Factors Affecting Thai Workers’ Use of Hearing Protection

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RESEARCH ABSTRACT

This study used an ecological model to examine Thai workers’ beliefs and attitudes toward using occupational hearing protection. Data collection involved focus group sessions with 28 noise-exposed workers at four factories in Chiang Mai Province and an interview with a safety officer at each organization. Detailed content analysis resulted in the identification of three types of factors influencing the use of hearing protection: intrapersonal, including preventing impaired hearing, noise annoyance, personal discomfort, and interference with communication; interpersonal, including coworker modeling, supervisor support, and supervisor modeling; and organizational, including organizational rules and regulations, provision of hearing protection devices, dissemination of knowledge and information, noise monitoring, and hearing testing. Effective hearing protection programs depend on knowledge of all of these factors. Strategies to promote workers’ use of hearing protection should include the complete range of factors having the potential to affect workers’ hearing.

In 2000, an estimate of the global burden of occupational illness indicated that 16% of hearing loss in adults is attributable to excessive noise exposure in the workplace (Nelson, Nelson, Concha-Barrientos, & Fingerhut, 2005). Thai workers reporting noise-induced hearing loss (NIHL) increased from 1.15% in 2000 to 4.68% in 2001 (Bureau of Occupational and Environment Diseases, 2004). Additionally, surveys have shown that 21% to 76% of workers across a wide range of industries, including food canning, pressing machines, lumber mills, weaving mills, and a sugar refinery, have hearing loss (Chaloemvipaht, 1998; Jaijong, 1999; Khunkongme, 2000; Tantranont, 2004; Tarnpeam, 2007). Although these studies may substantially underestimate the total number of Thai workers with NIHL, the available literature indicates that NIHL is a significant occupational health problem among these workers.

In Thailand, the Ministry of Industry and the Ministry of Labour mandate the maximum permissible noise exposure level (PEL) at 90 dBA for no more than 8 hours per day (Ministry of Industry, 2003; Ministry of Labour, 2006). Employers are required to control noise under 90 dBA, or provide hearing protection devices (HPDs) for noise-exposed workers if the noise level is higher than the PEL. Similar to many other developing countries, even if noise legislation exists, it is poorly enforced (World Health Organization [WHO], 1997). As front-line health care professionals, occupational and environmental health nurses must implement effective strategies to prevent NIHL among workers.

The occupational principles of prevention and control include three strategies to reduce noise exposure: engineering controls, administrative controls, and personal protection (HPDs) (National Institute for Occupational Safety and Health [NIOSH], 1998). Engineering or ad-
ministrative controls should be used as primary measures to reduce noise exposure whenever possible (NIOSH). However, engineering noise controls are not always feasible because of excessive application costs (Driscoll, 1998). Furthermore, the implementation of engineering and administrative measures cannot always guarantee that noise is reduced to a safe level (Arjkamol, Kangchai, & Premjai, 2005; Thommaphornphihla, Green, Carnahan, & Norman, 2003). Thus, the third strategy, use of personal protective equipment, may be the most feasible method of protecting workers against hearing loss. Brink, Talbott, Burks, and Palmer (2002) demonstrated that workers who do not wear HPDs are nearly twice as likely as those who wear HPDs to experience NIHL. This implies that if noise-exposed workers use HPDs, NIHL can be significantly reduced or eliminated.

SIGNIFICANCE OF THIS STUDY

Although it has been established that the use of HPDs can protect workers from NIHL, studies in developed countries such as the United States determined that noise-exposed workers used HPDs only 14% to 49% of the time when required (Hong, 2005; Lusk, Kerr, & Kauffman, 1998; Seixas, Ren, Neitzel, Camp, & Yost, 2001). Similarly, in Thailand, the literature revealed that only 29% to 41% of noise-exposed workers in a wide range of industries, including marble factories, the press-milling machine industry, a food-canning factory, and lumber mills, use HPDs continuously when exposed to hazardous noise (Chaloemvipaht, 1998; Khrimak, 1997; Tantranont, 2004; Tonchumporn, 2007). Furthermore, 24% to 56% of workers in these settings had never used HPDs (Chaloemvipaht, 1998; Khrimak, 1997; Tantranont, 2004). Reported studies stress the necessity of promoting the use of hearing protection among these vulnerable workers. To develop an effective intervention to encourage HPD use, it is necessary to understand the factors that influence this specific health behavior.

According to available literature, information on factors influencing the use of HPDs among Thai workers is limited. Only three studies addressing this important issue have been reported (Chaloemvipaht, 1998; Prechaworawet, 1992; Tonchumporn, 2007). Chaloemvipaht found that perceived susceptibility to NIHL, perceived severity of NIHL, and perceived benefits and barriers to NIHL prevention were significantly related to hearing loss prevention behavior among workers in factories using pressing machines \((p < .01)\). Prechaworawet found that perceived severity of NIHL, cues to action, and perceived susceptibility to NIHL accounted for 30% of variance in HPD use among female workers at a textile factory. Tonchumporn found that HPD use was best predicted by perceived barriers and provision of HPDs; these together accounted for 52.8% of variance in HPD use among workers in large lumber mills.

Although various studies have identified some of these factors among workers in the United States and other countries, they may be different among Thai workers. Because workplace cultures and contexts differ, it may be inappropriate to translate and generalize these findings to workplaces and workers in Thailand. Additionally, all of these studies applied health behavior theories in predicting the use of HPDs. It is possible that factors, not integral to these behavioral theories, have not been identified.

The research reported in this article is an exploratory study of a sample of Thai workers employed in high-noise industries. The purpose of the study was to investigate the unique factors affecting their use of hearing protection. An understanding of workers’ perceptions is critical for occupational and environmental health nurses who wish to develop effective strategies to prevent NIHL by promoting HPD use among noise-exposed workers in Thailand.

THEORETICAL FRAMEWORK

For the purposes of this study, a modified version of the ecological framework of McLeroy, Bibeau, Steckler, and Ganz (1988) was used as a guide. Three levels of influence were examined: intrapersonal, interpersonal, and institutional/organizational (Figure). The intrapersonal factors include workers’ attitudes and beliefs about hearing protection. The interpersonal influences include both formal and informal social networks and social support systems from primary groups in workplaces (i.e., coworkers and supervisors). The organizational influences refer to formal and informal structures or functions in organizations that directly affect hearing protection behavior of both individual workers and groups of workers (e.g., the organizational policy related to NIHL prevention and the use of HPDs, the provision of HPDs, and education and training about noise and its prevention).

METHODS

Sample and Setting

Because it has been determined that noise levels of 80 dBA and above pose a hazard to workers (NIOSH, 1998), factories that reported noise levels greater than 80 dBA for an 8-hour period and provided hearing protection for their workers were eligible for the study. Four manufacturing plants in Chiang Mai Province fulfilled these criteria and were selected for inclusion, including an electronics plant, a wood furniture factory, a food canning factory, and a paper mill. In addition, these companies...
were selected so that a variety of industrial environments, industrial processes, noise sources, and machines would be represented in the sample. This purposive selection of industries enhances the representativeness of Chiang Mai Province industries.

Two groups of participants were included in this study—noise-exposed workers who were employed in the factories and safety officers, one from each of the four factories. Polit and Beck (2004) noted that purposive sampling allows a researcher to extract information from respondents that will most benefit the study by maximizing the range of important and relevant information uncovered. Purposive sampling was used to select the noise-exposed workers using the following inclusion criteria: workers currently working in noisy areas (> 80 dBA) and HPDs were available.

A total of 28 workers participated in four focus group sessions. The majority of the participants (71.4%) were female (Table). Their mean age was 35.2 years. Employees had worked in their current factories from 5 months to 20 years (M = 9.4 years).

All of the safety officers interviewed (n = 4) were men between 38 and 50 years old (M = 44.8 years). They had worked in their current factories from 11 to 29 years (M = 19.2 years).

Data Collection
To ensure the inclusion of a complete list of factors, data collection consisted of exploratory focus sessions with noise-exposed workers and in-depth interviews with safety officers. The purpose of the focus group sessions was to gather workers’ perspectives about factors that in-

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Figure. Ecological model for an industrial worker in Thailand.
fluenced their use of HPDs. The in-depth interviews were designed to clarify information from the focus group sessions as well as examine the safety officers’ perspectives about other factors influencing workers’ use of HPDs. Prior to data collection, the study was approved by the Research Ethics Review Committee of the Faculty of Nursing, Chiang Mai University. Only the researcher and her dissertation committee had access to the data. The researcher agreed to destroy all sources of data, including audiotapes and notes, within 1 year of completing the study.

**Focus Groups.** Group process can influence participants’ reactions to the responses of other group members, resulting in the production of information that might not be obtained through one-on-one interviews (Kitzinger, 1995; Stewart & Shamdasani, 1990). For this study, a semistructured focus group guide was developed, based on the ecological model. To identify the full range of factors that influence workers’ use of HPDs, the guide included broad, open-ended questions (Sidebar). Additional questions were used to build on responses to the primary questions.

Each focus group session was moderated by the researcher and facilitated by a research assistant. The focus groups were conducted in a private room at each factory and lasted about 35 to 45 minutes. A light meal was provided during the discussion. Prior to focus group sessions, the moderator and the process facilitator introduced themselves and then asked participants to introduce themselves. During this period, the process facilitator created a seating chart of each group. The moderator described the objectives of the study, focus group process, the role of participants, the reason for using audiotapes, and methods to protect participants’ rights. Each participant was asked to sign a consent form to participate in the study. After that, the moderator used the focus group guide to begin the discussion. The process facilitator made field notes and audiotaped the discussion during the meeting. At the end of the sessions, the moderator thanked the participants for providing the data.

**Interviews With Safety Officers.** Because an interview is a flexible technique, the researcher used this method to explore safety officers’ perceptions in more depth than is possible with other methods (Burns & Grove, 2007). For this study, semistructured interview questions were developed, based on the ecological model, to elicit safety officers’ opinions about organizational policy to protect workers from NIHL. The interview sessions were conducted in a private room at each factory. Prior to the interviews, interviewees were provided details of the study and informed about the methods used to protect their privacy (i.e., disposition of the interview data). They were asked for oral permission to use audiotapes. Each participant was asked to sign a consent form to participate in the study. Interview sessions took 20 to 40 minutes per individual to complete. At the end of the interview session, the researcher thanked the interviewees for providing the data and stressed the importance of the information generated.

**Data Analysis**

The audiotapes were transcribed for analysis after each focus group and interview session. To prevent transcription errors, the written transcripts were compared repeatedly with audiotape recordings of each session. The qualitative content analysis method developed by Graneheim and Lundman (2004) was used to analyze data in the current study. After the transcripts were reviewed word by word and line by line, the data were analyzed according to the following steps: (1) meaning units (sentences or paragraphs containing aspects related to each other) were identified and then brought together into one text; (2) the meaning units were condensed into shorter meaning units while preserving the core of the meaning units; (3) the condensed meaning units were abstracted and labeled with codes; and (4) codes were compared based on differences and similarities and sorted into categories.
RESULTS
The data were sorted into categories using the three levels of the ecological model: intrapersonal, interpersonal, and organizational (Sidebar).

Intrapersonal Factors
This category included a range of statements about specific reasons workers did or did not use hearing protection. A range of opinions emerged, including both positive and negative aspects of HPD use categorized as “Why we use hearing protection” and “Why we do not wear hearing protection.”

Why We Use Hearing Protection

Preventing Abnormal Hearing. The majority of participants who used HPDs regularly indicated their use prevented damage to their hearing. This was illustrated by the following comment:

We are afraid of hearing loss, so we have to put earplugs in our ears. Sometimes the eardrums are exposed to high noise levels. I am afraid that the eardrum will be damaged, so I have to wear hearing protection devices to prevent this damage when there is loud noise.

Preventing Noise Annoyance. In addition to preventing damage to hearing, participants mentioned that noise annoyance influenced them to wear hearing protection:

Hearing protection devices can prevent many things. They can reduce noise, resulting in preventing ear pain as well as noise annoyance. . . . If I went to high noise areas without wearing earplugs, it bothered me, and then I would be in a bad mood.

One participant described the effect of noise annoyance on work concentration:

I use earplugs regularly. If one breaks, I always get a new one from staff. If I do not use them, it is really noisy and that bothers, distracts me. But if I use them, I can concentrate on my work.

Interpersonal Factors

Coworker Modeling. Some participants described how coworkers’ use of hearing protection makes them think about using HPDs:

Categories of Responses

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<td>Intrapersonal level</td>
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<td>Preventing abnormal hearing</td>
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<td>Preventing noise annoyance</td>
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<td>Why we do not wear hearing protection</td>
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<td>Personal discomfort</td>
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<td>Interference with communication</td>
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<td>Interpersonal level</td>
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<td>Noise monitoring</td>
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Using earplugs hurts my ears and bone. They are not soft. If I use the cotton ones, they are soft. When I put cotton in, they do not hurt and they fit tightly.

Interference With Communication. Participants indicated that wearing HPDs makes communicating difficult, especially when communicating with coworkers:

In the past, I used earplugs . . . another worker could not understand my words, so I took them out.

If coworkers ask me to do something but I cannot hear because I am wearing earplugs, I do not respond, so I do not use them.

On the other hand, one worker said that wearing earplugs could compromise her safety:

Sometimes, another worker tells me to turn on or turn off a machine. If I cannot hear, I could put my hand in the machine. It is very dangerous.

Interpersonal Factors

Coworker Modeling. Some participants described how coworkers’ use of hearing protection makes them think about using HPDs:

When I see coworkers wearing hearing protection devices, I feel like I want to use hearing protection devices . . . want to imitate this behavior.
Seeing coworkers wear hearing protection devices, I think it is good. I realize that I should wear hearing protection devices.

**Supervisor Support.** A supervisor in the organization is an important person in supporting the workers’ use of HPDs. As one safety officer said:

If we, safety officers, see them, workers, without earplugs, we inform their supervisors. Ask their supervisors to remind them. In case workers still do not use earplugs, we usually report this to the manager so the manager will order the workers to wear the earplugs.

This finding confirms reports by workers. One focus group participant described support from individuals who are in charge of workers using HPDs:

Supervisors tell us if workers do not use HPDs, they will ask them to use them.

**Supervisor Modeling.** Some participants described how a supervisor’s use of HPDs influenced their decision to use hearing protection:

The supervisor is my model. The supervisor is a leader, so I will wear HPDs whenever the supervisor wears them. If the supervisor does not wear HPDs, I will not wear them.

. . . in the beginning, our supervisor used earplugs. He suggested we use them, so we wore earplugs. At that time, they reconstructed the building. It was very noisy. When they finished reconstruction, the supervisor took his earplugs off, so we took them off too.

**Organizational Factors**

**Organizational Rules and Regulations.** Although all of the factories did not prescribe explicit rules and regulations related to the use of HPDs, some factories still required workers to wear them when working in noisy areas. As one safety officer said:

There are signs in noisy areas to remind workers to use hearing protection.

Most participants agreed that having rules and regulations affect their use of hearing protection. As one worker said:

They have to prescribe rules and regulations. If they have rules and regulations, they (workers) will use HPDs. It will influence every worker to use HPDs.

**Providing Hearing Protection Devices.** All factories provided earplugs for workers who worked in noisy areas. As one safety officer described:

In the beginning, we give earplugs to supervisors or workers. If they do not work, they can bring them back and change them for new ones.

Workers can also obtain new earplugs if they lose them. However, they will be provided with the following warning:

If you lose them, we will give them again, but we will ask the reasons they were lost. We have a book to check the date of withdrawal. If it is long enough, it does not matter. We give them the new ones. But if they lose them only after 1 or 2 weeks, we have to talk. But we still give them new ones.

The data from focus groups also indicated that the provision of hearing protective equipment affects workers’ use of HPDs. According to one worker:

If they ask us to use earplugs, I will use them. I want to use them too. In my department, they do not provide earplugs for us.

In addition to the availability of hearing protection, another concern of some workers was HPD characteristics. Specifically, workers will refuse to wear some types of earplugs that hurt them. One participant said:

They should provide another type of HPDs. Right now, we use silicone rubber earplugs, but if we use disposable foam earplugs, we can only roll it and then wear it. In the previous factory, I used this type of earplug (disposable foam earplug). They do not bother me, so I always use them. . . . But this factory provides silicone rubber earplugs with the spiral shape. When putting them in, I feel pressure. It hurts, so I do not wear them consistently.

One participant was concerned about the size of the earplugs:

They have to provide alternative-size earplugs. Some workers have small ears, but they get big earplugs. It is inappropriate.

**Knowledge and Information Dissemination.** All factories provide information about noise hazards using four main strategies: annual training, new worker orientation, periodic training, and bulletin board postings. For annual training, they usually invite an expert from outside to present the training. One safety officer described this as follows:

In the past, we used to invite the staff from the safety center, Lum Phun, and the staff from the welfare organization, Chiang Mai, to train workers about chemicals and everything. For noise topics, we usually invite Mr. P from the safety center, Lum Phun, to educate workers about noise hazards and the use of earplugs, how to wear earplugs . . . .

New workers in all organizations are provided infor-
Promotion about noise hazards and hearing protection, especially how to wear HPDs, from the supervisors or the safety officers:

In the beginning, new workers are oriented by the human resource staff about accident prevention. After that they are transferred to the supervisor. The supervisor will give them on-the-job training about work tasks and the use of personal protection. Then, they are asked to get earplugs and so forth.

Supervisors also take responsibility for providing information about noise hazards and hearing protection for workers periodically:

At the workstation, supervisors usually train their workers informally. It is one kind of job training.

In addition to the training, some factories provided information by posting it on the entry door or a bulletin board:

They post the method of wearing HPDs on the board.

The majority of the participants are positive about the training. This attitude was reflected by the following statements:

Training is good because it increases our knowledge. We will know something that we did not know before.

If they did not recommend the usage, some workers would not use earplugs, some would use only the cotton, and some would not wear anything.

Noise Monitoring. Noise level in all factories was measured by either the safety center, an occupational and environmental health nursing student, or staff from a private organization. As some safety officers described:

We invite the staff from the safety center at Lum Phun to measure light, noise, and so forth every year.

We hire the staff from a private organization (to measure noise level).

In the past, we used the services of the safety center. Right now, we use the services of occupational and environmental health students so we can make the report by ourselves.

The safety officers said that the workers were informed about noise levels by postings on the bulletin board or through announcements by supervisors:

After the noise level is measured, the results will be posted on the board.

We informed the supervisors about the noise level results. They also were asked to inform their workers, stress the importance of wearing earplugs, and meet with their workers every month.

Hearing Test. All of the factories provided audiometric testing for noise-exposed workers annually. According to some of the safety officers:

The audiometric testing is included in training. If we have training, we will provide audiometric testing at the same time.

. . . we test hearing about three to four times . . . we select only workers who are working in the problem zones (noisy areas). We do not provide this for all workers.

The safety officers said that workers are informed about the results of their hearing tests either via a record book, via a posting on the bulletin board, or through supervisors’ announcements. They commented:

We inform everybody about the results of their hearing tests. We also give them a small record book.

I post the results of hearing tests on the board of each department . . . so workers can see the results on the board.

The results of the hearing test, we usually bring them to the supervisors, so the supervisors will inform their workers.

DISCUSSION

Through the use of the ecological model, the results of this study revealed the complex interplay of factors that affect Thai workers’ use of hearing protection. The intrapersonal factors identified indicated that these noise-exposed workers have two attitudes toward hearing protection use. The first reflected favorable attitudes; they believe in the ability of these devices to protect them from hearing loss and being annoyed by noise at work. The second reflected unfavorable attitudes such as the discomfort when wearing HPDs (i.e., headache, ringing in the ears, and skin rash) and the communication problems resulting from wearing HPDs (i.e., difficulties in hearing others and warning signals, and difficulties in understanding speech communication).

These findings confirm a study by Robertson, Kerr, Garcia, and Halterman (2007). They conducted a qualitative analysis of Latino construction workers’ experiences with occupational noise and hearing protection. Similar to the current study, Robertson et al. determined that workers did not wear HPDs because they were uncomfortable and HPDs made communication difficult. Several other studies also found that workers’ perceptions of barriers and benefits of HPD use significantly influenced
HPD use (Kerr, Lusk, & Ronis, 2002; Lusk, Ronis, & Hogan, 1997; Lusk, Ronis, Kerr, & Atwood, 1994; McCullagh, Lusk, & Ronis, 2002; Prechaworawat, 1992; Tonchumporn, 2007).

The comments of some participants suggested that the interpersonal level also influences workers’ use of hearing protection. Of particular note, some indicated that supervisor and coworkers’ use of hearing protection is particularly important to their decision to use HPDs themselves. Seeing coworkers or supervisors using HPDs influences them to wear hearing protection, and it facilitates other hearing protective behavior. It can be concluded that these individuals (coworkers and supervisors) can role model hearing protection. Additionally, some participants believed that supervisors or those in charge of workers can influence workers’ use of hearing protection in other ways (both positive and negative). For example, they can support the workers’ use of HPDs by encouraging, praising, or advising workers.

The majority of participants indicated that the organization should prescribe and enforce rules and regulations about HPD use. Some participants felt that if organizational rules and regulations were enforced, workers would comply with HPD use. This may be related to Thai workers’ cultural respect for authority. Additionally, some participants indicated that HPDs should be available and accessible at the workplace. Some felt that personal protective devices should be soft and fit each worker. A minority of participants learned about noise and hearing protection from training, postings on bulletin boards, and meetings. They believed that providing information will influence workers to use hearing protection. The findings from this study are similar to those from a study about the use of respiratory protective equipment conducted by Salazar et al. (1999), which suggested that the training related to this equipment was a major factor influencing workers’ use of this equipment.

IMPLICATIONS FOR OCCUPATIONAL AND ENVIRONMENTAL HEALTH NURSES

This exploratory study described three levels of factors influencing HPD use among Thai workers. These include intrapersonal factors (e.g., personal discomfort), interpersonal factors (e.g., coworker modeling and supervisor support), and organizational factors (e.g., organizational rules and regulations). Further research is needed to develop an instrument for eliciting the personal and environmental factors affecting Thai workers’ use of hearing protection. In addition, the findings demonstrate the need for more than individual change strategies. At the individual level, occupational and environmental health nurses should deliver educational interventions that target workers’ knowledge and beliefs about hearing protection. Moreover, they should develop strategies to eliminate the discomfort of hearing protection use (e.g., providing comfortable earplugs that fit individual workers).

At the interpersonal level, occupational and environmental health nurses should assist workers to create a support group or self-help groups to promote workers’ use of HPDs. For example, they might choose workers who are wearing HPDs consistently to be leaders who can support and encourage their coworkers to use hearing protection. Occupational and environmental health nurses might also consider using “train the trainer” strategies to promote hearing protection use among noise-exposed workers. Occupational and environmental health nurses can collaborate with others (i.e., supervisors, managers, and safety professionals) in developing an intervention at the organizational level, such as policy development, to ensure that HPDs are used by all workers who are at risk for occupational NIHL.

CONCLUSIONS

The findings from this study provide important information about factors that influence Thai workers’ use of hearing protection and a basis for future research in promoting the use of HPDs. A major strength of this study is that the data were obtained directly from the population of interest. The majority of the focus group participants were female, a representative sample of noise-exposed workers in the factories (74.0% female). Focus group discussions allowed participants to describe their beliefs and attitudes in their own words. Furthermore, the ecological model as a guiding framework enabled the researchers to uncover factors beyond personal factors that influence hearing protection.

These focus groups relied heavily on the skills of the moderator. It is possible that the responses may have been influenced by the moderator. To limit possible weaknesses that might occur in the sessions, the researcher was trained in the fundamentals of focus group moderation. Although the focus group discussions were conducted across four different factories, the results cannot be generalized beyond the study population. Despite these limitations, study results can assist occupational and environmental health nurses to develop tailored interventions aimed at promoting hearing protection use among noise-exposed workers in Thailand.

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