Nurses' Knowledge Regarding an Electronic Waste Management and Work Environment

Mohammed Munawir Mohsen Abu-Alruhaylah[1], Gehan Mohamed Ahmed Mostafa[2] & Mahmoud Mohamed Mahmoud Elkhouly [3]

1- *M.Sc. Nursing Administration, Faculty of Nursing, King Saud University, Kingdom of Saudi Arabia*
2- *Professor of Nursing Administration, Administration Nursing Department, Faculty of Nursing, Helwan University, Egypt*
3- *Professor of Information Technology, Faculty of computers and Information Technology, Helwan University, Egypt*

Abstract

Background: Electronic waste is a rapidly growing problem worldwide due to the increasing consumption of electronic devices and the short lifespan of these products. **Aim:** This study aimed to assess nurses' knowledge regarding an electronic waste management and work environment. **Design:** A descriptive research design was utilized. **Setting:** the current study was conducted at Badr University Hospital, which is affiliated to Helwan University. **Subjects:** Convenience sample of (n =82 nurses) was used. **Tools of data collection:** Data were collected using two tools; (I) Electronic waste questionnaire and (II) Work environment scale. **Results:** the result illustrates that only (36.6%) the studied nurses had a satisfactory level of knowledge regarding electronic waste management, as well, (40.2%) of the studied nurses had a positive work environment during the study. **Conclusion:** this study concluded, there was a highly statistically significant positive correlation between knowledge regarding electronic waste management and work environment among the studied nurses. **Recommendations**: Nursing personal should had an electronic waste management training program on work environment

Key words: E-Waste Management, Nurses, Work Environment.

Introduction

Today, Electrical and Electronic Equipment (EEE) has become necessary and reinforces living principles, but often holds poisonous chemical compounds that negatively impact human well-being and the surroundings and fuel the climate confrontation. EW is one of the most crucial and urgent challenges of our period; however, it is usually avoided. Across the globe, the growing amount of EW warns the surroundings and local societies, as incorrectly given e-waste results in history-threatening toxic chemical compounds liberated into the surroundings and the casualty of expensive metals **(Forti et al., 2020)**.

Technological progresses are fast replacement for millions of unoriginal manoeuvres, developing in their devastation in appropriated dumps owned by overdone unfavourable environmental belongings. The main beginning of EW among developing countries with their

own governments is the mean of electronic waste and electrical elements from grown nations because former, inferior environmentally continual technology gets dropped **(Begum et al., 2023)**.

Electronic waste is a swiftly increasing problem in general on account of the growing devouring of electronic instruments and the short age of these devices. EW recycling and exercise have emerged as potential solutions to this issue **(Mishra et al., 2024)**. Uncovering EW has been proven to influence teenagers, lead poisoning. Periodic uncovering to lead, conceivably through breastfeeding, affects future creation, precluding their growth, duplication, and even neurobehavioral structures if this uncovering happens without appropriate cautions **(Neves et al., 2024).**

Conveniences and the state of electronic waste acknowledge the potential for fire and discharge due to the presence of chemical compounds and combustible fabrics. Employees and the surrounding public may suffer injuries or possibly die as a result of these risks. The strength, security, and material repercussions of EW situations can be increased by unethical management and conclusion methods, including the disposal of e-waste in landfills. Appropriate management techniques that reduce these effects by reusing and disposing of waste responsibly **(Nandan et al., 2023).**

Workplace environment is the surroundings at which point nations work that involve material background, task characterization, and civilization and display condition, while conduct is the incident of characterized goals. Working place environment determinants like material surroundings, institution reward, guidance style, work history equilibrium, and preparation have own effect on clerk efficiency in arrangements. Academies are between the organizations. In academies, skilled is a cutthroat contest; the company is confronted through attracting challenge, maintaining, and stimulating the staff members. These labourers confronted with a numerous of problems concerning the work surroundings **(Alemu, 2022)**.

The procedures, guidelines, forms, structures, and surroundings that affect nurses' behaviour, whether positively or negatively, are referred to as the working environment. The active environment can also be thought of as a setting where activities are able to be done in a way that is perfect, safe, healthy, and simple. It can also be defined as the ability to exchange information throughout the planning process, depending on how the entire environment is intended to authorise plans to apply the entire environment as though it were advantageous **(Emmanuel, 2021)**.

Concerning nurses awareness electronic waste is a promptly increasing question in general on account of the growing use of electronic instruments outputs. EW reusing and application has arisen as potential answers to these question massive amounts of EW are created annually. Still, nurses concentrated with the EW crucial hazards and impacts on work qualification and work environments. EW administration enhances ownership by restoring valuable and rare metals and preserving well-being and environments **(Mishra et al., 2024)**.

On account of nursing profession fast change in using up-to-date services and electronic devices, in addition to the intense worsening that emerges from concerning details progress, skilled techniques resulted in a massive amount of EW. But, except that end-of-growth

sustenance is not cautiously controlled, EW can cover a variety of hurtful compounds that can cause incidental harm and influence human wellbeing. It is expected that biotechnological hardware improvement approaches would play a critical duty in continuous development by permitting more cost- and environmentally intimate actions. The demand for new mines for specific training for dealing with e-waste prepare, recycling disposing, and making it individual of its largest benefits on work environment *(Begum et al., 2023)*.

Significance of the study

Electronic-Waste wealth is Electrical and Electronic Equipment Waste containing all elements, substitute assemblies, and consumables that are constituent of the brand concurrently with an activity of discarding. EE is one of the fastest increasing waste streams in many nations that create about 5% of EW which planet expansive and the fastest increasing stream of concerning cities completed. Informal recyclers presents at several countries; that concentrated with appreciated portions in EW and unessential or non-valuable fractions. Some official reuses of items were presenting but mainly had low value**.** The foremost categories of precarious contaminants present in EW belong to; heavy metals, halogenated molecules, radioactive combinations and various constituents such as plastics, ceramics and resins (***Bhandari et al.***, ***2023).***

The Global e-waste Monitor 2020 reckoned that the global documentation and recycling of e-waste are minimal (14.66%); the highest is 42.5% in Europe, followed by 11.7% in Asia, 9.4% in the Americas, 8.8% in Oceania, and only 0.9% in Africa. Today, 71% of the population has incorporated policies on e-waste, different from region to region; the remaining 29% are yet to bind themselves with a legal framework to ensure legal practices for a sustainable e-waste management. (**Forti et al, 2020**).

E-waste management becomes essential to recover the valuable and precious metals, and protect health and environment. Egypt is a significant market for electric and electronic products that ends as e-waste and in the top of African countries in e waste generation. The e-waste generated in Egypt is about 20.1% that of the African continent, while the population in Egypt is about 8.6% of Africa (**Hesham, 2021**).

Aim of the study

The aim of this study to assess nurses' knowledge regarding an electronic waste management and work environment.

Research questions

1. What the nurses' knowledge regarding an electronic waste management?
2. What the nurses' knowledge regarding work environment?
3. What is the relation between nurses' knowledge regarding an electronic waste management and work environment?

Subject and methods

Research design: Descriptive research design was utilized to conduct this study.

Setting: The study was directed at Badr University Hospital affiliated with Helwan University and localized the region of Badr City, Cairo, Egypt.

Sampling: A convenience sample of (82 nurses) from both sex working in the critical care unit, emergency room, and inpatient department accepted to participate in this study, available at the time of the study.

Tools for data collection:

Tool (I): Self-administrative electronic waste questionnaire: This tool assessed the awareness of the nurses about the electronic waste. It entailed of two parts:

- **Part (I): Personal characteristics sheet;** collect data related to personnel characteristics data of the study subjects such as: (Age, gender, material status, nursing education, job title, years of experience, department, work shift, place of birth and residence).

- **Part (II): A structured self-administrative questionnaire;** constructed and adapt by the researcher based on *Sultan, (2022) & Okoye, A. and Odoh, C. (2014)* and revised by 5 experts, and pilot tested. The scale consists of 38 items that contain 4 dimensions; (1) the level of knowledge towards importance of e-waste (8 items); (2) the level of awareness towards importance of e-waste (12 items); (3) the involvement in electrical/electronic waste generation (8 items); and (4) the impact on the environment (10 items)

  The scoring system:-

  The questionnaire consisted of 4 dimensions (38 items) with a total score of (76). Two grades were given for correct answer and one grade given for incorrect answer. The total grades of items summed up, converted into a percentage score, and classified in to three levels as the following:-
  - The satisfactory level, is equal or more than 60 % (46-76 score).
  - The unsatisfactory level, is less than 60% (38-45 score).

Tool (II): Work environment scale; constructed and adapted by the researcher based on as **Moos (2008),** revised by 5 experts, and pilot tested. The scale consists of 10 dimension that contain (90 items) as the following; (1) involvement (9 items); (2) co-worker – cohesion (9 items); (3) supervisor support (9 items); (4) autonomy (9 items); (5) task orientation (9 items); work pressure (9 items); clarity (9 items); managerial control (9 items); innovation (9 items); and physical comfort (9 items).

  The scoring system:-

  The scale consisted of 10 dimension and (90 items) with a total score of (180). Two grades were given for yes response and one grade given for response of no). The total grades of items summed up, converted into a percentage score (**Mahgoub et al., 2019**), and classified in to three levels as the following
  - The positive level, is equal or more than 60 % (108-180 score).
  - The negative level, is less than 60% (90-107 score).

Validity and reliability:

  Validity:

  Validity of the tools was approved (face and content). The forms were interpreted into numbers and tested by a group of five experts specific to nursing administration from various three Universities, that is to say; three professors from Ain sham University;

Damanhour University (one professor); Cairo university (one professor), and Cairo University (one professor).

Reliability:

Cronbach's Alpha was used to determine the internal reliability of the tool. Reliability of the tools was test to determine the extent to which the questionnaire items are related to each other and the result was (0.926 & 0.994) for electronic waste questionnaire and work environment scale.

Ethical and legal consideration:

The research authorization got from the Faculty of Nursing ethical committee of Helwan University before offset the training, an authorization got from the Manager of Badr Hospital connected with the University. Informed consent was given to each sharing subject superior to information accumulation; participant informed about the determination and wonted consequences of the study, and confident about harmless presence, participant's partnership was willing, and nurses had the right to be removed from the study at whatever time outside some reason. Participants still were confident that anonymity and confidentiality remained approved, as were the assembled information second-hand for the study purpose. Ethics, principles, civilization and trust were esteemed.

Pilot study

The pilot study was completed activity on (10%) of the total sample content (8 nurses) to test relevance and clearness of forms and occasion wanted to complete it. No adjustments existed finished so participant in the pilot study remained contained in the study sample.

Field work:

The researcher join the Director of Badr Hospital connected the University to clarify the purpose of the study, together all essential knowledge about nurses (numbers, qualifications, areas, gender, age and years of experience occupied in the hospital). Attended the pilot study on 10% of the total nurses (8), furthermore the researcher start to accumulate data from beginning of August 2023 completed at beginning of September 2023 (one months), by utilizing the tools from the study participants in the setting thought-out applicable work opportunity outside bothering the everyday work and subsequently demonstrating the purpose of the study.

The researcher scheduled the visits to the ward accompanying the preparation area as following; the researcher visited the hospital 3 opportunities per week eventually shift; each visit was categorized from 4-5 hours (from 9am to 2pm).

Firstly, the researcher started with the self- administrative questionnaire to assess nurses knowledge about electronic waste. The time wanted to end this tool categorized between (10-15) minutes. **Secondly** the researcher used the work environment scale assess nurses knowledge about work environment. The time wanted to complete this form categorized between (15-25) minutes. Total period wanted to complete two together forms was categorized middle from two points (25-40) record.

Administrative design

Authorization to complete activity this study was acquired from the Dean of the Faculty of Nursing, Helwan University, and the Manager of Badr Hospital connected with the University to conduct the study. Individual spoken consent was still acquired by each fostering work force to participate in the study.

Statistical design

Data admission and exploration were completed using SPSS statistical package version 26. Categorical variables were articulated as number and percentage while incessant variables were conveyed as (mean ±SD). Chi-Square (x2) tested the association between row and column variable of qualitative data. ANOVA test associate the mean of typically disseminated quantitative variables. While T independent test associate the mean of typically disseminated quantitative variables in two groups. As well, Pearson correlation measured correlation between quantitative variables. For all tests, a two-tailed p-value ≤ 0.05 was considered statistically significant, P-value ≤ 0.01 was considered highly statistically significant, while, p-value> 0.05 was considered not significant **(Cognitive and Brain Science Unit, 2021*).*

Table (1): Frequency distribution of personal characteristics among the studied nurses (n=82)

Personal characteristics		No	%
Age (in years)	< 20	10	12.2
	20- < 30	64	**78.0**
	30- < 40	7	8.5
	40- < 50	1	1.2
	$\overline{x} \pm SD$	**25.68 ± 4.86**	
Gender	Male	45	**54.9**
	Female	37	45.1
Place of birth	Rural	56	**68.3**
	Urban	26	31.7
Place of residence	Rural	52	**63.4**
	Urban	30	36.6
Marital status	Single	56	**68.3**
	Married	25	30.5
	Divorced	1	1.2
Education	Technical institute	68	**82.9**
	Bachelor's degree	14	17.1
Job title	Staff nurse	66	**80.5**
	Head nurse	13	15.9
	Supervisor	3	3.6
Year of experience	1 < 5 years	25	30.5
	5 years < 10 years	45	**54.9**
	≥ 10 years	12	14.6
	$\overline{x} \pm SD$	**7.36 ± 4.52**	

Department		Critical Care Unit.	27	32.9
		Emergency room.	13	15.9
		Inpatient Department	42	**51.2**
Work shift		Full time	75	**91.5**
		Part time	7	8.5

Table (1) shows that **(78%)** of the age of the studied nurses were ranged from 20- < 30 years old, with a mean age of **25.68 ± 4.86**. About gender, **(54.9%)** of the studied nurses were male, and **(45.1%)** were a female. As well, **(68.3% & 63.4 %)** of the studied nurses were from rural area at place of birth and place of residence, respectively. Considering marital status, **(68.3%)** were single. Additionally, **(82.9% & 80.5%)** of nurses holding a technical certificate and being staff nurse, respectively. Moreover, **(54.9%)** of nurses had experience lasting from 5 years < 10 years with a total age of **7.36 ± 4.52**. Finally, **(51.2%)** and **(91.5%)** of nurses working at in-patient department and were working full time respectively.

Table (2): Percentage distribution of level of knowledge regarding e-waste management among the studied nurses (n=82)

Items	Satisfactory		
	No	**%**	$\overline{x} \pm SD$
Importance of E-Waste	٣٣	40.2	13.88±2.26
Importance of E-Waste management	30	36.6	19.80±2.8
Involvement in Electrical/ Electronic Waste Generation	16	19.5	13.00±2.33
Impact on the environment	46	56.1	15.41±3.29
Total		**36.6**	**47.70±12.5**

Table (2) illustrates that **(56.1%)** of the studied nurses had a satisfactory level of knowledge regarding e-waste management impact on the environment with main score **(47.70±12.5)** in addition to total level of knowledge regarding e-waste management among the studied nurses was **(36.6%).**

Table (3): Percentage distribution of level of knowledge regarding work environment among the studied nurses (n=82)

Items	Negative		Positive		Negative	Positive	Total
	No	**%**	**No**	**%**			
Involvement	50	61.0	32	39.0	9.06±0.24	17.50±1.2	12.35±4.2
Co-worker cohesion	51	62.2	31	37.8	9.02±0.14	17.39±1.4	12.18±4.1
Supervisor support	50	61.0	32	39.0	9.02±0.14	17.25±1.6	12.23±4.1
Autonomy	49	59.8	33	40.2	9.02±0.14	17.18±1.9	12.30±4.2
Task orientation	49	59.8	33	40.2	9.00±0.0	17.0±2.0	12.22±4.1
Work pressure	48	58.5	34	41.5	9.02±0.14	17.12±1.9	12.38±4.2

Clarity	52	63.4	30	36.6	9.08±0.26	17.63±1.1	12.21±4.20
Managerial control	48	58.5	34	41.5	9.02±0.14	17.09±1.7	12.37±4.4
Innovation	48	58.5	34	41.5	9.02±0.14	17.09±1.9	12.37±4.1
Physical comfort	14	17.1	68	82.9	9.0±0.0	16.09±2.18	14.88±3.33
Total	**59.8**		**40.2**		**94.18 ±3.61**	**172.03±17.39**	**125.51±40.0**

*Significant p ≤ 0.05   **Highly significant p ≤ 0.01   F: ANOVA Test

Table (3) illustrates that **(40.2%)** of the studied nurses had a positive level of awareness regarding work the environment with main score **(172.03±17.39)** compared to **(59.8%)** of the studied nurses had a negative level of awareness regarding work the environment with main score **(94.18 ± 3.61).**

Table (4): Correlational matrix between dimensions of knowledge regarding e-waste management and work environment dimensions during pre, post & three months follow-up among the studied nurses (n=82)

Work environment	Level of knowledge regarding importance of E-waste management							
	Importance of E-Waste		Importance of E-Waste Management		Involvement in Waste Generation		Impact on environment	
	R	P	r	P	R	P	R	P
Involvement	0.941	0.000**	0.915	0.000**	0.600	0.000**	0.889	0.000**
Co-worker Cohesion	0.951	0.000**	0.931	0.000**	0.625	0.000**	0.905	0.000**
Supervisor Support	0.950	0.000**	0.929	0.000**	0.620	0.000**	0.902	0.000**
Autonomy	0. 943	0.000**	0.919	0.000**	0.606	0.000**	0.894	0.000**
Task Orientation	0. 952	0.000**	0.931	0.000**	0.623	0.000**	0.904	0.000**
Work Pressure	0.942	0.000**	0.914	0.000**	0.600	0.000**	0.980	0.000**
Clarity	0.947	0.000**	0.926	0.000**	0.618	0.000**	0.901	0.000**
Managerial Control	0.948	0.000**	0.919	0.000**	0.607	0.000**	0.894	0.000**
Innovation	0.945	0.000**	0.918	0.000**	0.603	0.000**	0.893	0.000**
Physical Comfort	0.688	0.000**	0.687	0.000**	0.519	0.000**	0.740	0.000**

*Significant p ≤ 0.05   **Highly significant p ≤ 0.01

Table (4) clarifies that, there was a statistically significant positive correlation (Ranged from moderate to high correlation) between dimensions of knowledge regarding e-waste management (Importance of e-waste, importance of e-waste management, involvement in electrical/electronic waste generation and impact on environment) and dimensions of work environment (Involvement, co-worker cohesion, supervisor support, autonomy, task orientation, work pressure, clarity, managerial control and innovation) throughout the program among the studied nurses at r= ranged from 0.525 to 0.952 & P= 0.000.

Table (25): Correlational matrix between knowledge regarding importance of E-waste management and work environment during pre, post & three months follow-up among the studied nurses (n=82)

Items	Knowledge regarding importance of E-waste management	
	R	P
Work environment	0.900	0.000[**]

*Significant p ≤ 0.05   **Highly significant p ≤ 0.01   F: ANOVA Test

Table (25) explains that, there was a statistically significant high positive correlation between knowledge regarding e-waste management and work environment among the studied nurses at r= 0.900 & P= 0.000.

Discussion

Electronic waste has reached alarming proportions worldwide, posing serious dangers to the environment, business, and public health. It addresses the problems, effects, and possible solutions related to the management of electronic waste in developing nations with independent governments. Researchers emphasise the urgent need for appropriate laws, nursing education, and expertise to address the expanding issue of managing electronic waste (**Khanal et al., 2024**).

The aim of this study was to assess nurses' knowledge regarding an electronic waste management and work environment among nursing personals. Concerning the personal characteristics of the studied nurses, as regard the age and gender; the study results show that more than three-quarters of the nurses' age were ranged from twentieth to less than thirteen years old, with a mean age of 25.68 ±4.86. As well, more than half of them were male. From researcher point of view, most of male had a good direction toward nursing profession.

This result was in consistant with *Thirunavukkarasu et al. (2022)* study entitled "Knowledge, attitude and practice towards bio-medical waste management among healthcare workers: a northern Saudi study" who described that more than three-quarters of the nurses' age were than thirteen to thirteen nine years old, with a mean age of 34.35 ±9.5. Also, more than half of them were male.

Oppositely, *Mahmoud et al (2022)* study entitled "Effect of an educational program for nurses working in maternal and child health care centers about health care waste management", and found that about twentieth of nurses' age were ranged from twentieth to thirteen and from thirteen one to fourteen years old, with a mean age of 42.2 ±9.9. Moreover, the majority of nurses were female.

With regard to the studied nurses' marital status and residence; more than three-fifths of nurses were single from rural area at place of birth and place of residence. This result supported by *Thirunavukkarasu et al. (2022)* who illustrated that more than half of the participated nurses were single live away from urban areas. On contrast to *Mahmoud et al (2022)* study who bring into being that the majority of the studied sample were married and also more than half of nurses born and live in rural area.

Concerning the studied nurses' Education, job title, and year of experience; the results demonstrated that the majority of nurses were technical institute and only seventeen of them were bachelors; working as staff nurses with more than half of them had less than tenth years of experience. From researcher point of view most of nurses with bachelor's degree or get enough experience prefer to work in privet hospital or travel for financial causes hospital need only limited number of nurses had high job titles due to limited positions.

In the same line *Mahmoud et al (2022)* study showed that the majority of the studied nurses were diploma and institute nursing; working as staff nurses with more than half of nurses had tenth years of experience. On the other hand **Saleh et al. (2023)** study entitled "Effect of green management training program on nursing managers' perception of occupational safety and green management practices" who found that more than three-quarters were staff nurses had bachelor degree with a half of them had more than tenth years.

Regarding the studied nurses' working department and work shift time; the result of the study demonstrated that the most of nurses had full time working in inpatient department. From researcher point of view most of hospital need only limited number of nurses to work in critical and emergency units and the rest of nurses were distributed in other hospital inpatient departments. In the same line *Nuwematsiko et al. (2021)* study entitled "Knowledge, perceptions, and practices of electronic waste management among consumers" who found the most of nurses had full time working in different inpatient department with more than a half of them were informal employment.

In relation to the percentage distribution of level of knowledge regarding e-waste management; the result of the study illustrates that more than half of the studied nurses had a satisfactory level of knowledge with the higher mean score regarding e-waste management impact on the environment with a total level of knowledge regarding e-waste management among the studied nurses was less than two-fifths. From the researcher point of view, nurses had a good awareness regarding the importance of e-waste management knowledge improvement and educations were proven to have the largest impacts.

In the same line *Nuwematsiko et al. (2021)* study found that the majority of the studied sample had less than two-fifth of overall knowledge score about e-waste management. As well, *Jalal et al. (2021)* study entitled "Assessment of knowledge, practice and attitude about biomedical waste management among healthcare professionals; during COVID-19 crises in Al-Ahsa" who illustrated that only one-quarter of the studied nurses had satisfactory level of knowledge.

As well, the result supported by the study done by *Nguyen, et al. (2024)* entitled "Determinants of residents' e-waste recycling behavioral intention" and stated that there obvious high mean score in the studied sample understanding of e-waste management intention and its potential environmental effect with a highly statistically significant difference between total mean score of at pre-test before program implementation.

In relation to the level and mean score of work environment; the result of the study denoted that the more than two-fifth the studied nurses perceived a higher mean score with positive response to the work environment. From researcher point of view, nurses were realized

that there great relation between workplace environment and employees' performance. Nurses reported that factors, such as level of physical comfort (availability of resources, proper furniture, and lighting), channels of mmanagerial communication, work interaction and involvement, supervisory support and balanced workload, privacy are considered important factors in nurses' innovation and productivity.

This result supported by **Shaikh** *(2023)* study entitled "Relationship between employees' performance and workplace environment" and found that more than one-third of the studied nurses had appositive response in relation to the work environment (Job satisfaction, supervisor support, innovation and creativity, organizational managerial skills, workplace environment incentives, furniture, lighting, and ventilation).

Likewise, the result the study completed by ***Herawati et al. (2023)***, entitled "The effect of workload and supervisor support and coworker support on job satisfaction and job performance" and found that about two-fifths of the participants reported a positive satisfaction regarding work environments as workload, supervisor support throughout managerial control, co-worker support, and job tasks clarity, awareness and orientation and on job performance satisfaction.

As regard correlational matrix between dimensions of knowledge regarding e-waste management and work environment dimensions among the studied nurses; the study result clarifies that, there was a statistically significant high positive correlation between dimensions of knowledge regarding e-waste management and dimensions of work environment.

As well, the study done by **George** and **Cekuls (2024)** entitled "driving sustainable e-waste recycling behaviors in India: challenges, models, and solutions" and found that there were a positive statistically significant relation between level of e-waste knowledge and awareness and e-waste generation recycling challenges, e-waste collection preferences, e-waste disposal practices, and technological change and between work environment concern, government policies and regulations, managerial skills and control, staff relation, and work pressure.

Similarly, the study done by ***Almulhim (2022)***, entitled "Awareness and participation in sustainable electronic waste management practices" and illustrated presence of a positive statistically significant relation between level of e-waste knowledge, processed, and practical management and work environment susceptibility, and its impact on environmental problems associated with improper disposal, and willingness to engage in managing e-waste.

In relation to correlation between knowledge regarding e-waste management and work environment; there was a statistically significant high positive correlation between knowledge regarding e-waste management and work environment. This result constant with ***Madkhali et al., (2023)*** study entitled "Comprehensive review on e-waste management strategies and prediction methods" found a statistically significant positive correlation between knowledge and awareness regarding e-waste management and work environment sustainability.

Similarly, the result of the study done by ***Jahan*** and ***Mim (2023)*** entitled "Evaluating the Level of Knowledge and Awareness Regarding E-Waste" and found a statistically

significant positive correlation between knowledge regarding e-waste management process and health work environment.

Conclusion

Based on the study result only less than two-fifth of the studied nurses had a satisfactory level of knowledge regarding electronic waste management, as well, more than two-fifth of the studied nurses had a positive work environment during the study. Furthermore, there was a highly statistically significant positive correlation between knowledge regarding electronic waste management and work environment among the studied nurses.

Recommendation

Nurses Level

1. Enhance intellectual aware of government regulation on EW management.
2. Inform nurses about the impact of e-waste on environmental and health hazards

Organizational Level

1. Make healthcare professionals aware that toxic waste needs special handling in order to be disposed of in an environmentally friendly manner.
2. Clarify rules and regulations for the environment hazard for the health care providers.

Educational level

1. Promote environmental hazard training session on e-waste to improve waste management.

Research level

1. Explore the effect of electronic waste protocol on organizational climate.

Reference

Alemu, K.A., (2022). Effect of Work Place Environment Factors on Performance of Employees: Empirical Study on Wollo University Staffs. DOI: 10.21203/rs.3.rs-1560832/v1 https://www.researchgate.net/publication/359995127_Effect_of_Work_Place_Environment_Factors_on_Performance_of_Employees_Empirical_Study_on_Wollo_University_Staffs

Almulhim, A.I. (2022). Awareness and participation in sustainable electronic waste management practices in Saudi Arabia; Ain Shams Engineering Journal, June, Volume 13, Issue 4, https://doi.org/10.1016/j.asej.2022.101729

Begum, J.P.S., Ngangom, L., Venugopal, D., Rawat, B., & Rawat, J.M. (2023). E-waste and Its Management by Using Algae. Microbial Technology for Sustainable E-waste Management.

Bhandari, G., Gupta, S., Chaudhary, P., Chaudhary, S., & Gangola, S. (2023). Bioleaching: A Sustainable Resource Recovery Strategy for Urban Mining of E-waste. In book; Microbial Technology for Sustainable E-waste Management. Pp.157-17. DOI: 10.1007/978-3-031-25678-3_10

Cognitive and Brain Science Unit (2021). Rules of Thumb on Magnitudes of Effect Sizes. Cambridge University MRC CBU Wiki. http://imaging.mrc-cbu.cam.ac.uk/statswiki/FAQ/effectSize

Emmanuel, O.O. (2021). The Dynamics of Work Environment and Its Impact on Organizational Objectives. Annals of Human Resource Management Research 1, 145–158.

Forti, V., Balde, C.P., Kuehr, R., & Bel, G. (2020). The Global E-waste Monitor 2020: Quantities, Flows and The Circular Economy Potential. United Nations University/United Nations Institute for Training and Research, International Telecommunication Union, and International Solid Waste Association, Bonn, Geneva and Rotterdam.

George, N. & Cekuls, A. (2024). Driving Sustainable E-Waste Recycling Behaviors in India: Challenges, Models, and Solutions; Engineering for Rural Development; May 24; Jelgava, 22.-24, available at https://www.iitf.lbtu.lv/conference/proceedings2024/Papers/TF227.pdf

Herawati, H., Setyadi, D., Michael, M., & Hidayati, T. (2023). The Effect of Workload, Supervisor, and Coworker Supports on Job Performance through Job Satisfaction. International Journal of Finance, Economics and Business, 2(1), 13–33. https://doi.org/10.56225/ijfeb.v2i1.168

Hesham, S., Mohamed, S., & Saraya, Mohamed, S. (2021). Current Status of the Electronic Waste Problem in Egypt. Mansoura Engineering Journal: Vol. 46: Issue. 4, Article 3. Available at: https://doi.org/10.21608/bfemu.2021.204325

Jahan, D. & Mim, A. (2023). Evaluating the Level of Knowledge and Awareness Regarding E-Waste among University Students in Bangladesh; International Journal of Economics, Commerce and Management United Kingdom ISSN 2348 0386 Vol. 11, Issue 3, March , available at https://ijecm.co.uk/wp-content/uploads/2023/03/1135.pdf

Khanal, A., Sherpa, P., Chataut, P., & Khanal, A. (2024). Transforming E-Waste Management: Challenges and Opportunities; International Research Journal of Multidisciplinary Technovation; February, doi: 10.54392/irjmt2429

Madkhali, H., Duraib, S., Nguyen, L., Prasad, M., Sharma, M., & Joshi, S. A. (2023). Comprehensive Review on E-Waste Management Strategies and Prediction Methods: A Saudi Arabia Perspective. *Knowledge* 2023, *3*, 163-179. https://doi.org/10.3390/knowledge3020012

Mahgoub, A.S., Shazly, M., & El-sayed, S.M. (2019). Relationship between Work Environment and Innovative Behavior among Staff Nurses. Egyptian Journal of Health Care 10, 64–77.

Mahmoud, S.F., Alhanafy, S.I.A. & Negm, H.E.A. (2022). Effect of an educational program for Nurses working in Maternal and Child Health Care Centers about Health Care Waste Management; Egyptian Journal of Health Care, EJHCVol.13 No.1, available at https://ejhc.journals.ekb.eg/article_214077_7b069f468842e6e8b352d0dade44b5e3.pdf.

Mishra, K., Siwal, S.S., Thakur, &V.K. (2024). E-waste Recycling and Utilization: A Review of Current Technologies and Future Perspectives. Current Opinion in Green and Sustainable Chemistry 47, 100900.

Moos, R.H. (2008). Work Environment Scale Manual: Development, Applications, Research, 4th ed. Mind Garden, Inc.

Nandan, A., Suresh, A., Saole, P., Jeevanasai, S., Chandrasekaran, R., Meili, L., Wan Azelee, N., & Selvasembian, R. (2023). An Integrated Approach for Electronic Waste Management—Overview of Sources of Generation, Toxicological Effects, Assessment, Governance, and Mitigation Approaches. Sustainability 15, 16946.

Neves, S.A., Marques, A.C., & de Sá Lopes, L.B. (2024). Is Environmental Regulation Keeping E-Waste Under Control? Evidence from E-Waste Exports in the European Union. Ecological Economics 216, 108031.

Nguyen, T.T.H., Hung, R-J., Lee, C-H., & Thi Thu Nguyen, H. (2024). Determinants of Residents' E-Waste Recycling Behavioral Intention: A Case Study from Vietnam. Sustainability; 11(1):164. Republished MDPI; retrieved from https://doi.org/10.3390/su11010164

Nuwematsiko, R., Oporia, F., Nabirye, J., Halage, A.A., Musoke, D., & Buregyeya, E. (2021). Knowledge, Perceptions, and Practices of Electronic Waste Management among Consumers in Kampala, Uganda. J Environ Public Health. 2021 Feb 12; 2021:3846428. Doi: 10.1155/2021/3846428. PMID: 33628280; PMCID: PMC7895594.

Okoye, A., & Odoh, C. (2014). Assessment of the Level of Awareness of E-Waste Management and Concern for the Environment amongst the Populace in Onitsha, Southeastern Nigeria. Journal of Environmental Protection 5, 120–134.

Saleh, N.M.A., Eldeep, N.M., & Soliman, S.M. (2023). Effect of Green Management Training Program on Nursing Managers' Perception of Occupational Safety and Green Management Practices; Egyptian Journal of Health Care, September EJHC Vol 14. No.3, available at https://ejhc.journals.ekb.eg/article_317241_e3cf1ec83f862f801545112f8e66db73.pdf

Shaikh, F. (2023). Relationship between Employees' Performance and Workplace Environment; OPUS HR Journal; September 13(2):22-36.

Sultan, M. Muzzammil, A. Zin, M. & Hasimah, N. (2022). Level of Awareness towards E-Waste Management. Volume: 8 Year: e-ISSN: 2682-9193. www. ejoms.com.

Thirunavukkarasu, A., Al-Hazmi, A.H., Dar, U.F., Alruwaili, A.M., Alsharari, S.D., Alazmi, F.A., Alruwaili, S.F., & Alarjan, A.M. (2022). Knowledge, Attitude and Practice towards Bio-Medical Waste Management among Healthcare Workers: A Northern Saudi Study. Peer J., Jul 20; 10: e13773. Doi: 10.7717/peerj.13773. PMID: 35880221; PMCID: PMC9308458.