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Evaluation of Electromagnetic Hypersensitivity (EHS) of Business Process Outsourcing (BPO) Employees Under Traditional and Remote Work Environments

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ABSTRACT

Following the success of remote work in the Business Process Outsourcing (BPO) industry during the Covid-19 pandemic, several organizations have considered choosing a permanent remote work policy for their employees over the traditional face-to-face setup. The primary determinants that dictate adopting a permanent working environment are often centered on cost-related considerations with little regard for the slow onset of occupational health hazards. Studies have identified various health hazards experienced by BPO personnel, including headaches, back pain, neck and shoulder discomfort, wrist and hand pain, eye strain, overweight, hearing loss, and digestion issues. Electromagnetic hypersensitivity (EHS) is a term used to describe such symptoms that manifest in response to exposure to electromagnetic field (EMF)-emitting devices. In the context of the Philippines, most are unaware of the potential implications of EMF exposure, hence it is worthwhile to closely investigate the EHS of BPO employees. This study aims to investigate the health-effects of EMF-emitting devices on BPO personnel in both traditional and remote work setups. The study used a web-based questionnaire to collect and assess data from two discrete populations. A self-reporting questionnaire (SRQ-20) was used to pre-assess the respondents' general wellness and health status. Statistical significance was established using the independent t-test. Principal component analysis was used to identify the major symptoms associated with EHS, whereas the EMF sources were analyzed using an independent sample t-test with bootstrapping. Based on the SRQ-20, traditional BPO personnel encounter health risks with statistically higher severity ($p < 0.05$) than their remote counterparts which may infer that the two different working settings possibly have distinct effects on the health of the workers. However, upon further evaluation, the two distinct populations both exhibited negligible to moderate indications of EHS symptoms in separate environments. A significant difference in the perception of BPO workers is observed regarding the intensity of the effects of EMF across all possible sources except three specific devices: a computer, a television, and a television or radio transmitter. However, the source analysis indicates that the influence of EMF-emitting devices on the EHS of employees is low to negligible in both occupational settings. The study concluded that there is an absence of potential health risks stemming from exposure to EMF in both occupational settings for BPO employees. Considering the negligible impact of EMF exposure on EHS symptoms, BPO industries possess the flexibility to choose between the two work setups, as both environments do not pose significant EMF-related occupational health and safety threats.

Keywords: Occupational health, Safety, Electromagnetic hypersensitivity, Remote work, Business process outsourcing, Electromagnetic frequency

INTRODUCTION

The prevalence of electromagnetic field (EMF) production has increased with the advancement of technologies, potentially generating various types and forms of health hazards and threats. Currently, EMF sources are widespread, facilitating transformative technologies such as synthetic illumination, electrical heating, radio transmission, television broadcasting, wireless cellular communication and data extraction, microwave cooking, computer use, antitheft mechanisms, radar, and Wi-Fi. According to Röösli, Dongus, Jalilian, Feychting, Eyers, Esu, Oringanje, Meremikwu, and Bosch-Capblanch (2021), EMFs are fields containing frequencies between 100 kHz and 300 GHz. Numerous pieces of equipment used in households and businesses produce these fields.

In 1991, William Rea coined the term electromagnetic hypersensitivity (EHS) to describe the clinical condition of individuals who report experiencing health symptoms after being exposed to EMF (Belpomme and Irigaray, 2020). A number of scientific investigations have established that prolonged exposure to EMFs can lead to diverse health issues. Röösli, Moser, Baldinini, Meier, and Braun-Fahrländer (2004) conducted a study to develop a questionnaire, assessing symptoms, identifying potential sources of EMF in Swiss individuals, exploring possible associations between EMF and diagnoses, and gaining insight into the consultation patterns and progress of individuals who reported symptoms related to EMF exposure. In 2006, Schreier Huss, and Röösli surveyed the general public in Switzerland concerning their perceptions of the health risks posed by EMFs and other environmental exposures. In Finland, Hagström, Auranen, J., and Ekman (2013) conducted a study investigating the subjective experiences of Finnish individuals concerning their exposure to EMF. The study focused on individuals who reported experiencing EHS, their diagnoses, self-perceived sources of physical problems, and the utilization of medical services and related alternative treatments. Similarly, Kato and Johansson (2012) analyzed individuals that have an interest in EHS in Japan and assessed which EMF sources were responsible for the symptoms experienced by the subjects. Out of the 75 responses, 45.3% were reported to be medically diagnosed as EHS, 49.3% were self-diagnosed with EHS, and 5.3% regarded themselves as sensitive to EMF but not EHS. In France, Andrianome, De Seze, Braun, and Selmaoui (2018) confirmed the presence of individuals who have self-diagnosed EHS syndrome where 59% of respondents reported suffering from headaches, 35% from fatigue, 31% from sleep disorders, 29% from musculoskeletal pain, and 25% from concentration difficulties. An average 80% agreement in the samples identified that wireless networks caused the symptoms they experienced. Slottje, Van Moorselaar, Van Strien, Vermeulen, Kromhout, and Huss (2017) broadly performed the same study in the Netherlands.

According to Kakacek (2023), hypersensitivity is occasionally denoted as an allergy, but EHS does not trigger a histamine-mediated allergic response within the body. Individuals affected with EHS will experience a consistent impact upon being exposed to EMFs, regardless of their age and time of exposure. According to Lin, Chen, and Lu (2009), work-related symptoms

such as hoarseness or sore throats, musculoskeletal discomfort, and eye strain are commonly experienced in the IT and Business Process Outsourcing (BPO) industry. Filipino BPO employees were found to experience various health issues (Amante, 2010). Symptoms include headaches, fatigue, eye strain, chest and back pain, voice problems, hearing problems, ulcers, hypertension, and urinary tract infections.

According to an analysis conducted by the International Labor Organization (ILO), the Philippines is among the leading sources of digital platform workers, where the BPO industry is one of the leading employment producers. It has become one of the most significant export businesses of the country, alongside electronics, annually contributing approximately $30 billion to the economy of the nation. It was projected in 2019 that the number of BPO companies in the Philippines employing 1.3 million individuals would exceed a thousand entities, with an annual growth rate of 8% to 10%. The nation is expected to capture a significant portion, ranging from 10% to 15% of the global BPO industry. The services provided by the entities are primarily directed toward the United States, Europe, Japan, New Zealand, and Australia.

BPO AND REMOTE WORK

The BPO industry successfully implemented remote work arrangements during the Covid-19 pandemic (Isip and Icamina, 2021). Because of the perceived advantages of remote work settings, despite the absence of an evaluation of the occupational health of BPO personnel in remote environments, various industries are progressively considering a permanent remote work policy for their employees over the traditional face-to-face setting. Given that both work environments have their respective advantages and disadvantages in different aspects, enterprises have a scarce basis on which setting may be more beneficial, and in particular, safer in terms of occupational health of their employees. The primary determinants that dictate adopting a permanent working environment are often centered on cost-related considerations with little regard for the slow onset of occupational health hazards. In the context of the Philippines, most are unaware of the potential implications of EMF exposure. Several studies, including Campo, Garcia, Hernandez, and Chua (2017), demonstrate that BPO workers frequently experience physical discomforts such as tension, headaches, rhinitis, and colds. Despite the existing information, corporations continue focusing on profitability, efficiency, and other cost-related factors to determine the suitability of a given work setting, regardless of whether one working setting might induce a more significant threat to the health of the BPO workers. The identified symptoms suggest the possible incidence of EHS among BPO workers and the work environment as possible contributor to the problem. Minimal information regarding the relationship between occupational environments and the potential health risks induced by exposure to EMF is available in the literature.

In the interest of contributing to the discourse and promoting the physical well-being of BPO workers, this study seeks to answer - between the traditional and remote working settings, does one work environment poses more occupational health hazards in terms of EMF exposure than the other?

To answer the research question, the study generally aims to evaluate the effects of EMF-emitting devices on BPO employees in both traditional and remote work setups. Specifically, the study wants to assess the general health of BPO employees, the associated health risks based on EHS symptoms, and the sources of EMF in the work environment.

METHODOLOGY

The investigation is composed of three parts: pre-assessment of respondents, symptoms analysis using principal component analysis, and sources analysis. Data collection employed e-mail correspondence to communicate with 25 companies and requested the distribution of the survey instrument to 20 customer service personnel in the BPO industry, with equal representation from traditional and remote work arrangements, through a randomized selection process. The study was able to gather 847 samples, with 410 samples collected from those working in traditional settings and 437 samples collected from those operating under remote settings after one month. Based on the 500 anticipated total for both traditional and remote work environments, the response rates are 82% and 87.4% respectively. These response rates are significantly greater than the 20% participation threshold needed in survey evaluations for practical significance (Layaoen, Abareshi, Abdulrahman, Abbasi, 2023; Malhotra & Grover, 1998). Using Cochran's formula, the study was able to establish that 386 samples were required. The collected data were analyzed to identify the predominant sources and symptoms prevalent among the population in two distinct working environments.

The Self-Reporting Questionnaire (SRQ) developed by Harding, Iqbal, Budd, Tranter, Francis, Chiscop, Baguley, Chauhan, Spencer, Bhutani, and Wright (1980), to investigate mental conditions in developing countries was adopted. Colombia, India, Sudan, and the Philippines primarily employ this method to examine specific populations intended to detect non-specific psychological distress using a yes or no format. Eltiti, Wallace, Zougkou, Russo, Joseph, Rasor, and Fox (2007) assert that inquiries about individuals' general wellness provide a comprehensive understanding of their potential health status.

Following Kacprzyk, Kanclerz, Rokita, and Tatoń (2021), the study incorporated pre-assessment measures to identify and exclude symptoms that were not directly related to EHS as reported by the participants. The EHS-detecting instrument was derived from the work of Eltiti et al. (2007), comprising 57 items. The symptoms listed are all the associated with EMF devices reported by the EHS population from the United Kingdom. The sources included in the study comprised a collection of nine items derived from the research conducted by Hojo et al. (2016). All the sources were considered available in both remote and traditional working environments. Both the symptoms and sources underwent evaluation using a 5-point Likert scale.

An exploratory principal component analysis (PCA) with direct oblimin rotation was employed to evaluate the symptoms because of its theoretical capacity to establish associations between the components, as opposed to the widely used varimax rotation. Eltiti et al. (2007) used exploratory PCA to investigate symptoms' fundamental pattern structure and group the

57 symptoms into a feasible quantity of symptom components. The investigation utilized the factor loading with the highest value for each symptom. Suppose a sign exhibits cross-loading and has a marginal difference in factor loading scores, the researcher has the option to allocate the symptom to the component where it demonstrates coherence with other symptoms. A cumulative score of 17 and below indicates having no to mild symptoms, moderate when it is between 17 to 47, and severe when it is 47 and above. Independent samples t-test with bootstrapping adapted from the methods of Layaoen et al., 2023 was used to analyze the EMF sources and EMF perceptions and Crosstabs and Chi-square to analyze the SRQ-20.

RESULTS

Out of the total respondents, 47.72% were male and 52.28% were female BPO employees. In terms of age across five groups, 22.46% were 18 to 25 years old, 15.44% were 26 to 30 years old, 16.14% were 31 to 35 years old, 24.21% were 36 to 45 years old and everyone above 45 years old comprised 21.75% of the responses. Samples were collected from nine cities across Metro Manila. Using the SRQ-20, traditional BPO workers encounter health risks with statistically higher severity ($p < 0.05$) than their remote counterparts. This may initially infer that the two different working settings possibly have distinct effects on the health of the workers. When asked regarding the level of sensitivity of BPO workers on EMF, those in traditional work environment perceive that they are moderately sensitive to EMF with a mean score of 1.55, while those in remote setup perceive that they are very sensitive to EMF with a mean score of 2.52, with a statistically significant difference. When asked regarding the intensity of the negative health changes the BPO worker experience in their current work setting, employees in traditional work environment perceive that they experience moderate negative health changes when exposed to EMF with a mean score of 1.57, while those who work remotely perceive that they also experience moderate negative health changes when exposed to EMF with a higher mean score of 2.44, with a statistically significant difference.

Moreover, traditional workers exhibit poorer sleep quality, are more easily frightened, more nervous, tense, or worried, experience worse digestion problems, have more trouble thinking clearly, are unhappier, cry more often, find decision- making to be more difficult, experience more disability on playing a useful part in life, feel more worthless, experience more tiredness, experience more headaches, and have lesser appetites than their remote worker counterparts with a statistically significant difference between the responses of two distinct populations.

Symptoms Analysis

A principal component analysis (PCA) was conducted on 57 symptoms, utilizing direct oblimin rotation. Following Eltiti et al. (2007), several forced-factor solutions were applied to evaluate the EHS symptoms encountered by BPO employees, where the eight-factor forced solution demonstrated superior coherence of its symptom categories as opposed to alternative forced factors. The results of the symptoms analysis is summarized in Table 1.

Table 1. Symptom scores for traditional and remote work environments.

Symptoms	Traditional	Remote
Cardiovascular-related	2.55	1.02
Allergies	1.76	1.33
Respiratory-related	1.42	2.07
Blood pressure-related	1.40	1.32
Neurovegetative	1.09	2.16
Auditory Vestibular	1.07	1.18
Chronic Fatigue	1.01	1.79
Head-related	1.51	1.80
Cumulative EHS Score	11.81	12.69

Despite remote work environments having a higher symptom score, the two distinct populations both exhibited negligible to moderate indications of EHS symptoms in separate environments. A cumulative EHS score below 17 indicates low sensitivity to EMF devices among the population.

Sources Analysis

The study utilized an independent sample t-test with 2000 bootstrapped samples to examine potential differences in mean scores, given that the two populations exhibit non-normality. A significant difference in the perception of BPO employees is observed regarding the intensity of the effects of EMF across all possible sources except three specific devices: a computer, a television, and a television or radio transmitter. For the computer, the attained significance value is 0.14, and therefore, the null hypothesis is accepted, which states that the means of two independent samples are equivalent. The same was performed for all devices and the results are summarized in Table 2. Despite significant differences for some devices, the source analysis indicates

Table 2. Results of the source analysis.

DEVICE	SETTING	PERCEPTION	p-value
Computer	Traditional	very concerning	0.14
	Remote	very concerning	
Electric Appliances	Traditional	moderately concerning	0.00
	Remote	moderately concerning	
Fluorescent Lighting	Traditional	very concerning	0.00
	Remote	slightly concerning	
Microwave Oven	Traditional	not concerning	0.00
	Remote	slightly concerning	
Mobile Phone	Traditional	very concerning	0.00
	Remote	very concerning	
Power Line	Traditional	slightly concerning	0.00
	Remote	slightly concerning	
Television or Radio Transmitter	Traditional	slightly concerning	0.05
	Remote	slightly concerning	
Telecommunication Mast	Traditional	slightly concerning	0.00
	Remote	slightly concerning	
Television	Traditional	slightly concerning	0.05
	Remote	slightly concerning	

that the influence of EMF-emitting devices on the EHS of employees is low to negligible in both occupational settings.

CONCLUSION

In the end, both work environments have been found to have minimal occupational risks associated with the EHS of BPO employees. Although the initial results show a higher perceived risk in the traditional work environment, further evaluation revealed negligible impact of EMF exposure on EHS symptoms in both work settings. The study demonstrated the importance of validating perceptions of risk to mitigate bias over certain work environments. The outcome depends on the agreement of symptoms experienced by the population in the same environment and the consistency of associating risks to perceived hazards commonly present in those settings.

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