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Analysis

Learning Networks in the pandemic: Mobilising evidence for improvement

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KEY MESSAGES

- The paucity of evidence and availability of data during the early phase of the pandemic provided an opportunity for real time learning driven by communities of practice generating clinical and service innovation.
- A mix of opportune and strategic support provided by regional and national bodies in England created clinical learning networks which adopted and spread change rapidly.
- There is an opportunity for health systems to strategically develop learning networks to co-ordinate resources to innovate, evaluate and implement emerging best practice and evidence for healthcare improvement needed for both pandemic and non-pandemic times.

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Contributors and sources

Prof C Michael Roberts is guarantor for this article. During the first 18 months of the pandemic he was a community Respiratory Physician supporting a COVID virtual ward in Essex, UK, and Managing Director of UCLPartners, an Academic Health Science System, that led a number of COVID related initiatives. He is now CEO of Safer Care Victoria, Melbourne, Australia.

39

40 Dr Manbinder Sidhu is first author for this article and a Research Fellow at the Health Services
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43 remote home monitoring for COVID-19 patients.

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51 Research Collaborative. He is a practising consultant acute stroke physician in the NHS. During the
52 pandemic he led the production of rapid guidance for adapting stroke services during the pandemic.

53

54

55 **Patient involvement**

56 An early draft manuscript was reviewed by members of the RSET and BRACE COVID Oximetry
57 @home evaluation patient and public involvement group and feedback was provided collectively in
58 a meeting co-led by MS along with another member of the evaluation team. As a result,
59 improvements were made to the manuscript in response to suggestions made by this group.

60

61 **Conflicts of Interest**

62 *We have read and understood [BMJ policy on declaration of interests](#) and have the following interests
63 to declare. Note: where a competing interest exists that might disqualify an author from
64 contributing, it is wise to discuss it with a BMJ editor before writing the article.*

65 C Michael Roberts was previous managing Director of UCLPartners (August 2021).

66 Manbinder S Sidhu has no conflict of interest to declare.

67 Naomi J Fulop has the following interests: NIHR Senior Investigator, non-executive director of
68 Whittington Health NHS Trust and trustee of Health Services Research UK. She is a non-executive
69 director of the organisation COVID-19 Bereaved Families for Justice and has legal representation in
70 the UK COVID-19 Inquiry.

71 Gary A Ford the following interests: Personal financial interest: Non-Executive Director NICE Board,
72 CSL Behring consultancy stroke trial design. Personal non-financial interest: Trustee Picker Institute;
73 NIHR Strategy Board member; Health Services Research UK Trustee; Accelerated Access
74 Collaborative Board member; Chair Pfizer/Bristol Myers Squibb independent atrial fibrillation
75 detection improvement grants panel; Chair Cardiovascular Healthcare Systems Strategic Forum,
76 Novartis funded; Bristol Myers Squibb/PwC Life Sciences 2030 Cancer Moonshot Roundtable; He is
77 Chief Executive Officer of the Oxford Academic Health Science Network, which has multiple joint
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79 Oxford University Hospitals NHS Trust the host organisation for the Oxford AHSN.

80

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89 Standfirst

90 *In the absence of existing evidence of how to best manage COVID-19, communities of practice were*
91 *established rapidly to address areas of urgent clinical need. These generated new learning about*
92 *clinical care and care models. Ad hoc collaborations between applied researchers, Academic Health*
93 *Science Networks and regional NHS structures formed learning networks that supported rapid*
94 *sharing of learning, evaluation and incorporation of research evidence and data, and implemented*
95 *innovative change at pace. This approach was highly effective in the pandemic and deserves the*
96 *consideration of strategic alignment of existing clinical, evaluation, research and implementation*
97 *resources to create learning networks as a continuous improvement model for the NHS and other*
98 *health systems.*

99

100

101 **Introduction**

102 The challenges of embedding a range of evidence into practice are well known in relation to clinical
103 practice, service organisation, and delivery. Less discussed is an effective mechanism to both
104 generate and implement evidence rapidly into clinical practice at scale. The COVID-19 pandemic
105 presented a unique challenge where clinical practice needed to develop and spread 'emerging novel
106 practice' to both manage COVID-19 patients in the absence of research evidence and adapt existing
107 models of care that were safe for non-COVID-19 patients.

108 In this paper we discuss how clinicians and researchers came together organically to develop
109 learning networks, in the absence of national or regional co-ordination. We narrate how these
110 networks came to share evidence. At the onset of the pandemic this was reliant on personal
111 relationships and individual leadership but was eventually supported by regional and national NHS
112 systems to facilitate evaluation. We describe three cases where clinically led innovation generated
113 communities of practice which evolved into 'clinical learning networks (CLN)'^{1,2} and produced rapid
114 change at scale to meet the needs of the health system.

115 **The emergence of Communities of Practice and Clinical Learning Networks at the outset of the** 116 **pandemic**

117 COVID-19 was a new disease and in the absence of specific evidence-based guidance for treatment.
118 Clinicians initially extrapolated from existing evidence of other viral respiratory diseases, but it
119 became rapidly clear previous guidance on SARS-2 infections lacked understanding of the
120 complexities of COVID-19. In this evidence vacuum, clinicians began to share emerging knowledge
121 nationally and then internationally in real time³.

122 UK Research funders responded to the pandemic by mobilising rolling rapid research calls from
123 February 2020. In parallel, several national and regional groups emerged to develop innovations in
124 practice during the early stages of the pandemic^{4, 5}. Such collaborations 'of shared purpose' are
125 described as communities of practice (CoP)⁶. CoPs provide a mechanism for those working across
126 health services to share tacit knowledge leading to innovative practice and new learning based on a
127 common interest^{7,8}. CoPs move beyond the acquisition of knowledge and centre on three key
128 domains: 1) joint enterprise (what it is about); mutual engagement (the interactions that lead to the
129 shared meaning); and a shared repertoire (of resources such as techniques, tools, experiences or
130 process and practice)⁹⁻¹¹. CoPs allow people to come together to solve complex problems with
131 common goals using knowledge-in-practice-in-context mechanisms, and support for formal and
132 informal interaction between members with resultant learning and knowledge sharing^{12,13}.

133 A key characteristic of CoPs is the facilitation of communication amongst individuals across networks
134 to promote the uptake of new knowledge in health care settings⁹. We argue this key characteristic
135 forms the essential element of a CLN that can support clinicians with knowledge generation
136 processes and decision-making. Defined elements of a CLN are 1) the structured exchange of
137 information and learning, with members 2) the sharing of practical insights of adaption and adoption
138 of evidence-based protocols, and 3) using innovation to overcome deficiencies in care^{1,6,7}.

139 During the early pandemic there were no evidence-based protocols, or national data sharing to front
140 line staff nor a national programme of innovative service evaluation. What ensued was a model that
141 shared knowledge of “what works best” back to clinicians in real-time in the absence of robust data
142 or research evidence¹⁴. As the pandemic unfolded these networks were supported, to incorporate
143 data and emerging evidence whilst also generating new evidence, through partnerships with
144 Academic Health Science Networks (AHSNs), NHS Regional Offices, National Institute for Health
145 Research (NIHR) Applied Research Collaboratives (ARCs) and Rapid Research and Evaluation centres.

146 **Learning from new care models during the COVID-19 pandemic**

147 In the following section we refer to examples of new care models and draw out lessons on their
148 approach. We have used a conceptual framework developed by Bertone et al.¹⁵ to assess the
149 impact of CoPs and CLNs.

150 *Case 1: An ICU clinical learning network, that drew in medical specialties, generating real time*
151 *knowledge changing practice across continents*

152 In March 2020, robust evidence from randomised controlled trials regarding ICU management of
153 COVID-19 was lacking¹⁶. As a pragmatic response, clinicians applied National Institute for Clinical
154 Evidence (NICE) guidance for management of acute respiratory distress syndrome, but adoption was
155 associated with high mortality. The Intensive Care Society (ICS) approached UCLPartners, an
156 academic health science system including an AHSN, to form a collaboration to share emerging
157 clinical experience (e.g. insights from key experts, front line key workers, and patients) between
158 intensivists across the UK. A weekly series of webinars for ICS members was established at which
159 emerging experience was shared including the value of proning and the early recognition of
160 thromboembolic disease.¹⁷ The sessions were recorded, and thematic analysis was undertaken by
161 the AHSN team. Within 24 hours analyses were distributed via email to ICS members. Applied health
162 researchers (NIHR North Thames ARC) supported the group with evidence searches of rapid
163 publication trial data where relevant. Within the first week members had begun to disseminate the
164 summary, via multiple media channels to over 5000 intensivists worldwide. As this shared learning

165 revealed COVID-19 to be a multisystem disease, experts in renal medicine, haematology, respiratory
166 and cardiology were drawn into the learning network.

167

168 *Case 2: Development of national remote home monitoring using pulse oximetry of COVID-19 patients*
169 *using shared learning and research evaluation*

170

171 This was an example where there was greater alignment of national and regional NHS and NIHR
172 resources to evaluate and to spread practice at scale and pace. This evaluation, completed in two
173 months by the two NIHR rapid evaluation teams ([Rapid Service Evaluation Team \(RSET\) and](#)
174 [Birmingham, RAND, And Cambridge Evaluation \(BRACE\) Centre](#)), provided evidence of how remote
175 home monitoring models (also referred to as *virtual wards*) were implemented during the first
176 wave¹⁸, together with a rapid systematic review¹⁹, provided lessons for preparation for the second
177 wave and the national roll out of these services²⁰⁻²². Findings from the evaluation were rapidly
178 disseminated during autumn 2020 through networks which had been established to share best
179 practice, resources and learnings including the COVID-19 Oximetry Community of Practice Group,
180 the National Learning Network and its regional forum-based equivalents facilitated by AHSN Patient
181 Safety Collaboratives, supported by the NHS Futures Platform (a network of NHS staff who want to
182 connect with each other to accelerate their work). Some COPs were established from scratch while
183 others built on established networks such as the National Deterioration Forum, but all brought
184 together clinicians from primary, community and secondary care settings. As a result, a national roll
185 out of this programme across the whole of England was achieved within a matter of weeks in late
186 2020²³.

187 *Case 3: Adapting non-COVID pathways to the virtual first approach for transient ischaemic attack*
188 *(TIA) and stroke care*

189 In parallel, the consequence of researchers and clinicians pivoting to focus on managing the
190 pandemic had a significant impact (or lack of) on building the evidence for the provision of services
191 for non-COVID-19 health conditions. Oxford AHSN and programmes such as Getting It Right First
192 Time adopted a learning network approach rapidly producing guidance and resource hubs to
193 support clinicians and health system planners organise non-COVID-19 services during the pandemic
194 synthesising *available* evidence on remote evaluation and management of conditions along with
195 drawing on the early experiences of sites (e.g. guidance on the organisation of stroke and TIA
196 services)²⁴. In some instances, this supported the rapid roll out of service models that had been
197 tested in a non-pandemic context e.g. remote assessment by senior clinicians of acute stroke for
198 reperfusion therapies²⁵. In other instances, e.g. remote assessment of suspected TIA and stroke

199 more generally^{25,26}, recommendations were based on clinical experience and reasoning without
200 drawing upon a research evidence base as apparent in case studies 1 & 2.

201 **What can be learnt from the cases we present?**

202 The three cases described evolved differently but all show how CLNs established in the absence of
203 evidence and delivered change at pace when facilitated by an administrative infrastructure. CLNs
204 also had the ability to bring together researchers, evaluative/academic organisations, and funders to
205 incorporate emerging evidence. Specifically, there were several mechanisms which enabled CLNs to
206 produce real time 'evidence' in the absence of robust methodological evaluation. First, CLNs
207 generated new learning through collaborative and interdisciplinary working. For example, gathering
208 both evidence-based and tacit knowledge from key experts, front-line clinicians, and patients, which
209 led to the development of new learning applicable to different clinical contexts to treat COVID-19.

210 Secondly, both evaluation and research were grounded in service need whereby clinical innovation
211 drove the research agenda across CLNs. Notably, it was widely acknowledged by CLNs that
212 transferable learning can be obtained from rapid service evaluation and not just formal research.
213 Lastly, electronic media offered an unrealised opportunity in forming CLNs and then in disseminating
214 learning. This was observed both in the formal use of new media e.g. Microsoft Teams and Zoom to
215 facilitate organised meetings but also informally by the personal use of WhatsApp and Twitter by
216 those with a shared interest. This can be a particularly effective mechanism for spreading learning at
217 scale and pace across clinical specialities as demonstrated in case studies 1 & 2. Electronic media
218 was most effective in CLNs which achieved a high level of trust amongst its members and those
219 which had a clear collective commitment under a common purpose^{27,28}.

220 **What worked well?**

221 A key strength of CLNs was clinicians stepping up and focusing on a clinical priority that brought
222 large numbers of multi-disciplinary experts together in a common cause as part of a shared
223 community of purpose. As part of this community, it was important for those clinicians to be honest
224 about the challenges they faced (and expected) when establishing relationships that grew
225 organically as part of CLNs. For example, CLNs were proactive in getting the 'right' people (i.e. active
226 practitioners and key leaders who were able to share current and lived experiences that are relevant
227 and valuable to others involved) to share knowledge. In part, this may explain why CLNs that
228 emerged during the pandemic were novel in their collaborative and hierarchical structures²⁹.

229 What also worked well was the engagement between applied health researchers and CLNs which
230 was vital to the speed of knowledge dissemination, as generated by the networks³⁰. A key

231 component to achieving this engagement was the role of knowledge brokers i.e. people with hybrid
232 professional roles who have membership across several CLNs and CoPs and facilitated interaction
233 and co-ordination¹³.

234 As the pandemic progressed, regional NHS services provided leadership as part of joined up working
235 with ARCs and AHSNs to support system wide service change. Such co-ordination was absent prior to
236 the pandemic and the risk is that such collaborations will diminish as the health sector returns to
237 business as usual. Yet, there are examples of good practice that go against this trend. The National
238 Patient Safety Collaborative³³ has operated pre-pandemic with support from the AHSN network. The
239 [Manchester Academic Health Science Centre](#) operates across regionally based research and
240 innovation organisations to provide a Rapid Research Response Group³¹. Others evolved during the
241 pandemic including the London Evaluation Cell³² that brought together the NHS Regional Team with
242 three regional NIHR ARCs and three AHSNs to collectively agree pandemic related service changes
243 prioritised for research grade evaluation. Importantly, none of these initiatives had central oversight.

244 **What were the challenges?**

245 First, there was an apparent lack of national planning for or co-ordination of real time clinical
246 learning and service innovation at the onset of the pandemic. In parallel, there was no national plan
247 to use existing administrative structures to support emerging clinical networks. All were initially
248 hampered by the lack of a supportive infrastructure at national and regional level that may have
249 provided access to clinical data, research organisations for rapid evaluation, and planned rather than
250 opportunistic support from AHSNs. As a result none systematically incorporated patient and carer
251 co-design and there was a lack of consideration of health inequities as key drivers, with case 2 being
252 the exception. Many of the CLNs developed during the pandemic to address COVID-19 have now
253 discontinued rather than continue with revised goals through lack of ongoing national or regional
254 NHS support and direction³⁴.

255

256 Finally, there was a shortage of capable service evaluation staff who could support rapid evaluation
257 of front-line innovation during the pandemic. The lack of national alignment of the NIHR
258 infrastructure was a result of a pre-existing failure to systematically address the competing pressures
259 from academic and policy worlds whilst many staff were deployed to respond to the national
260 research agendas³⁵.

261

262 **What barriers existed to shared learning and how were they overcome, where they were? Can we**
263 **learn from experiences elsewhere?**

264 Across our three cases we identified several barriers. Shared learning was largely limited to
265 members of CLNs whereby disseminating learning in real-time to front-line practitioners took time
266 and constant refinement to ensure messages were clear. Further, traditional dissemination
267 strategies to share learning were paused e.g. suspension of conferences, roundtable discussions, and
268 rapid peer review of academic publications. However, other much faster routes of dissemination
269 were developed e.g. electronic media (WhatsApp, Twitter) as well as NIHR rapid evaluation teams
270 working closely with CLNs to share formative feedback on findings using slide decks and online
271 workshops. National alignment of CLNs with NICE when it occurred helped facilitate shared learning
272 and dissemination but was limited as well as unsystematic.

273 The presence of organically developed CLNs during pandemic provided an opportunity for an
274 alternative paradigm in knowledge generation linked to rapid implementation compared to the
275 traditional generation of knowledge through research methodology. The NHS has run clinical
276 networks previously and last made major policy changes to these in 2013³⁶; the year that AHSNs
277 were established. The opportunity to formally link the two was however neglected. These previous
278 iterations established effective knowledge sharing, but their impact on bottom-up service
279 transformation was ultimately diminished by top-down government demands³⁷ and an absence of a
280 formal implementation partner. NHS clinical networks lacked the linkage to the academic research
281 and evaluation community and ultimately relevant and contemporary data so never meeting the
282 criteria of a true clinical learning network.

283 In contrast there are examples of successful CLNs in other countries, including in the United States
284 (100 000 lives)³⁸, Denmark (operation LIFE)³⁹, and Japan (Partners campaign)³⁹. These sought to
285 design and construct a sustainable national learning network for improving health care whose
286 usefulness outlives a time-bounded improvement initiative⁴⁰. Common to all were CLNs that support
287 knowledge generation and exchange: the need to have clear aims and leadership alongside
288 brokering relationships with a range of stakeholders, rapid dissemination of learning to frontline
289 practitioners using web-based applications, and encouraging critique and reflection⁴⁰.

290 Nationally, common interests broke down silos between specialties and across secondary and
291 primary care. Supported by regional structures including the AHSNs and NHS Regional Offices, CoPs
292 were empowered to develop and deliver innovations at scale and pace with an emphasis on learning
293 from each other in close to real time so forming clinical learning networks. Relationships developed
294 with the research community that highlighted the need for rapid evidence generation through
295 evaluation and research so binding clinicians and academics to an aligned purpose. Most
296 importantly, collaborative knowledge production and mobilisation, as part of CLNs, during a

297 pandemic required health system improvisation and collective leadership to drive forward an
298 agenda in the absence of evidence.

299 However there also remains a tension between promulgating 'best practice' prior to robust evidence
300 being available which could result in implementing a clinical practice later proven to be ineffective or
301 harmful. Determining what is 'good enough' evidence to support 'best practice' is an on-going
302 challenge: whether clinicians believe available evidence is sufficiently reliable and relevant to
303 support service change and if further, more robust evidence will be generated. There is a need for a
304 collaborative relationship between CLNs with academics to undertake evaluation rapidly but also to
305 provide research evidence in a format that supports the implementation of evidence into practice.
306 We suggest that alignment of rapid evaluation and applied health research generated by CLNs is
307 essential in creating CLNs based on robust evidence addressing relevant questions for the NHS (e.g.
308 impact on workforce and workflow) so optimising translation at scale and pace.

309 This approach has been used successfully overseas with strategic partnerships between academic
310 researchers and clinical services such as the United States Veterans Administration's Office of
311 Research & Development⁴¹ and Kaiser Permanente's Health Research Institute⁴². Others have
312 embedded academic researchers within the health system³ to promote research priorities driven by
313 the needs of the health system. Yet, to promote an effective clinician-academic alliance, change is
314 also required throughout the academic research system. A recent analysis of UK research showed
315 that half of all funding is spent on 'underpinning' (understanding normal biological, psychological
316 and socioeconomic processes which forms the basis for subsequent research) and 'aetiology' (the
317 risks, causes and development of disease)⁴³. In comparison just 5.6% of funds were allocated to
318 health service research⁴³ which is further compounded by the very limited capacity within NHS non-
319 research budgets for evaluation.

320 A summary of the questions we pose for the English government's inquiry into the COVID-19
321 pandemic are summarised in Box 1., aligned with the COVID-19 Inquiry Terms of Reference⁴⁴.

Box 1. Questions for the COVID-19 inquiry

- Did the national government have adequate plans to support and evaluate the innovation (both clinical and service) required of the NHS during the first phase of the pandemic?
- Should there be a national repository of all NHS service evaluation supported by national funders (such as NIHR) working with ARCs, AHSNs as well as independent university/academic research?
- How should evaluation of NHS large scale expenditure programmes be funded?

- What infrastructure is necessary to integrate research and services, to ensure rapid evaluation of service innovation takes place?
- In what ways can capacity be increased for the NHS to undertake its own local evaluations and what are the appropriate structures to support this?
- How can a system be developed across the NHS for the rapid dissemination of new learning during events such as a pandemic?

322

323 So what is the opportunity for the future? Learning from the pandemic experience, government
324 funding bodies, including the NHS and NIHR, can recognise the potential to align clinical
325 communities with evaluation, research and implementation resources to establish clinical learning
326 networks. Linking multi-professional clinical communities, working with patients and carers, into
327 existing regional and national infrastructure can create an effective change system. What evolved
328 from the experience in England were learning networks driven by clinical need, incorporating
329 clinician experience supported by a range of knowledge production methods, and implemented at
330 scale and pace using new media and support from regional NHS funded structures. Decisive
331 leadership from those who commission AHSNs, ARCs and other regional support structures, to
332 ensure alignment, is now required if we are not to lose the learning of the value of working as a
333 collaborative system.

334

335

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