Technostress and remote Virtual work environment among University Staff Members: A cross-sectional study

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Abstract

Background

Technostress during the COVID-19 pandemic has become more prevalent as a result of the global preventive measures applied to limit the spread of infection. These measures included remote working from home in both public and private organizations.

Objectives

To study Technostress and challenges of remote Virtual work environment among University Staff Members at Menoufia University, Egypt.

Methods

A cross-sectional study was conducted over Menoufia university academic staff members in Egypt. The participants were chosen from both practical and theoretical colleges in Menoufia University using a multistage random sample. Tarfadar techno-stress questionnaire was used. Cortisol blood level was measured for all participants.

Results: This study included 142 participants. The mean age of the group was 36.32± 6.41 years. 52.1 percent worked in practical colleges, and 60.6 percent were lecturers or higher. Their mean cortisol level was 15.61± 7.07mcg/dl. Participants who were females, reside in rural areas, held a lecturer or higher position, had poor work-environment Wifi, and lacked technical training had significantly higher levels of technostress subscales. Most of the technostress subscales were significantly correlated with age and blood cortisol levels. The predictors of work overload in multivariate regression were female gender and a work environment with poor WIFI. Female gender, theoretical colleges, being lecturer or higher and poor WIFI were the predictors for invasion.

Conclusion

Among university staff members, Technostress was found to be evident. High levels of technostress were significantly influenced by age, higher professions, female gender, and a bad workplace environment.

Introduction

COVID-19 became a pandemic at the beginning of 2020, affecting many countries worldwide, including Egypt. Many measures have been implemented to reduce its spread, the most significant of which was remote home working, which kept people at home and socially separated (Spagnoli & Molinaro, 2020)

Following this public health disaster, quarantine and lockdown measures have been implemented globally. These measures can cause a variety of psychological issues, including increased stress and decreased emotional well-being (Sica et al., 2021).

Many factors may contribute to fear and stress following COVID-19, including not only the direct impact on people's health, but also fears for unemployment due to COVID-19-related restrictions, economic difficulties, and concerns about one's health. These stressors and concerns may result in a lower quality of life (van Ballegooijen et al., 2021).

Over the past few years especially after COVID-19, Various Information and Communication Technologies (ICTs) such as television, mobile phones, the internet, satellite systems, and computer technologies have changed daily. Education, health, the environment, culture, art, and entertainment are all affected by these changes (Hoffman, Novak, and Venkatesh 2004). As a result, the majority of the population is struggling to keep up with rapid technological advancements. Change is an unavoidable part of life, and everyone treats it differently. The ICTs have a dual effect (Ayyagari et al., 2011; Hoffman et al., 2004; Liaw, 2002). Whereas the use of ICTs has made substantial productivity gains, creativity, and organizational efficiency, their negative impact should not be ignored on organizations and staff. Organizational culture has become a major source of stress for today's workforce as a result of disruptions in business processes, employee duties, and roles caused by ICTs (Rowden & Conine, 2005).

Stress is defined as a mental and physical situation that influences an individual's health, work, and quality of life, with a focus on work-related stress that deprives workers of work satisfaction and quality of life. Technostress is defined as modern disorders of adaptation resulting from a lack of safe handling of new technologies. It is driven by technological tasks like planning meetings, business plans, and concern over time limits for work (Choudhury, 2013).

ICT is not the only cause of technostress; many other factors contribute to the development of this stress. Many organizations make the use of ICT one of their primary requirements (Tarafdar, Tu, and Ragu-Nathan 2010), as do coworkers, who frequently have an impact on individuals' use of ICT (Avanzi et al. 2018). Technostress caused by misfits between teachers and different aspects of the university setting may influence university teachers' performance negatively, leading to job burnout and even plans to leave the profession (Al-Fudail and Peterson 2004; Tarafdar, Pullins, and Ragu-Nathan 2014; Pignata et al. 2016). This stress may manifest itself in both physical and psychological symptoms and this has been reported by researchers in the computer science, health, and accounting fields (Sami & Pangannaiah, 2006). This stress can cause an increase in blood pressure and heart rate, as well as muscle tension, such as a clenched jaw and increased skin conductance. These various symptoms shed light on the physical effects of ICT on users, the presence of which can indicate the presence of Technostress. Techno Stress psychological symptoms include the inability to focus on a single issue, increased irritability, and a sense of loss of control. Technostress also has an impact on employee job satisfaction and commitment, as well as organizational outcomes (Sami & Pangannaiah, 2006).

To the best of our knowledge, there is a scarcity of studies on technostress among Egyptian university staff members. Thus, the purpose of this research was to investigate the impact of rapid technological development, particularly in the field of education, on Egyptian university faculty members.

Participants And Methods

- **Sample and data:**

A cross-sectional study was conducted from the first of December 2020 to the end of February 2021 on a probability sample of Egyptian university academic staff members from Menoufia University. The study included staff members who are affiliated with practical and/or theoretical colleges and fulfill the inclusion criteria. A multistage random sample was used to select practical and theoretical colleges from Menoufia University, then the second stage to select the departments in each selected college and finally staff members were chosen from each selected department by simple random sampling technique.

The sample size was calculated using the EPI 7 ™ info program (Dean, 1999) with a 95% confidence interval, a 5% margin of error, and a 10% prevalence of technostress among university academic staff (K.M, 2017). The minimum representative sample size was estimated to be 138, but this was increased to 150 to account for the non-response rate. A total number of 142 staff members responded, for a 94.7 % response rate.

The criteria for inclusion were: Egyptian staff members who are affiliated to the selected departments of Menoufia University for three years or more, have good English language skills, and agreed to participate.

Subjects with hormonal disorders such as Cushing syndrome or Addisonian disease, subjects on steroid therapy, females taking oral contraceptives, and subjects with known psychological disorders that could influence the results of the technostress subscales were excluded from the study.

- **Measures of variables:**

All participants were subjected to the following:

1- A predesigned self-administered questionnaire that included two main parts:

The first part Included :

socio-demographic data such as age (in years), gender, residence, college specialty (practical or theoretical), and academic grade.

Questions about the presence of modern computers, good WIFI in the virtual work environment, and attendance at training ICT workshops. Modern computers were considered highly efficient computers with windows 7 or 10 and core i3 or higher. Good WIFI was considered as a continuous presence of online access at or above 25Mbps.

The second part included:

The survey tool is an adapted version of the techno-stress questionnaire that was developed by Tarfadar and his colleagues in the English language (Tarafdar et al., 2010a). It has three dimensions: 1- techno-

overload: the feeling of increased workload due to ICTs (four items), 2- techno-invasion: the feeling of work entering into other areas of life due to ICTs leading to higher levels of family-to-work conflict (three items), and 3- techno-complexity: refers to the user's lack of confidence in using new technologies (four items). Responses to the statements were given on a five-point Likert scale ranging from zero (strongly disagree) to four (strongly agree).

Validity and reliability of the three domains (techno-overload, techno-invasion, and techno-complexity) were tested by Ragu-Nathan and his colleagues (Ragu-Nathan et al., 2008) where they found it to be 0.82, 0.80, and 0.77 for each domain respectively that indicated internal consistency of the scale.

2- Blood Cortisol level measurement by Cobas e411 immunoassay analyzer (Roche Diagnostics, Mannheim, Germany). Venous blood samples were withdrawn from each participant at a fixed time of the day (9-12 am), to overcome diurnal variation of the cortisol level.

- **Data analysis:**

Data were tested for normality with the Wilks Shapero test. The student's t-test was used to compare quantitative variables of normally distributed data, while Mann Whitney's test was used for not normally distributed ones. Pearson correlation was used to test the correlation between two continuous normally distributed variables while Spearman correlation was used for not normally distributed ones. Multiple linear regressions were used to test the association between multiple possible risk factors and each component of the technical stress. Two-sided P-value of < 0.05 was considered statistically significant. All the analyses were done using SPSS V. 23 (SPSS Inc. Released 2015. IBM SPSS statistics for windows, version 23.0, Armnok, NY: IBM Corp.).

Results

The study included 142 participants with full valid questionnaires. Their mean age was 36.32 ± 6.41 y (ranging from 25.0 to 60.0). Fifty-three % (75 participants) were males, 64.1% were of rural residence, 52.1% were working in practical colleges, 60.6% were lecturers or higher, 54.9% had training workshops/courses, 78.2% had good WIFI and 85.9% had modern computers (see table 1). Their mean cortisol level was 15.61 ± 7.07mcg/ dl (ranging from 6.0 to 29.0 mcg/dl).

Among the entire participants, the mean score (±SD) of work overload was 9.45 (±2.92) out of 15, the mean invasion score was 6.61 (±2.76) out of 12 and the mean complexity score was 12.47 (±4.20) out of 20.

Female participants, participants who were lecturers or higher grades, participants who did not have good WIFI or modern computers had significantly higher mean overload, invasion, and complexity than males or participants who were teaching assistants or up (P-value <0.001 for each).

Participants who are living in rural areas had a significantly higher overload and complexity scores than participants living in urban areas (P-value 0.002 and 0.001; respectively), while participants working in

practical colleges had significantly higher mean invasion than participants in theoretical ones (P-value 0.004). Participants who did not attend training had significantly higher mean overload, invasion, and complexity than participants who had training (P-value 0.007, 0.021, <0.001). (see table 2).

Age had a significantly significant positive correlation with all three aspects of the technostress scale (p <0.001 for each) (fig 1).

The multivariate linear regression model showed that overload was significantly related to female gender and work environment with poor WIFI (P-value <0.001 and 0.002 respectively). the invasion was significantly related to the female gender, theoretical colleges, being lecturer or higher and poor WIFI (P-value 0.001, 0.023, 0.030 and 0.002 respectively) while complexity was significantly related to the female gender, rural residence, no training, poor WIFI and absence of modern computers (P-value <0.001, 0.014, <0.001, <0.001 and 0.001 respectively) (Table 3). The three models were statistically significant (P <0.001 for each). The adjusted R2 was 0.482, 0.362 and, 0.705 for overload, invasion, and complexity respectively.

Blood cortisol level was found to be higher among participants with higher scores of the technostress subscales. It was significantly correlated with overload and complexity scores (P-value = 0.001 and <0.001 respectively) (fig 2).

Table (1) : Sociodemographic characters of the participants (n=142):

Character	No. (%)
Age	36.32 ± 6.41
Mean±SD	25.0-60.0
Range	
Gender	75 (52.8)
Male	67 (47.2)
Female	
Residence	51 (35.9)
Urban	91 (64.1)
Rural	
Work type	68 (47.9)
Theoretical	74 (52.1)
Practical	
Academic degree	56 (39.4)
Up to ass. lecturer	86 (60.6)
Lecturer and higher	
Training workshops	78 (54.9)
Good Wi-Fi	111 (78.2)
Modern computers	122 (85.9)
Cortisol (mcg/dl)	15.61 ± 7.07
Mean±SD	6.0-29.0
Range	

Table (2): Mean values of technical stress component with different risk factors:

Character	Overload* Mean ± SD	Invasion** Mean ± SD	Complexity*** Mean ± SD
Gender	7.65 ± 2.23	5.37 ± 2.09	9.76 ± 2.71
Male	11.46 ± 2.21	8.01 ± 2.78	15.52 ± 3.42
Female	<0.001	<0.001	<0.001
P-value			
Residence	8.52 ± 2.41	6.01 ± 2.40	10.78 ± 3.64
Urban	9.96 ± 3.07	6.95 ± 2.91	13.42 ± 4.21
Rural	0.002	0.109	0.001
P-value			
Work type	9.16 ± 2.93	5.95 ± 2.69	11.91 ± 4.04
Practical	9.71 ± 2.92	7.22 ± 2.71	13.00 ± 4.30
Theoretical	0.235	0.004	0.142
P-value			
Degree	8.16 ± 2.57	5.25 ± 2.05	10.00 ± 2.97
Up to ass. lecturer	10.29 ± 2.84	7.51 ± 2.81	14.09 ± 4.10
Lecturer or higher	<0.001	<0.001	<0.001
P-value			
Training	10.17 ± 3.04	7.20 ± 2.79	14.60 ± 3.84
No	8.85 ± 2.70	6.14 ± 2.67	10.73 ± 3.66
Yes	0.007	0.021	<0.001
P-value			
Good wifi	12.09 ± 2.03	9.12 ± 2.37	17.16 ± 2.64
No	8.71 ± 2.70	5.91 ± 2.45	11.17 ± 3.58
Yes	<0.001	<0.001	<0.001
P-value			
Modern computers	12.15 ± 1.89	9.10 ± 2.22	18.05 ± 1.43
No	9.00 ± 2.82	6.21 ± 2.64	11.56 ± 3.78
Yes	<0.001	<0.001	<0.001
P-value			

*Overload: the feeling of increased workload due to ICTs

** Invasion: the feeling of work entering into other areas of life due to ICTs leading to higher levels of family-to-work conflict

*** Complexity: refers to the user's lack of confidence in using new technologies.

Table (3): Multivariate regression of possible risk factors of technical stress components:

Variables	Overload		Invasion		Complexity	
Beta	P	Beta	P	Beta	P	
Age	0.145	0.117	-0.066	0.523	0.129	0.066
Gender	0.495	<0.001	0.270	0.001	0.391	<0.001
Residence	-0.076	0.225	-0.040	0.567	-0.118	0.014
Work type	0.023	0.706	0.157	0.023	0.021	0.655
Degree	-0.027	0.782	0.233	0.030	0.080	0.273
Training	0.013	0.841	0.035	0.628	-0.206	<0.001
Good wifi	-0.231	0.002	-0.259	0.002	-0.214	<0.001
Modern computers	-0.058	0.408	-0.090	0.247	-0.187	0.001
F	17.42	<0.001	11.01	<0.001	43.02	<0.001
R^2 adj	0.482		0.362		0.705	

Discussion

COVID-19's global lockdown had impacted everyone's quality of life by disrupting their daily routines., students as an example, had higher levels of "perceived academic stress" and higher depressive symptoms (De Man et al., 2021; Vyas & Butakhieo, 2020).

Employees who work from virtual offices can do their work anywhere at any time, which may blur the lines between work and home. As a result, workplace stress has been allowed to spread from traditional offices to virtual offices, potentially leading to fewer social interactions and poor communication (K.M, 2017; Stich, 2020)

Participants in this study reported moderate to high levels of the technostress questionnaire's various subscales. Job overload had a mean score of 9/15, which was 60 % of the maximum overload score, followed by work complexity (57 %of the maximum score) and invasion (50 % of the max. score). Remote working was found to be strongly associated with the three technostress subscales by Molino and his

colleagues. Work-family conflict on the one hand, and work overload on the three technostress subscales on the other, were found to have a strong positive association in their analysis. They also discovered a significant positive relationship between behavioral stress and workload, as well as technostress subscales and work-family conflict (Molino et al., 2020).

The higher levels of stress among employees who use ICT were explained by the constant availability of the individual, predicting quicker and better work (Ayyagari et al., 2011).

Technostress caused by virtual work is multifactorial. The induced technostress was caused by both personal and environmental risk factors. The multivariate analysis of our findings revealed that gender and Wifi quality both contributed significantly to all subscales of technostress. Other risk factors may differ depending on the subscale.

In our study, Senior participants with higher academic degrees were found to be significantly associated with higher levels of the three domains of technostress. In the study done by (Orlando, 2014), old-age teachers who have taken years in establishing their teaching practices suffered greatly to change them than the younger teachers. Also, (Tsertsidis et al., 2019) stated that older people have more negative attitudes towards the use of new technologies and feel less competent. Sahin and Coklar found that techno- stress increase with age (Şahin & Çoklar, 2009).

Female participants in this study reported higher technostress levels than males. This was also reported by (Efılti & Naci Çoklar, 2019) and (Thomée et al., 2012) who found that women experience higher levels of anxiety and exhaustion than men in the use of ITC's. Liaw's study also indicated that males had more positive perceptions towards computers and Web technologies than females (Liaw, 2002). Broos survey revealed that males had less computer anxiety than females as they use computers for longer periods so they show less computer anxiety (Broos, 2005). Females' high technostress in our sample could be due to the fact that they have to care for their children and families when working from home during lockdown, which adds to their burden.

Even though industrialized areas in Italy had substantially higher COVID-19 infection and death rates (Coccia, 2021), participants in our study who lived in rural areas had higher levels of technostress. This may be explained by the rural areas' lack of resources. Poor Wifi and recurrent interruptions of internet access will make it difficult to complete necessary tasks and create a stressful virtual work environment (Chuang et al., 2015).

 Poor Wi-fi connection was significantly associated with higher levels of technostress. (K.M, 2017) stated that a slow internet network was considered a factor contributing to technostress.

Participants in practical colleges experienced significantly higher mean invasion technological stress than those in theoretical colleges. According to (Mishra et al., 2020), Because of the need for equation manipulation and laboratories, practical subjects have traditionally been difficult to teach online. This may also be due to educators' negative attitudes toward new technologies and tools. Educators also have

limited time and patience to address minor technical issues throughout the process of adjustment to new tools.

Participants who did not attend technological training workshops had significantly higher mean overload, invasion, and complexity than participants who had. This was **in agreement with** (Tarafdar et al., 2007, 2010b) who indicated that users with high levels of computer knowledge could avoid technostress to a larger degree. (Gaither Shepherd, n.d.) **,** concluded that computer skills influenced technostress levels.

University support was considered an essential component of preparing teachers to use ICT effectively (Luchman & González-Morales, 2013)**.** According to (Shedletsky & Aitken, 2001), teachers frequently avoid university supplies such as professional development workshops and technical seminars.

(K.M 2017) stated, that there was no statistically significant relationship between technostress and respondents' age group, gender, or attendance at technology-related training.

According to our study, Cortisol level was significantly higher with overload and complexity domains of technostress (P-value 0.001 and <0.001 respectively). (Riedl, 2012) found that cortisol levels increased significantly as a result of system breakdown in a human-computer interaction task. Also (Riedl et al., 2012) revealed significantly elevated cortisol levels due to human interaction with ICT.

Recommendations: To ensure a technostress free work environment, the following measures should be considered:

Set clear boundaries between working and non-working hours.

Create a separate working area in your home and stick to a strict schedule.

Employees should be motivated by positive reinforcement and reassured by positive messages.

Further research should take personality traits into account.

Conclusion

Technostress was prevalent among university staff members. Female participants, being lecturers or higher profession, not having rapid WIFI or modern computers were predictors of technostress**.**

Cross-sectional design was a limitation to our study as longitudinal studies will be needed to determine the causal relationship among these variables.

Another limitation was the negligence of the personality traits and considering the sociodemographic factors as the only factors that affect the level of technostress.

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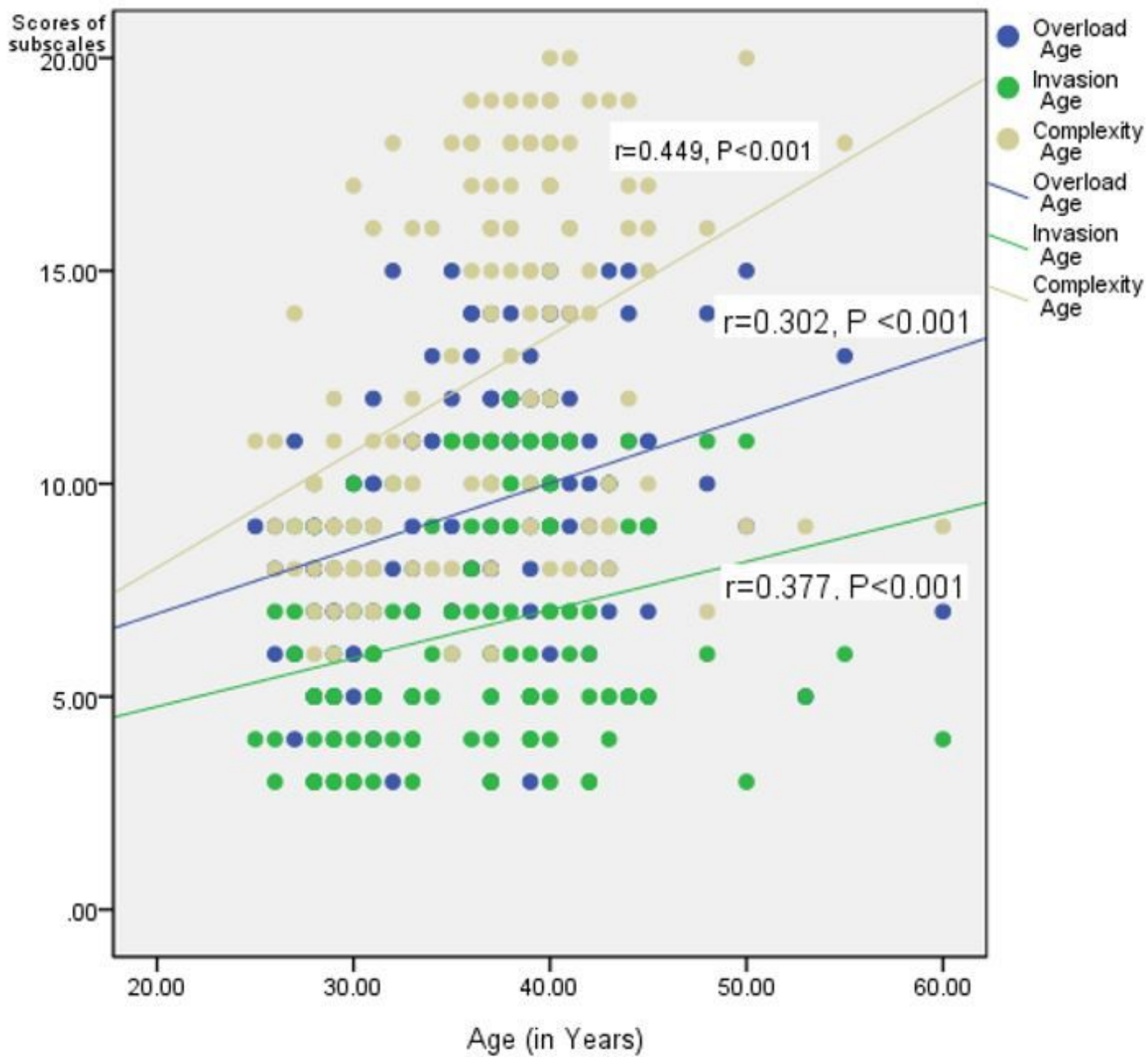Vyas, L., & Butakhieo, N. (2020). *The impact of working from home during COVID-19 on work and life domains: an exploratory study on Hong Kong*. https://doi.org/10.1080/25741292.2020.1863560

Figures

Figure 1

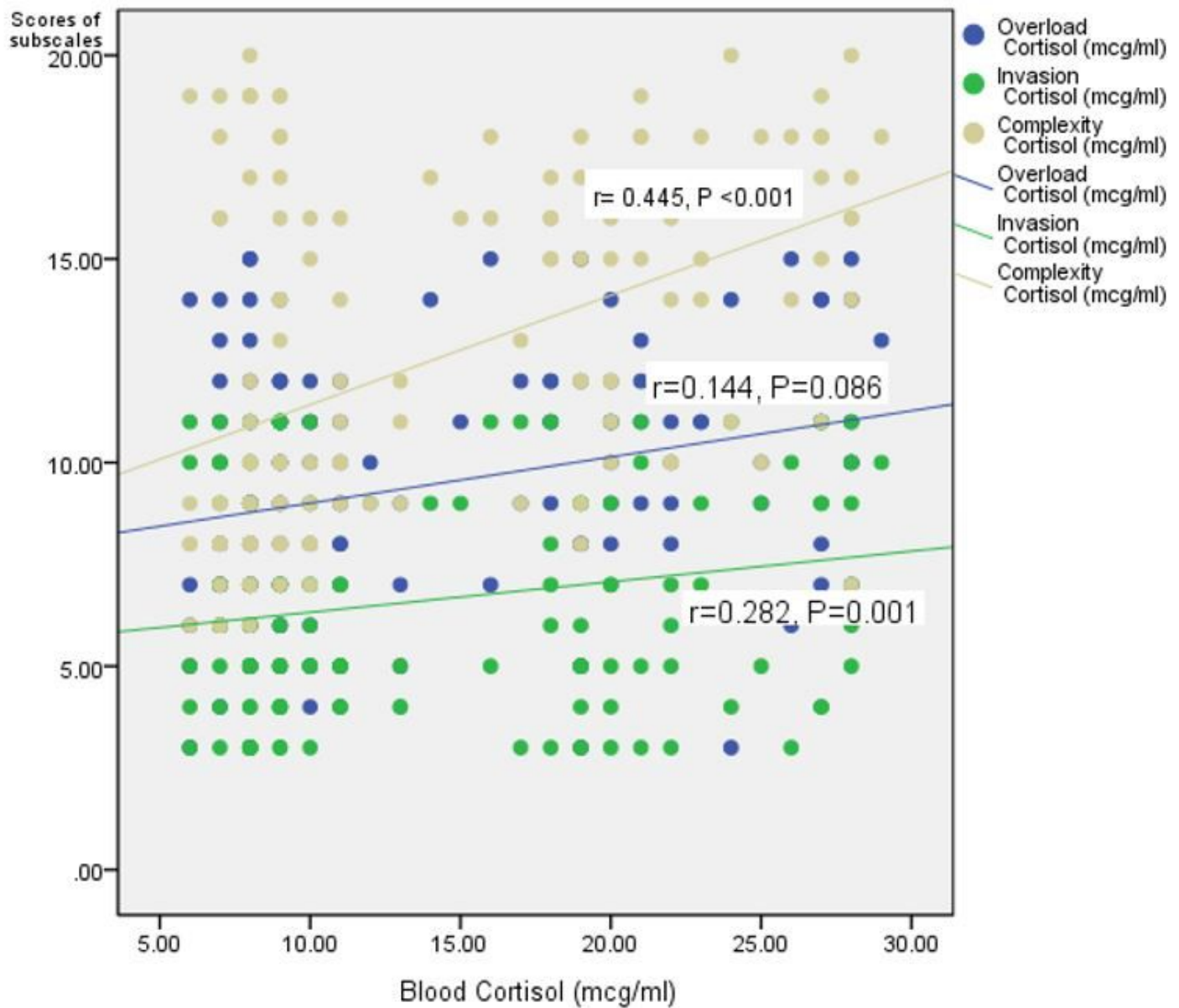scatter plot of age correlation with technical stress components

Figure 2

scatter plot of cortisol level (mcg/dl) association with technical stress components