Claudie, G & Himawan K.K. (2016) The Correlation between sound sensitivity and affective reactivity of nurses in Jakarta: A Pilot study, *Australian Counselling Research Journal*, Vol. 10, Issue 2. Pp.

Australian Counselling Research Journal
www.acrjournal.com.au

The Correlation between sound sensitivity and affective reactivity of nurses in Jakarta: A Pilot Study

Georgiana Claudie & Karel Karsten Himawan

Contact
Karel Karsten Himawan
Faculty of Psychology,
Universitas Pelita Harapan
Jl. M.H. Thamrin Boulevard, Lippo Karawaci
Tangerang 15811 – Indonesia
karel.karsten@uph.edu

Abstract

The aim of this study is to examine the correlation between subjective sound sensitivity and irritability toward elevated sound emissions in hospitals, resulting from a sharp increase in human activity following the Social Security Health Benefit (*BPJS Kesehatan*) program in Jakarta; particularly among nursing staff who constantly experience intense work-related stress. Nurses (n=101) assigned in inpatient wards completed the Khalfa Hyperacusis Questionnaire and Brief Affective Reactivity Scale as measurements. Results showed a significant correlation between sensitivity to noise and affective reactivity (irritability) ($p<0.05$), as well as correlations to a specific dimension of sound sensitivity and several demographic characteristics. It was indicated that exposure to noise may increase affective reactivity (irritability) or that being in an irritable mood worsens the perception of sound. Other mediating factors might also exist to report individual differences relating to either variable, such as personality traits, threshold differences, appraisal processes, and perception of crowd dynamics.

Keywords: noise, sound sensitivity, nurses, Jakarta

Introduction

Establishing physically favorable health care environments is a critical process in health administration. This process is needed to understand the functioning and recovery of hospital occupants, as health care workers are groups of employees who frequently experience exposure to stressors and health hazards (Maguire, et al., 2013; Imam, et al., 2013). The types of stressors or hazards are categorized into tangible (e.g. medical and biohazard waste) and intangible forms (e.g. psychosocial work-related issues), and the complexity of work characteristics may increase the experience of stressful labor situations when it interacts with such stressors.

Amid human service and care workers, nursing is a profession that meets the criteria of experiencing intense work-related stress, as they are demanded to be physically and emotionally involved in their duties (Ribeiro, et al., 2014). They are prone to changes in healthcare environments from the increasing demand for medical care resulting from population growth, progression of modern medical technology and its effect on patient turnover, the need to master advanced equipment, and other changes due to development-related factors (Tsara, et al., 2008; Imam, et al., 2013). Imam et al. (2013) provided additional stressors originating from occupational hazards being ergonomic (mechanical operations), chemical (solid and liquid matter), biological (urine, bacteria, viruses), psychosocial (mental and social stress), and physical hazards (noise, temperature, lighting, radiation).

To account for the changes in healthcare environments, a recent prevailing phenomenon in Indonesia is the sharp increase of patients with *BPJS Kesehatan* (social security health benefit) cards as part of the *Jaminan Kesehatan Nasional* (National Health Security) program established in January 2014. The distribution of the *BPJS Kesehatan* cards has caused a 100% increase of a hospital's regular patient intake, causing nurses to report distress from sudden work overload and the disarray of activities during patient administration (Zahra, 2014). Reports from nurses may be explained by the discrepancy between work stress, work demands and pay rate, however, what appear to be less introduced to an urban context are unnoticed variables in hospital environments.

A particular feature of the hospital environment following this development is the acoustic atmosphere within the hospital area. Corresponding to this event, Ryherd et al. (2011) asserted how a variety of sound sources occupy many areas of hospitals as activities prolong throughout the day, primarily when facilities are located within densely populated areas. Seeing that noise is an occupational hazard that holds the potential to risk physical and psychological health, it may influence the quality of service provided by health care personnel (Ryherd et al. 2011; Khademi, et al., 2011). As an unnoticed component of the hospital environment, sound emissions following increased patient intake is a potential concern for research.

The World Health Organization has addressed the problem of noise pollution by understanding the threat noise poises upon short and long-term effects on health and well-being, particularly when noise imposes greater risks toward certain vulnerable groups; healthcare workers, alongside children and the elderly (Berglund, et al., 1999). Indonesia's Occupational Safety and Health regulations also support the necessity to prevent and control the advancement of many types of environmental hazard including noise (Kementrian ESDM, n.d.). Hospitals in Jakarta are not silent work places, as many departments within a hospital are exposed to certain intensities of noise that may exceed sound levels determined by OSH regulations (Kementrian ESDM, n.d.). As the capital of Indonesia and similar to other major capital cities, Jakarta's population density of 9.7 million citizens causes a relay of intra-city developmental effects, and therefore inner city hospitals may find noise sources as an extreme nuisance (Badan Pusat Statistik, 2010).

As both auditory and non-auditory effects of noise may occur when noise is intensified, auditory loss or marked sound tolerance is one of the most common results of noise exposure, as functional changes within the central auditory system occur due to increased sensitivity of auditory cortex neurons (Sun, et al. 2012). From a non-auditory standpoint, Cohen, et al. (1986) who conducted field studies on physical stressors stated that uncontrollable noise is generally stressful and may cause shifts in task performance and lowered motivation. However, prior to hearing loss, individuals must have different levels of sensitivity toward sound as enhanced responses to acoustic stimuli occur. Those with lower tolerance are demanded to adjust their psychological states in noisy situations to reduce discomfort (Stansfeld & Matheson, 2003), which means that cognitive and emotional perceptions to noise are transformed into physiological stress responses (Piazza, et al., 2013). In this sense, individuals who are more sensitized toward sound do not have more superior hearing, but they may have lower thresholds for stress reactivity and emotional reactions to stressors as hospital activity noise increases (Hill, Billington, & Krägeloh, 2014).

The increase of acoustic stimuli should not cause individuals to be at risk for irritability since loudness tolerance is correlated with emotional states and anxiety (Khalfa, et al., 2001). A common response to excessive sound is irritability, and in short, irritability is a state of annoyance that is shown through temper outbursts and may be indicative of emotional difficulties (Stringaris, 2012), although not all environmental stressors can elicit irritability when mediated by appraisal processes on perception of the stimulus itself. From an employment perspective, when emotional states are compromised, abatements in many areas of work performance might occur as seen through a decline in empathy, involvement, concentration, and interest thus contributing in affect reactivity (Fang, et al., 2008). The urgency to assess manifested affective reactions due to increased acoustic stimuli in Jakarta hospitals with *BPJS Kesehatan* affiliations is necessary to shield nursing staff, and patients respectively, from a specific hospital hazard; noise.

This study aims to investigate whether a significant correlation exists between sound sensitivity and affective reactivity (measured through irritability) within nursing groups across Jakarta following the *BPJS Kesehatan* program since 2014. When physical hospital hazards pose as threats and trigger affect reactivity, specific dimensions (functional, social, or emotional) of sound sensitivity can be affected and therefore a bidirectional relationship between affective states and stressors might appear.

Methods

Participants

Participants consist of 101 nurses from one state-operated hospital in South Jakarta that administrates social security health benefits (*BPJS Kesehatan*), with an age range between 18 to 55 years (M=26.95, SD=6.91). All subjects signed an anonymity and informed consent form to participate in the study. The name of the establishment is undisclosed by request of the hospital's Research and Development Department for ethical considerations.

Instruments

The Khalfa Hyperacusis Questionnaire (HQ) (Khalfa, et al., 2001) was used to measure subjective sound sensitivity. The Khalfa HQ was initially developed to detect clinical hyperacusis (extreme sound sensitivity), however, the instrument can be used to detect general discomfort toward sound through the levels of mild to major distress from the instrument's score gradations. The instrument consists of 3 dimensions; attentional, social, and emotional. These dimensions are not scored separately – 14 items (given on a 4 point rating scale) produce a unified score. The maximum score for the Khalfa Hyperacusis Questionnaire is 42. To differentiate the influence of their work and the possibility of developing irritability and sound sensitivity, the Khalfa HQ places three preliminary questions (Q1, Q2, Q3) in the first section of the questionnaire to identify history of hearing damage or noise exposure that may relate to sensitivity from exposure. Two non-HQ closing questions (Q4, Q5) were placed in the end of the questionnaire to measure current perception of hospital noise, as well as the level of personal disturbance due to environmental noise.

The Brief Affective Reactivity Scale (AR) was developed to measure the degree of irritability without measuring aggressive tendencies or hostile behavior through threshold, frequency of feelings, and durations of angry reactions. It is a self-report measure based on irritability symptoms of mood disorders in the DSM-V, as well as theoretical constructs of the State Trait Anger Expression Inventory - 2 (Spielberger, 1988) and Affective Reactivity Index (Stringaris, et al., 2012). The BARS initially consisted of 15 items given on a 4-point rating scale, however, subsequent to tryouts on intern nurses at the author's university hospital, and consistent score results with the field samples, 4 items with low item validity were removed, leaving 11 items for statistical analysis. The BARS' maximum score after item removal is 33. Item validity and internal consistency of the BARS is presented in Table 1.

Table 1.

Validity and Reliability of the Brief Affective Reactivity Scale

Samples	n	Aspect (Item)	Item Total	Item Validity	Cronbach's α
Try out (before item removal)	37	Frequency (1,2,3,4,5) Intensity (6,7,8,9,10) Duration (11,12,13,14,15)	5 5 5	.360 - .601 -.120 - .501 .139 - .273	.677
Try out (after item removal)	37	Frequency (1,2,3,4,5) Intensity (6,7,10) Duration (12)	5 3 1	.508 - .670 .409 - .539 .204	.806
Field (before item removal)	101	Frequency (1,2,3,4,5) Intensity (6,7,8,9,10) Duration (11,12,13,14,15)	5 5 5	.355 - .563 -.206 - .524 .148 - .513	.736
Field (after item removal)	101	Frequency (1,2,3,4,5) Intensity (6,7,8,10) Duration (11,12)	5 4 2	536 - .640 .480 - .576 .476 - .576	.853

Permission to use the Khalfa HQ was received through electronic mail. Adaptations were made for the Khalfa HQ by forward and back translating the items into Bahasa Indonesia with the assistance of two native English speakers from a Jakarta-based language institution.

Our data showed that both instruments have adequate psychometric properties from field sample analyses. Only 4 items in the BARS held corrected item-total correlation values below .20. These 4 items were removed to generate greater internal consistency seeing that the amount of samples obtained (n=101) met the requirements for item removal (5 x N items) (Cohen et al., 2013). Cronbach's α is also satisfactory for both instruments; the Khalfa HQ reaches .884, and .853 for the AR. The following table represents the descriptive statistics for both instruments. Greater scores in the Khalfa HQ indicate greater sound sensitivity, and greater degrees of irritability in the AR scale.

Table 2.

Psychometric Description of the Instruments

Instrument	n	Min. Score	Max. Score	Mean	SD	Cronbach's α
Hyperacusis Questionnaire (HQ)	101	2	28	11.36	6.21	0.884
Brief Affective Reactivity Scale (AR)	101	0	22	5.59	4.62	0.853

Design

This study applied a cross sectional design to verify the significance of the relationship between the two variables. The significance level is set at 0.05. Items are considered reliable if Cronbach's alpha is greater than .60 and internal validity is based on the corrected item-total correlation value >.20 (Latan & Temalagi, 2013).

Statistical Analysis

Data was processed with SPSS version 20. Analysis of supplementary data was generated with analysis of variance and Mann-Whitney tests for age, gender, residency, ward of placement, and BARS and HQ scores.

Results

Descriptive Statistics

Most of the participants are women (92.07%) with the mean age of 26.95 years old. Regarding the educational level, 99% of the participants are graduated from the diploma level in the nurse education. Table 3 summarized the more complete characteristic of the participants.

Table 3.

Demographic Characteristics of Participants

Demography	Category	n	%	Mean
Age		101		26.95
Sex	Male	8	7.92	
	Female	93	92.07	
Education	Diploma (*Ahli Madya)*	100	99	
	Bachelor (*Ners*)	1	1	
	Master (*Magister*)	-	-	
	Doctoral (*Doktor*)	-	-	
	Undisclosed	-	-	
Residency	East Jakarta	8	7.92	
	South Jakarta	53	52.47	
	Greater area (*Depok, Tangerang, Bekasi)*	34	33.66	
	Undisclosed	6	5.9	
Ward of Placement	VIP	19	18.8	
	First Class	19	18.8	
	Second Class	25	24.75	
	Third Class	16	15.84	
	Maternity & Post natal	9	8.9	
	Pediatric (inpatient)	13	12.87	
Work duration (years)	-	101	-	5.79

Normality Tests

The one-sample Kolmogorov-Smirnov test was used to conclude the normality of distribution. The purpose is to further determine the correlation method to test the hypotheses. The level of significance used is .05, meaning that a 5% error rate is allowed. Data can be processed with parametric tests if $p>0.05$. The normality test is presented in the following table.

Table 4.

K-S Normality Tests for Each Variable

Variable	Sig.	Conclusion

Sound sensitivity (Khalfa HQ)	.063	Normally distributed
Irritability (BARS)	.013	Not normally distributed

Hypotheses Test

Spearman's rho (*ρ*) showed a significant correlation between sound sensitivity and affective reactivity among the respondents as measured by the BARS and HQ (*ρ*= .700, p= .000). In addition, the preliminary questions reveal that 38.6% of nurses (n=39) reported that they currently feel exposed to noise (**Q1**), while 65.3% (n=66) are less tolerant toward noise compared to previous years (**Q2**), and 2.9% (n=3) nurses have a history of hearing problem (two subjects reported a history of otitis media and cerumen buildup, while the other did not disclose the hearing problem type) (**Q3**). It was assumed that current perception toward noise exposure (Q1), current tolerance of noise compared to previous years (Q2), and history of hearing problems (Q3) will yield different HQ scores. Only those who answered 'yes' to Q1 produce greater sound sensitivity scores (U=911.5, $p<0.05$), compared to those who responded 'yes' to Q2 and Q3. However, no significant correlation between nurses who provided higher ratings to **Q4** and HQ scores ($p>0.05$), neither with **Q5** and HQ scores ($p>0.05$).

Table 4.

Summary of supplementary data

Variable	Spearman's *ρ*	Mann-Whitney U	Anova *F*
1. Attention dimension and AR	.639**	-	-
2. Social dimension and AR	.662**	-	-
3. Emotional dimension and AR	.533**	-	-
4. Age and AR	-0.127	-	-
5. Age and HQ	0.893	-	-
6. Gender and AR	-	308	-
7. Gender and HQ	-	140*	-
8. Residence and HQ	-	-	2.902*
9. Ward of Placement and HQ	-	-	2.865**

Note: all tests are two-tailed. *p<0.05 **p<0.02 (AR: affective reactivity or irritability, HQ: hyperacusis questionnaire or sound sensitivity).

To provide comparisons with the base literature, gender and age are demographic variables assumed to correlate with sound sensitivity and irritability. The AR scores were significantly correlated to the attentional dimension (*ρ*= .639, p<0.01), social dimension (*ρ*= .662, p<0.01), and emotional dimension (ρ= .553, p<0.01). However, there is no significant correlation between the age of nurses and HQ scores (ρ=.893, p>0.05). Age was also assumed to correlate with the social dimension due to maturation and loss of habituation to noise exposure, yet results only yielded a significant and negative correlation between age and attention (ρ=-.198, p=0.048), but not with the social dimension (p=0.842), and emotional dimension (p=0.681). A significant HQ score difference was found with males producing greater sound sensitivity (HQ) scores compared to females (p=0.03), but there is no significant AR score (irritability) difference between males and females (p=0.419) despite female respondents exceeding the number of males.

There exists a significant mean difference of sound sensitivity (HQ) scores and ward of placement, whereby nurses stationed in the pediatric ward tend to have greater sound sensitivity (F=2.865, p=.019) compared to nurses in the first class, second class, maternity/post-natal, and VIP ward, with $p \leq 0.05$ respectively for each ward, but no differences with the third class ward nurses (p=0.038). In addition, first class and pediatric ward nurses have greater irritability (AR) scores compared to other wards ($p \leq 0.05$). Finally, based on residence and commuting distance, nurses who live in South Jakarta produced greater irritability (AR) scores compared to those living in East Jakarta (p=0.048).

As this study reveals a correlation between aspects of sound sensitivity and irritability, the researcher asked for brief, unstructured testimonials from nurses in several stations regarding their perception of the changing hospital environment since the *BPJS Kesehatan* program establishment. The researcher discovered that nurses have greater concern relating to the disorderly environment in inpatient units during visiting hours rather than the intensity of noise produced. Inpatient visitors who visit in large groups were reported to ignore the nurse's reprimand to lower their voices. On the other hand, nurses in the outpatient clinic are concerned with the lack of order during administration and that patients were not occupying waiting areas in an organized manner. Nurse's perception of noise may have more to do with the visitor behavior and its impact on patient discomfort rather than the intensity of noise itself, primarily with the multitude of visitors and patients since the *BPJS Kesehatan* program. In this case, crowd dynamics can be considered a confounding variable as appraisal processes (negative affect) toward the environment can be separated from sound sensitivity itself. For example, certain departments in a hospital (e.g. radiology, CAT scan, and MRI wards) may be filled with patients but noise emissions are lower compared to the central outpatient clinic. Therefore the existence of a crowded, but less noisy environment will affect the perception of noise severity.

Discussion

The main objective of this study is to determine whether a significant correlation exists between sound sensitivity and irritability among nurses in a heavily occupied *BPJS Kesehatan* hospital. Environmental factors are assumed to increase sound sensitivity based on the intensity and source of sound (Khalfa, et al. 2001), and irritable mood is assumed to worsen the perception of sound as it elicits annoyance toward the stimulus or event that produces the stimulus (Frijda, 2009). Based on the Khalfa et al. (2001) study results on the development of the Hyperacusis Questionnaire, exposure to noise may be one of the many, though not definite, factors as to why sound sensitivity increases. We must take into account that individual differences (e.g. personality, appraisal processes, age) may be risk factors to respond to increasing stimuli (Topf, 2000). The findings in this study corresponds to Ramirez' et al. (2004) study, revealing a significant correlation between individual sensitivity to sound and feeling components, particularly in aspects of anger state and trait. To better explain the relationship of sound sensitivity and affective reactivity, mediating variables may exist to determine the significance of the relationship that is not included in this study. Such mediating variables that co-exist in sound sensitivity and affective reactivity in previous studies are personality traits (e.g. neuroticism and introversion) (Hill, Billington, & Kräegloh, 2014), pre-existing appraisal processes (negative affect) (Piazza, et al., 2013), and perception of sound during stressor and non-stressor days (Khalfa, et al., 2001). For example, to express either variable, an individual with high irritability (AR) scores may be high in trait neuroticism and possess negative attitudes toward the acoustic environment. Individuals with these characteristics demonstrate a condition in which a person has lower reactivity thresholds toward stimulus when they are in an irritable mood (Västfjäll, 2002), further asserting that acoustic stimulus from human activity is perceived as annoying or threatening. In addition, stress that is generated from environmental noise may induce particular affective reactions or modify other aspects of adaptive functioning, such as cognitive processes in support of various work-related performances, seen through the attentional dimension scores of the Hyperacusis Questionnaire (Khalfa, et al., 2001).

The preliminary questions in the Khalfa Hyperacusis Questionnaire were also included in the translated questionnaire. Significance was seen only for Question 1 ($p<0.05$), in which HQ scores were higher for those who answered 'yes', but no significance found for 'yes' responses to Question 2 and 3. Habituation processes might be an explanation as to why 65.3% of respondents have felt (or currently feel) exposed to noise to (Question 2) but have lower HQ scores. In general, habituation occurs when an arousal reaction is suppressed by inhibitory mechanisms when a stimulus is repeatedly anticipated (Stein, 1966), meaning that noise levels might be expected during certain times of the day and have no direct consequence to hearing processes. Furthermore, the final questions in the booklet were placed to reveal the directional relationship between higher ratings of noise perception and disturbance levels toward HQ scores. No statistical significance was found between Questions 4 and 5 toward the HQ scores ($p>0.05$). However, a central tendency effect is found seeing that 40.6% of the responses ($n=41$) indicated that they perceived the hospital environment over the past 6 months as moderately noisy, and 45.5% rated moderate disturbance due to the noise conditions. However, the HQ scores cannot rely entirely on the perception and level of disturbance from noise, as the aforementioned factors such as negative affect toward sound, appraisal processes, and intrapersonal traits may affect reported HQ scores.

An analysis of variance (ANOVA) was conducted to detect the difference of human activity in different wards and how it may influence both sound sensitivity (HQ) and irritability (AR) scores. A few significant effects were found; the pediatric ward nurses produced greater scores compared to nurses in other wards i.e. second-class, VIP, maternity/post natal, and VIP ($p>0.05$) except nurses assigned in the third class wards. Based on existing reports following the *BPJS Kesehatan* patient rise (e.g. Zahra, 2014; Surya, 2015), noise levels generally occupy the outpatient clinic where administration takes place, also third class wards where the number and placement of beds trigger the lack of noise control compared to first class or VIP wards. Patients in these third class wards receive visitors with no partitioned spaces. Significance was also found in AR scores being greater among pediatric and first-class nurses compared to second-class nurses ($p>0.05$), showing consistency with the HQ score differences. From a literary perspective, the similarities of HQ and AR scores between the third class and pediatric ward is unknown, as studies generally show greater criticism on sound levels in intensive care units and accident/emergency rooms compared to inpatient wards (e.g. Khademi, et al., 2011; Konkani & Oakley, 2012; Ryherd et al., 2011). For example, the findings by Konkani and Oakley (2012) from critical care units are centered in high intensity medical equipment, ventilation systems, and staff activity rather than visitor activity. A possible explanation for the ward placement findings is that nurses in this group have similar intrapersonal characteristics in response to ambient stressors and that the pediatric inpatient ward in this particular hospital comprises of VIP, first, second, and third class beds. This could mean that responses to noise in the pediatric ward is mediated by reaction to varying work stress relating to parental demands in caring for children, and the management of health care for children as being more multifaceted compared to caring for adults.

In the context of other demographic variables, it is assumed that certain factors such as age and gender might influence sound sensitivity among females of older age as they have been more exposed to acoustic stimuli (Khalfa et al., 2001). However, results show that there is only a significant correlation between age and overall sound sensitivity scores ($p>0.05$), and a significant and weak correlation only with the attentional dimension of the HQ ($\rho=-.198$, $p=0.048$). This finding might reveal that certain age groups have greater awareness to noise levels and the need to avoid it in order to maintain cognitive functioning, and that age may pose as a significant risk factor to stressor reactivity (Ramirez, et al., 2004). Furthermore, gender differences were significant with males having higher mean ranks in HQ scores ($p=.003$). Contradicting the imbalance of male and female respondents, it was expected that female respondents would produce greater AR scores compared to males. Socio-biological developments might account for these differences, meaning that males express their discomfort toward sound more readily than the females (Ramirez, et al. 2004).

Residence is another factor for analysis, seeing that 33.6% of nurses reside in Jakarta's greater area and require greater commuting distance. It was assumed that nurses who take longer travel hours might be more exposed to noise from high traffic roads compared to those who live closer to the hospital of employment, which may exacerbate their perception of noise in their respective wards. Our findings show that nurses residing in South Jakarta and the greater are have greater mean differences in irritability scores compared to those residing in East Jakarta. Population density in each area was assumed to account for these findings, however, population differences for each square kilometer was not found. The statistical figure for South Jakarta inhabitants being fewer compared to East Jakarta and Jakarta's greater area cannot be a reliable source to account for these differences (Badan Pusat Statistik Kota Administrasi Jakarta Selatan, 2013), therefore the researcher considers population density around the South Jakarta hospital as the basis for exposure, not solely on travel distance or domicile. In essence, sound sensitivity differences based on residence are inconclusive.

Conclusion

The effects of living in a noisy work environment in Jakarta reflect the lack of anti-noise regulations and its correspondence to population density, hence changes in the work environment is more likely to improve a person's overall health rather than the particular organ that is being affected (Chepesiuk, 2005). The evaluation of the acoustic environment and the responses of its occupants can be acknowledged to provide substantial bases for effective hospital environment management. The key finding in this research is that an increase in hospital activity noise may be a determinant of discomfort toward sound and irritability toward major sound sources. Key components to adjust in future research are the sample size and hospital location, occupational context, and other intrapersonal measurable variables. The Brief Affective Reactivity Scale will require further validation before use in future studies. Other hospitals with greater and lower visitor capacity may also affect mood states and the perception of acoustics; therefore comparisons can be made based on hospital facility size and location. The generalizability of the outcomes are confined only to the sample of nurses collected in this South Jakarta hospital only, not towards the general nurse population or population of healthy adults exposed to noise originating from human activity. It is also not possible to generalize relationships between sound sensitivity and irritability when other factors are not included in analyses, such as personality traits and lifestyle, but these findings may account for possible changes due to increasing hospital noise levels.

Investigations on other occupational sectors that involve intense employee–noise interaction can also be conducted to provide comparative analysis and help identify the risks that noise poses for workers (e.g. airport ground staff, construction workers, and nursery teachers). Other stimulus forms and its effect on irritability in work settings can also be included to assess mood changes, such as lighting and temperature. Lastly, other variables that may contribute to the onset of irritable mood and sound sensitivity other than demographic factors can be included. Such factors can be subjective health complaints, pre-existing negative affect that worsens the perception of stimuli, personality traits (neuroticism and introversion) that correlates with reactions to stimulus, and personal negative attitudes during stressful and non-stressful days.

Recommendation

A practical recommendation would be to raise public awareness to comply with crowd control regulations in hospital settings, such as limiting the number of inpatient visitors per visiting hour with reinforced assistance of hospital security personnel. Changes in the ambience of inpatient wards and outpatient clinics can also be done with soothing music played during daytime to induce calming effects for nurse's sound perception and mood. The Occupational Safety and Health board (*Keselamatan dan Kesehatan Kerja*) in Indonesia should study building design modifications and interventions to reduce noise produced from human activity, or to evaluate crowd dynamics that pose as stressors for health care staff. This particular hospital may also implement stress reduction programs for nurses through mindful meditation designed to enhance well-being, increase resilience, reduce anxiety and exhaustion, and overcome performance issues. These programs are aimed at counteracting the effect of stimulus overload upon the nervous system and can be incorporated to daily schedules to achieve adjusted responses to stressors.

Acknowledgments

We wish to thank the authors of the Khalfa Hyperacusis Questionnaire, and the Research and Development Department as well as nurses at the anonymized hospital in South Jakarta for their participation in our research. We would like to extend our gratitude to the anonymized translators from The British Institute for translating the instruments used in this study.

References

Badan Pusat Statistik. (2010). *Penduduk Indonesia menurut Provinsi 1971, 1980, 1990, 1995, 2000 dan 2010*. Retrieved from: http://www.bps.go.id/tab_sub/view.php?tabel=1&id_subyek=12

Badan Pusat Statistik Kota Administrasi Jakarta Selatan. (2013). Jumlah penduduk menurut kecamatan, jenis kelamin dan rasio jenis kelamin, 2013. Retrieved from: http://jakselkota.bps.go.id/index.php?hal=tabel&id=4

Berglund, B., Lindvall, T. Schwela, D.H. (1999). *Guidelines for community noise*: *World Health Organization Document*. Retrieved from: http://whqlibdoc.who.int/hq/1999/a68672.pdf

Chepesiuk, R. (2005). Decibel hell: the effects of living in a noisy world. *Environmental Health Perspectives,* 113(1), A34-141. Retrieved from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1253729/

Cohen, S., Evans, G.W., Stokols, D., & Krantz, D.S. (1986). *Behaviour, health, and environmental stress*. In Landy, F.J. & Conte, J.M. (2004). Work in the 21st Century: An Introduction to Industrial and Organizational Psychology. USA: McGraw-Hill

Cohen, R.J., Swerdlik, M., Sturman, E. (2013). Psychological testing and assessment – An introduction to tests and measurement: 8th Edition

Fang, J., Kunaviktikul, W., Olson, K., Chontawan, R., & Kaewthummanukul, T. (2008). Factors influencing fatigue in Chinese nurses. *Nursing and Health Sciences,* 10, 291-299. DOI: 10.1111/j.1442-2018.2008.00407.

Frijda, N.G. (2009). Mood. In D. Sander & K.R. Scherer. (Eds.). *The oxford companion to emotion and affective sciences* (p. 10). New York: Oxford University Press

Hill, E.M, Billington, R., & Krägeloh, C. (2014). Noise sensitivity and diminished health: Testing moderators and mediators of the relationship. *Noise and Health,* 16(68), 47-56. DOI: 10.4103/1463-1741.127855

Imam, M.E., Alazab, R.M., Wahed, A.A., Ghandour, A.A., & Elsaidy, W.H. (2013). Risk assessment of physical hazrads in Al-Azhar University hospital in New Damietta, Egypt. *Egyptian Journal of Hospital Medicine,* 53, 1019-1035. DOI: 10.12816/0001665

Kementrian Energi dan Sumber Daya Mineral. (n.d.) *Undang-Undang Nomor 1 Tahun 1970. Keselamatan Kerja*. Retrieved from: http://prokum.esdm.go.id/uu/1970/uu-01-1970.pdf

Khademi, G., Roudi, M., Farhat, M.S., & Shahabian, M. (2011). Noise pollution in intensive care units and emergency wards. *Iranian Journal of Otorhinolaryngology,* 23(4), 141-148. DOI: 10.1308/003588408X261582

Khalfa, S., Dubal, S., Veuillet, E., Perez-Dia, F., Jouvent, R., & Collet, L. (2001). Psychometric normalization of a hyperacusis questionnaire. *Journal of Otorhinolaryngology*, 64, 436-442. DOI: 10.1159/000067570

Konkani, A. & Oakley, B. (2012). Noise in hospital intensive care units – a critical review of a critical topic. *Journal of Critical Care*, 27, 522e1-522e9. DOI: http://dx.doi.org/10.1016/j.jcrc.2011.09.003

Latan, H. & Temalagi, S. (2013). *Analysis multivariate: teknik dan aplikasi.* Bandung: Alfabeta

Maguire, D.J., Burger, K.J., O'Donnell, P.A. & Parnell, L. (2013). Clinician perceptions of a changing hospital environment. *Health Environment Research & Design Journal*, 6(3), 69-79. Retrieved from: http://ezproxy.library.uph.edu:2334/ehost/pdfviewer/pdfviewer?sid=7d797c57-99d4-4494-bd88-b87d41fd3b13%40sessionmgr112&vid=7&hid=105

Marcysiak, M., Dabrowska, O., & Marcysiak M.B. (2014). Understanding the concept of empathy in relation to nursing, *Progess in Health Science*, 4(2), 75-81. Retrieved from: http://ezproxy.library.uph.edu:2333/ehost/pdfviewer/pdfviewer?sid=0df1d4a3-cced-4737-8afb-495effda3816%40sessionmgr4004&vid=1&hid=4204

Piazza, J.R., Charles, S.T., Sliwinski, M.J., Mogle, J. Almeida, D.M. (2013). Affective reactivity to daily stressors and long-term risk of reporting a chronic physical health condition. *Annual Behavioral Medicine*, 45, 110-120. DOI: 10.1007/s12160-012-9423-0

Ramirez, J.M., Alvarado, J.M., & Santisteban, C. (2004). Individual differences in anger reaction to noise. *Individual Differences Research,* 2(2), 125-136. Retrieved from: http://ezproxy.library.uph.edu:2333/ehost/pdfviewer/pdfviewer?sid=fc78a417-0d3c-4f64-ab19-1bfa64e1df76%40sessionmgr4004&vid=6&hid=4214

Ribeiro, V.F., Filho, C.F., Valenti, V.E., Ferreira, M., Carlos de Abreu, L., de Carvalho, T.D., Xavier, V., de Oliveira, J., Gregory, P., Leão, E.R., Fransisco, N.G., Ferreira, C. (2014). Prevalence of burnout syndrome in clinical nurses at a hospital of excellence, *International Archives of Medicine,* 7(22), 1-14. DOI: 10.1186/1755-7682-7-22

Ryherd, E. Okcu, S., Hsu, T., Mahapatra, A. (2011). Hospital noise and occupant response. *ASHRAE Transactions*, 1(117), 248-255. Retrieved from: http://ezproxy.library.uph.edu:2334/ehost/pdfviewer/pdfviewer?sid=7d797c57-99d4-4494-bd88-b87d41fd3b13%40sessionmgr112&vid=11&hid=105

Spielberger, C.D. (1988). *Manual for the State-Trait Anger Expression Inventory.* In Ramirez, J.M., Alvarado, J.M., & Santisteban, C. (2004). Individual differences in anger reaction to noise (p.135). *Individual Differences Research,* 2(2), 125-136. Retrieved from: http://ezproxy.library.uph.edu:2333/ehost/pdfviewer/pdfviewer?sid=fc78a417-0d3c-4f64-ab19-1bfa64e1df76%40sessionmgr4004&vid=6&hid=4214

Stansfeld, S.A., & Matheson, M.P. (2003). Noise pollution: non-auditory effects on health. *British Medical Bulletin*, 68(1), 243-257. DOI: 10.1093/bmb/ldg033

Stringaris, A., Goodman, R., Ferdinando, S., Razdan, V., Muhrer, E., Leibenluft, E., & Brotman, M.A. (2012). The affective reactivity index: a concise irritability scale for research and clinical settings. *Journal of Child Psychology and Psychiatry,* 52(11), 1109-1117. DOI: 10.1111/j.1469-7610.2012.02561.x

Sun, W., Deng, A., Jayaram, A., & Gibson, B. (2012). Noise exposure enhances auditory cortex responses related to hyperacusis behavior. Brain Research, 02(08), 108-116. DOI:10.1016/j.brainres.2012.02.008

Surya, I.T. (2015). "Pasien BPJS Antre Tiga Hari untuk Dapatkan Tempat Tidur di Rumah Sakit", *Tribunews,* Kamis 26 Februari 2015. Retrieved from: http://m.tribunnews.com/regional/2015/02/26/pasien-bpjs-antre-tiga-hari-untuk-dapatkan-tempat-tidur-di-rumah-sakit

Topf, M. (2000). Hospital noise pollution: an environmental stress model guide research and clinical interventions. *Journal of Advanced Nursing, 31(3),* 520-528. DOI: 10.1046/j.1365-2648.2000.01307.x

Tsara, V., Nena, E., Serasli, E., Vasileiadis, V., Matamis, D., & Christaki, P. (2008). Noise levels in Greek Hospitals. Journal of Noise & Health, 10(41), 110-112. DOI: 10.4103/1463-1741.44350

Västfall, D. (2002). Influences of current mood and noise sensitivity on judgments of noise annoyance. *The Journal of Psychology,* 136(4), 357-370. Retrieved from: http://ezproxy.library.uph.edu:2334/ehost/pdfviewer/pdfviewer?nobk=y&sid=697bc173-5613-4461-8ea2-e5d32f9424f3@sessionmgr114&vid=8&hid=124

Zahra, N. (2014). "Perawat Keluhkan Lonjakan Pasien BPJS Kesehatan". *Kompas 19 March 2014*. Retrieved from: http://megapolitan.kompas.com/read/2014/03/19/1908200/Perawat.Keluhkan.Lonjakan.Pasien.BPJS.Kesehatan