

Nurses' and preschool teachers' experiences of taking part in a participatory intervention project in communication-intense working environments

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Abstract.

BACKGROUND: Noise is a common workplace problem that can affect health and performance. High sound levels have been found in sectors that largely has been overlooked in noise research such as health care and education. In these communication-intense environments the work requires speech communication, thus making it difficult to wear hearing protection.

OBJECTIVE: To explore nurses' and preschool teachers' experiences of taking part in a participatory intervention project aiming to improve the sound environment and the psychosocial work environment.

METHODS: One preschool and one obstetrics ward took part in the study, and a qualitative design was used to evaluate the experience of the participatory intervention approach.

RESULTS: Five main themes were found in the analysis: Awareness; Taking control of the sound environment; Influence of the building and interior design; Circumstances influencing the intervention process; and Motivation to maintain change.

CONCLUSIONS: Despite demanding working situations and lack of financial resources, preschool and obstetrics staff described being creative in planning and implementing several different solutions to improve the sound environment at their workplaces, while interventions specifically improving the psychosocial work environment were fewer. Hence, our study suggest that a participatory intervention approach may facilitate participation and motivation, but resources and support are needed for a comprehensive and effective implementation.

Keywords: Occupational noise, sound environment, participatory interventions, communication-intense working environment, qualitative analysis

1. Introduction

Noise is a common workplace problem that can negatively affect health, well-being and performance

[1–4]. While a large number of studies have been directed to the investigation of noise-induced hearing loss in industrial settings [5–8], there is a lack of research on the effects of occupational noise exposure in workplaces that are traditionally female dominated [9]. This is also acknowledged by the European Agency for Safety and Health at Work [2]

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highlighting that certain sectors such as the health and education sector are largely overlooked in relation to noise research. Previous research has found that preschool personnel are exposed to moderately high sound levels, around 80 dBA Leq (A-weighted equivalent levels) [10, 11], and that they have an increased risk of self-reported hearing-related symptoms, such as hyperacusis and sound-induced auditory fatigue, compared to women in the general population [12]. In addition, it has been found that obstetrics personnel are at risk of noise-induced hearing-related symptoms, such as tinnitus [9]. The study also found that noise exposure levels in the obstetrics ward exceeded the Swedish Work Authority regulations aimed at preventing hearing damage. In these communication-intensive environments, a good ability to hear and communicate with others such as children or patients is required for optimal care. As the work requires speech communication, wearing hearing protection in such settings may be perceived as more difficult, obstructive and ethically challenging compared to industrial environments.

A previous study introduced different interventions that aimed to decrease noise at preschools in Sweden [13]. The interventions were classified into physical or acoustical interventions including new tables, noise-absorbing wall panels and less noisy new toys, and organizational interventions including noise and risk education, voice education and recovery rooms as well as reduction in the number of children at the department. While neither the acoustical nor the organisational interventions had a statistically significant impact on the subjectively rated sound level, for example, the disturbance reported from children's voices was reduced slightly by less number of children in the group.

Another study aimed to reduce noise levels for patients and staff at a hospital [14]. A number of different interventions were introduced, including education for staff, work reorganisation and earplugs for patients. The interventions were evaluated by measurement of noise levels and self-reported patient satisfaction, with both measures displaying improvement after six months. The authors concluded that the noise-reduction strategies resulted in a more quiet work environment, benefiting both staff and patients. Yet another intervention study investigated the use of hearing protection devices (HPDs) in childcare workers in an institution for children and adolescents [15]. A little more than half of the participants reported that they were still capable of fulfilling their teaching duties while wearing the HPDs. The general satisfac-

tion with wearing them decreased over time, and the percentage who found it unpleasant to wear hearing protection in the presence of parents had increased at the end of the study. Wearing the HPDs did not reduce subjective noise exposure or burnout risk. However, the authors state that there were signs that stress levels increased during the period of the study and that the HPDs might have alleviated some of this additional stress in the intervention group. A literature review of studies of hospital noise in intensive care units aiming to understand sources, effects and best practices to reduce noise levels concluded that many interventions, including educational noise reduction programmes, behavioural modification and environmental alterations did not appear to be adequate to minimise noise levels [16]. Another important finding was that as the number of patients and staff increased, the noise levels also appeared to increase. Similar findings were also reported in a later review [17]. Comparable results have also been reported from preschool, where noise levels decreased when the number of children in the department was decreased [13]. We have not found any previous studies on interventions relating to sound environment in the obstetrics care.

Interventions aiming to reduce noise at the workplace can be described as occupational health interventions. There has been much interest in how to improve the implementation and evaluation of organisational-level occupational health interventions, and many researchers conclude that to improve success, interventions should involve the employees [18–21]. Nielsen et al. [22] found that employees' perceived influence on the intervention activities was associated with their voluntary participation in the intervention activities. It was therefore recommended that the employees should have influence over the content of the interventions. The participatory approach means that employees take an active part in the analysis of the workplace problem and the process of finding solutions, and it has the potential to increase the employees' job control, commitment, involvement and create interventions that are designed to fit with the specific needs of the workplace [23]. Participatory methods at the workplace can be described as employees planning and controlling work activities and having sufficient knowledge and power to influence processes and outcomes in order to reach defined goals [24]. Another relevant factor for success is management support, without which occupational health interventions may become "sidelined" because management do not con-

sider the intervention as important for the workplace [18].

The aim of the present study was to explore the staffs' experiences of taking part in a participatory intervention project aiming to improve the acoustic and psychosocial work environment at a preschool and an obstetric ward.

2. Methods

2.1. Procedure

A qualitative design was used, as this was a suitable method to explore the staffs' experiences of taking part in a participatory intervention project aiming to improve the acoustic and psychosocial work environment. Semi-structured interviews were used to collect the data, as this approach allows for flexibility during the interviews. The interview schedule contained open questions about the experiences of the interventions, the sound environment, and the psychosocial working environment. Examples of questions included the following: "Can you describe the sound environment at the workplace?" "What changes have been made during the intervention project?" "How have the changes been made?" "What have been obstacles and drivers for change?" Four focus group interviews were conducted. Two of the interviews were done at the participants' workplaces by one of the authors (KG). The other two interviews were done at Gothenburg University; one was conducted by two of the authors (KG and KPW), and the other interview by two of the other authors (SF and MS). The interviews were tape-recorded and transcribed verbatim. The quotes used to support the analysis were translated from Swedish to English by a professional translator. This study has been approved by the Regional Ethical Review Board, Gothenburg, Sweden (Dnr 659-18). Informed consent was ensured with a written form signed by the participants.

2.2. Participants

Staff at one preschool and one obstetrics ward took part in the study. The preschool, with 23-24 part time and full-time employees, was located in a small city in Sweden. About 75% had a university preschool teacher's degree, while the rest were employed as child caretakers. The working hours

were between 06:00 – 18:15, with different shifts during these hours. Most shifts were between 4 to 10 ½ hours, with around 8 hours being most common. Longer shifts usually included workplace meetings in the later part of the afternoon. The main work task was to take care of the children, which involved early childhood education and caretaking, organising and supervising playtime indoors and outdoors, assisting in dressing and undressing after playing outdoors, sitting with the children at meals, helping the children to nap. Work tasks also included planning for the education of the children, workplace meetings and communicating with the parents. The preschool had six different departments that were divided according to the children's ages, and the staff worked in teams of three to four individuals. The obstetrics ward was located at a hospital in a large city in Sweden and had approximately 100 full- or part-time employees, and additional approximately 40–50 hourly substitutes (often age-retired midwives). About three quarters of the staff were midwives and the rest mostly auxiliary nurses. The staff worked either day, evening or night shifts. The day shift started around 06:30 and was most often 8–9 hours, while the evening shift started around 14:30 and was most often around 7–8 hours. The night shift started around 21:00 and was usually 9–10 hours. The main work task was to assist when mothers gave birth to children and responsibilities related to that task, such as assessing the stage in childbirth, helping during the delivery, contacting medical doctors if needed (in Sweden midwives are responsible for childbirth and medical doctors are only consulted if there are complications), document in the medical records, cleaning the rooms and the equipment (usually the auxiliary nurses) and communicating with visiting partners. Each shift started with a staff meeting to hand over information to the next shift about the mothers currently in the ward. There were also additional workplace meetings on a regular basis, which the staff working at the time attended.

The workplaces were taking part in an intervention project, conducted by the same research group as this study, aiming to improve the acoustic and psychosocial work environment [25]. The workplaces were recruited to the intervention on the basis of having problems with the sound environment and being communication-intensive workplaces. As part of the intervention project, some of the staff had been interviewed before the interventions were introduced (authors, 2021, manuscript in preparation), which was about two years prior to the interviews conducted

Table 1
Participants

Participant	Workplace	Focus-group
1 Female, midwife	Obstetrics ward	1
2 Female, midwife,	Obstetrics ward	1
3 Female, midwife	Obstetrics ward	1 and 2
4 Female, midwife *	Obstetrics ward	2
5 Female preschool teacher	Preschool	3 and 4
6 Female preschool teacher	Preschool	3 and 4
7 Female manager *	Preschool	3
8 Female preschool teacher	Preschool	4
9 Female preschool teacher	Preschool	4

*Did not participate in interview prior to intervention.

in the current study. Participants in the current study were selected based on the criteria of having taken part in the first interview study (prior to the intervention) and having worked at the selected workplaces during the time of the interventions. Two participants in the current study had not taken part in the interviews prior to the intervention; however, they were invited to replace two individuals who had been interviewed but were not able to attend again. In total, nine participants took part in this study, and the mean age was 52, with a range of 44–66 years, see Table 1 for further information. Only females took part in the interviews. Only one male was employed at the preschool and none at the obstetrics wards.

2.3. Data analysis

The interviews were analysed by inductive thematic analysis [26], a method for identifying, analysing and describing themes within qualitative data. This method was suitable, as it is a theoretically flexible approach that can provide a rich, detailed and complex account of the data. It was assumed that the investigation of the experiences of taking part in an intervention study could result in different themes rather than being explained by one single phenomenon or theory. Inductive thematic analysis, an approach that can present several themes grounded in the data, was therefore found to be more suitable than other qualitative approaches such as grounded theory. It was used as a realist method reporting exper-

iences of the participants. The analysis was mainly conducted by one of the authors (KG), who works as a psychologist and researcher and had met the participants a few times during the project. The author being part of the project from the beginning might have influenced the analysis. Thus, it was important to strengthen the inter-rater reliability (described below) and to be open to and explore negative experiences of taking part in the project. The analysis was done in accordance with Braun and Clarke [26], and the first step was to become familiar with the data by reading and re-reading each transcript and noting down initial ideas and codes. From the coding, abstract sub-themes were developed, and these were then refined and organised into main themes. After this, the initial list of main themes was reviewed, and the specifics of each theme were refined until a final list of themes with clear names and definitions of each theme was produced. To strengthen inter-rater reliability, two of the authors (SF and SW) also read the interviews and checked the generation of themes developed by the first author. Consequently, some of the themes were revised until a final list of themes was agreed upon. An example of the analytic process can be seen in Table 2.

2.4. The interventions

The intervention project used a participatory approach [23] where the participants took an active part in the intervention process. The intervention process started with a meeting in September 2017 with the researchers and representatives from the participating workplaces. Employees, managers and union representatives from the workplaces participated. The representatives were selected by the employees and manager at each workplace, without influence from the authors. At this meeting the aim of the project was explained, and presentations regarding noise, stress and organisational interventions were given. The next step was for the workplaces to start to plan the interventions they wanted to introduce at their workplaces. The authors emphasised that

Table 2
Example of the analytic process

Unit of analysis	Code	Subtheme	Main theme
<i>"If you and I need to talk about something private we can sit somewhere more secluded where we don't disturb everybody else. And I think people have become better at doing this, or I experience that this has been improved."</i>	Thinking of not disturbing colleagues when talking, going to other room not to disturb	Individual responsibility	Taking control of the sound environment

Table 3
Interventions chosen at the workplaces

Workplace	Interventions chosen
Preschool	<p>Physical environment and hearing protection devices: Sound-absorbing materials in play area and in dining hall, sound-absorbing screens, hearing protection device available at workplace, information about hearing protection device from management</p> <p>Organisational and psychosocial: Awareness of sound and noise when purchasing new toys, split times for lunch in smaller groups in the common lunch area, discussions and reminders regarding the sound environment, speaking in moderate conversational volume voice and not shouting across the room, dividing the children into smaller groups, discussion on work tasks and helping each other out, staff workshops focusing on what and how changes could be made to improve the work environment</p>
Obstetric department	<p>Physical environment and hearing protection devices: Renovation – one large meeting room/office was replaced with smaller team rooms, enabling division into smaller teams, new staffroom closer to the ward, a silent work room for documenting, sound absorbents in the silent room and in the meeting room, lower levels on acoustic alarms, soft music in the corridor, ventilation system has been overruled, information regarding hearing protection devices, hearing protection devices accessible in each team room, a “quiet corner” in the staffroom with hearing protection devices and comfy chairs, no acoustic alarms in the staffroom</p> <p>Organisational and psychosocial: Routines during shift change (no loud talk in the corridor), one person being in charge of hearing protection devices and reminders at workplace meetings, speaking in moderate conversational volume voice and not shouting in the corridor, asking the mothers giving birth to scream in the oxygen mask, workshop with all staff focusing on what and how changes could be made to improve the work environment</p>

the interventions could focus on different aspects of the working environment, both the physical and psychosocial environment. Within 3–5 months of the first meeting, interviews were conducted where the participants were encouraged to describe needs, opportunities and ideas for interventions. During this time, pre-intervention measurements were being collected some of which have been reported elsewhere [25] (which will be described in another article presenting the results of the interventions). In May 2018 there was a second meeting with the same representatives from the participating workplaces and researchers as in the first meeting in September 2017. At this second meeting, a list of suggested interventions for each workplace was outlined with support from the researchers. The workplaces were encouraged to present the list of suggested interventions, get input and confirmation from the rest of the workplace and then start introducing the planned interventions. In order to support the intervention process, two of the authors (SF and KG) led workshops with the staff at the different workplaces, with the aim of helping them to focus and make realistic plans for what and when the interventions could be introduced. The workshops were held during regular workplace meetings, in which the staff working that day attended. Thus, the attendees included most of the staff in preschool, but in the obstetrics ward the attendance was limited to one work shift. The manager at the obstetrics ward was responsible for distributing the

information to the rest of the staff, and the attending employees were encouraged to discuss it with their colleagues. The researchers also had two additional meetings with the managers and one union representative at the obstetrics ward to support the workplace in focusing on the interventions, and the researchers gave additional support via email and phone contact with managers and employee representatives at both workplaces during the intervention period. During 2018 and 2019 several different interventions were initiated; see Table 3. The interventions were initiated by the staff and or the managers at the workplaces, and most of the changes were triggered in discussions between staff and management for example, using more sound absorbing materials, making hearing protection devices more available and reminding each other to speak in moderate conversational volume. At the obstetric department the renovation and the routines during shift change were initiated by the management. The chosen interventions were focused more on the sound environment rather than on the psychosocial working environment.

3. Results

Five main themes concerning the staffs' experiences of taking part in a participatory intervention project were found in the thematic analysis; see Table 4. The data from the different workplaces has

Table 4
Main themes and subthemes

Main themes	Subthemes
1. Awareness	1.1 Health risks of noise 1.2 Usefulness of hearing protection devices 1.3 Routines for hearing protection 1.4 Specific demands in communication-intense work environments
2. Taking control of the sound environment	2.1 Individual responsibility 2.2 Shared responsibility
3. Influence of the building and interior design	3.1 Layout of rooms 3.2 Quiet spaces
4. Circumstances influencing the intervention process	4.1 High workload 4.2 Economical limitations 4.3 Engagement by the managers 4.4 Lack of support from experts
5. Motivation to maintain change	5.1 Noise an important work environment issue 5.2 Empowerment and creativity

been analysed as one sample and the themes presented are grounded in data from both workplaces. The workplaces were chosen on the basis of having taken part in the same intervention project and therefore could contribute to the research aim of exploring the staffs' experiences of the intervention process as a whole. The aim has not been to compare or contrast the different workplaces, nor to compare the specific interventions implemented, but rather to find common experiences of having taken part in a project that uses a participatory intervention approach.

3.1. Awareness (main theme 1)

3.1.1. Health risks of noise (subtheme 1.1)

The participants described increased awareness of the health risks of noise. At both workplaces, there was an increased focus on the sound environment and a commitment to protect the hearing of the staff.

[T]he awareness has been raised because of this project, and we have talked a lot about noise and protecting our hearing. (Preschool)

Discussions relating to the interventions and the measurement of sound levels (that was a part of the evaluation of the interventions) had increased the focus on noise. When taking decisions on alterations or when ordering new toys and materials, the noise aspect of the product was now one parameter that was considered.

Of course, it is better than it was before . . . before we did these changes, according to me. And there is an increased sound awareness compared to previously. (Obstetrics ward)

No, but I think that generally everybody has become aware of this because . . . of this project, and we talk about it in a completely different manner, and we order toys and materials in a completely different way. (Preschool)

At the obstetrics ward, there were discussions about formulating and providing written guidelines to new personnel that would include information about hearing protection devices. For some it could be seen as embarrassing or strange to wear hearing protection devices at work, and the participants thought it was important to help new colleagues to become aware of risks of noise so they could prevent future hearing damage.

[W]e use HPDs here, and there is nothing strange about that. It is not because you are extremely difficult, but actually, we are using it to protect our hearing. (Obstetrics ward)

3.1.2. Usefulness of hearing protection devices (HPDs) (subtheme 1.2)

There was an increased acceptance and usage of hearing protection devices (HPDs), both at the preschool and the obstetrics ward, and the participants reported that they had noticed an increasing number of colleagues wearing them.

You see more and more people with HPDs today and it is good, that they consider their hearing. (Preschool)

Some staff were wearing the HPDs all the time, whereas others were wearing them during specific situations at work where the noise levels could become disturbing and/or loud, such as before the children go to sleep, during lunch hour at the preschool and during labour at the obstetrics ward.

We have some that never enter a delivery room without them [HPDs], that have them hanging around their neck all the time. We discuss this issue more often I think. (Obstetrics ward)

I see it mostly in the dining hall, and now when we are outside. We have some small children that are sleeping outside, and then we have seen, we can stand and watch them [the staff] standing there rocking them and wearing HPDs. (Preschool)

The staff reminded each other to use HPDs. This was a display of collegial support that could help to protect the hearing and also help to normalize the use of HPDs.

And we remind each other to wear HPDs, and I had a childbirth the other night and a woman was screaming like crazy, and then the door opened gently and then a pair of HPDs appeared. (Obstetrics ward)

3.1.3. Routines for hearing protection (subtheme 1.3)

The participants highlighted that it was important to have clear structures and routines regarding ordering and providing HPDs, and that this responsibility had to be assigned to one or several employees by the managers. It was emphasised that ordering and making sure that HPDs were available was an ongoing responsibility. If they were to run out of HPDs and there was a delay in ordering new ones, there would be a big risk that the usage would rapidly decline and staff would forget to use them. It was highlighted that it was important that the HPDs were easily accessible when needed, as it sometimes could be difficult to know exactly when that might be.

That is one thing that we can influence, that HPDs are easily accessible. Because of course if I am stuck in a room, then I need... then I may need them straight away and I cannot leave... It was decided that they would be available in the team rooms, but I think that there is one of our assistant nurses who thinks that, "This is crap, they should not be sitting here," and then they are thrown out, and I think that this is a question for the management, that this is what has been decided. (Obstetrics ward)

As highlighted previously in the text (subtheme 1.1), the obstetrics ward were planning to include information about the benefits of using HPDs to protect hearing, as a part of the introduction to new members of staff, and they wanted this information to be a natural part of the "introduction package".

3.1.4. Specific demands in communication-intense work environments (subtheme 1.4)

Listening and being able to communicate with children, colleagues and patients was an important part of the job. The workplace can hence be seen as a communication-intense work environment, and participants expressed that it meant that it was sometimes difficult to wear HPDs. In both the preschool and the obstetrics ward some of the staff expressed that it felt morally questionable to wear HPDs in front of children, parents and patients.

I think that many feel that, no, it feels wrong to wear HPDs. (Obstetrics ward)

At the preschool, one issue that was discussed was that it could feel strange to use HPDs in front of parents, since the children also were exposed to the same sound environment without any protection. However, the use of HPDs had not been questioned by parents at the preschool.

But if someone were to question it [wearing HPDs], then it is not difficult to explain why; we have evidence. (Preschool)

At the obstetrics ward, there was a culture of wanting to keep the environment as natural and non-medical as possible, to fully focus on the patient and disregard one's own well-being. This may have contributed to the feeling of it being wrong to use HPDs (this could sometimes be an explanation for why it was difficult to use HPDs).

Yes, we completely ignore ourselves. Absolutely. It is all about the patient. (Obstetrics ward)

It was very important to have ongoing discussions regarding HPDs, where staff could raise different questions and concerns. It was also an opportunity to share different options regarding the use, and to support each other.

Yes, managers... all of us, I think, in the working group have supported each other in this, and then when we discuss it you say, "No, I will not consider it," and someone else replies, "I use it." When it comes to HPDs, we have ongoing discussions. (Obstetrics ward)

3.2. Taking control of the sound environment (main theme 2)

3.2.1. Individual responsibility (subtheme 2.1)

As well as in increased awareness of the shared sound environment, the participants described an increased responsibility to reduce disturbing noise. This could manifest itself in lowering the voice when talking to colleagues, closing doors in order to shut out the noise and moving to a more secluded area or room when having conversations, to avoid disturbing others.

Because we have spoken to you... I think that everyone is well aware of it, and we often talk about it, that you should lower your voice and... and how we should think in order to avoid too much noise and that. (Preschool)

We consider going to another room. If you and I need to talk about something private, we can sit

somewhere else where we don't disturb everyone else. And I think that people have become better at doing that, or it is my experience that this has improved. (Obstetrics ward)

3.2.2. Shared responsibility (subtheme 2.2)

The sound environment at the workplace was viewed as a shared responsibility among staff and it was expressed that it was socially accepted to remind colleagues to lower their voices and to ask them to move to a secluded area or room to talk. This theme also links back to the first main theme, Awareness, which described the development of a work culture that prioritises a good sound environment.

We tell each other to hush up a little more often, that is my experience. (Obstetrics ward)

3.3. Influence of the building and interior design (main theme 3)

3.3.1. Layout of rooms (subtheme 3.1)

The layout of the rooms played an important role in the experience of the sound environment. The preschool was newly built, and according to the participants, the preschool staff were very dissatisfied with the new building in terms of sound environment. In the new building, the lunchroom was one very large room with a high ceiling, and there were no walls separating it from the play areas on the second floor. This layout meant that the lunch situation was experienced as very noisy, despite the fact that absorbents and textiles had been installed to reduce the sound transmission between the two areas.

Well, the building is working against us, so to speak. (Preschool)

The dining hall is the big problem. And yet, we have put up textiles, and some extra absorbents have been added, but it doesn't help. (Preschool)

Another problem was the fact that each department in the preschool had only one large room and one small room where the children could play. This meant that it was difficult to prevent a noisy sound environment, as there were many children in the same space. There was nowhere to take children who were upset and screaming, and some children became very easily distracted by the noise.

There are problems with one large room. There is nowhere to take children who are upset. Now, there is one large room with perhaps fifteen children who could be there at the same time, and then there is one

small room. So, actually, there are many children in the same space. Even if we try to go out and split them into smaller groups. So, it is difficult to keep the noise level down one in room. (Preschool)

At the obstetrics ward, as part of the intervention, there had been a renovation where one large meeting room/office was converted to three smaller team rooms, and an additional secluded, sound-treated administrative room was set up. According to the staff, the renovation was an improvement in terms of the sound environment, because the old meeting room had been a noisy space where many nurses gathered in a small space to chat and eat during breaks, while others were working with medical documentation and administrative tasks.

Previously, we had to sit in this large meeting room/office, regardless of what you were doing. And if you had some time without patients and should do things, then you had to sit in that buzz with people reporting and eating and talking, and you had to sit there and perhaps fill in some statistics. Now, you can go to this quiet room and do this work. (Obstetrics ward)

3.3.2. Quiet spaces (subtheme 3.2)

Quiet spaces at the workplace can be useful for getting auditory rest and recovery during work. At the obstetrics ward, several quiet spaces had been created as a part of the intervention, and the participants described these spaces as useful both for relaxing during breaks and for doing more cognitively demanding work tasks without being disturbed by noise.

I think that this quiet office room that we now have, that it is quite nice. You can go there and get away. We didn't use to have this before. I think it is good. (Obstetrics ward)

A further improvement at the obstetrics ward was a new location of the staffroom that was now more easily accessible compared to the previous staffroom. Moreover, a quiet space had been created within the staffroom, with comfortable chairs, earmuffs and a blanket.

It feels like a peaceful room, and there are two comfy chairs there. And there are hearing protectors, and one can sit there and wrap oneself in a blanket and have a rest. We hardly ever have the time, but we can do it if we want. (Obstetrics ward)

At the preschool, there was a room that could be used as a quiet space, but there was no guarantee the room would be available, as it was used for various meetings. According to the participants, the room was often occupied.

3.4. Circumstances influencing the intervention process (main theme 4)

3.4.1. High workload (subtheme 4.1)

The workload was high before, during and after the intervention, and this was clearly a serious obstacle for the intervention process, both at the obstetrics ward and at the preschool. The participants reported that more staff were needed. It was reported that it had been difficult to spend time and energy on the interventions aiming to improve the sound environment. At the obstetrics ward, the managers had to focus on getting enough staff to cover the shifts, which meant that there was less focus on the sound environment and interventions.

Obstacles are ... firstly, we have had a very difficult and pressing work situation, so we have managers that have to focus on getting in the daily staff to keep this place going, and then it is natural that everything else is moved down in priority. (Obstetrics ward)

Although awareness of the sound environment and noise had increased among the staff, these obstacles made it difficult to prioritise working with improving the sound environment.

The awareness is still there. I think that everyone is well aware of it, and I kind of hear that everyone is trying to work with the noise levels. But, really, it is not sustainable. People are on leave; there are no substitute teachers. As we say, all these open spaces, it is not sustainable no matter how good our intentions are. (Preschool)

3.4.2. Economical limitations (subtheme 4.2)

The lack of economic resources was a further obstacle, and the participants reported that more costly interventions were not realistic. There was a perception that the budget and getting the cheapest possible solutions were prioritized by the organisations.

But we know it is all about money. So, even if we check good or bad, dining hall this and that [referring to the annual staff survey], it is still only about money in the end. (Preschool)

Considering the difficulties with a lack of staff and limited budgets, noise was not prioritised. However, it was recognised that small and low budget changes could make a difference in the experience of the sound environment, like having soft, relaxing music in the corridor.

3.4.3. Engagement by managers (subtheme 4.3)

The managers actively participated in the work of improving the sound environment. They talked about the interventions during staff meetings and provided resources such as HPDs, absorbents and textiles that were part of the interventions. There appeared to be a general perception that the managers had done their best, with limited resources, to make sure that changes were made.

She is very responsive if we bring things up; then it happens. If there are opportunities to actually do something, then she will do it. (Preschool)

The participants expressed that the managers at the obstetrics ward had become more aware of noise than before the intervention and helped to remind the staff to think about the noise levels.

"They [the managers] are more observant, I think; they are aware of sounds. (Obstetrics ward)

3.4.4. Lack of support from experts (subtheme 4.4)

Some of the participants expressed that they had wanted and expected more help from the researchers or other experts in deciding on and implementing interventions. Further contact and support could have helped to improve the motivation to make more changes, and there appeared to be a certain disappointment with the little contact with experts.

[I]f we could have gotten a little hint, that now we have done this, and summarised, and it looks like this. So, you could feel more involved, that it is something ongoing." (Preschool)

If we had an audiologist who came to us and said, now do this and that, perhaps it would have been easier for us, because we are fumbling in the dark. (Preschool)

Both workplaces suggested that it would have been preferable if their Occupational Health Care Departments had taken part in the project.

3.5. Motivation to maintain change (main theme 5)

3.5.1. Noise an important work environment issue (subtheme 5.1)

The participants stated that they believed that noise was an important work environment issue, and that, despite several difficulties and obstacles, they thought it was important to continue working to improve the sound environment. They said that they would

continue to remind each other of the noise levels, which could be one way of maintaining the risk awareness.

I think we will continue to remind each other... like this, with the team room, and that we have absorbents. It is something that we think about, actually. And it does make a difference for the noise. And I am thinking like this with sound in the corridor... some music in the corridor and this; it is something that we can continue with. (Obstetrics ward)

It [the sound environment] is really a question that is engaging." (Preschool)

One participant said that when she had filled in the annual work environment survey, she had added that she wanted to discuss the sound environment with her manager, thus highlighting that it was important that noise was not forgotten when considering the work environment.

It was probably the only thing I added, that it is something during this talk with the manager or principal, it is something else that you would like to discuss. The sound environment. It was the only thing I wrote. (Preschool)

3.5.2. Empowerment and creativity (subtheme 5.2)

Some described a creative atmosphere at work, where it was fine to try out new things to see whether they would work out or not. And there was also a sense of empowerment, where the staff felt that they were able to make further changes in the future.

And this with music in the corridor, it was someone that had that idea. "But do it... They have it on the other ward. Should we not have it here as well to see if it can have any effect?" And it happens... some things. And there are no bans for things. We can try quite a lot and see – does this work, does it not work...? (Obstetrics ward)

I think that people feel that it is our responsibility and that we can drive changes if we want. Because it is how it works at this place: If you bring something up that you think is a problem and drive it hard, then there is usually a change. (Obstetrics ward)

4. Discussion

The aim of this study was to explore the staffs' experiences of taking part in a participatory intervention project aiming to improve the acoustic and psychosocial work environment at an obstetric department and a preschool. Five main themes

were found in the analysis: Awareness; Taking control of the sound environment; Influence of the building and interior design; Circumstances influencing the intervention process; and Motivation to maintain change. In the first main theme, Awareness, the participants reported that the interventions had led to an increased awareness of the health risks relating to noise exposure. Previous research has found that obstetrics personnel are exposed to high noise levels and are at risk of noise-induced hearing-related symptoms [9]. Similarly, preschool personnel have an increased risk of self-reported hearing-related symptoms compared to women in general [12]. These previous studies have found that, although a majority report noise exposure, few wear hearing protection devices [9, 12]. In the current study, the participants reported that there was an increased acceptance of using hearing protection at the workplace and improved routines relating to the use of these. A previous intervention study, with childcare workers, found that the satisfaction with wearing hearing protection decreased over time, as did the fraction of those who thought it was reasonable to wear hearing protection [15]. It was concluded that in that particular context, wearing hearing protection was not considered an appropriate occupational measure, as it was difficult for the staff to wear HPDs regularly, and consequently, the implementation could not be effective. One difficulty with wearing HPDs was feeling uncomfortable wearing hearing protection in front of parents, and the authors suggested that qualitative interviews would have been useful in order to better identify the reasons for the lack of compliance. The authors pointed out that childcare workers are exposed to informative noise that has to be heard and understood, which is in contrast to employees in industry. Indeed, the results presented by Koch et al. [15] and the results from the current study highlight the idea that working environments that require a lot of communication with children or patients, face different challenges compared to industrial settings, where different alternatives of reducing the noise can be adopted, such as replacing or confining the noise source and wearing HPDs. Since the Swedish work environment regulations prescribe that efforts to reduce the noise at the source take precedence over wearing protective equipment, it is important to implement other preventive measures as well. These aspects were expressed in the theme Specific demands in communication-intense work environments. Interestingly, taking control of the sound environment emerged as a main theme in

the current study, and the participants reported that they took responsibility for improving their working situation by for example dividing preschool children into smaller groups and reminding each other to keep their voices down. Similarly, a previous intervention study that succeeded in reducing hospital noise reported that the staff had identified and carried out a number of interventions to decrease noise [14]. The authors concluded that it had been essential to involve committed staff in order to achieve successful outcomes of the interventions. The control demand model is the most established model of work stress [27]. Control alone, and being able to exercise influence at work, has been found to have a positive relationship with health, including mental health [28–30], and of importance when implementing occupational health interventions [22]. However, if too much of the responsibility for achieving an acceptable working environment is handed over to the personnel, highly committed staff may try and find various solutions to compensate for a lack of resources, in the long run increasing the risk for ill health [31]. There is a risk for negative health if there is a lack of job resources [32]. In the current study, the process to improve the work environment was hindered by obstacles relating to organisational resources, such as high demands (high workload) and lack of economic resources, and these issues were highlighted in the theme Resources influencing the intervention process. Previous reviews of studies of hospital noise have found that most interventions to reduce noise were not effective and suggested that one reason for this was the increasing number of patients and staff, i.e. increasing demands [16, 17].

Influence of the building and interior design was a further main theme in the current study, and in this theme, the importance of quiet spaces was highlighted. One of the participating workplaces had introduced a quiet space, and this was viewed as very positive and as a way to facilitate recovery at work, whereas staff in the other workplace reported that they really missed having a noise-isolated quiet space where they could relax. In the study by Sjödin et al. [13], one out of many interventions was the introduction of a noise-isolated room for recovery and relaxation for the staff. The study found no statistically significant changes in subjective ratings, but significantly lowered measured stationary sound levels following this intervention.

Within the main theme, Circumstances influencing the intervention process, it was emphasised that support and engagement from managers was important

in the intervention process. Both to provide resources for the interventions and to inform and remind the staff about the interventions. This is in accordance with previous research that has found that management support is an important factor for successful implementation of occupational health interventions [23]. In the current study, participants formulated their expectation and need for further support from experts during the intervention process. Thus, an important lesson to be learnt from this project is that, in a participatory intervention approach, the level of support that will be provided by the experts should be clear from the very beginning of the project, and that also managers need to acknowledge their participation, support and engagement in the process, in order to avoid disappointment. It is possible that more support from expert could have increased the effect of the interventions.

The final main theme was Motivation to maintain change. Here, the participants strongly expressed that they wanted to continue to work on improving the sound environment. These results can be related to the theory of individual readiness for organisational change [33], which refers to the extent to which individuals believe that they are capable of implementing a proposed organisational change. The individual readiness for change is influenced by whether the change is viewed as appropriate and beneficial for the organisation and if the leaders support the change. In the current study, we observed that the participants described a high level of individual readiness for changes relating to improvement of the sound environment, as they expressed both capability and views meaning that the interventions would benefit the organisation. This could be positive for their continuing work with the sound environment and for future interventions. The motivation for change was expressed together with the recognition that there was a lack of financial resources to make important changes. In addition, motivation to maintain change could also be an indication that the participants were experiencing a certain level of psychological empowerment [34], involving the competency and capability to make changes and self-determination in the sense of having a choice to initiate changes. Empowerment reflects employees' perceptions about being able to shape the work, and this was evident in the current study, where participants described how they felt that it was possible to make further changes at the workplace relating to the sound environment. However, this psychological empowerment was not evident regarding their possibility to change and improve

the psychosocial working environment. The aim of the intervention was to improve the acoustic and the psychosocial environment but very few of the interventions related to the psychosocial working environment. This could indicate that it is easier to make changes relating to the sound environment, that is generally more related to the physical work environment, than to make changes to the psychosocial working environment. The economical limitations described by the participants may also have played a role in the lack of psychosocial interventions relating to staffing. Even though the interviews indicated a need for more staff to cover shifts, a strain that may even have influenced the intervention process, the cost of such an intervention would be large.

The intervention used a participatory design, which meant that the workplaces themselves decided which interventions should be carried out. The researchers did hence not intentionally demand that acoustical or psychosocial interventions should be chosen. It is though possible that the health hazards described from a sound environment with high sound levels were considered more serious or more easy to attend to. It is also possible that the task of improving both the acoustic and the psychosocial environment was considered overwhelming.

Regarding limitations, it may be possible that the participants found it difficult to freely express their opinions in the interviews, particularly because the participants came from the same workplace. It is also possible that participants felt hindered by the interviewers being part of the research group that initiated the intervention study. The interviewers informed the participants that there was no need for consensus in the interviews; that all opinions, experiences and ideas were welcome; and that full integrity outside of the group was ensured. Furthermore, no males participated in the interviews due to very few males being employed at these workplaces. This reflects the fact that both of these workplaces are traditionally female dominated. In addition, the aim of this qualitative study was not to assess whether there were any significant differences between different groups of employees. Regarding transferability of the findings, these themes can be relevant to other, similar workplaces. This is supported by the reports from participants that some of the improvements from the obstetrics ward had already been implemented in the maternity ward at the same hospital. It is however not possible and not the intention to make great generalisations from qualitative studies, but it is important to relate the findings to previous research and thereby add to the

accumulation of results on the topic under study [35].

Some of the contributions of this study were the expressed increased positive attitude towards use of personal protective equipment (HPDs), and the perception of responsibility for the working environment expressed by the participants, which shows great potential for identifying and implementing occupational health interventions. Regarding learning from using a participatory intervention method, we found that psychological empowerment among participants appeared to be facilitated by this method, and that it is important to pay attention to expectations of support from external experts involved in the process. These are some aspects that could be considered in future studies.

5. Conclusion

In conclusion, this study explored personnel at an obstetrics ward and a preschool experiences of taking part in a participatory intervention project aiming to improve the acoustic and psychosocial work environment. The results showed increased awareness relating to noise exposure at work, and staff taking responsibility to improve the sound environment. The building and interior design played a role in the experience of noise, and having a quiet space at work was seen as very positive. Lack of resources had a negative influence by slowing up the intervention process, but the participants were motivated to maintain the changes that had been achieved during the study. These findings highlight that despite a very demanding working situation and lack of financial resources, staff at both preschools and obstetrics departments can be creative and inventive and implement a variety of solutions to improve the sound environment. However, interventions focusing on improving the psychosocial work environment were lacking. Hence, our study suggest that a participatory intervention approach may facilitate participation and motivation, but resources and support are needed for a comprehensive and effective implementation.

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Conflict of interest

None to report.

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