Which Factors of Digitisation Bias the Work-Related Stress of Healthcare Employees? A Systematic Review

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Abstract. Background: Digitisation affects our working environment. It demands new cognitive and digital skills of healthcare employees. Technostress and burnout are more likely to occur due to the additional workload. Aim: Objective is the identification of determinants affecting work related technostress. Methodology: We carried out a systematic review according to the PRISMA statement. For the identification of the digital factors, we applied an inductive content analysis based on Mayring's theory. Results: Included studies showed the following factors to be relevant for coping with technostress: autonomy, competence, understanding of roles, time pressure, attitude, security and ergonomics. The emerging factors serve the regulation of stress in the healthcare system and contribute to better healthcare and higher occupational safety.

Keywords. technostress, healthcare workers, computerization, occupational stress, digitisation

1. Introduction

Healthcare workers are exposed to many different demands, including everchanging digital technologies, especially since the onset of the Covid 19 pandemic. Digital systems and technological equipment in intensive care units require health workers to adjust to a work-place with an increased level of digitisation [1]. Technostress, as described by the psychologist Brod in 1982 is the inability to maintain a healthy approach to technology [2]. Technostress marks the beginning of a long cascade of psychological problems and health complaints. which are emotional, physical or cognitive stress resulting in concentration problems, frustration, exhaustion and nervousness [3]. An approach to technostress in health care is particularly useful since the rapid rise of device usage has not been accompanied by a growth in related research.

The objective of this paper is to describe the current state of scientific knowledge about it. By conducting a systematic review, we would also like to specify factors that influence the emergence of technostress in the workplace of health facilities.

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2. Methods

A systematic search of published literature dating from 1990 until 2020 was conducted. The initial search built on the specified key words. After reconciliation of the key concepts with the Medical Subject Headings (MeSH) [4] thesaurus from the National Library of Medicine, search terms were phrased. Only articles written in english or german were considered. We did not limit the selection of papers in terms of study design and study type due to the low number of search results. Articles discussing stress referring to the usage of health information systems or medical technology were included. Burnout as an effect of prolonged Technostress was included. External validity was rated higher for studies with big study samples and sufficient randomization. Studies with a higher reduction of interference factors and therefore reduction of systematic bias were associated with better internal validity. Also standardised test situations were assessed more positively. Instruments with a Cronbach's alpha value higher than 0.7 passed as reliable. The methodical procedure for the literature review was carried out according to the PRISMA statement [5]. For the identification of factors each included scientific article was summarized followed by word processing according to Mayring [6]. In this way seven categories emerge as research results, which are presented in the further course.

3. Results

A total of 925 articles were identified. The majority of studies can be searched through the user interface of PubMed (n=915), the remaining articles derived from reference lists and other databases (n=10). The duplicates amounted to 356 articles, which were removed, resulting in 569 remaining articles for the first review. The abstract screening resulted in 29 articles, that were eligible for the full text analysis. The final selection of included articles is n=22. Table 1 summarizes the most important features and aspects of the selected literature. The majority of the selected studies are based on a quantitative research design (n=13). Furthermore we identified n=7 studies that applied qualitative research designs and two studies with qualitative and quantitative elements. Two sources were only included to a limited extent because they are based on recommendations and comments [7,8]. Cross-sectional studies and panel studies combined with personal interviews were determined as particularly advantageous study designs. The assessment of the methodological quality proved to be a difficult process, as the requirements of the Cochrane Collaboration were partially fulfilled. Quantitative studies are assessed on their quality based on validity, reliability and objectivity [6]. Criteria for evaluating qualitative studies are transparency, coverage and intersubjectivity [9]. Seven Factors could be extracted as regulators of technostress. *Time pressure* is the strongest predictor for technostress. The added number of technological tasks in the same amount of work time causes the need for faster processing and often overstrains health employees in their usage of new technologies. Technostress is more likely to decrease if technologies are operated by skilled personnel, because workers themselves are empowered to solve their problems [10,11,12,13].

Table 1. Included Studies and characteristics

Study	n	Findings	Study design
[11]	20	Technologies cause stress and increase time pressure. Training is helpful. Personal characteristics play a role in the development of technostress	qualitative, descriptive Study
[12]	22	Acquisition of competence reduces technostress	Phenomenology
[19]	379	Devices with basic functions reduce technostress	Cross-sectional study
[20]	402	Insecurity and work overload promote technostress	Cross-sectional study
[7]	-	Technology promotes work overload and thus time pressure	Whitepaper
[21]	317	Technostress promotes frustration, time pressure and burnout	Cross-sectional study
[22]	1095	Time pressure is associated with a higher stress level. More complex technologies promote stress	Trend study
[23]	1109	Time pressure promotes technostress	Trend study
[14]	35/16	Automation reduces the perception of work control. Technological malfunctions increase technostress	Panel study
[16]	118	Increased strain and limitation through technology	qualitative cross-sectional study
[24]	146	A positive attitude reduces stress and increases job satisfaction	Cross-sectional study
[25]	40	Technologies increase time pressure and thus stress. Poor software design increases technostress	Cross-sectional study
[26]	665	Training, optimism and the ability to innovate reduce technostress	Cross-sectional study
[27]	150	Technologies are a risk factor for burnout	Secondary analysis
[28]	158	Technostress relates to technological complexity and competence	Cross-sectional study
[15]	10	Competencies reduce technostress	qualitative, descriptive Study
[8]	-	Introduction of technologies causes a change in work roles and workload	Article
[29]	313	Technologies contribute to work overload	Cross-sectional study
[30]	6375	Technostress varies according to the medical specialisation of the doctors	Cross-sectional study
[10]	3607	Lack of competence and safety promotes time pressure and thus technostress	Cross-sectional study
[31]	1860	Lack of safety, poor ergonomics and negative mindset promote technostress	Cross-sectional study
[17]	30	Technologies promote time pressure and reduce autonomy	Systematic review

Moreover, *optimism and innovativeness* promote openmindedness towards technologies and encourage their utilization [13]. To prevent higher level of technostress it is useful to allow more options in decision-making. Especially in health care professions, feelings of *work control* and safety are important factors for stress reduction [14]. Technostress of employees is significantly related to the *technological design* [7,10,13,15,16,17]. Technologies with a low number of functions are perceived as more uncomplicated and therefore believed to be more user-friendly and trustworthy.

4. Discussion

The studies show an increased risk for the prevalence of technostress due to the negative change in identified factors: autonomy, competence, mentality, time pressure, understanding of roles, safety and ergonomics. Changes in these aspects can whether have a positive or a negative influence on the perceived technostress at work. The influences of a digitalised working environment on health care workers have not yet been researched sufficiently. In total, 22 studies are included in the literature research. No randomised control trials or meta-analyses have been carried out. Altough the total amount of articles is quite low, all articles state that digitization in health care causes increased technostress of health personnel. In comparison to other countires the national implementation of digital applications in Germany is low. Therefore it is difficult to find research results for such specific scientific problems [18]. The search in only one database (PubMed) may also be a reason for the low study count. It would be important to extend the search for articles to further databases for a bigger hit ratio. Surveys should take place in a more controlled setting and participants should be questioned about their general psychological health status to avoid the confusion between work stress and technostress.

5. Conclusion

Although the quality of the studies were insufficient concering the evidence level all studies state that digitisation in health care causes increased technostress of health personnel. Research on Technostress is mainly in need of further development.

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