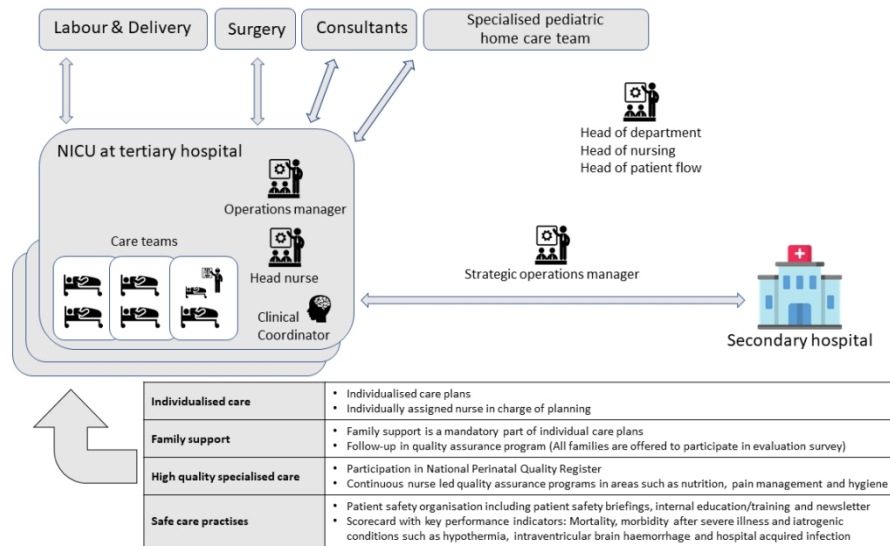51
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Fig. 1 The studied NICU in a tertiary level hospital with surgical capacity. Managers are visually located to illustrate their vicinity to the clinical care teams. Overarching goals are presented at the base of the figure with examples of how they are expressed in daily work. A selection of peripheral wards and units are illustrated in the surrounding area. The arrows are double headed to symbolise a two-way relationship of demands and possibilities for negotiation of for example patient transfers.

108x60mm (300 x 300 DPI)

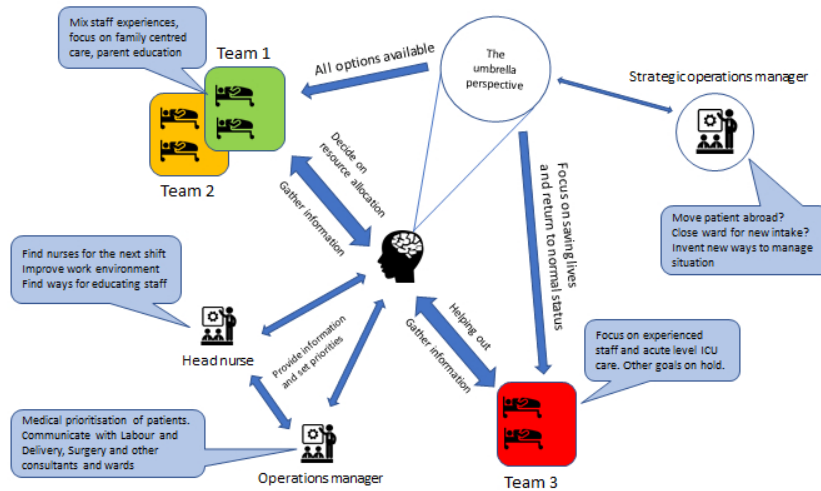Fig. 2 Illustration of the work of balancing goal-settings for system wide coherence, maintaining the umbrella perspective and streamlining communication to meet rapidly changing demands with the shadowed clinical coordinator at the centre. The width of double headed arrows visualises an estimation of the most frequently observed communication for the respective manager.

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Appendix 1

Q1

(Clinical coordinator) We have put those two [patients] together in 9:1 to get an emergency cot in 9:2 for the twins [9 refers to a room divided in two sections equipped for one patient per section 9:1 and 9:2], I told the father that they may have to move out. But then we'll be in the situation where they maybe… They may need… That father is very new. So, I think that in that case they'll have to be two [staff] out there too.
(Operations manager) The [NN] twins?
(Head nurse) Right. Now there are two kids there, so one person can take care of them. But if you add those two [twins] then there'll be four babies, so then you need another person out there [on the ward] and there'll only be two staff left in there [room 9].
(Operations manager) Mm, it's tricky.
(Head nurse) Oh... so there are three of them who can help each other and... in [room] 7 and 8?
(Operations manager) Okay... I understand that to mean that we have a bit of leeway here if we need it in an emergency... but nothing that we can give to anyone else. Okay. [previously wanted to lend a nurse to another ward in need]
(Head nurse) Yeah, that's too bad. We'd love to be able to.
(Operations manager) Take over week 36 twins who need it, say. And then send them back, that's no fun.
(Clinical coordinator) And then we'd have to open like [rooms] 13 and 14.

Q2

The coordinator calls for an ad-hoc on-site face-to-face discussion with the strategic operations manager. This happens when the CMT experience that basic safe care practices at the clinical level consume every opportunity for maintaining overarching quality goals, the unit stop lending help to others and start sacrificing continuity of care for individual patients. The plan for today is to admit one intermediary level patient that were born during the night and is waiting for a room at the NICU. One patient has been diagnosed with a multi-resistant bacterium and will need increased hygiene standards. One baby currently in another hospital are being assessed by a surgeon for the need of possible transport and surgery, one will possibly arrive by helicopter for eye surgery today. Three babies are planned for being transported back to their respective local hospitals, one by helicopter today and twins tomorrow (Observers notes after the coordinating management team's morning huddle).

- *(Clinical coordinator) We are plenty of people today, that is nice. But when NN [strategic operations manager] asked if we had a lot of capacity, I had to say no.*

The clinical coordinator checks the antenatal list of at-risk mothers who are under observation.

- *(Clinical coordinator) Oh, there is a lot here, induction, ich... a lot of bleedings. There is a lot waiting... but you don't know when... It could be calm... I will not read all their charts.*
- *(Operations manager) ...one important thing. This baby that needed eye surgery is now acute and will arrive soon. They will land directly in the operating room and the transport team will take care of the baby until it can go back home its own hospital.*
- *(Strategic operations manager) Can we lend out some staff to [a neonatal ward in a neighbouring hospital].*
- *(Head nurse) I can check, we have plenty of staff, but they are all in use.*

- *(Strategic operations manager) I ask because they are not doing so well [the other unit]. Twins are being born and they are asking for allowance and resources to move them to another region.*

Q3

- *(Clinical coordinator) This is not good, its full [the ward]. We have no space when this eye baby arrives.*

The clinical coordinator walks to the room where a nurse oversees the twins that were supposed to be transported out the next day but are now showing symptoms of infection.

- *(Clinical coordinator) Lets´ see when [Strategic operations manager] gets back, maybe we can send someone else.*
- *(Nurse) But they went to fetch the week 31 from delivery to there [points to an empty cot].*
- *(Clinical coordinator) Yes, and the eye baby is coming [points toward the 2nd empty place for a cot. Then its full here. Do you think these twins could be together in a twin cot?*
- *(Nurse) Well, I don´t know. This one is just on the margin of managing without incubator, and that one is getting treatment for bilirubin [treatment includes being exposed to light from a special lamp].*
- *(Clinical coordinator) The problem is that I don't have staff to open another room.*
- *(Nurse) Maybe if we reconsider the lamp-treatment...*
- *(Clinical coordinator) Exactly, and then we hope that the eye baby can go back to his own hospital later in the evening.*

Standards for Reporting Qualitative Research (SRQR)

O'Brien B.C., Harris, I.B., Beckman, T.J., Reed, D.A., & Cook, D.A. (2014). Standards for reporting qualitative research: a synthesis of recommendations. *Academic Medicine, 89(9)*, 1245-1251.

No.	Topic	Item
Title and abstract		
S1	Title	Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended **Qualitative descriptive study is part of the title.**
S2	Abstract	Summary of key elements of the study using the abstract format of the intended publication; typically includes objective, methods, results, and conclusions **The 300 words abstract contain objectives, design, participants, results and conclusions**
Introduction		
S3	Problem formulation	Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement **Problem statement on line 68-71 followed by relevant theory. Study Aim is located at line 90-92.**
S4	Purpose or research question	Purpose of the study and specific objectives or questions **The explorative qualitative design is guided by the study aim. A specific area for improvement in indicated on line 88-89.**
Methods		
S5	Qualitative approach and research paradigm	Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., positivist, constructivist/interpretivist) is also recommended **The ethnographic design and participatory observations are described in the methods section, sub headline "Design" line 95-99.**
S6	Researcher characteristics and reflexivity	Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, or transferability

		The researchers characteristics is mentioned in the methodological bulletpoint on page 3 line 63-64 and further discussed in "Limitations" line 403-405. Trustworthiness is discussed in the second last paragraph in "Limitations"
S7	Context	Setting/site and salient contextual factors; rationale[a] **Setting is presented in the *introductions first paragraph* and a subheading under methods "Design and setting" Line 100-105.**
S8	Sampling strategy	How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale[a] **The sample of data are mentioned in line 119-127. Saturation is not specifically discussed.**
S9	Ethical issues pertaining to human subjects	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues. **Ethics approval information on line 436.**
S10	Data collection methods	Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale[a] **Data collection and data sources are presented in the methods section, sub-headline "Data collection".**
S11	Data collection instruments and technologies	Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study **Audio recording presented on line 137. Other instruments are not applicable in the ethnographic design.**
S12	Units of study	Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results) **Not applicable in the ethnographic design, ample data is presented through quotes and appendix 1.**
S13	Data processing	Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/deidentification of excerpts **Analysis and collection of data were iterated according to the study design.**
S14	Data analysis	Process by which inferences, themes, etc., were identified and developed, including researchers involved in data analysis; usually references a specific paradigm or approach; rationale[a] **Analysis method presented in line 141-152 and "table 1" for further transparency.**
S15	Techniques to enhance trustworthiness	Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale[a]

	Trustworthiness discussed in line 405-411
Results/Findings	
S16 Synthesis and interpretation	Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory **Results is based on an interpretation through a lens of the theoretical concept of resilience. Integration with theory is found in the discussion.**
S17 Links to empirical data	Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings **Extensive quotes and field notes presented in results and appendix 1.**
Discussion	
S18 Integration with prior work, implications, transferability, and contribution(s) to the field	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field **Integration with existing management theory for example in line 328-331, 358-360, 372-373.**
S19 Limitations	Trustworthiness and limitations of findings **Trustworthiness and limitations are discussed in lines 390-416**
Other	
S20 Conflicts of interest	Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed **No competing interests line 445**
S21 Funding	Sources of funding and other support; role of funders in data collection, interpretation, and reporting **No specific funding line 447.**

^aThe rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together