



DEMAND Hub

Theatre cloth cap
review

April 28
2021

Company Name: WarwickMed

Report Owner: Dr Gillian McNab

Date of Report: 25-Jun-2021



Expert review of hospital theatre cloth caps

Contents

1.	Introduction	2
1.1	About DEMAND Hub	2
1.2	Company	2
1.3	Report’s objective	3
2.	Summary	3
3.	Review	4
3.1	Reviewers	4
3.2	Tasks	4
4.	Findings	5
4.1	Original objections to changing to cloth hats	5
4.2	Washing the cloth hats at home	8
4.3	Evidence used to implement cloth hats.....	10
4.4	Infection Prevention Control Team and the implementation of cloth hats	11
4.5	Gaining approval to change from disposal hats.....	13
4.6	Levels of infection rates since implementing cloth hats.....	15
4.7	Policies regarding infection control risks	16
4.8	Do the cloth hats save money?.....	17
4.9	Staff forgetting to bring clean cloth hats to work.....	18
4.10	Lifespan expectations of cloth hats	19
4.11	Discomfort wearing cloth hats may cause overtime	19
4.12	Hospital’s carbon footprint	20
4.13	The difference name and role cloth hats make to team work and interaction.....	21
4.14	Other Trusts using cloth hats	23
4.15	Downsides to using cloth hats	24
4.16	Do your staff like wearing cloth hats?	25
4.17	Advantages to hijab-style and big-hair style cloth theatre hats with name and role.....	25
5.	Literature review: comparison of infection rates when using cloth or disposable hats	27
6.	References	28

Expert review of hospital theatre cloth caps

1. Introduction

1.1 About DEMAND Hub

The Data-Enabled Medical Technologies And Devices (DEMAND) Hub project is funded by the European Regional Development Fund as part of the European Structural and Investment Funds Programme 2014-2020 – Priority Axis1: Promoting Research and Development. The project is delivered by the University of Birmingham in strategic partnership with University Hospitals Birmingham NHS Foundation Trust. The DEMAND Hub programme will run until June 2023 and will support SME businesses in, or looking to enter, the healthcare market by delivering scientific services and commercial pathway support. In addition, there will be a strong focus on the utility of patient reported outcomes and healthcare data in guiding product design, testing and development, removing barriers for innovative businesses and stratifying product development.

The distinctive offering of the DEMAND Hub is characterised by the creation of new academic-clinical-innovation pathways between our existing Birmingham Health Partners expertise in medical technologies, health data and clinical trials, working with established medical technology companies as well as innovative digital SME companies, to enable them to access the opportunities within the regional medical and healthcare sector so as to facilitate development of new technologies across systems software, devices, algorithms, AI solutions and beyond.

1.2 Company

WarwickMed have designed and created latex-free, customised, reusable “name and role” cloth caps for the NHS in a bid to change from single use, disposable theatre caps. The company claim they boost staff morale and reduce patients’ anxiety as they enable everyone to identify the people around them, quickly and easily.

Expert review of hospital theatre cloth caps

1.3 Report's objective

The purpose of this review was to gather information from NHS hospital staff who have implemented or are planning to implement wearing cloth hats in the Theatre environment. The company wanted to explore the end user's experience in the instigation and utilisation of cloth caps compared to disposable hats and demonstrate that they work well and pose no increase in infection rates or cross contamination.

This report aims to provide the company with highly valuable feedback from an NHS hospital staff's perspective, in order to provide evidence on the effectiveness of reusable cloth hats compared to disposable hats. The reviewers shared their experience and gave feedback on the design, use and care of the cloth hats.

In addition, a search was performed of published literature relating to studies in the literature looking at what happens to infection rates when cloth hats are used.

This information will help in the development of the company's products from a medical standpoint and potentially NHS England can use these findings to present to the Infection Prevention Control lead for the Country.

2. Summary

As part of DEMAND Hub (Data-Enabled Medical technologies ANd Devices Hub), Dr Gillian McNab conducted expert evaluations based on her extensive experience and interest in the development of the translation of ideas, technologies and pharmaceutical products to the clinic as effectively as impossible. The purpose was to collate evidence from the end user's in this field from feedback on the implementation and use of reusable cloth hats and demonstrate that cloth hats work well.

In addition, Dr Ts'ong Sui performed the literature review outlining the academic research regarding the infection rates whilst using cloth hats compared to disposable hats. Dr Sui is a Research Fellow in DEMAND Hub and his research areas cover biomaterial, tissue engineering, multifunctional micro/nano

Expert review of hospital theatre cloth caps

material, imaging, terahertz, MRI contrast agent, encapsulation and controlled release. Dr Sui has published 5 full peer reviewed papers, filed 2 patents and worked with Unilever, Philips and Firmenich global companies. This review was based on his extensive academic and industrial research experience and interest in technologies and biomedical products.

As part of the expert review, DEMAND Hub provided a package for WarwickMed, comprising finding the right people, obtaining their evaluations and feedback on their cloth hats as well as providing their responses in the form of this written report. Furthermore, a comprehensive review of the published literature on the infection rates whilst using reusable cloth hats compared to disposable hats was included in this report.

3. Review

3.1 Reviewers

The reviewers consisted of 7 subject matter experts including an anaesthetist, an Operating Department Practitioner (ODP), a Matron in Theatre & Recovery, an Energy and Sustainability Manager, a Senior ODP, a Clinical Procurement Lead for Theatres and a Lead Midwife for Continuity of Carer from University Hospitals Birmingham Trust, Northampton General Hospital NHS Trust, NHS Fife, University Hospital Coventry & Warwickshire NHS Trust and the Liverpool NHS Trust. All reviewers have recent and regular experience in their area of expertise, with over 5 years' experience and so were highly skilled.

3.2 Tasks

The reviewers had implemented or were planning to implement wearing cloth caps in their hospital environment. Therefore, they were asked to review their hats online via zoom according to their own

Expert review of hospital theatre cloth caps

experience, honest opinion and preferences. The evaluation comprised of a question and answer session followed by feedback which is included in this report.

The evaluations and answers to the questions are as follows.

4. Findings

4.1 Original objections to changing to cloth hats

There were not many objections given from the reviewers. One said originally people wanted to buy their own funky hats that were on the market but then this reviewer got involved with the “Theatre hat Challenge” that recommends that the names are put on the hats. The evidence they found when working with their Infection Prevention Control (IPC) team meant that there was no real objection. This reviewer stated “It was no different from a nurse washing her uniform when she has worn it all day”.

Another reviewer acknowledged that there were a few staff who thought the hats would be too warm and other staff who did not welcome change. However, there were not many who objected and most were happy to get on-board with the change. Even those few who objected are now wearing their cloth hats.

A different Trust did find objections and so decided to start using the cloth hats voluntarily on a trial basis i.e. across the surgical theatres staff volunteered to wear the cloth hats and were not forced to do so. The main objection was not wanting to wear their name on their hat as some people do not want everyone knowing their names.

The use of cloth hats was initially pushed by an anaesthetist from a patient’s safety perspective in an additional Trust. The original objections were concerns about the washing and infection prevention, some people not wanting their name on their hat and the funding for it i.e. who would pay for them. The anaesthetist wore them and had been trying to get them introduced for approx. one year before it was looked at by the reviewer from a sustainability perspective. The name issue was overcome by letting staff choose what name and title went on their hats. Finding a good and reasonably priced supplier was also

Expert review of hospital theatre cloth caps

difficult. An Infection Prevention nurse was brought on-board who wrote a paper and did a literature search comparing cloth hats to single use hats and shedding. This information and the sustainability side considering the fact that to make disposable hats, forest needed to be chopped down, was taken to the Infection Prevention Steering Group. Having the IPC team onside helped with this issue. Washing of the cloth hats was the biggest issue. Therefore, there are protocols for washing at home. One theatre matron wanted staff to sign to say they understood they were taking their dirty hats and would wash them at home. However, this hospital is fortunate in that they have a Medical Equipment Library (MEL) that washes mattress covers and, at the end of every day, a 90°C wash is used to clean the industrial washing machines. The first wash in the morning are the cloth theatre hats which are each washed in their own embroidered bags which were bought with the hats. The bags with the dirty hats are left in the changing rooms and collected every day by either by MEL laundry or theatre porters in exchange for the clean laundered hats. This is how the washing obstacle was overcome.

A separate hospital also found it difficult to find a provider of the cloth hats as their first provider was too expensive with 4 hats per member of staff being a lot of money for this Trust to outlay. However, this was overcome by this Trust using WarwickMed whose caps were a lot cheaper. This hospital is only at the very beginning of the process of change and at the moment the matrons are the only ones with cloth hats with their names on them and the first order has now been placed. When they first started talking about changing to cloth hats about 18 months ago, there were quite a few initial objections. A lot of staff did not want to take them home and wash them and wanted them to be washed by somebody else but this was not worthwhile. Bit by bit, what they decided was it will not be compulsory to wear one when they are offered to their staff as they do not see the value in that. The reviewer stated "If someone is made to order them, they will not be worn especially as there is still the option of having a disposal hat as these have to be around from an infection and control point of view. All staff will be offered cloth hats apart from students, visitors and new starters for the first 3 months. These will be given green disposal hats to denote people in training or those who would not know the answer if asked as they are new to the theatre".

This reviewer had support from the Theatre Matron and positive vibes from their manager even though they were worried about costs, if people would use them and infection control. The reviewer decided

Expert review of hospital theatre cloth caps

to go and speak to their IPC team, putting forward the idea of the cloth hats and asking if there were any problems or issues from their side in the theatres. The IPC team said no there were no problems and they fully supported the idea. The reviewer indicated that there are lots of papers and reports on surgical site infections with reusable hats, there is no evidence to suggest an increase in infection. This reviewer stated “Communication through colour coding, name and roles on the cloth hats helps with safety issues, team work, better team engagement and instant recognition of who you are and what you are there to do. The first order was put in for the consultant anaesthetists and the okay has now been given to get the hats across the board for trainees and other staff members i.e. the operating department practitioners, the scrub team, the recovery nurses, the health care assistants and porters. There is currently a revamp happening with the colour coding so this has yet to be finalised for everyone e.g. for team leaders and unit leaders”. The reviewer’s ultimate plan is to have the same colour coding for all hospital staff members across the region. Therefore, when a trainee rotates across the region from one hospital to another, they will go into one theatre environment and be recognised for who they are by the colour of their cloth hat. The reviewer messaged different staff members and anaesthetists a few weeks after the hats came out and there was a lot of positive feedback. The reviewer also commented that when a patient comes to the operating theatre, they are vulnerable, anxious and scared and, on occasion, they do not know who they are talking to. “Even after an introduction, they do not take it all in but the hats with the name and role on them go a long way to allay patient anxiety”.

Another reviewer said there were some minor objections from a few individuals who did not want a reusable cap with their name on it and they did not like the style. There were no major objections from management or the IPC team. There are a couple of consultant surgeons who have raised issues about the infection control risks but the reviewer is in touch with the head of IPC for their Trust and they have assured the reviewer that if there are any issues they can be passed on.

The final reviewer indicated there were no objections as such, rather questions around what the hats were and why they were being worn but this was only small scale in maternity where the reviewer worked. Initially, in January 2019, the reviewer sought and received permission from the Trust to start writing her name on her disposal hat after seeing the initiative. This raised lots of queries from colleagues after which she got support from consultant obstetricians who started to do it as well. At the time, the reviewer was a

Expert review of hospital theatre cloth caps

new midwife and was unaware of the Quality Improvement (QI) projects that were going on in the background. When she went into theatre, especially the high risk acute maternity unit she was involved in, it was normally for an emergency situation although elective surgeries did occur also. The reviewer stated “the midwife holds a lot of responsibility in theatre but is not a part of the theatre team and if people do not know you or your role, then they do not know whether directing something to you or giving you a task is appropriate for you or whether they are communicating it to the right person”. The reviewer could instantly see that writing her name and role on her hat could only ever have a positive impact in respect to communication. From the first time she started to do this, there was instant change. Eventually this initiative was seen as a QI project and they asked if she could lead with their support which is what she did. They anticipated that infection control might be an issue so they started the process of getting in touch with the IPC team early on, asking what their objections might be. The reviewer commented “IPC put a few small rules in place with respect to laundry but apart from that it did not go against any policies within the hospital so they were quite happy”. Presently, this maternity unit has cloth hats with the person’s name and role on them, with staff being able to choose exactly what goes on the cap. The reviewer confirmed “As it was part of QI, there was an initial amount of money but this was not a limitless resource. Therefore staff knew that there would only be enough money for a certain number of hats. By mid-2019, this was put out to everyone in maternity as to who would want a cloth hat and then the hats were ordered. At the end of 2019, the only staff who did not have a cloth hat were the new band 5 midwives and the new junior doctors but the majority of people who wanted one had obtained one by that point i.e. 200+ colleagues. Once staff had their first one, they were more inclined to purchase more for themselves and everyone was given the details of the company they were using with a discount code that was offered”.

4.2 Washing the cloth hats at home

This hospital did not mandate the use of reusable cloth hats when working with COVID-positive patients. However, since things have settled down, the staff have gone back to using their cloth hats and do not object to taking them home to wash. The reviewer stated “A lot of staff pay tax relief for their laundry so they claim and use this monetary support for washing their hats at home”.

Expert review of hospital theatre cloth caps

More than one hospital was supplied with wash bags from their manufacturer with their orders. Each person receives a wash bag and the used hats are put into this bag which then goes straight into the washing machine, meaning staff do not have to handle them again. This reviewer indicated “the majority of people take them home and hardly anyone sends them to the hospital laundry. There is a laundry system in this hospital that would work but it would be slow getting the hats back. However only 1 or 2 people within the main 2 hospitals actually use this facility as most people take them home. Staff have cleaning schedules that they have to sign to say that they are washing their hats within the guidelines that they have been given”.

Another reviewer specified that the manufacturer of their cloth hats also provided wash bags to this hospital so that each staff member was supplied with the appropriate number of hats (staff members working 4 days per week were given 4 hats). One wash bag was provided that could be hung in the lockers for dirty hats to be put in at the end of every day so that by the end of the week the wash bag is taken home and washed in the bag. This also means the dirty hats never come into contact with their own washing. This is how this Trust was able to overcome the fact that they were their own hats and had to be washed at home, especially during the Coronavirus pandemic. This hospital still recommended that staff use disposable rather than the reusable cloth hats if they are looking after a patient who has Coronavirus. These staff had no issues in taking their hats home to wash.

This reviewer acknowledged that there were issues with taking the hats home, as the IPC team stated they needed to be washed at 60°C which is contrary to the fact that they were not too worried about wearing disposable hats that sit on a shelf gathering dust and not being sterile. However, no bags were provided to take the dirty hats home and some staff do not like the 60°C wash as, the reviewer stated “most people do not wash their coloured clothes at home at this high temperature anymore. The cloth hats used are all colour coded i.e. surgeons wear green, anaesthetists wear blue, midwives wear turquoise and porters wear grey and so all the hats are brightly coloured and staff did not want these hats with their whites at 60°C”. However, the reviewer commented “there was a recent issue with the Medical Equipment Library (MEL) where some work was being performed and so the industrial washing machines were out of action for 3 weeks and not able to wash the cloth hats on site. In this instance, the disposable hats were reintroduced. The majority of staff use the onsite MEL rather than wash their hats at home”.

Expert review of hospital theatre cloth caps

Other reviewers said that the cloth hats are washed at 60°C like any other part of their uniform which is an issue with some in this regard. They confirmed “No bags will be provided to take hats to or from work. Some people, because of COVID, have ended up with uniform bags which they can use for their hats also”.

A different reviewer indicated “No one has raised issues with taking the hats home to wash. Emails were sent out when the hats arrived instructing staff that the hats had to be washed at 60 °C as per the recommended policy from the IPC team about washing of hospital uniforms. Each person is provided with an individual wash bag”.

The final reviewer maintained “Nobody expressed any opposition in taking their hats home to launder them and it was made very clear to staff that the Trust did not have a facility to send them to a laundry department so they knew straight away they had to take them home. It was one of the things that the IPC team put in place that they needed to be washed daily or if they became soiled. When the cloth hats first arrived they were provided in a plastic pocket so that they could be transported to and from work when laundered”.

4.3 Evidence used to implement cloth hats

The Theatre Hat Challenge was by many reviewers in the evidence when implementing the cloth caps. One reviewer used this plus articles around the safety aspect. This reviewer commented “in an emergency situation, a specific person called by name is better in terms of responding to a request rather than a general “can someone get me this please?”. In addition, with the mandatory wearing of face masks, everyone is anonymised and it is hard to tell who anyone is. Hence the name and role theatre caps make a huge difference”.

Another reviewer detailed how the implementation of cloth hats started with an in-house leadership training programme where they had to pick something in their department that they thought could be changed for the better. The reviewer then attended the EFPP residential and heard someone speaking about the #Theatre Hat Challenge campaign. They looked at the research behind this and patient safety which was then presented as feedback to their group which included the Director of Nursing.

Expert review of hospital theatre cloth caps

A different reviewer performed a literature survey which illustrated shedding etc. In addition, a quick survey was performed to look at general interest, any objections and to see if staff would wear the cloth hats. Also, a member of the IPC team and the Energy & Sustainability Manager went and spoke to staff about the hats.

Other hospitals used research articles and some presentations. However, because wearing the cloth hats here are on a voluntary basis, it was easier to implement.

When this hospital first started thinking about cloth hats 18 months ago, there was a Working Group which included the reviewer and others within the Trust and someone from one of their Patient Groups who all looked at what they thought about the cloth hats. They also looked at the information from the Theatre Hat Challenge.

This reviewer used the environmental issue and costing. They stated “patient safety, patient communication, team engagement were important factors”. The reviewer decided which colours were to be used for different staff as they did not believe they would get a consensus if it were left up to the individual.

The final reviewer had seen the cloth hats on Twitter being used by a student midwife in the North of England. They confirmed “this was also around the same time that an anaesthetist in New Zealand was doing exactly the same thing. He had done a huge amount of collation of information to support the use of cloth caps so I did not need to do any additional research as the anaesthetist forwarded all his resources to back up what they were doing. There were videos of him presenting all the benefits”.

4.4 Infection Prevention Control Team and the implementation of cloth hats

This reviewer’s IPC Team were really engaged with it. They did a literature search and found there was no evidence against the use of cloth hats. The reviewer commented “the IPC team did stipulate the cloth count needed to be the same as that used in the scrubs and that staff wash the hats at 60°C as stated in the uniform policy as long as the material could take it. Each member of staff was given 3 hats so they could evidence having a clean one at work if one got soiled”.

Expert review of hospital theatre cloth caps

Another reviewer acknowledged that they had to make sure the cloth hats was something their IPC team would support. Therefore the team was emailed the evidence from the reviewer and actually shown the hats and information from the cloth hat supplier. The Theatre Manager liaised with IPC who specified the necessity for proper maintenance and laundry of the cloth hats, with a weekly sign in sheet which was required to record the cleaning of the hats by staff. They detailed “cloth hats should be looked after as with the rest of the uniform i.e. scrubs etc. and if any contamination occurred with bodily fluids or spillages, they should be replaced”.

A different reviewer said “the IPC team are okay with the cloth hats and I have not had anything come back from them”. The reviewer still needs know if the IPC team want to check if the hats are being washed correctly but everything has been slightly different at present because of the Coronavirus pandemic.

Other hospitals confirmed their IPC team were encouraging and pleased that the reviewer was going ahead with the idea of getting cloth hats. Furthermore, a reviewer affirmed their cloth hats were implemented theatre by theatre and funding was obtained from charitable funds to kick start it all off. There were originally issues with the supplier who was a small SME and had trouble keeping up with the demand and taking a long time to get the orders which caused issues. The reviewer stated “then the COVID-19 pandemic started which delayed everything. People were almost being offered shower caps because of a lack of PPE but this increased the uptake of the cloth hats. A big sign-up sheet was put out for people to write their name, job title for the specific colour of the hat, the name they wanted to be known by and whether they wanted the male or female style of hat. The sign-up sheet also had a poster saying what the colours would be depending on job role and also included pictures of anaesthetists proudly wearing their hats. These were sent out to all theatre managers and the COVID-19 pandemic helped with getting people to sign up. The anaesthetist with the original idea of obtaining cloth hats went to the IPC team first and they were thoroughly on-board and thought they were a great idea as they used to be around 20 years ago!”

Yet another reviewer maintained their IPC team were part of the original Working Group. They were very happy with the implementation of cloth hats and had no issues with the washing of hats at 60 °C at home. The stated “one thing that it will cause to change is that initially, as part of the uniform, hats had to

Expert review of hospital theatre cloth caps

be taken off when walking around especially after leaving the theatres. This will no longer be the case as the name and role of the person is on the cloth hats and this is needed”.

The final reviewer had already foreseen how other places had had issues with their IPC team and so sent an email and received confirmation that the cloth hats were not in conflict with their uniform policy. However, they did have some rules that needed to be disseminated to all staff before receiving their cloth hat. The rules included that:-

- a hat could be used for a whole shift unless it became soiled which was why many members of the theatre team purchased a second hat
- a fresh hat for needed to be worn for every shift
- temperature for laundry was specified
- cloth hats needed to be kept in an individual bag for transport to and from work

4.5 Gaining approval to change from disposal hats

Most reviewer said that it was difficult to get the money to fund the costs of the cloth hats but it was not difficult to gain approval. Everything was then delayed because of the COVID-19 pandemic.

One reviewer commented that trying to get funding and release was quite a lengthy process but the COVID pandemic sped this up as there was a need to see staff with their names as it is difficult to tell who people were with both a mask face and hat covering their faces. This reviewer covers 2 hospitals in their city and when the first lockdown happened, people were helping out and mixing between departments so it was then that they recognised they needed to get cloth caps through quickly as it was vital to have name and role cloth hats to distinguish and identify individual staff.

Funding and the environment were two main issues with this reviewer. They could offset against disposable hats for about a year but the staff turnover is such that they have to keep on buying hats so it does not pay for itself financially if they had to pay for them out of their budget. This hospital sourced funding for their cloth caps through a charity. Disposal hats are still provided for visitors and those who forget their

Expert review of hospital theatre cloth caps

cloth hats. They also questioned if it was better for the planet i.e. less landfill and burning of paper hats against washing at 60°C when all the other washing is done at 40°C.

This reviewer asked 18 months previously for approval of cloth hats and it was a definite no. They stated “It took a year to get the management on board with a lot of pushing. To get approval, the cost implications, research into whether staff would agree to wash the cloth hats themselves, the impact on the environment and most importantly, the current cost and budget of the single use hats had to be thoroughly investigated. The hardest thing was finding the costs and how much “the spend” was on a single use hat. As the current manufacturer were doing them at a cheaper rate than others, it made the cost effective especially as on initial introduction, thousands of cloth hats would need to be ordered with a big upfront cost. Some of the companies were charging a lot for hats and it was not suitable for the budget”. The reviewer also commented that “There was a hiccup as the Director of Nursing was convinced and chaired the IPC Steering Group. The reviewer then went onto the charitable funds bid because they thought it was a done deal but in the meantime there was a change of Director of Nursing and the new director had not seen the evidence. More bureaucracy had to be gone through for approval again as this new director had not been involved in the original process. In hindsight, they think if they had put all the information in the charitable funds bid, it would have been easier with the IPC team”.

Another reviewer trialled the hats in one theatre first. Then they were put into other theatres in April/May 2020. The reviewer confirmed “Now cloth hats are in all the theatres, midwives, birth partners: mom and dad cloth hats, heart centre, endoscopy and one theatre is now also providing them for patients in the eye theatres. The heart centre and endoscopy were the last ones in August-September 2020 because of the delay”. The reviewer has found a cheaper supplier with quicker delivery. The original supplier had a tie-back for men and a toggle for women for adjustable sizes. Another company did different sizes and so everyone had to decide whether they were small, medium or large which was difficult to ascertain which size fitted best. The company did not want to put a toggle on as they said it was an infection control risk or that it could fall off. The reviewer had to get a disclaimer from the IPC Matron to say they were happy to have a toggle on, bearing in mind they had already been in theatres for the past 9 months. This made it a lot easier for the current staff as they are asked if they want a toggle or a tie style cloth hat.

Expert review of hospital theatre cloth caps

The final reviewer acknowledged that as their Trust had already allowed her to wear cloth hats, it was a natural progression to let the rest of the staff do so also and this was not difficult. The reviewer was unsure as to how the Trust would respond to everyone having cloth hats so she did go to individuals within management to seek their approval and make sure the hats did not conflict with any rules that were currently in place. The reviewer messaged one of the consultant midwives who were in place to ask for their approval to write their names and roles on their disposal hat as there were no cloth hats present at that time. When it got to the attention of the Quality Improvement project, it was natural to progress to cloth hats with names and roles on them.

4.6 Levels of infection rates since implementing cloth hats

For some of the hospitals the cloth caps have only been in use for a short period of time and so it is too early to tell if the infection rates have been affected. One reviewer clarified “the infection rates have not changed but staff morale, safety, atmosphere and cultures in the theatre has changed as everyone knows who everybody else is and can speak to people using their names.

Other reviewers have commented that there has not been any feedback saying there has been any increase or decrease in infection rates so they believe the infection rates have stayed the same, stating “there have been no incidences and the staff are good at taking their hats home to clean”.

Another reviewer indicated they had not heard of any change but because a lot of this period has been through the COVID-19 pandemic, there has been a reduced number of patients being operated on because a lot of the electives were cancelled. However, this reviewer is going on the assumption that they would not have theatre managers asking where they can obtain some more cloth hats if there was a noticeable increase or if there was any increase or anything that linked back to increasing levels of infection when using cloth hats. This reviewer’s hospital has also gone on to use reusable gowns.

The final reviewer specified that the information given to them from the New Zealand anaesthetist confirmed there had been a decrease in infection rates since using cloth caps which the reviewer believes

Expert review of hospital theatre cloth caps

concerns the makeup of the cloth hats compared to the disposable ones. The reviewer is not aware of this research being done at her hospital.

4.7 Policies regarding infection control risks

Almost all reviewers stated the uniform policy encompasses the cloth hats which states that the hats need to be washed at 60°C. This can form part of the standard operating procedures (SOPs) where it is mandatory to wear cloth hats as part of the uniform and to wash them although it is not specific for infection control.

A number of hospitals use the general policies for infection control and an SOP is then put together in relation to the washing, with everyone signing an agreement that they will be washed every day. Others only have policies in terms of the washing procedure that came from the IPC team with the disclaimer that staff wash their cloth hats at home.

Still others have a Trust Infection Control Policy but not a Theatre Infection Control Policy. Cloth hats are referred to in the uniform policy and cloth hats are seen as part of the uniform. This is part of the Infection Control Policy and washing at 60°C will apply to the hats when taken home just as it does the rest of the uniform.

Lastly, for some there is a uniform infection control policy which is forwarded to the theatre matrons before being sent out to other staff members advising them to wash their hats at 60°C and to clean their spares. As with most hospitals, they have not currently got rid of all of the disposable hats as they are made available for people who visit theatres although for most the plan is to get cloth hats for them as well. Until there are cloth hats for everyone across the board, it is not possible to completely get rid of disposable hats.

Expert review of hospital theatre cloth caps

4.8 Do the cloth hats save money?

Most reviewers stated that the money for the cloth caps was obtained from charitable funds to kick start the use of the cloth hats. Initially cloth hats do not save money. One reviewer confirmed they were introduced a year ago but they presumed the cloth caps would save money eventually. For this reviewer, initially the money came from an NHS charity i.e. an Endowment fund. Surgeons on the hospital payroll were provided with cloth hats, whereas visiting surgeons had to wear paper hats. This reviewer is now putting in another order for people who want to buy their own for extra colours, hats etc.

Another reviewer stated that the cloth hats will save money eventually when they get more people on board. The reviewer's plan is at 6 months to look at what the budget is and then see how much they are spending on single use hats but this will have to be done over a couple of years as there are cases where they still have to use the disposal hats because of Coronavirus.

A different reviewer worked out that they would probably be about cost neutral on an ongoing basis but the cloth hats would probably have saved money over the last 12 months with the amount that they used, especially as they now have them cheaper i.e. about half the price. About 2 years ago when they first started looking there were not many manufacturers of cloth hats with a lot of imports.

A further reviewer commented "there was an initial big outlay but over the next 5 years, there will be a cost saving overall. There is also a saving to the environment as what they are not doing is disposing of hats all the time. Trusts get through thousands of disposable hats". This reviewer looked at how much it costs per year for disposable hats which was £20-30,000. They stated "this will be massively reduced as disposable hats will only be used for visitors and for infected cases".

This other hospital has a number of operating theatres which dispose of more than 100,000 disposal hats. The monthly pre-COVID costs on disposal caps was more than £2000 so the annual expense was in the region of £25,000 per year. In addition to this, the costing for getting the cloth hats was worked out and the conclusion that was put to the management was that they would be spending a lot of money in one go initially but in the long run they would save money, as the caps last at least 5 years or longer.

Expert review of hospital theatre cloth caps

The final reviewer stated “over time we knew cloth hats would save money although initially there was a large outlay. Everyone had 2-3 caps which would be sufficient as each person would do three long 12.5h shifts. The supplier was giving a 3 year guarantee that the name and role would not fade. Therefore they knew that over 2-3 years there would be a cost reduction by purchasing cloth hats as opposed to the disposable hats which were being used in the thousands”. Also the reviewer commented on the environmental benefits to using cloth hats.

4.9 Staff forgetting to bring clean cloth hats to work

The majority of the reviewers said there was no issue in staff bringing in clean hats to work as paper hats were still available so this is not really a worry.

One reviewer stated “Most people do bring their cloth hats to work and there are only rare instances of leaving hats at another site or the laundry not getting the hats back to staff quick enough” and another reviewer claimed “There are staff who forget to take their hats home to clean and so do not wear them the next time which is fair as there are the paper alternatives. There are also staff who agree to wear the cloth hats but when they start to wear them they become paranoid”.

The final reviewer commented “Staff did sometimes forget them but the disposable hats were still available and people would just put their name and role on the disposable hats instead. It was more likely that staff would lose their hats whilst on shift, putting the hats down and forgetting to pick them up. However, staff knew that it was a limited resource so once the hat was gone, they needed to purchase another one themselves. This message was clearly relayed to everyone to encourage the staff to look after their hats”.

Expert review of hospital theatre cloth caps

4.10 Lifespan expectations of cloth hats

Some reviewers had only just implemented the use of cloth caps at their hospital and so it was too early to say if the lifespan of the hats met their expectation. However, the manufacturer told the reviewer that the lifespan of the cloth hats was 4-5 years depending on how well they are looked after.

For this hospital where cloth hats had been in use for a couple of years, the reviewer stated “they have lasted well so far with none replaced unless the staff have lost their hats and then they are expected to fund the replacement themselves”.

One reviewer still had their matron hats which have lasted for 3 years and are still absolutely fine. Another reviewer declared that “The cloth hats are very well made. They wash well and there are no problems with stitching. The initial ones were quite heavy duty and made from a thick cotton but the other hats are thinner and so probably more comfortable to wear and I imagine they will last long”.

The final reviewer was told by her supplier that the hats would last for 2-3 years and the reviewer has used her hat very frequently with no deterioration. The reviewer commented that there were options to have the name and role either printed or embroidered with the latter having a longer lifespan but both have a lifespan of at least 2 years which they believed was worth the cost considering the amount of use that they would probably get out of them.

4.11 Discomfort wearing cloth hats may cause overtime

A reviewer reflected that with a hat, facemasks, goggles and respirators, it is all uncomfortable and so the cloth hats are nothing compared with all they are having to wear presently. The reviewer did comment that when they first got them the cloth hats were a bit warmer than the disposables because they are more enclosed but they soon got used to them.

Another reviewer shared that she has a few piercings at the top of their ear and so others with similar piercings may need to wear a bigger cloth hat for comfort. Other people have said because the hats are a bit

Expert review of hospital theatre cloth caps

thicker, they cannot hear as well at times and so lift the hats away from their ears to hear better in the operating theatre which has a lot of background noise.

The other reviewers also made similar comments saying “some staff say their heads get a bit too hot and it muffles their hearing” and “the hats are normally hot so we went for very lightweight fabric as they are much more wearable in all weathers”.

One reviewer confirmed that the cloth hats were very light and comfortable. In addition, buttons are now stitched on so that the loops of face masks can be put over the buttons thereby not hurting the ears.

The final reviewer had an elasticated cloth hat that overtime started to cut into their ears depending on how long they were worn. They stated “This is not so much an issue in maternity normally the theatres are used for a caesarean or perhaps a perineal repair and neither of these take hours. This would be more of a consideration for those on the main side of the hospital that could be in theatre for 5-7h plus as it could get a little sore around the ears”. However, they did confirm that there are now different options and the supplier has tie back cloth hats which would mitigate this issue.

4.12 Hospital’s carbon footprint

A couple of the reviewers were unsure or had no idea if their hospital’s carbon footprint had been affected by the introduction of cloth caps as either the hats had not been in use long enough or the reviewers did not know if this research had been carried out.

One reviewer acknowledged that they did not use the paper hats anymore apart from for visitors or reps or new doctors so imagined the carbon footprint will have improved.

Another reviewer confirmed that the hospital’s carbon footprint had not been calculated but they were using a machine wash that was already happening through their Medical Equipment Library. They stated “Imported single use hats are made from wood fibres probably from areas of the world not ideal for deforesting. Plus, the environmental side and the process of making viscose is unpleasant with lots of

Expert review of hospital theatre cloth caps

pollutants in the area that it is made. Taken together, these factors may not impact the hospital's carbon footprint but using cloth hats will have a potential reduction in deforestation”.

This reviewer was passionate about recycling and sustainability and conscious of the environmental hazards that the NHS is doing. Initially they looked at websites and costing for each full time theatre staff member who needed at least 4 hats taking into consideration some would be in the laundry, some being worn at work and others on standby.

The final reviewer did not know if their use of cloth hats would affect their hospital's carbon footprint as the hats were only used for the 200 people in their department. However, the reviewer believes “if there was a wholesale change to cloth hats it would ultimately affect the hospital's carbon footprint as the number of disposable hats that would not be used must help the environment significantly”.

4.13 The difference name and role cloth hats make to team work and interaction

All reviewers strongly agreed that having their names and roles on their cloth caps had a positive influence on team work and interaction within the team. For some, as well as the name and role, their hats are also colour coded in the theatre e.g. the Team Leader (senior) has a yellow hat and so everyone is easily identifiable by name, role and colour thereby making it easy to see who is there. One reviewer stated “In addition, there is a feeling of pride when students, e.g. nurse apprentices and ODP students, qualify and get a different colour hat. This is like a rite of passage which is nice for morale”.

Another reviewer agreed 100% that the name and role hats had made a difference in how their teams work and interact. They commented “Even at team briefs where everyone is introduced, the name and role on the hats can also be clearly seen and so the team won't forget who everyone is and what they do”. The reviewer imagines that in an emergency situation, everyone will be able to quickly see who the ODP or nurse or an auxiliary who can quickly grab something. “It is especially good for surgeons to know who you are and what you do”. The reviewer has also noticed that people constantly look up at the hats to check which is good.

Expert review of hospital theatre cloth caps

A different reviewer acknowledged “There is better communication in the theatre area and lot of anaesthetists have taken it on-board and said it is amazing how many surgeons now know their name. There is also more personal thanks when things are being done. It also increases team morale”.

An additional reviewer specified that the size of the font and the title being used had to be taken into consideration especially as some of the titles are so long. This hospital decided to have first name only followed by the title. A survey was performed before introducing cloth hats and what they found from the staff’s point of view was that 85% of the staff wanted people to know that they were either a nurse or ODP.

This hospital has the name, chosen by the wearer, and the role as well as having hats that are colour coded according to their role which includes anaesthetist, scrub nurse, theatre manager, matron etc. The reviewer indicated “Sometimes the staff work in recovery or as a scrub nurse or as both so, from the patient safety point of view, colour coding was done as well as the name and job title”. A follow up survey by the reviewer will be performed to see the effects on team work and interactions.

This reviewer stated “The name and role on the cloth hats will definitely make a difference as to how the team works and interacts. After team briefings at the beginning of the day, the surgeons cannot possibly remember the names of the entire team. So not only will it make a difference to that surgeon and everyone in that team but, from the patient point of view, they are fantastic as no one wants to look at the chest area to find out someone’s name. With cloth hats, the name and role can be clearly seen and the patients love this”.

Another reviewer confirmed “There is better team engagement as there is a barrier that is lost when calling out that person’s name as you can see who that person is. The cloth hats also give a unified camaraderie in a professional way e.g. in an emergency situation people respond better when their name is used”.

The final reviewer agreed the name and role on the cloth hats definitely has positive influence “as soon as somebody knows your name, even without the role, the way they interact with you changes straight away. The addition of the role on the hats makes everything more seamless because in an emergency situation in theatre, the priority is to keep the mother and baby safe at that time and everyone is very

Expert review of hospital theatre cloth caps

working quickly in a high pressure environment". The reviewer stated that sometimes people can be calling out for equipment or other specific things and a request is not directed to the right person because staff are unaware of who they are. "Unless you are in a regular theatre team, the chances are that every time you go to theatre you could be with somebody different. It makes a huge difference for somebody to know who you are e.g. as the midwife, I would be able to listen to the baby's heartbeat but would find it more difficult to pass a piece of anaesthetic equipment if asked so it makes a huge difference to how people communicate in theatre. Also if someone knows your name and they need you for something, they can get your attention immediately, especially in a theatre which normally has a lot of noise".

4.14 Other Trusts using cloth hats

Quite a few of the reviewer were aware that there were other Trusts using cloth caps but did not know who or where specifically they were. One reviewer stated they had seen other Trusts using cloth hats on the Facebook movement Theatre Hat Challenge which they knew encourages the use of cloth hats. The reviewer stated cloth hats are big in other countries e.g. Australia.

Others did not know of any other Trusts but did know surgeons and anaesthetists who were visiting from another city in the region or were on rotation that have their own. However, they do not know of any other hospitals in their area that have done such a big scale cloth hat order that encompasses all the departments and specialities.

This reviewer had a long list of other Trusts who were also using cloth hats when they were doing their initial research and so was aware of other hospitals using them. This also applied to another reviewer who had heard of other Trusts using cloth hats due to contacts when the supplier changed. This reviewer had also seen other cloth hat users through Twitter and the Patient Safety Network although they did not know if other Trusts were changed wholesale or just led by a particular theatre and so this hospital is pioneering to have changed to cloth hats everywhere within their Trust.

Expert review of hospital theatre cloth caps

The final reviewer was unaware of any other Trusts using cloth hats but they are on a North-west sustainability group and one of the other members had mentioned they are using reusable cloth hats. The reviewer also asserted that cloth hats have taken off in New Zealand and Australia.

4.15 Downsides to using cloth hats

The majority of the reviewers stated that they were not aware of any downsides to using cloth caps and even went on to add that they could not see why anyone would not want to wear a cloth hat!

One reviewer commented that there had not been any negative feedback. There were the logistics to consider at their hospital of setting up the collections and when the Medical Equipment Library closed. In addition, they did state that a high turnover of staff with named cloth hats is a disadvantage although the staff can take them with them but other than putting them in a recycled bank, they may potentially end up with unused ones.

Other reviewers agreed that there were no downsides other than having to take them home to wash, the initial cost and the cost when there are new starters but this, they said, would be outlaid by the cost of the disposable hats and the carbon footprint.

Some downsides mentioned were that in long and tiring shifts which are close together, some staff may forget or be too tired to launder their hats if they only have one but because there is always the option of wearing a disposable hat this is not a real issue.

Another issue alluded to was that bigger hats are needed if they decided to grow their hair.

The biggest consequence to wearing cloth hats was that they are too warm and muffle hearing. Reviewers stated some people think they are warm and a little hard when brand new. However, the reviewer verified that they soften with washing. In addition, because the cloth hats are thicker than the paper ones, hearing can be affected when the ears are fully covered but this is because of all the other equipment around.

Expert review of hospital theatre cloth caps

Lastly, one reviewer commented that they had heard of rumours of a bit of hierarchy with who has what written on the hats with surgeons and anaesthetists.

4.16 Do your staff like wearing cloth hats?

Everyone agreed that their staff liked wearing cloth hats. One reviewer suggested this was because their staff were able to pick their own colours, 2 to start off with, then if they wanted more, they could purchase them themselves. “They were excited to receive their first set with bags and they have been well received across the board. It has brightened up the place”.

Another reviewer commented “anaesthetists are really keen on them and through the COVID-19 pandemic staff have appreciated wearing them a lot more”.

Yet another stated “Definitely, as the more people who have seen the matrons wearing their cloth hats, the more they ask when theirs is arriving. Since the COVID-19 pandemic started the requests have quietened down but in early 2020 everyone wanted one and was asking when they could order theirs. The majority of the staff definitely want cloth hats”.

A final reviewer corroborated “Some people have gone on to purchase their own additional hats and the majority of people have felt a benefit to wearing them and continue to wear them”.

4.17 Advantages to hijab-style and big-hair style cloth theatre hats with name and role

One reviewer said this was not an issue at their hospital. However another commented that their staff are allowed to wear their own hijabs if they can demonstrate that they have brought a clean one to change into in theatre. They thought a hijab-style theatre cloth hat may be a good idea and said there are also mock type Rastafarian style hats for people with big hair.

Expert review of hospital theatre cloth caps

Another reviewer commented that one member of their staff did wear a head scarf and, because the manufacturer did not have a hijab-style cloth hat, she had to wear a bandana-style tie to wear over the top of her scarf which would have been very warm. “As hijab-style cloth hats were not an option, we had to ask a local man to embroider the name and role on her scarf. Anyone else with big hair has been wearing extra-large hats. Therefore it would be good to offer hijab-style and big-hair style cloth theatre hats with name and role although not many would be needed but it would definitely cater for those who do”.

A different reviewer stated “A single use hijab was requested by the supplier so that a cloth one could be developed but it was not possible to get hold of one during the pandemic. Having the toggle and the elasticated back does help with the bigger style hair. The hijab-style cloth hat would definitely be useful”.

This hospital has a lot of staff who have large hair or wear a hijab. They have tried one disposal hat that is for larger hair that the staff like and there is also a disposable hijab but the reviewer said “it looks ridiculous as it stands up on top of the head!” The reviewer took the disposable hijab to 6 people and they said that it was completely unwearable. However, WarwickMed have given this reviewer a cloth hijab which they have trialled and the staff love it. This supplier is making it 5cm longer and the reviewer is hopeful they will be able to have them with names on as well as they need to be diverse and cover diversity.

A further reviewer knew of one trainee surgeon who wears a hijab but at the moment this hospital provides disposable hijabs for use in the theatre that are available in the changing rooms.

The final reviewer thinks that hijab-style and big-hair style cloth theatre hats with name and role are absolutely necessary. This reviewer recognised that early on and specifically asked for larger hats to be made. “We have quite a few black colleagues with big afro hair and so definitely needed a much larger hat. The manufacturer made a couple of prototypes and some of the staff tried them on. They decided the elasticated ones would be better for holding everything in place as opposed to a tie one”. They managed to get these sorted quickly so there was no delay and they got their hats the same time as everyone else. “There was a long turn around between ordering and actually getting the delivery of the cloth hats. The supplier also made some prototype hijab style cloth hats but these took much longer to arrive which was more difficult to get right as they had to ensure it stayed secure for the woman’s dignity as some of the options tended to come loose”. The last prototype was agreed on and was being trialled.

Expert review of hospital theatre cloth caps

5. Literature review: comparison of infection rates when using cloth or disposable hats

In America, several research reports mention that a change to disposable bouffant hats resulted in an increased Surgical Site Infections (SSI) compared to the previous theatre hats that were cloth hats or disposable skull caps.¹ During mock operations, the bouffant hats and the disposable surgical skullcaps had similar airborne particle counts. However, cloth skullcaps do not exhibit a porous crown compared with the disposable counterparts, and they outperformed bouffant hats, showing lower particle counts and significantly lower microbial shedding at the sterile field compared to bouffant hats.² It has also been reported that there is no relationship between the type of surgical hat worn and the infection rates in terms of incidence of postoperative wound events. The cloth cap exhibits slightly lower infection rate than the disposable ones. The SSI rate and surgical site occurrence requiring procedural intervention (SSOPI) rate are calculated below based on the data provided in the paper³:

Disposable surgical skull cap: SSI rate = $137/(137+3296) = 3.99\%$

Cloth surgical skull cap: SSI rate = $24/(24+591) = 3.99\% = 3.90\%$

Disposable surgical skull cap: SSOPI rate = $200/(200+3233) = 5.83\%$

Cloth surgical skull cap: SSOPI rate = $31/(31+584) = 3.99\% = 5.04\%$

There was also a statistically slightly lower rate of SSI, when primarily disposable skull caps were used and cloth caps were also permitted.⁴ Disposable bouffants yielded greater permeability, greater particulate contamination, and greater passive microbial shed, compared with cloth skull caps.^{5,6}

The transmission of pathogen is mainly attributed to the lack of hand hygiene, based on the findings among 81 articles, including 12 randomised controlled trial, 21 literature reviews, 13 descriptive studies, 6 experimental studies, 9 life-cycle studies, 6 cohort studies, 2 meta-analysis, 4 case reports and 8 other studies. Disposable medical devices and clothing in the operating theatre do not demonstrate a reduction of SSI, but have a greater impact on the environment, finance and social contact compared with the reusable ones.⁷

Expert review of hospital theatre cloth caps

The key point affecting the infection rate is the liquid barrier property of the material. Regarding protective clothing, the basic unit is the fibre which prevents transmission of particles with its high surface area and relatively shorter length. However, less absorbent or hygroscopic fibres wick liquid along the fibre surface, enhancing the capillary movement of liquid containing pathogens. Thus, less absorbent synthetic fibres (such as polypropylene and polyester), which neither absorb liquid nor admit bacteria to be trapped inside their structure, provide better liquid barrier properties than those of natural origin (such as cotton, wool, silk, etc.) and are commonly used for protective clothing. Moreover, the capillary absorption of fibrous assembly is governed by the following factors: the characteristics of the fluid (surface tension, viscosity, and density); fibre surface energy and surface morphology; fluid's interaction with the fibre surface (interfacial tension and contact angle); and pore characteristics (size, volume, geometry, and orientation). In addition, the level of twist in textile yarns can also influence the barrier properties of fabrics.

Several studies⁸⁻¹¹ have evaluated and compared the performance of both cloth and disposable medical gowns and, in most cases, the impermeable materials are effective in reducing transfer of pathogens. Furthermore, disposable surgical gowns made of spun-bond-melt-blown-spun-bond (SMS) polypropylene laminate offer higher fluid resistance than the gowns made of a polyester-cellulosic blend. There are also several studies^{8,11,12} which have highlighted that the laundering process causes fabrics to break down, leading to reduction of its penetration resistant to pathogens through its surface. Nevertheless, gowns with reinforced layers display better durability to laundering.

6. References

- 1 Farach, S. M. *et al.* Have recent modifications of operating room attire policies decreased surgical site infections? An American College of Surgeons NSQIP review of 6,517 patients. *Journal of the American College of Surgeons* **226**, 804-813 (2018).
- 2 Cloth Caps More Effective Than Disposable Caps at Preventing Contamination in the OR.
- 3 Haskins, I. *et al.* Is there an association between surgeon hat type and 30-day wound events following ventral hernia repair? *Hernia* **21**, 495-503 (2017).

Expert review of hospital theatre cloth caps

- 4 Shallwani, H. *et al.* Mandatory change from surgical skull caps to bouffant caps among operating room personnel does not reduce surgical site infections in class I surgical cases: a single-center experience with more than 15 000 patients. *Neurosurgery* **82**, 548-554 (2018).
- 5 Markel, T. A. *et al.* Use of environmental air quality indicators to assess the types of surgical headgear typically used in a dynamic operating room environment. *Journal of the American College of Surgeons* **225**, e29-e30 (2017).
- 6 Markel, T. A. *et al.* Hats off: a study of different operating room headgear assessed by environmental quality indicators. *Journal of the American College of Surgeons* **225**, 573-581 (2017).
- 7 Reynier, T., Berahou, M., Albaladejo, P. & Beloeil, H. Moving towards green anaesthesia: are patients' safety and environmentally friendly practices compatible? A focus on single-use devices. *Anaesthesia Critical Care & Pain Medicine*, 100907 (2021).
- 8 Rutala, W. A. & Weber, D. J. A review of single-use and reusable gowns and drapes in health care. *Infection Control and Hospital Epidemiology* **22**, 248-257 (2001).
- 9 Vozzola, E., Overcash, M. & Griffing, E. An environmental analysis of reusable and disposable surgical gowns. *AORN journal* **111**, 315-325 (2020).
- 10 Overcash, M. A comparison of reusable and disposable perioperative textiles: sustainability state-of-the-art 2012. *Anesthesia & analgesia* **114**, 1055-1066 (2012).
- 11 Leonas, K. K. Effect of laundering on the barrier properties of reusable surgical gown fabrics. *American journal of infection control* **26**, 495-501 (1998).
- 12 Scott, R. A. *Textiles for protection*. (Elsevier, 2005).