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How to Avoid Medication Errors – Investigating the Roles of Policies and Nudging from A Stress Perspective

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ABSTRACT

According to the World Health Organization (WHO), one of the most frequently occurring error types in healthcare are medication errors which arise due to manual data transfers and time pressure when transferring the data. Errors that occur during this manual procedure often go unnoticed and can have far-reaching health-consequences for patients. To avoid human errors, the healthcare sector often relies on guidelines and policies. However, research from the field of information security found policies to be additionally increasing professionals' stress. Therefore, we aim to investigate how nudging can help to foster medical professionals' compliance without causing stress due to regulations.

Keywords: Medication Errors, Errors in Manual Data Processes, Transactional Model of Stress, Policies, Nudging.

INTRODUCTION

In healthcare, one of the most frequently occurring error types are medication errors (WHO 2019). According to the World Health Organization (WHO), one out of thirty patients are affected by medication errors (WHO 2023). The estimated costs associated with medication errors exceed 40 billion USD each year globally (WHO 2017). In addition, medication errors can

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result in serious health consequences for patients and may even lead to a patient's death (Manias et al. 2020; Ash et al. 2004).

Medication errors can occur in the process of prescribing, transcribing, dispensing, administering, and monitoring medication (e.g., missing or inaccurate data) (Manias et al. 2020). Generally, medical professionals are responsible for the correctness of medication data (Heart et al. 2011). Thus, medication errors can be considered as medical professionals' non-compliance. Previous research found that time-constraints, interruption during data transfers from patient medication plans to Health Information Systems (HIS), and inattention are main drivers of medication errors (Callen et al. 2010).

Current information security and compliance research shows that time constraints and high workloads contribute to professionals' perceived stress (Tarafdar et al. 2017; Zhao et al. 2020). Furthermore, it has been revealed that professionals' stress leads to non-compliance (Trang and Nastjuk 2021).

Generally, it is often attempted to boost compliance by defining policies which often incorporate sanctions. However, studies reveal that policies can increase professionals' stress and do not always work as intended (D'Arcy and Teh 2019). In contrast to that, an approach that aims to foster compliance intrinsically and increasingly receives attention in the domain of information security and compliance is nudging. Nudging is defined an intervention that directs individuals' behavior into a desired direction (Meske and Potthoff 2017).

To this background, this study aims to show how nudging fosters professionals' compliance while reducing professionals' regulation-related perceived stress at the same time. In doing so, we contribute to compliance research as we gain a better understanding for the influence of policies and nudging in situations where professionals experience stress.

Furthermore, we aim to contribute to the literature on medication errors by investigating the role of stress in compliance. Also, our research offers valuable insights to define mechanisms that can help to prevent medication errors.

CONCEPTUAL BACKGROUND

Medication Errors

HIS often store health data in different formats. Furthermore, many processes in healthcare are still paper-based (Kohli et al. 2016). As a result, health data often cannot be exchanged in a standardized manner (Kohli et al. 2016). Thus, medication data still needs to be transferred manually most of the time which is prone to errors.

Medication data generally contains the following information: the names of the prescribed medications, information on the dose in which the medications are provided, and the frequency in which the patient receives the medications as well as some additional information such as the reason of the prescription (Baehr 2018). According to Callen et al. (2010) the following errors in manual medication data transfers can occur: data is omitted, data is transferred inaccurately, and data is listed additionally.

Most of the existing research in the context of medical errors aims to avoid errors by improving the design of HIS such as validating the professionals' input data (Heart et al. 2011; Kumar and Leroy 2021). However, studies on medication errors identified a wide range of causes which go beyond the design of HIS. Examples for human factors that cause medication errors are a lack of physical well-being and the resulting lack of concentration. A prominent socio-technical factor is physicians' missing attitude towards the use of HIS. From an organizational perspective, physicians often face heavy workloads which result in time pressure and stress (Callen et al. 2010).

As human and organizational factors are reasons for medication errors, we argue that organizational mechanisms that foster professionals' awareness for medication errors are necessary. These however should not stress medical professionals' even further.

Transactional Theory of Stress

In literature, several approaches that define the concept of stress have been proposed. One of the most popular models to explain stress is the transactional model of stress by Lazarus and Folkman (1984). Following this theory, stress is considered as “*a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being*” (Lazarus and Folkman 1984). Following this concept, stress is triggered by external influences in the environment (see Figure 1). As the concept of stress is seen as a process, the person firstly appraises the situation either as positive, irrelevant or as a harm, threat, or challenge for their personal well-being. In case of a positive or irrelevant appraisal, the situation is not perceived as stressful and no coping is necessary. If a specific situation is appraised as a harm, threat, or challenge the person evaluates if their coping resources are sufficient manage the situation. If the person appraises its coping resources as insufficient, a situation is perceived as stressful (Lazarus and Folkman 1984). The transactional model of stress has widely been applied in IS research (Nastjuk et al. 2023).

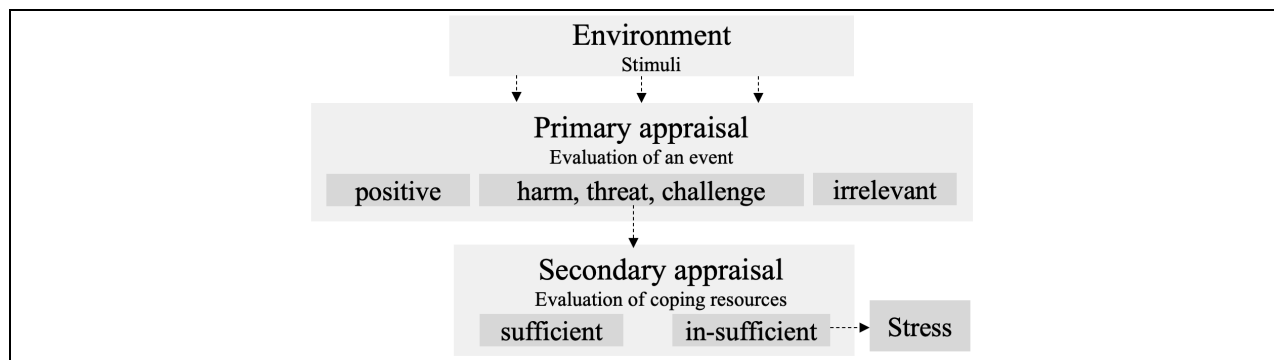


Figure 1. Illustration of the Transactional Model of Stress (Lazarus and Folkman 1984)

Previous studies identified several sources of stress such as time-pressure, task-complexity, or techno-overload but also information security policies (Tarafdar et al. 2017; D’Arcy and Teh 2019). Policies are positively related to professionals’ stress as they often are associated with additional workload and inconveniences in the task procedure (D’Arcy and Teh 2019).

Approaches to Foster Compliance

Studies from the field of information security and compliance often rely on mandatory regulations such as policies and sanctions (Trang and Brendel 2019). Following this approach, policies aim to avoid non-compliance by defining undesired behaviors and its consequences.

A contrary approach to mandatory regulations that is continuously growing in importance in research is nudging. Since in the context of medication errors, the interplay between the task (transferring medication data) and the HIS is of interest, we define nudging as “*a subtle form of using design, information, and interaction elements to guide user behavior in digital environments, without restricting the individual’s freedom of choice*” (Meske and Potthoff 2017, p. 2589). Unlike policies, nudging has the advantage of fostering compliance without impeding professionals in their decision-making competence (Sharma et al. 2021).

PROPOSED HYPOTHESES AND RESEARCH MODEL

We aim to investigate the relation between medical professionals’ stress and the occurrence of medication errors and to examine approaches that help to avoid medication errors (see Figure 2). As a theoretical basis, we rely on the transactional model of stress by Lazarus and Folkman (1984).

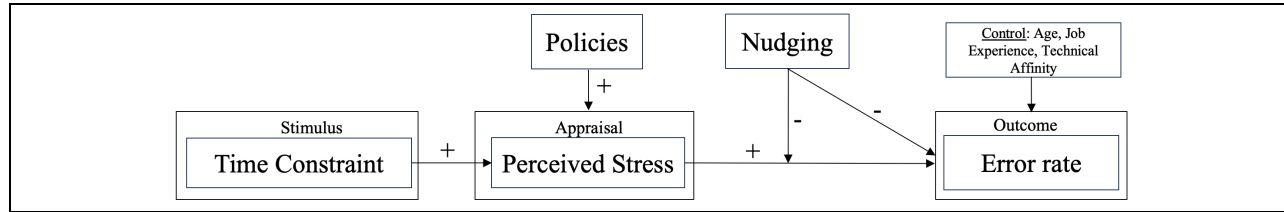


Figure 2. Research Model

One main reason for medication errors is a heavy workload (see Background section). Therefore, it can be assumed that medical professionals will aim to accomplish the data transfer as fast as possible which results in stress (Trang and Nastjuk 2021; Bandura et al. 1988). Accordingly, our first hypothesis is as follows:

H1: Time constraint during the manual medical data transfer positively influences the medical professionals' perceived stress.

In case a person tries to cope with a stressful situation emotionally, stress can lead to undesired behaviors such venting or distancing from the task (Tarafdar et al. 2017). As a result, stress leads to lower task performances (Tarafdar et al. 2017; Zhao et al. 2020). In relation to non-compliance, Trang and Nastjuk (2021) revealed that stress leads professionals' non-compliance. Due to the stress of transferring the data under time pressure, it can therefore be assumed that medical professionals will make mistakes while transferring the data. Following this, we build the following hypothesis:

H2: Stress perceived by medical professionals increases the rate of medication errors.

As introduced in the Background section, research and practice often aim to foster compliance by defining policies. Policies define undesired behavior. In stressful situations such as transferring data under time pressure, policies however do not provide mechanisms to avoid the undesired behavior. Therefore, policies often increase professionals' perceived workload and therefore the perceived stress as well (D'Arcy and Teh 2019). According to that, we formulate the following hypothesis:

H3: Policies that aim to avoid medication errors increase medical professionals' stress.

Besides policies, nudging has already been applied to the context of information security (van Bavel et al. 2019; Sharma et al. 2021). According to Lazarus and Folkman (1984) stress arises due to the inability to cope with a given situation (see Background section). Corresponding studies that focus on the role of coping mechanism in managing stressful situations have shown that active control of the situation helps to improve the output in stressful situations (Pirkkalainen et al. 2019; Zhao et al. 2020; Tarafdar et al. 2017). Furthermore, Trang and Nastjuk (2021) showed that external influences that aim to help professionals to cope with the situation can buffer stress. This study aims to use nudging as this external mechanism. Therefore, we derive the following hypotheses:

H4a: Nudging has a negative effect on the relationship between medical professionals' perceived stress and the rate of medication errors.

H4b: Nudging decreases the rate of medication errors.

RESEARCH APPROACH

To test the hypotheses, we plan to conduct an online experiment with medical professionals in a between subject design. The data collection procedure is as follows. First, each participant receives a short introduction with explanations on the task. The task will be to enter six medications from a medication plan to an online formular within a given time. For each of the medications, the participants are advised to transfer to the medication data into a HIS. To provide a realistic scenario, the online formular includes key design-elements of a HIS such as a dropdown-menu with pre-defined medications. After the tasked is performed, the participants will be asked to complete a questionnaire. The participants will be recruited by using an online survey platform, which allows us to acquire participants from various countries.

The experiment is structured in a 2x2 design with the manipulation of time constraints (high and low) as well as the presentation of a policy and a nudging element. To manipulate time constraint and trigger time pressure, the task needs to be accomplished within 120 seconds since a pre-test with three participants revealed an average duration of 149 seconds to transfer the data. The policy element contains the organizational sanctions which will be pronounced in case medication errors are detected (see Figure 3).



Figure 3. Policy element

The nudging element provides information to increase the awareness for medication errors as well as information on how to cope with the situation (van Bavel et al. 2019; Tarafdar et al. 2020) (see Figure 4).

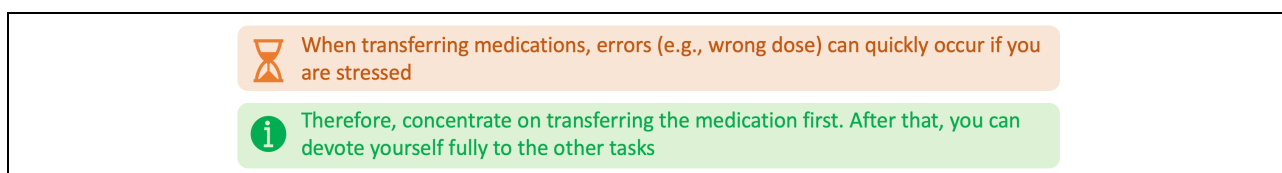


Figure 4. Nudging element

The in-task behavior will be measured by the total number of errors committed by participants. We chose an experimental setting to shed light on the interplay between stress and medication errors.

CONCLUSION

This research-in-progress paper introduces our identified research problem on medication errors and summarizes our research approach to investigate the role of stress as well as policies and nudging. With the study, we aim to contribute to the literature on medication errors and compliance research. To validate our research model and research approach, we invite other researchers to provide feedback on our study.

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