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Original Research

A qualitative study exploring the barriers and facilitators of conducting the SARS-CoV2 Immunity & Reinfection Evaluation (SIREN) study during the COVID-19 pandemic: Implications for developing resilient NHS research structures

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ABSTRACT

Objectives: The SARS-CoV-2 Immunity and Reinfection Evaluation (SIREN) study is a prospective multicentre cohort study established to evaluate the immune response to SARS-CoV-2 following infection and vaccination in UK healthcare workers. The aim of this study is to explore barriers and facilitators experienced by SIREN sites to set-up and run the study, and implications for future research within NHS systems.
Study design: Qualitative study.
Methods: Seven focus groups (n = 33) and three one-to-one semi-structured interviews (n = 3) were conducted via MS Teams with SIREN site teams and SIREN participants.
Results: A thematic analysis indicates a decentralised model, multidisciplinary team working, pre-existing networks, visible senior support, diverse recruitment methods, and co-design methods contributed to the success of SIREN. Barriers to setting up SIREN sites included limited experience of running a large-scale study, lack of processes and resources, and limited organisational support. Providing SIREN sites with the flexibility to develop models of practice that consider the local context worked well. More centralised support including documents, templates and provision for peer support and shared learning can lower the administrative burden of local site teams.
Conclusions: Participation in the SIREN study has strengthened the research infrastructure of local sites and promoted more collaborative research processes which should be maintained to address future challenges at pace within NHS systems.

1. Introduction

The SARS-CoV2 immunity and reinfection evaluation (SIREN) study was established in June 2020 by the United Kingdom Health Security Agency (UKHSA formerly Public Health England; PHE). The SIREN study is a prospective multicentre cohort study established to evaluate the immune response to SARS-CoV-2 following infection and vaccine effectiveness in UK healthcare workers (HCWs).[1] Throughout the pandemic, SIREN provided regular surveillance data on COVID-19 infection and emerging variants and has played a critical role in informing the national COVID-19 response.[2,3]

The National Health Service (NHS) provides publicly funded healthcare systems in the United Kingdom (UK). NHS services include hospital services, mental health trusts and community trusts. In its first year, SIREN recruited 44,546 participants from 135 NHS hospital sites across all four UK nations,[4] and regular sampling of HCWs means it is the largest study of its kind globally and enabled the creation of a biobank to support ongoing HCW research efforts in the UK.[6–8]

The SIREN study was conceived and led by the central UKHSA SIREN study team, in partnership with Devolved Authority public health agencies, and was delivered as a decentralised multi-centre study, with individual sites responsible for participant recruitment and testing and

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operational management/delivery at their site. Each site was responsible for recruiting participants, collecting samples, and sharing results with participants on behalf of the central SIREN team. Participants could be any member of staff (clinical or non-clinical) at the site. Every two weeks, participants were required to complete a questionnaire about symptoms and potential exposures to COVID-19 and undergo COVID-19 polymerase-chain-reaction (PCR) testing, and monthly or quarterly antibody testing by blood sampling. In 2022-23, a Winter Pressures sub-study was established within SIREN to include influenza (A/B) and respiratory syncytial virus (RSV) testing in addition to COVID-19 testing.[5] SIREN study participation, particularly during earlier stages of the pandemic, was conducted during a period of high-pressure for HCWs due to workplace challenges such as increased workload, a lack of training in redeployed roles, and psychological pressure experienced during the COVID-19 pandemic[9–12] alongside wider pandemic-related challenges such as lockdowns and social distancing measures.

The long-term success and high participant retention rate in the SIREN study (84.7 % of participants (n = 32,275) completed 12-months of follow-up; of 14,772 participants extending their follow-up to 24-months, 12,635 (85.5 %) completed this)[13,14] indicates there may be specific components of SIREN that can inform strategies to increase NHS research capacity and develop an inclusive and collaborative research environment that is vital to generate the evidence required to transform services and improve health outcomes.[15,16] The SIREN study was established as a National Core Study to increase research capacity within the NHS at pace during the pandemic. The NHS research infrastructure includes regulatory systems, public involvement programmes and research active hospitals which embed research within health and care strategies and drives healthcare innovation. While delivering research in a pandemic is challenging and has historically yielded limited results,[17] understanding the mechanisms underpinning the successful operationalisation of SIREN as a multicentre cohort study, particularly the way it was set up and implemented at pace during the COVID-19 pandemic, could identify methods for conducting future research within NHS systems in the post-pandemic era and for future pandemic preparedness.

The aim of this study was to explore the barriers and facilitators of conducting the SIREN study during the COVID-19 pandemic, with the aim of understanding the implications for future research within existing NHS systems and infrastructure.

2. Methods

A semi-structured qualitative focus group and interview design was used as this design allows an in-depth exploration of the attitudes, beliefs and experiences of participating in the SIREN study.[18] To be eligible to take part in a focus group or interview, participants were required to be a member of any SIREN site team or SIREN participant at any site that was in active follow-up at the time of recruitment to this study (February and March 2023), or a member of staff at any site where the SIREN study was taking place. During this period, there were 65 sites, of which 38 sites were part of the Winter Pressures sub-study.

This study was divided into two workstreams. Workstream one interviewed SIREN participants and site teams about a range of experiences, and workstream two interviewed only local SIREN site teams about their experience of setting up SIREN at local sites. Data from both workstreams that relate to setting up and running the SIREN study were included in the analysis.

Purposive sampling was used. Targeted recruitment activities ensured there was geographical and role representation. Participants were recruited by sharing details about the focus groups and interviews through established SIREN communication channels (see Table 1). The SIREN Participant Involvement Panel (PIP) was established during the first year of the study and was made up of SIREN participants. Their role was to provide feedback about how the study was run including input into protocols and new sub-studies. An existing SIREN PIP meeting was used to hold one focus group. Participants were offered an honorarium of a £50 voucher for participation in line with NIHR guidance.[19]

Table 1
UKHSA SIREN communication channels used for recruitment into focus groups.

RESEARCH AND SITE TEAMS (number of people via communication channel)	Frequency
Principal Investigator (PI) Forum (158)	Monthly, all site PIs invited
All-Sites Debrief (529)	Monthly, all research teams from sites invited
General (via newsletter) (498)	Always open, newsletter monthly. Option to provide anonymous feedback.
PARTICIPANT	**Frequency**
General (via newsletter) (26,218)	Always open, newsletter every 2 months. Option to provide anonymous feedback.
Participant Involvement Panel (10)	Six-weekly

An interview schedule was developed for each workstream (see Supplementary File 1) by two researchers that were independent of the co-ordinating SIREN study team (AK and JH) and members of the co-ordinating SIREN study team (VH, DS, AH). Workstream one questions focused on positive and negative experiences of SIREN participation, attitudes towards testing, vaccination, and workplace absence. Workstream two questions focused on setting up SIREN at local sites, participant recruitment and retention, running the study, and experiences of the central UKHSA SIREN team.

All focus groups and interviews were conducted online via Microsoft Teams by AK and JH. Neither of the researchers were involved with the leadership or operationalisation of the SIREN study, which facilitated an open and honest conversation about positive and negative experiences of taking part in SIREN.[20] As SIREN was a UK-wide study, the online design enabled participants from all over the UK to take part to capture a wider range of experiences.

Data collection was conducted between February and April 2023. Seven focus groups (five for workstream one n = 21; and two for workstream two n = 12) and three one-to-one interviews (n = 3) were conducted with 36 participants in total.

Focus groups ranged from 64 to 116 minutes and semi-structured interviews from 36 to 54 minutes. Focus groups and interviews were recorded using the inbuilt Microsoft Teams recording function. Focus group and interview recordings were transcribed verbatim, anonymised, and checked for accuracy by the research team.

Transcripts were analysed inductively using thematic analysis.[21] This included familiarisation with data by reading and re-reading transcripts, generating initial codes by identifying key features based on participant responses, and identifying themes by making connections between codes which were grouped into categories. The themes were then reviewed, refined, named, and written up. Coding of each transcript was conducted independently by AK and JH who met regularly to compare coding for each transcript and to form connections, resulting in themes that were included in the analysis.

The study was approved by the Berkshire Research Ethics Committee, Health Research Authority (IRAS ID 284460, REC reference 20/SC/0230) on 22 May 2020; the qualitative workstream amendment 25 was approved 27/02/2023. Participants gave informed written consent prior to the interview.

3. Results

Participants were all HCWs in clinical and non-clinical roles and were representative of the UK healthcare workforce with 86 % female, 25 % minority ethnic, covering all working age groups (see Table 2).

A thematic analysis identified four themes.

Table 2
Focus group and interview participants' demographic details (N = 36).

	Count *(%)*
Age[a]	
25–34	2 *(5.6)*
35–44	8 *(22.2)*
45–54	16 *(44.4)*
55 or older	10 *(27.8)*
Gender[b]	
Man	5 *(13.9)*
Woman	31 *(86.1)*
Ethnicity[c]	
Asian	6 *(16.7)*
Black	2 *(5.6)*
Mixed Race	1 *(2.8)*
White	27 *(75)*
Region[d]	
East of England	10 *(27.8)*
London	7 *(19.4)*
Northern Ireland	1 *(2.8)*
North East	1 *(2.8)*
North West	3 *(8.3)*
Scotland	4 *(11.1)*
South East	5 *(13.9)*
Wales	1 *(2.8)*
West Midlands	3 *(8.3)*
Yorkshire and the Humber	1 *(2.8)*
Occupation	
Nursing (including range of specialities)	17 *(47.2)*
Research (including co-ordination, analysists, management and administration)	11 *(30.5)*
Pharmacy	2 *(5.5)*
Domestic Services	1 *(2.7)*
Microbiology	1 *(2.7)*
Midwifery	1 *(2.7)*
Palliative Medicine	1 *(2.7)*
Pathology	1 *(2.7)*
Respiratory Medicine	1 *(2.7)*

[a] Participants were asked to select from: 18–24; 25–34; 35–44; 45–54; 55 or older; prefer not to say.
[b] Participants were asked to select from: woman; man; non-binary; prefer not to say; other [open text box].
[c] Participants were asked to select from: Asian; Black; Mixed race; White; prefer not to say; other [open text box].
[d] Participants were asked to select where they work from: East Midlands; East of England; London; North East; North West; Northern Ireland; Scotland; South East; South West; Wales; West Midlands; Yorkshire and the Humber.

3.1. Barriers to setting up the study

Some SIREN site teams encountered several physical barriers at a site level such as no access to a research room, IT equipment, blood sampling equipment and physical space for taking samples. Teams were required to identify and locally source resources including borrowing from other departments. COVID-19 pandemic measures required additional logistical considerations. Physical distancing reduced the capacity of available space, and clinical vulnerabilities meant some SIREN site team members could not be patient-facing and were allocated roles accordingly. Staff availability was also a challenge as staff were redeployed to cover increased frontline demands. Some ongoing challenges were attributed to external barriers, such as offsite laboratories that had a limited testing capacity which caused delays in sharing results with SIREN participants and couriers delivering study items late or to the wrong location.

> *Finding space and equipment just to be able to set up … that was one of our biggest challenges.* (WS2, FG2)

Some SIREN site teams had limited experience of running large-scale studies and new processes and standard operating procedures were created de novo. These included processes to collect and report samples, quality control measures, training site team members, and planning staff rotas to ensure availability of clinical and administrative staff. Many teams learned through 'trial and error' to develop efficient processes. Some sites used a manual system to record and share results with participants which was time-consuming and resource intensive, and other site teams developed automated systems using Excel and Mail Merge functions that were perceived to be more efficient.

> *There were only two people in the team who were not nurses … but they were fantastic with Excel and Mail Merge. And so, they were able to do that in a really efficient way. Otherwise, we could have been there for weeks, just sending out one batch of results.* (WS2, FG2)

3.2. Organisational support

Organisational support varied with some sites receiving senior management and occupational health team support. Support from occupational health teams meant SIREN participants that tested positive could be contacted using established electronic and mailing systems. At sites that did not have support from occupational health teams, there was an increased administrative burden on teams. Senior management support facilitated access to the resources required to set up the study and raised the profile of SIREN making it easier to run. At sites where this support was not available, organisational barriers such as space issues were harder to resolve.

> *Nobody would take responsibility for it being an organisational challenge. And then we've moved around a bit as a result. It was getting somebody to*

state that it was an organisational wide requirement to provide space if we were going to participate. (WS2, FG1)

Setting up SIREN at pace relied on the goodwill of pre-existing relationships and networks that had established lines of communication. New relationships were also developed to ensure site teams included the skills and expertise required to run the study. SIREN teams were multidisciplinary, drawing on expertise from IT, communications, clinical, and administrative teams.

Our team were pulling in favours from people they already had relationships. (WS2, FG1)

Dual roles, where SIREN team members were also SIREN participants or organisational support staff, promoted the principles of co-design and co-creation as it generated insights into the 'end user experience' which allowed site teams to improve SIREN communications and processes. At one site, having a PI that worked in the laboratory meant more efficient processes were developed that minimised errors when collecting samples and returning results.

The benefit, actually, of running the study and being a participant meant that you could see exactly what everyone else was getting. So you just had a bit of a heads up, and a bit of insight into that experience for the participants. And you could troubleshoot a little bit, as well because of that. (WS2, FG2)

Many of the barriers of setting up SIREN were due to a lack of existing processes which were experienced at the start of the study. Once these barriers had been overcome, site teams reported long-term benefits of taking part in SIREN including increased provision of resources and processes, increased visibility of the research and development (R&D) department, and networking and collaboration with other teams that will facilitate future research with a wider range of departments. The rapid responsiveness required to set up SIREN reduced the barriers of multidisciplinary team working by promoting a shared goal that extended beyond individual specialities and divisions and contributed to a positive change in workplace culture.

The R & D department worked in different specialties, or in four or five different divisions, and never the twain shall meet … Suddenly, we all had to get together in one room and just make it work. That was brilliant. And we're still reaping the benefits of that now, to be honest with you. And it changed the way we worked as a department and our profile within the hospital as a whole. (WS2, FG1)

As the SIREN study required regular interaction between sites teams and participants over months and years, it was felt a relationship developed which enabled SIREN participants to leave busy clinical areas and potentially release some stress they were experiencing during the pandemic.

It's been a bit of space for staff, especially in the height of the pandemic … that space where they could just breathe, and they could just talk … I would say that kind of emotional toll and impact that we were able to hold for staff, that I don't think was available anywhere else really. (WS1, Site Team, FG1)

3.3. Targeted recruitment

SIREN participant recruitment was successful as site teams met their recruitment target within two to six weeks. At some sites, demand for participation exceeded the places available with staff placed on waiting lists. Recruitment activities ranged from passive strategies such as sharing study information via the staff intranet, newsletters, hospital screens, computer flashes, leaflets in the canteen and physical environment to more active strategies which were targeted approaches to increase participation from staff in different job roles and from different demographic backgrounds. Targeted approaches included attending departmental team meetings, focusing on specific specialities and wards, sharing information via daily manager meetings and visible senior support. Participant booking systems allowed site teams to identify groups that were over or under-represented which informed the use of targeted approaches to increase participant numbers in under-represented groups.

We kept a track of how many [participants] we'd had from each staff group specifically, so we can make sure that we had a good representation of some of the porters, the cooks, people from a BAME background specifically. Because it did end up a bit front loaded as white British office workers, and we wanted to spread it all out a bit. (WS2, FG1)

In some Accident and Emergency (A&E) and Intensive Therapy Unit (ITU) departments barriers to the recruitment of participants were reported. It was perceived that staff working in these departments had more time constraints and were physically too tired to participate due to increased pandemic-related workloads. Closed swipe-only access wards, which are wards that cannot be accessed by all staff due to safety reasons with only specific staff members able to enter without requesting access, were in place due to COVID-19 restrictions. This meant study details were not as accessible as SIREN teams were unable to physically access these wards to share study information and contributed to underrepresentation in some specialities.

Because of it being COVID, there were obviously restrictions upon where people could actually go. So I think we've got more ward or more physios actually involved, rather than the ITU, the respiratory ward, and A&E team members. It seems to be they were the difficult areas to actually recruit from. And I think that's because they were actually restricted in places that they could actually go into. (WS2, FG2)

3.4. Centralised support

The centralised study design and co-ordination with sites acting as decentralised spokes allowed flexibility at sites to adapt delivery of the study based on local resourcing, while benefiting from centralised leadership and study co-ordination. This model appeared to work well although participants reported some challenges and additional potential opportunities to maximise centralised support.

The central UKHSA SIREN team gave local SIREN teams the autonomy and flexibility to develop testing models that reflected site capacity and local needs. This appeared to work well with different testing approaches reflecting the availability of resources and staff requirements, and enabled site teams to incorporate local solutions to challenges the central SIREN team may not have known about.

We had different systems for some people. Some people would work in an area where they had phlebotomists, so they'd do their bloods and then they'd drop them down to us. Or some people work permanent nights, so they'd do their bloods and their PCR, and they'd drop it off with us first thing in the morning. (WS1, PI)

Communication between central and local SIREN teams was perceived to improve over time, going from pressuring and directive, to more collaborative and equal. Communication became clearer and more efficient, and additional resources such as the dashboard were helpful to identify participants. However, some site team members were unable to access information provided by the central team via the dashboard as security settings on site computers prevented access.

Communication from PHE has improved significantly latterly, actually. And it seems to be more collaborative rather than directive. (WS2 FG1)

While communication improved, many teams felt more centralised support could have eased the administrative burden and facilitated shared learning across sites. A central repository of study documents and templates to adopt or tailor to the local site context could reduce the administrative burden and duplication of each site creating new

Table 3
Recommendations for future multi-centre cohort studies to promote equitable research based on successful implementation of the SIREN study.

Recommendation	Rationale
Visible senior support at each site.	Senior support will facilitate access to resources, add credibility to the study and promote participant recruitment and retention.
Develop and maintain cross-departmental networks routinely using existing communication channels and established groups that can be mobilised at pace during emergencies.	The ongoing use of existing networks and relationships, where lines of communication are already established, can facilitate access to staff expertise and physical resources required to set-up studies.
Multidisciplinary site teams with varied skills and expertise.	Include team members from different clinical specialties, administrative, IT, and occupational health teams to develop efficient processes and maximise participant recruitment.
Flexible delivery model.	This will address local site capacity and varied needs of site teams and participants.
Co-design and co-create communications, processes, and resources with NHS staff.	To improve study research processes and provide 'end user' experiences as part of the study design.
Central provision of resources that can be tailored to the local context.	Reduce duplication of activities and development of similar resources in parallel across sites.
Central communication channels including newsletters, webinars and emails.	To share outputs and create a sense of community across sites.
Provision for shared learning.	Central teams to create cross-site communication channels for sites to share experiences, peer learning and innovation. This could include digital platforms, webinars and online groups.
Embed wellbeing information within existing systems of support.	To promote staff mental health and wellbeing.
Create qualitative feedback loops at each stage of the study research cycle.	Create a mechanism in real-time to identify barriers and enablers of the existing research infrastructure.

resources.

> *I think all sites could have benefited, actually, from some kind of centralised documentation given to us by the sponsor at the beginning. Because we were all doing our own thing. Designing posters, designing documentation to make the process run more smoothly. I think if that had been in place, it would have allowed us to get on with our job of recruiting, rather than getting so bogged down with the admin.* (WS2, FG2)

Site teams reported that a mechanism for peer learning, facilitated by the central co-ordinating SIREN team, could have been implemented sooner to inform the development of more efficient processes and allowed technological developments and innovation to be shared more widely during earlier stages of the study.

> *There was a presentation from [site] showing off about their bot that was doing everything, that was doing requests. They'd done some in-house development, it sounded as though SIREN was running with the press of a button and we were doing manual requests … It would have been quite nice to have had a bit of sharing of innovation that had helped in other sites, earlier. We were a little bit aggrieved. We thought it was pretty insensitive to showcase it so late on. It was a technological development. Why should it be kept just in one trust.* (WS2, FG1)

In response to this feedback, the co-ordinating team established weekly regional PI forums and debriefs with the local clinical research network leads to facilitate shared learning. This enabled sites to develop relationships with other SIREN teams to co-ordinate and standardise activities. Sharing local resources and provision of peer support enabled teams to identify more meaningful ways to run the study.

4. Discussion

The SIREN study brought together multiple specialities over a prolonged period and tested the strength and resilience of the NHS research infrastructure during a national emergency, exposing its strengths, weaknesses and inequalities. The current study has identified components of SIREN that were key to developing a research infrastructure that could withstand pandemic-related challenges.

The central SIREN team gave all UK NHS hospital sites an opportunity to participate irrespective of known research structures and while this created an equal opportunity to take part in national research, it did not create an equitable opportunity as there were differences in resource availability at different sites. Where resources were limited, having access to existing internal networks and pre-existing relationships made it possible to set SIREN up at pace. This highlights the importance of not only building physical infrastructure but also the development of networks to facilitate and promote research.[22]

One of the strengths of SIREN was multidisciplinary team working and visible senior support at an organisational level. The NHS Leadership Competency Framework highlights the importance of senior leaders being engaged with research boards and supporting the development of research strategies.[23] Organisational oversight of research portfolios can develop research that is aligned with national priorities and build research capacity at the site level, and minimise duplication of activities such as SIREN teams and Occupational Health teams reviewing guidelines independently within the same organisation, or missing opportunities to implement more efficient automated processes.

The centralised SIREN structure that supported a decentralised implementation model enabled site teams to identify and address local needs but work collaboratively to address national priorities. Similar large-scale studies during the pandemic such as RECOVERY and REMAP-CAP, which used the UK research infrastructure during the pandemic to achieve rapid results, also incorporated flexibility into their study design which facilitated a 'learning by doing' approach.[24] This flexibility, also evident in the SIREN study, was essential to be able to adapt to the dynamic context of the COVID-19 pandemic. While the decentralised model was seen as a positive, additional support from the central co-ordinating team could have minimised duplication of site team activities when setting up the study. Improvements to SIREN communications and support indicate the central team was agile and responsive to feedback. Collaborative communication is a well-evidenced approach to share power and strengthen relationships. It creates an opportunity to capture a wider range of issues and strategies for joined up solutions.[25]

Allowing SIREN teams to have dual roles facilitated interprofessional research and quality improvements as several professions came together to integrate expertise and scientific perspectives to resolve a shared research question or issue.[26] This is aligned with the principles of patient and public involvement policy which ensures people with relevant experience contribute to how research is designed, conducted, and disseminated to ensure it is relevant, acceptable and understandable.[27] Adapting these principles for NHS staff research, such as developing a national staff research policy which encourages dual roles where possible, may provide a better experience of research and promote wider participation as it allows barriers to be identified and resolved sooner.

The use of active recruitment strategies has important implications for addressing wider barriers to research participation in the NHS to

ensure diverse groups have the opportunity to participate in research and inform the development of treatments and services that reflect the needs of a diverse population.[16] By going beyond passive methods of communication, some of the systemic barriers of engaging in research were reduced contributing to a more diverse and inclusive research environment. Evidence shows staff satisfaction, recruitment and retention is higher among staff who are involved in research[23] and reinforces the importance of engaging HCWs in research.

The SIREN study has been a catalyst for many sites to develop and strengthen their research infrastructure and build capacity to continue research beyond the COVID-19 pandemic. These legacy effects of the SIREN study should be maintained to ensure NHS research systems are resilient and prepared for future national emergencies. This includes maintaining enhanced and extended networks generated by the SIREN study and retaining resources and processes that contribute to a visible, active research culture. Table 3 outlines recommendations for future multi-centre cohort studies in healthcare settings to promote equitable research opportunities amongst all HCW.

To our knowledge, there are very few qualitative studies that report the experiences of running large, multi-centre cohort studies.[28,29] Qualitative methods that are incorporated within clinical settings from the outset can contribute to important changes in the design, conduct and day-to-day running of activities. This can include content development, selection of outcome measures, delivery and acceptability. Qualitative work undertaken during the SIREN study identified important insights which had implications for SIREN activities. The SIREN study included a PIP panel as part of its monitoring and evaluation process which provided qualitative insights at different stages of the study to identify and improve barriers encountered. Embedding qualitative methods into existing research structures has the potential to optimise future multi-centre studies by generating in-depth understanding of issues that impair efficiency when setting up and running studies. For mixed-methods studies, qualitative feedback loops could also be complemented by quantitative insights that can be monitored throughout the study.

Inclusion of two independent researchers to collect data promoted more open discussion and broader theoretical and practical considerations during the analytic process due to their differing backgrounds (health psychologist and a public health registrar with a medical background).

Study limitations include risk of selection bias as participants were indicative of a more engaged cohort as they were required to be SIREN participants or members of any SIREN site team that were in active follow-up during recruitment of this study, which means challenges for less engaged cohorts may not have been captured, particularly as existing SIREN communication channels were used to support recruitment.

4.1. Conclusion

The SIREN study is an example of a successful prospective cohort study of HCWs. Now in its fifth year, it has produced high impact peer-reviewed papers and shaped national policy. This has been against the backdrop of pandemic-related challenges, and can be attributed to organisational, relational, and individual factors. It demonstrates the capacity for research that can be achieved in the NHS. As NHS systems recover from the impact of the pandemic, it is important that lessons are learned and areas of good practice from the SIREN study are adopted within the NHS research infrastructure to facilitate ongoing research post-pandemic. In the event of a future pandemic or national emergency, the mechanisms that underpin the success of the SIREN study can be adopted which include maintaining and developing multidisciplinary collaborations, a centralised structure that supports a decentralised implementation model, and policies to promote more active and inclusive NHS research environments.

Author statements

Ethical approval

The study was approved by the Berkshire Research Ethics Committee, Health Research Authority (IRAS ID 284460, REC reference 20/SC/0230) on 22 May 2020; the qualitative workstream amendment 25 was approved 27/02/2023. The study is registered with ISRCTN (trial ID: ISRCTN11041050). Participants gave informed consent before taking part in the study.

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Competing interests

None.

Author contributions

The study was designed by VH, DS, AK, JH and AH. AH and SR supported with participant recruitment. AK and JH collected the data and led the analysis. AK wrote the first draft of the manuscript. All authors reviewed and edited the manuscript. SH is the chief investigator of SIREN.

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Appendix A. Supplementary data

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