



COVID Oximetry Evaluation Write Up

Executive Summary

Objective

To explore the lived experience of individuals from a subset of three vulnerable populations in using pulse oximeters at home.

Design and setting

This particular study was designed as an exploratory qualitative study that took place initially in 3 settings (food bank, Mosque, homeless shelter via linked GP practice).

Method

Pulse oximeter packets were distributed to 15 individuals at each of the three sites. Following a two-week waiting period, phone call interviews were conducted via the research team. The interviews were semi-structured with an open-ended question format (appendix a) and lasted between 5-10 minutes with a focus on personal experiences using the pulse oximeter at home.

Results

92% of participants interviewed were male (n=12) and 84% (n=11) were of Asian ethnicity. Qualitative analysis revealed the following themes: initial lack of knowledge around what an oximeter is and what it can be used for; willingness to learn how to use pulse oximeter and take regular readings at home; enthusiasm and positivity around oximeter's ease of use; lack of preventive education around Covid and viruses in general in 'hard to reach' communities; community platforms as potential route to raise awareness on pulse oximetry benefits

Conclusion

These initial qualitative findings complement research into the the remote monitoring of patients with coronavirus symptoms. It is known that patients with serious coronavirus symptoms often do not go to hospital early enough, and this can negatively impact patient outcomes. Promoting general public knowledge of pulse oximetry monitoring can mean those with rapid deterioration and silent hypoxia are more likely to be identified and can get the help they need as quickly as possible.



Background

More than a year into the pandemic, there is still community spread of Covid-19. The risk of developing the disease, and the risk of complications, is much higher in people who are over 65, those with comorbidities (e.g., diabetes, lung disease, heart disease), those from minority ethnic groups and those who are poor. People with more than one of these risk factors are at much higher risk. Early oxygen therapy improves outcome in acute Covid-19 but many people who need it have “silent hypoxia” (i.e., no symptoms), so an oximeter is needed to detect it. There is a national initiative, COVID Oximetry @home (CO@h), in which people with risk factors and suspected acute Covid-19 are supported to monitor their oxygen levels which you can find more information about [here](#).

Local context

Currently there is a large socio-economic skew in who uses oximeters. The CCG have a stock of pulse oximeters available to support the local community but required help working out how best to target the relevant groups. This particular study was designed as an exploratory qualitative study that took place initially in 3 settings (food bank, Mosque, homeless shelter via linked GP practice). In each setting, a 3-stage process was followed.

The first stage included gaining access and building a relationship with contacts from each organisation. The second stage involved studying the CO@H resources site and other relevant sources and obtaining patient-friendly instructions for oximeter use. The third stage was informing and gaining buy-in from the local CO@H team including GPS, OOH and virtual ward support teams. For each of the partner organisations, a named contact and any other nominated staff was interviewed using a semi-structured format (list of open-ended questions). Working with staff, we co-designed an approach which would work for the specified organisation and aimed to identify people with multiple risk factors (see above).

Using the agreed approach, we recruited 15 individuals and their linked family or household. They were provided with an oximeter with instructions and were encouraged to explore. We gained consent to help us learn from their experiences of using an oximeter at home.

The oximeter packets that were given out included a pulse oximeter, national safety instructions on how to use it, a leaflet explaining the small study and a mail in survey with the option to complete it online. The thirteen-question survey included questions such as “how did you find using the oximeter?”, “having used the oximeter would you use it again?”, “compared to other health equipment at home, how did you find it?” “can you comment on the instructions provided” “what would you say to your local community about the oximeter”, “did you get an abnormal reading”, and additional demographics questions (see full survey in appendix).

Different approaches were used for distribution of the oximeter packs with the three sites based on factors like local knowledge, familiarity, resources available at each site and logistics. At Central Oxford



Mall, the Imam we were in contact with asked us to facilitate the distribution through a male volunteer on the men's side of the mosque as the women's side was closed due to Covid restrictions. A script was written for the imam which he used to make an announcement during Friday prayer at the mosque prior to distribution.

At the Homeless Shelter via linked GP practice, the practice manager introduced us to two nurses who had familiarity and experience with the homeless shelters near the medical practice, and as such they volunteered to visit the shelters and distribute the oximeters on their end. With Banbury Foodbank, our team was logistically too far to offer management of distribution, however the foodbank manager volunteered to carry out distribution herself with a few volunteers as she knew the group who visited the food bank well and had a few locals in mind.

Literature Review

Alongside our proactive pulse oximetry work, we wanted to gain insight into the public appetite for pulse oximetry as a "staple" in home healthcare monitoring. We conducted a literature review, looking at *who own oximeters at home* and *who uses oximeters at home*, focusing on the period since the start of the Covid-19 pandemic. We also reviewed media coverage on oximeters by the largest UK news outlets, to gain insight into public perception of the device.

Which populations use oximeters at home?

We found there is a relative dearth of information on exactly which populations have been employing oximetry at home over the pandemic. The majority of results from our literature search looked at oximeters in the context of studies on Covid-19 telemonitoring systems, rather than as an independent purchase by consumers. Patient numbers varied significantly between studies, ranging from the tens to thousands.

Only one study explicitly commented on background population oximeter usage; a Covid-19 follow-up service for emergency department patients found that approximately 10% (21/192) of their cohort already owned oximeters¹. However, with the small cohort and participants already predisposed to actively seek treatment, caution must be employed in extrapolating these findings. National schemes such as the UK's Covid Oximetry at home pathway (CO@h) have been offering oximeters for home monitoring to Covid patients at risk of becoming seriously unwell, successfully reaching over 17,000 patients². However, these oximeters are returned after 14 days, so this figure cannot be used to assess the number of households that own oximeters.

Nevertheless, there is evidence to suggest that home oximeter usage is becoming increasingly popular globally. An article in India reported that e-commerce company Snapdeal had a 300% spike in oximeter purchases³. Flipkart, another online store reported a 23 times increase in demand for oximeters over 6 months³. Demand mostly stemmed from Tier 1 and Tier 2 cities (metropolitan areas). Absolute values for oximeter sales remain unclear since baseline pre-pandemic figures are unavailable.

Challenges in home oximetry

Despite the absence of statistics on home oximeter use, the remote monitoring studies and wider literature are useful in illustrating some of the challenges in home oximetry, which may influence patient uptake. These include:

- technological literacy among the population
 - o can hinder using the device, accessing educational material and monitoring software
- language barriers
 - o can hinder accessing educational material and engaging with healthcare
- appropriate education on using and interpreting oximeter results
 - o ensuring patients know their target saturations, know to use CE accredited devices and are aware how to seek advice for abnormal results
- access to healthcare
 - o those who have easy access and are more willing to present to healthcare are more likely to be aware of oximeters and enrolled in monitoring schemes

This is important as groups such as the elderly, homeless, lower socio-economic classes and non-native language speakers, all of whom may be affected by the challenges above, are at greater risk of poor health outcomes⁴. This highlights the importance of proactively enfranchising these groups.

Oximeter coverage in the wider media

We reviewed articles on oximeters produced by the UK's most popular written news outlets, to gain insight into consumer perspectives of the device. The evolution of oximeter coverage paints a story that moves from excitement, to acceptance to increased scepticism over the course of the pandemic. Almost every major news outlet has published a feature piece on oximeters since March 2020. These pieces tend to follow the waves of the pandemic, with recurring themes despite the differing publishers. Towards the beginning of the pandemic, in spring and summer 2020, there were a wave of articles showing interest in oximeters for their potential in detecting and monitoring Covid, particularly with the shift to remote healthcare consultations. Many of these articles cite an April 2020 opinion piece in the New York Times by Dr Richard Levitan, who made an early impassioned case for using oximeters to detect silent hypoxaemia. Oximeter media coverage was generally positive, although measured, as its benefits at the time were largely outlined in terms of hypotheticals with regards to Covid. Many of these articles also mentioned that this was likely the first time the general public had been made aware of oximeters, despite them being routinely used in healthcare settings.

In autumn 2020, several articles were published around the Apple Watch 6, highlighting its ability to measure oxygen saturations as a key selling point⁶. Unfortunately, many of these articles did not stress that wearable technological devices are to date not as accurate as CE approved oximeters, which may be problematic if consumers were buying Apple Watches on strength of their oximeter capacity.



Feature articles on oximeters saw a resurgence in early 2021, during the UK's second Covid peak. These articles again portrayed oximeters in a positive light, focusing on the success of the UK's CO@h pathway and tentatively suggesting that all households should consider acquiring an oximeter. Certain outlets, such as the Mirror and Daily Mail also included links to the NHS's videos and leaflets on how to use oximeters. Many of these articles appear influenced by a BBC Radio 4 Inside Health episode featuring Dr Inada Kim, a lead in CO@h, who advocated for the benefits of home oximetry during the programme. It should be noted that during the peaks of the pandemic, headlines often touted oximeters as potential "lifesavers", but in the body of articles advice was often more cautious, emphasising the importance of clinical guidance in interpreting results.

Between these "peaks" of interest, oximeters have been mentioned sporadically in articles as equipment essential to the monitoring of Covid positive patients – these mentions have continued until the present. They have also been cited in articles touting the advent of home health technology and monitoring. The positive coverage and regular media mentions are likely to have embedded oximeters in cultural consciousness as a useful monitoring tool. This has translated into increased interest around oximeters - Google trends show that searches for oximeters have increased significantly compared to pre-pandemic levels, with searches peaking at each of the Covid waves (in spring 2020 and winter 2021)⁵. However, we cannot yet say whether this interest has translated into consumers actively buying oximeters for home monitoring.

In recent months, there has been a trend of more negative press around oximeters, particularly in the context of their reduced accuracy in individuals with darker skin. These articles have mainly emerged in the spring and summer of 2021. In July 2021 almost all the most popular news sources published articles, reporting on the MHRA (Medicines and Healthcare products Regulatory Agency) guidance that oximeters can overestimate oxygen levels in darker skinned patients. Although most of these articles did say that oximeters remain useful tools, for the layman reading headlines alone, this could weaken public trust in the value of home oximetry. Whether consumers will be discouraged from buying and using oximeters in the future remains uncertain.

Initial Findings

A total of twelve mosque participants were interviewed about their oximeter use two weeks after distribution of pulse oximeters at the mosque. All twelve participants were male, eleven of them were of Asian ethnicity (Bengali, Punjabi, Pashto), one was Black, and the mean age of the interviewees was 55. Ten were fluent in English and two could understand basic English but preferred to speak in Urdu during the interview. We were not able to interview any participants from the foodbank but we did have one written response interview from the homeless shelter from a White British female (age ranged 45-54). Following distribution of pulse oximeters at each of the three sites, there was a two-week waiting period followed up with a phone call interview. The interviews were semi-structured with an open-ended question format (please see appendix) and lasted between 5-10 minutes.



Preliminary Themes

Initial lack of knowledge around what an oximeter is and what it can be used for

Seven out of twelve participants said they hadn't really known about an oximeter or what it could be used for prior to the Imam's announcement at the mosque during Friday Prayer. One quoted "I learned something new that day. Another mentioned having an oximeter at home but not knowing what to do with it until that day. During distribution, we noticed a general sense of curiosity from mosque goers around the oximeter as well. Multiple people stopped by to ask about its benefits, others could be seen discussing in smaller groups and showing friends the oximeter while walking to their car. During the interviews, most confirmed not knowing about the device albeit having seen it at hospitals and clinics.

Willingness to learn how to use pulse oximeter and take regular readings at home

Although many did not initially know what an oximeter was, all participants were willing to learn and spoke about wanting to take regular readings of their oxygen levels. All participants said that they thought the instructions that were given with the oximeter were sufficient and easy to follow. They suggested no improvements on wording or language. When asked if they would use the oximeter regularly if there was another covid surge, they all said yes. No one had any abnormal readings and all of them said they would use the oximeter regularly if another covid wave hit. One of the interviewees suggested including a chart that explains what range a normal oxygen level reading was and what an abnormal reading was. One participant mentioned bringing the oximeter home and forgetting about it.

Enthusiasm and positivity around oximeter's ease of use

In general, there seemed to be an overall sense of enthusiasm and positivity regarding the oximeter. All interviewees discussed its ease of use, and many spoke with a tone of gratitude and appreciation around being given an oximeter. All the interviewees said that they found the oximeter easy to use and most said it was easier to use than a blood pressure machine or other household medical equipment. This was in line with the written response survey we received from the homeless shelter where the individual wrote "it's brilliant...I can keep an eye on myself". Some other quotes below to summarise:

"It's good to have in the house, I think everyone should have one"

"Nice to have it. You don't have to go to the GP to find out how you are. It's nice to check if you are at home."

"You must have it. It's a must."

"Go for it, it's very easy to use it."

"If I had to give advice to someone from the community about using an oximeter, I would say that they should use it, it's so easy to use, it's such an easy thing to do, you can keep it in your pocket, it's not a difficult piece of kit to use."

Lack of preventive education around Covid and other viruses in 'hard to reach' communities

A common trend we picked up on during interviews with participants was dissatisfaction around preventative education in the community. Two individuals discussed how community members



especially the elderly did not take covid seriously and would not adhere to social distancing rules in public places like the mosque. Another spoke about how locals would still shake hands and hug when meeting at the mosque even during peak covid times. When prompted about why they thought this was, they said “lack of education and understanding”. It was noticed with the mosque group that many of them lived in a multi-generational household and two participants had kids in university. One shared that his daughter had taught him about the importance of social distancing while another mentioned he knew about the oximeter through his grandson.

Community platforms as a potential route to raise awareness on pulse oximetry benefits

Community events such as Friday mosque prayer announcements can be a valuable platform to educate members of the community on important topics including importance of vaccinations, pulse oximetry, and general health advice. It is clear that local members look up to and listen to community leaders such as Imam’s and as such these leaders can use their platforms to raise awareness on important public health issues.

Vignettes

Ahmed is a British born Pakistani in his early 40s. He has an elderly mother in her late 80s who lives close by who he got the oximeter for from the mosque. He taught his mother how to use it in her native Punjabi tongue. Since then, he’s helped her use it at least a couple times when she feels ill, or her breathing feels difficult. His mum also has a thermometer and bp machine at home, but she found the oximeter much easier to use than those. The instructions and resources provided all seemed fine to Ahmed and he read and explained them with ease to his mother. Ahmed said ‘they were adequate and don’t need to be in a different language (as he was able to translate). The first time Ahmed used the oximeter with his wife and mother present, it gave a couple of variable readings. It went from 97 to 98 for mother and between 96 to 98 for himself, but no one had readings that went over 99. Ahmed felt that the heart rate readings were pretty accurate because it matched up with his smart watch. If there was another covid-19 surge, Ahmed said that him and his family would use it regularly. He also spoke about having an oximeter at home himself but never using it because he had no idea that it could point to an early sign of covid until it was mentioned in the imam’s announcement at the mosque. He said, “I didn’t know oxygen dropping was a sign, so I learned something important that day.”

Rahman is a 45-year-old Pashto speaking Pakistani. His elderly mother lives at home with him and suffers from Asthma and Diabetes. He showed a lot of enthusiasm and appreciation for the oximeter and said, “we are very appreciative and it's really helpful for my mother who is 65 years old and we use it and it's very helpful for us, she has asthma and diabetes and struggles with her breathing, now we have this oximeter at home and we check her breathing regularly and we control it”. When asked if he had to give advice to someone from the community about using an oximeter, he said “I would say that they should use it, it's so easy to use, it's such an easy thing to do, you can keep it in your pocket, it's not



a difficult piece of kit to use.” Rahman also thinks research in the Asian community should be focused on educating the community about prevention of covid including social distancing and how serious covid is.

Zain is a 60-year-old Bengali man who is one of 7 brothers and sisters. He spoke about how none of the siblings gave their mum a hug for almost a year until she had both of her vaccinations. He is quite mindful that others in the local Muslim, Asian community (especially the older community members) will shake hands and hug when meeting at the mosque or other public places. He thinks that even post covid, it’s important to educate the elderly community about covid and viruses in general because so many lives are unnecessarily lost due to lack of general education. He’s been using the oximeter with ease and had no trouble with it but in terms of instructions he said he “didn’t think there was a chart” telling you how to interpret readings so he used to google to look this up.

Sameer is 55 and had previously contracted covid and still recovering from it 6 months later. He got the pulse oximeter for himself and has used it a couple of time. He’s not a native English speaker so he had his friend translate the instructions to him. Compared to using a thermometer or bp machine, he said he found this very easy and helpful to use. He said he knows his normal oxygen levels now and just has to maintain them as previously he didn’t know what a normal oxygen level range was. He used to struggle with breathing issues when he had covid, so he spoke about how having the oximeter would’ve been helpful at that stage. Recommends that the community should all have it “it’s good to have in the house, I think everyone should have one”. He says he doesn’t use it regularly now but would if there was another covid surge.

Recommendations

Recommendations from working with the mosque on this project would include being open to trying less traditional ways of working with community members from this group. Using different messaging platforms, adapting to issues along the way, looking at comfort levels, and using the right ‘lingo’ can make a big difference in onboarding sites such as local mosques. A few logistical recommendations in hindsight would be to station oneself at a common point of interest from the start, have two people overseeing distribution, and have a table set up. Additionally, the low cultural distance between members of the research team and mosque participants allowed for handling of some situations naturally including knowing how to communicate with the imam, when the best time for distribution would be, how to write the script using relevant terminology like ‘salaat’, ‘brother so and so’, etc.

Recommendations from our experience with the homeless shelter and foodbank center around taking more of an active management role or providing an incentive to volunteers in these sites to oversee distribution and collect contact details. We were not able to interview any participants at the foodbank as only 2-3 oximeter packets were distributed via foodbank volunteers who also forgot to note down contact details. This meant we had no means of following up with these individuals unless they chose to mail in a completed survey or take part in it online (which they did not). We also recommend working



more closely with nurses in linked GP practices such as going out with them to distribute oximeter packets. Although the nurses at Luther St Practice were great and passed out 9/15 packets and collected contact details, and although we did receive one written survey response from them in the mail, we were not able to conduct phone call interviews with this group. This could be due to the nature of this particular population subset. Many homeless individuals do not have reliable mobile phones or contact means. We recommend alternative routes of interviewing these individuals, i.e. in person at the shelter.

A summarised list of recommendations from our experiences with the three project sites:

- Be open and flexible to trying less traditional ways of working with site contacts (i.e., using different messaging platforms, assessing comfort levels, and using the right 'lingo') can make a significant difference in onboarding target sites.
- When working with organisations such as medical practices, allow ample time for communications between site contacts and for arranging/carrying out distribution (nurses busy and did things in their own time).
- Distribution of pulse oximeters should be done actively through research team rather than relying on site volunteers to effectively manage how and when oximeters are distributed.
- If distribution cannot be done directly through research team, provide incentive to site volunteers to ensure that a thorough and timely process is followed.
- Distribution on site should be conducted with two members of the research team so that one person can note down contact details while the other passes out packets and answers questions.
- Set up distribution at common entrance point with a table.
- Two week waiting period prior to phone interview may be too long of a gap. Some participants had forgotten about the oximeter or did not recall giving their phone numbers at the mosque.
- Low cultural distance between researcher and target population can enable insightful conversations in preferred language for interview.
- Include guidance on oxygen level readings in instructional packet as the numbers showing up on pulse oximeter may not mean anything to the average person. A color-coded table on readings would be helpful.
- Arrange for both telephone and in-person interviews depending on population, i.e. interview homeless shelter and food bank participants at shelter or food bank if possible.



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