The Egyptian Journal of Hospital Medicine (January 2023) Vol. 90, Page 1801-1808

Effect of Technostress and Work Stress on the Productivity of Staff Members of The Faculty of Medicine

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ABSTRACT
Background: Technology is used in every aspect of life. On the level of professional life, it has great benefits in increasing productivity. Unexpectedly, it could negatively impact productivity through technology-induced stress (Technostress).
Objectives: This study aimed to study the effect of technostress and work stress on productivity. In addition to studying other associated factors of productivity.
Patients and methods: This was a cross-sectional study conducted on 337 staff members of the Faculty of Medicine of Zagazig University from July to September 2022. A survey was used to collect the questionnaire.
Results: Age, years spent on the job, degree, and training were significantly associated with productivity. Three out of five techno-stressors (techno-complexity**,** techno-insecurity, techno-uncertainty) in addition to role conflict were associated with productivity. Techno-uncertainty is the only significant predictor of productivity.
Conclusions: Technostress is a new but important phenomenon that could affect productivity so we should pay attention to it. In addition to that, some other factors associated with productivity such as training and role conflict are believed to be modifiable factors.
Keywords: Technostress, Work stress, Productivity, Staff members.

INTRODUCTION

The COVID-19 pandemic and its associated lockdown resulted in a lot of changes in the work environment. Some workers such as educators could proceed with their work from home with the help of technology. Without a doubt, technology and internet were crucial for protecting employees' jobs from the COVID-19 pandemic [(1)]**.**

Sadly, there is a dark side of technology named technostress (Tech.S) which was first introduced by the American Psychologist Craig Brod who discussed how could technology affect the psychology of individuals and cause stress and so he defined Tech.S as a "modern disease of adaptation caused by an inability to cope with new computer technologies in a healthy manner" [(2)].

Over more than 30 years, more technologies were invented, the dependence on ICT (information and communication technology) increased dramatically, continuous updates of hardware and software were introduced, skills of using complex ICT differed greatly between workers, and eventually work environment became essentially dependent on modern ICT [(3)]. So, technostress remained a big challenging problem.

Tech.S is usually manifested in the individual as strains: emotional exhaustion [(4)], work exhaustion [(5)], and anxiety and frustration [(6)].

Tech.S is caused by five variables named techno-stressors: techno-overload (too much), techno complexity (difficult), techno-invasion (always connected), techno-insecurity (uncomfortable), and techno-uncertainty (unfamiliar) [(7)].

On the other hand, there are some variables that could inhibit or decrease Tech.S (Tech.S inhibitors) as technical support [(8)], and training [(9)].

Some studies found that Tech.S has a negative impact on the individual's work life, it leads to decreased performance [(10)], increased work stress [(7)], decreased job satisfaction [(11)], decreased employee engagement [(12)] up to job turnover intention [(13)].

This study aimed to study the effect of technostress and work stress on productivity. In addition to studying other associated factors of productivity.

SUBJECTS AND METHODS

Study design and setting:

This cross-sectional study was carried out in the Faculty of Medicine, Zagazig University, Sharkia Governorate, Egypt, from July to September 2022. A survey study was used.

Study subjects:

The selected population was the staff members of Zagazig University's Faculty of Medicine. From each chosen department, a contact list of staff members was obtained.

The EPI 7 ™ info program was used to calculate the sample size according to the following:

There were 2570 working faculty members in the Faculty of Medicine of Zagazig University, with 70% working in clinical departments and 30% in academic ones. According to **Okonoda *et al.*** [(14)]**,** the Tech.S prevalence among university staff members is 54.2%. As a result, the sample size was measured to be 332 with an effect size of 1 and 80% power. It was divided by proportionate allocation as the following: 232 clinical staff members and 100 academic staff members.

We used a multistage random sampling technique for sample selection. The faculty of medicine has 36 departments, including 25 clinical departments and 11 academic departments. Using a simple random sampling technique, we chose the departments in the first phase by proportional allocation (clinical

Received: 19/08/2022
Accepted: 20/10/2022

departments to academic departments = 2:1). As a result, 6 clinical departments and 3 academic departments were randomly chosen. We used a simple random sampling technique to choose staff members from each department in the second phase.

Inclusion and exclusion criteria:

Staff members of the faculty of medicine at Zagazig University were included in the study. They were from academic and clinical departments (from associate lecturer up to professor emeritus).

As Tech.S is a psychological problem. So, some other common psychological problems were excluded.

The following participants were excluded from the study:

- Those who are currently diagnosed by a doctor with any psychological problem.
- Those who have Cushing syndrome, Addison's disease, or uncontrolled thyroid diseases.
- Those who are currently treated with systemic corticosteroid.

Prior to the study's start, a pilot study was conducted to evaluate the questionnaire's understanding and to assess the feasibility as well as the applicability of the study.

Data collection tool:

The questionnaire took about 10-15 minutes to be completed. It consisted of the following parts:

- The first part: An introduction with a description of the study's purpose and exclusion criteria.
- The second part: Sociodemographic characteristics including age, gender, residence, work type, years spent on the job, and degree. It also contained technology-associated factors (training, having modern computers and good Wi-Fi, the average daily hours spent on mobile phones and on computers).
- The third part: A questionnaire containing variables for technostress creators, role stress, and productivity. It is a valid questionnaire proposed by **Tarafdar *et al.*** [7]. This tool consists of 37 items and is measured by a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).
  - Tech.S creators: techno-overload (5 items), techno-invasion (5 items), techno-complexity (4 items), techno-insecurity (5 items), techno-uncertainty (4 items).
  - Role stress: role overload (5 items), role conflict (5 items).
  - Productivity (4 items).

The total scores of the 5 items' variables (techno-overload, techno-invasion, techno-insecurity, role overload, and role conflict) were 25. Whereas the total scores of the 4 items' variables (techno-complexity, techno-uncertainty, and productivity) were 20.

Statistical analysis

Data were analyzed statistically using Jamovi version 2.2*. The qualitative data were represented as frequencies and relative percentages whereas the quantitative data were represented as mean ± SD (standard deviation).

After assessing the normality of the sample, the appropriate statistical test was chosen. For calculating the difference between 2 quantitative variables, independent t-test test was used.

On the other hand, to calculate the difference between more than 2 quantitative variables, ANOVA or Kruskal-Wallis was used. Pearson correlation test was used to test significant linear relations between numeric variables. Multiple regression test was used to predict independent variables affecting a dependent variable. The threshold of significance for all the mentioned statistical tests is fixed at a 5% level (P-value). * The Jamovi project (2021). *jamovi*. (Version 2.2) [Computer Software]. Retrieved from https://www.jamovi.org.

RESULTS

This study was conducted on 337 university staff members who ranged from 29-70 years old and 63.2% of the employees were in the age group 29-43 years. Their gender distribution was almost equal (56% females), but the majority lived in urban areas (88.7%). 237 of the respondents were clinicians and 100 were lecturers. They spent from 4 to 46 years in their jobs and almost 61% of them spent from 4-18 years **(Table 1).**

Table (1): Socio-demographic characteristics of the staff members:

Variables	Staff members (No =337)	
	N	%
Age (years)		
• **Mean ± SD**	42.2 ± 8.86	
• **Range**	29-70	
• **29-43**	213	63.2
• **44-58**	109	32.3
• **>58**	15	4.5
Gender		
• **Male**	147	43.6
• **Female**	190	56.4
Residence		
• **Urban**	299	88.7
• **rural**	38	11.3
Work type		
• **Academic**	100	29.7 70.3
• **Clinical**	237	
Degree		
• **Assistant lecturer**	69	20.5
• **Lecturer**	100	29.7
• **Associate professor**	77	22.8
• **Professor**	80	23.7
• **Professor Emeritus**	11	3.3
Years spent on job		
• **Mean ± SD**	17.3 ± 8.59	
• **Range**	4-46	
• **4-18**	205	60.83
• **19-32**	112	33.23
• **33-46**	20	5.93

Regarding technology-related factors, almost 66% were trained in new technologies, 89.9% had good access to WI-FI services, and 91.7% owned good computers. The respondents spent from 1 to 15 hours using mobile phones every day, and the majority spent from 1 to 5 hours (82.2%). Besides that, the respondents spent from 0 to 12 hours using computers every day, and the majority spent from 0 to 4 hours (88.1%) **(Table 2).**

Table (2): Technology support measures among the staff members:

Variables	Staff members (No =337)	
	N	%
Received enough training on technology	221	65.6
Having good Wi-Fi	303	89.9
Having modern computer	309	91.7
Daily hours spent on mobile phone		
• **Mean ± SD**	3.81 ± 2.58	
• **Range**	1-15	
• **1-5**	277	82.2
• **6-10**	52	15.4
• **11-15**	8	2.4
Daily hours spent on the computer		
• **Mean ± SD**	2.45 ± 1.96	
• **Range**	0-12	
• **0-4**	297	88.1
• **5-8**	32	9.5
• **9-12**	8	2.4

Table (3) showed that there was a statistically significant association between productivity and age and years spent on their job. There was also a statistically significant association between productivity and degree.

Table (3): Relation between the productivity of the staff members and socio-demographic characteristics:

Variables	Productivity	t-test/ ANOVA	P-value
Age • **29-43** • **44-58** • **>58** • **Post-Hoc test**	14.9 ± 3.84 16.4 ± 2.97 13.7 ± 4.37	8.64	**0.000**
	P1=0.001 P_2=0.022		
Gender • **Male** • **Female**	15.4 ± 3.65 15.2 ± 3.71	0.59	0.559
Residence • **Urban** • **Rural**	15.3 ± 3.76 15.5 ± 3.01	-0.39	0.699
Years spent on job • **4-18** • **19-32** • **33-46** • **Post-Hoc test**	14.9 ± 3.84 16.3 ± 3.10 14.5 ± 4.07	6.61	**0.003**
	P_3=0.003		
Work type • **Academic** • **Clinical**	15.1 ± 3.63 15.4 ± 3.71	-0.77	0.440
Degree • **Assistant lecturer** • **Lecturer** • **Associate professor** • **Professor** • **Professor emeritus** • **Post-Hoc test**	14.5 ± 3.89 15.1 ± 3.81 15.3 ± 3.50 16.5 ± 2.99 13.4 ± 5.01	14.0*	**0.007**
	P_4= 0.009		

*** Kruskal-Wallis test.**

P_1 is the P-value between 29-43 years group and 44-58 years group. **P_2** is the P-value between 44-58 years group and >58 years group. **P_3** is the P-value between 4-18 years group and 19-32 years group. **P_4** is the P-value between assistant lecturer group and professor group

The training variable was the only technology-related factor that had a statistically significant association with productivity **(Table 4).**

Table (4): Relation between productivity of the staff members and technology support measures:

variables	Productivity	t-test/ ANOVA	P-value
Enough training • **Yes** • **No**	 15.7 ± 3.52 14.5 ± 3.85	2.97	**0.003**
Having good Wi-Fi • **Yes** • **No**	 15.4 ± 3.67 14.5 ± 3.71	1.40	0.162
Having modern computer • **Yes** • **No**	 15.4 ± 3.69 14.8 ± 3.65	0.73	0.465
Daily hours spent on mobile phone • **1-5** • **6-10** • **11-15**	 15.4 ± 3.45 15.0 ± 4.34 14.4 ± 6.39	0.19*	0.908
Daily hours spent on the computer • **0-4** • **5-8** • **9-12**	 15.3 ± 3.54 14.7 ± 4.88 17.0 ± 2.88	1.58	0.236

*** Kruskal-Wallis test.**

Table (5) showed the correlation between (technostress creators and role stressors) and productivity. There were significant negative correlations between techno-complexity, techno-insecurity, and role conflict with productivity. Whereas there was a significant positive correlation between techno-uncertainty and productivity.

Table (5): Correlation between (technostress creators and role stressors) and productivity among the staff members:

Variables	Productivity
	r (P)
1-Techno-overload	-0.065 (0.236)
2-Techno-invasion	0.065 (0.234)
3-Techno-complexity	-0.163 **(0.003)**
4-Techno-insecurity	-0.153 **(0.005)**
5-Techno-uncertainty	0.194 **(0.000)**
6-Role-overload	0.003 (0.950)
7-Role-conflict	-0.142 **(0.009)**

Table (6) showed the results of multiple regression for predictors of productivity. Techno-uncertainty was a statistically significant predictor for productivity and constituted 7.07 % of factors responsible for affecting productivity.

Table (6): Predictors of productivity among the staff members:

Variables	productivity
Age	0.801
Work type	0.643
Degree	0.397
Having good Wi-Fi	0.464
Daily hours spent on mobile phone	0.644
Techno-complexity	0.280
Techno-insecurity	0.093
Techno-uncertainty	**0.000**
Role conflict	0.347
Adjusted R^2	0.0707

DISCUSSION

Tech.S is a special type of stress that anyone can experience as a result of their interaction with technology either in their personal or in their professional lives. An employee spends nearly one-third of his or her life at work, and occasionally, the stress of the job is really high. Lately, the nature of almost all jobs has undergone significant rapid changes, ultimately making employees more prone to job stress [(15)].

The study results showed that age is a statistically significant associated factor with productivity. More specifically the productivity of the 44-58 age group is significantly higher than the other two groups (the 29-43 age group and the >58 age group) indicating an inverted U shape relationship where the productivity is low then it increases with age then it becomes low again. Börsch-Supan and Weiss found that productivity doesn't decline till 60 years old [(16)]. Maestas *et al.* also found that with each 10% increase in the percentage of people above 60 years old, there will be a 5.5% decrease in the per-capita GDP (Gross domestic product) [(17)].

In this era of technology, almost all types of jobs depend on technology usage. So, an explanation for decreased productivity with age would be that older people's modern technology adoption is far less than younger ones. It is so obvious in mobile phone adoption as 95% of adults aged 18 to 49 possess a smartphone, while smartphone possession amongst adults 65 years and older is only 61% [(18)].

Based on the study results, the 44-58 age group showed higher productivity than the 29-43 age group. This could be explained by the higher experience and degree of the former group. That is also obvious in the results where the 19-32 years' experience group is statistically significantly higher in productivity than the 4-18 years' experience group. Also, the professors' group is statistically significantly higher in productivity than the assistant lecturers' group. **Tagurum *et al.*** [(6)] support this result as they found that individuals with a higher level of education experienced a significant influence of technology usage on productivity.

Based on the results, training had a significant relationship with work productivity. That was in line with the study of **Abdullahi *et al.*** [(19)] which included the academic staff members of a tertiary institution and was also in line with the study of **Fejoh & Faniran** [(20)] which included staff members of ten public secondary schools. Actually, the relationship between training and productivity can't be denied. Job training enhances employee performance. It is a learning process to acquire the appropriate knowledge, skills, abilities, and attitudes to enhance the workers' performance [(21)].

Most of the literature examined the relationship between productivity and Tech.S in general without taking into consideration the different types of techno-stressors that could have different effects. Feng who examined the relationship between Tech.S generally and the productivity of proximity managers found that there is no significant relationship between them [(22)]. **Chou & Chou**[(23)] examined the relationship between Tech.S generally and the intention to continue online learning among higher education teachers and found that was also insignificant.

In this study, different techno-stressors' relationships with productivity were examined separately. Techno-complexity and techno-insecurity were inversely related to productivity in contrast to techno-uncertainty. This is partially in line with **Li & Wang**[(24)] who found that techno-complexity and techno-insecurity were inversely related to productivity, but techno-overload is directly related to productivity. On the other hand, **Kim & Lee**[(25)] found that all types of techno-stressors are directly related to counter-productive behaviors. Those are some behaviors that interfere with productivity such as disruptive work behaviors, wasting of work time and resources, hostile behavior toward coworkers, and unusual workplace behavior.

As Tech.S is a type of stress, hence its negative relationship with productivity is logical. On the other hand, the positive relationship of some techno-stressors with productivity could be explained by the techno-eustress phenomenon. This phenomenon represents the good stress that people experience when using technology. People perceive the characteristics of the technologies as challenges that they are determined to overcome because they believe that doing so will improve their situation. As a result, they adopt some coping behaviors to overcome the obstacles successfully. By doing all of this, the person experiences the phenomenon of "eustress" or "good" technostress [(4)].

Based on the results the relationship between role overload and productivity isn't significant, which is in line with the study of **Hoboubi *et al.*** [(26)] and also with the study of **Kumar *et al.*** [(27)]. **Yosiana *et al.*** [(28)] conducted a survey on nurses to find out that they indeed suffered from a high workload, but unexpectedly this workload didn't affect their performance because of the good working environment. **Parayitam *et al.*** [(29)] also found that role overload increased the worker's performance to a little extent because a certain degree of stress is needed to increase performance. So, according to the previous pieces of literature role overload either has no significant effect on job performance or even increases it.

On the other hand, role conflict in this study had a significant negative correlation with job performance. This was in line with the study of **Parayitam *et al.*** [(29)] and also with the study of **Zou *et al.*** [(30)]**.** According to **Soelton *et al.*** [(31)] role conflict didn't only create job stress, but it also led to turnover intention. In other words, if an employee experiences a high level of conflict, they are more likely to want to leave the job.

CONCLUSION

The productivity of university staff members is affected by various factors. One of the important but underestimated factors is Tech.S. Individuals and organizations should pay attention to its causes, symptoms, and effects. In addition to that, other factors were associated with productivity but some of them, such as age factor, are non-modifiable factors. On the other hand, training is a modifiable and important factor that could be easily modified, we shouldn't also forget the effect of work stress, especially the role conflict stressor in affecting the productivity of the staff members. It is also a modifiable factor that can be controlled.

Author contribution:

All authors contributed in the study. Alaa Abdelmohsen Ismail was responsible for data collection, statistical analysis, and initial writing. Elsayed Hassan Abdelhamid, Ghada Mahmoud Khalil, and Noha Mohamed Abdelsalam were responsible for the formulation of the study design, editing, revision, and preparation of the final manuscript.

Supporting and sponsoring financially: Nil.
Competing interests: Nil.

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