InfoSec Practices - a Survey Conducted in Greek Hospitals

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ABSTRACT
Background: Langerhans The information technology is present in every aspect of private, social, and professional sphere and is constantly evolving whilst remaining vulnerable to security alerts and attacks. The healthcare sector contains sensitive information and can be compromised causing even fatal delays to healthcare delivery, loss of reputation of the organizations, and traumatic experiences for patients who might be stigmatized by the disclosure of their medical files. Infosec practices that are applied by nurses can make the difference in defending or compromising healthcare data. Objective: The aim of this research is to investigate the Infosec practices which are applied by nurses who work in Greek hospitals. Correlation between the Infosec practices, the knowledge on Infosec policies, and attitude towards Infosec policies will be further examined. Methods: The KAP model is applied and the HAIS-Q tool consisted of 45 items in five areas of interest was used. A sample of 277 nurses was collected. Confidentiality issues and consent were respected. IBM SPSS 25.0 was used for the statistical analysis. Descriptive analysis (mean, st. dev.) and inferential statistics, ANOVA, and Pearson Correlations were conducted. The significance level was set up to 0.05. Results: A strong correlation between knowledge on Infosec policies and attitude towards Infosec policies, attitude towards Infosec policies and Infosec practices, and knowledge on Infosec policies and Infosec practices was established. Nurses apply good Infosec practices in three out of five areas of interest, while their practices concerning the report of security violations and their practices related to the Internet usage are average. Overall, nurses’ Infosec awareness is good. Conclusion: The findings showed that nurses demonstrate average to good knowledge on Infosec policies, good attitude towards Infosec policies, good to average Infosec practices and good total Infosec awareness. The most vulnerable area is the Internet usage.

Keywords: Security, Information Systems, Nursing, Practices.

1. BACKGROUND
The digital transformation of healthcare is occurring at an unprecedented pace (1) and information systems play a critical role in managing information and sharing knowledge (2). These systems are ubiquitous and can be found in every domain, including healthcare. Despite their importance, healthcare information systems (HIS) remain vulnerable to attacks that can compromise patient safety and disrupt care delivery (3). It is crucial to recognize that information security (Infosec) issues should not be approached solely as a technical problem but should be viewed from a sociotechnical perspective as the human factor is of paramount importance (4).

1.1. Infosec domains vulnerable to human involvement and factors that affect Infosec practices
The literature identifies several domains that are particularly vulnerable to Infosec practices, including information management, password management, HIS access monitoring, malicious software download, security incidence reporting, and Internet usage. Poor Infosec practices are frequently observed in the password management and the information handling (5, 6).

There are a number of factors that shape the attitudes of personnel to-
wards Infosec policies which can in turn affect Infosec practices (7). Researchers argue that attitude can be influenced by the perceptions about the severity of breaches and the effectiveness of responses to threats, as well as peer pressure (8). The lack of knowledge and understanding of the necessary measures for achieving security, as well as the misconceptions about responsibility and risk assessment, can contribute to personnel ignorance and carelessness leading to poor Infosec practices (9) resulting in negative consequences for the organizations (10). Finally, the sense of responsibility that has the healthcare professionals towards Infosec can influence Infosec practices (11).

Organizational issues such as the lack of funding for the installation and maintenance of appropriate equipment can lead to a failure in implementing good Infosec practices (12). Other organizational factors such as the inconsistent Infosec policies and procedures among healthcare providers and hospital departments can lead to confusion and low morale among staff creating a potentially harmful environment for the patients. Therefore, there is a demand for the use of ubiquitous Infosec policies across organizations to form a clear framework of responsibility and accountability and to support good Infosec practices. On the other hand, according to literature, strict governance of information systems can be considered as a factor related to poor Infosec practices applied by employees (13). To make matters worse, unrealistic deadlines and multi-tasking may be disheartening for staff that is forced to disregard Infosec standards (14) as they perceive them as obstacles in their clinical responsibilities (15). The pressure for high productivity may lead staff in violating Infosec guidelines and not applying good Infosec practices (16).

2. OBJECTIVE

The aim of this research is to analyze the Infosec practices of the nurses, test for correlations among the knowledge on Infosec policies, attitude towards Infosec policies and Infosec practices and define the areas for improvement.

3. MATERIAL AND METHODS

3.1. Hypotheses

This research was based on the KAP model which supports that knowledge influences attitude and practices and that attitude affects practices. The Hypotheses that were formed are the following: H1: Better knowledge of policy and procedures is associated with better attitudes toward policy and procedures. H2: A better attitude towards the security of information and information systems and processes is associated with less non secure practices. H3: Better knowledge of policy regarding the security of information and information systems and processes is associated with less non secure practices.

3.2. Tool

The HAIS-Q questionnaire was used with the consent of the researchers who developed it (19). This tool originally consists of 63 items in a Likert scale ranging from 1 to 5. However, a number of items were removed in order to fit in the Greek context. As a result, the final version included 45 items in 5 areas of interest: password management, email management, information handling, security incidence reporting, internet usage, and demographics. The tool was translated into Greek and the internal consistency was assessed with good results. Therefore, the tool was appropriately distributed to the sample.

3.3. Sample

The cluster sampling method was applied and 7 hospitals in Attica region were selected out of a total number of 27. The questionnaire was distributed to all nursing employees that use HIS. Exclusion criteria were the non usage of HIS, and the lack of Infosec policies in the organization. According to Tziallas et al. (20) and the National committee for the development of the palliative care in Greece (21), 6,059 nurses work in public hospitals in Attica region. 277 nurses were selected from this pool to participate. The response rate was 44%.

3.4. Analysis

The data was analyzed using IBM SPSS 25.0. The answers of the nurses, regarding the knowledge on the organization’s Infosec policy, their attitude towards these policies as well as the practices they apply were rated from 1-5 (1-Strongly disagree, 2-Disagree, 3-I am neutral, 4-Agree, 5-Strongly agree). For the correct statistical analysis, some sentences were reversed so that all sentences were worded negatively. Therefore, an answer close to 1 is considered optimal. Descriptive statistics, Pearson’s correlation and one-way ANOVA were selected as per recommendations (22, 23).

3.5. Ethics, consent and confidentiality

The participants were informed about the topic of the research, the corresponding researchers, the institution which approved the research, their right to participate voluntarily and their right to withdraw from the research at any time. Responses are strictly confidential and have been used for research purposes only and no details were published that could be used to identify the participants. The anonymity of the participants has been fully respected at all stages.

4. RESULTS

4.1. Demographics and employment status

The majority of the respondents, accounting for the 76.5%, were female and the rest of 23.5% were male nurses. The 15.9% of the nurses are aged between 18-28 years old whilst 32.1% were 29-39 years old. A percentage of 33.9% were nurses between 40 to 50 years old and 15.2% were between 51 to 60 years old. A minority of 2.9% were aged above 61 years old. Up to 14.1% of the respondents had been working less than 1 year in the same organization while 19.9 of the respondents had been working between 1-5 years. From the rest, 21.7% had been employed in the same organization for 6-10 years and 17.3 had been working between 11-15 years in the same organization. A percentage of 27.1% had been working more than 15 years. It is estimated that 53.1% of the participants had of-
Table 2. ANOVA for demographics and KAP. (all correlations were significant).

<table>
<thead>
<tr>
<th>Item</th>
<th>Knowledge</th>
<th>Attitude</th>
<th>Practices</th>
<th>Valid Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Password</td>
<td>2.20/ ±0.60</td>
<td>2.52/ ±0.71</td>
<td>2.88/ ±0.74</td>
<td>2.28/ ±0.65</td>
</tr>
<tr>
<td>Email</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet</td>
<td></td>
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<tr>
<td>Information</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Reporting</td>
<td></td>
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</tbody>
</table>

Table 3. Pearson Correlation for Infosec Knowledge, Attitude and Practices

<table>
<thead>
<tr>
<th>Item</th>
<th>Knowledge</th>
<th>Attitude</th>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Cor</td>
<td>1.000</td>
<td>0.692</td>
<td>0.659</td>
</tr>
<tr>
<td>Sig</td>
<td>277</td>
<td>277</td>
<td>277</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Knowledge, Attitude, Practices and Awareness in all areas of Interest

<table>
<thead>
<tr>
<th>Item</th>
<th>Notified of Policies Official or Unofficial and Search for Information from other sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum Sq</td>
<td>F</td>
</tr>
<tr>
<td>Sig</td>
<td>F</td>
</tr>
<tr>
<td>Sig</td>
<td>F</td>
</tr>
</tbody>
</table>

Table 6. ANOVA for demographics and KAP. (all correlations were statistically significant: p < 0.05)

<table>
<thead>
<tr>
<th>Item</th>
<th>Knowledge</th>
<th>Attitude</th>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Cor</td>
<td>0.692</td>
<td>1.000</td>
<td>0.740</td>
</tr>
<tr>
<td>Sig</td>
<td>277</td>
<td>277</td>
<td>277</td>
</tr>
<tr>
<td>N</td>
<td></td>
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<td></td>
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</tbody>
</table>

4.2. Descriptive analysis

The Table 1 shows the descriptive statistics about the knowledge on Infosec policy in the five areas of interest. Two out of five areas, more specifically the email management (2.52 ± 0.71) and the Internet usage were rated average (2.88 ± 0.74). The knowledge on Infosec policy in the remaining three areas of interest was rated as good. The following table demonstrates also the attitude towards Infosec policy that was recorded in the five areas of interest. The attitude towards Infosec policy in all areas of interest was rated good. The Infosec practices applied in the five areas of interest were also identified. Internet practices were average (2.56 ± 0.55) while Infosec practices applied in the other four areas of Interest were good. Concerning the Infosec awareness, all areas of interest were rated as good except from Internet usage which was rated average (2.59 ± 0.55). The total awareness in all areas of interest was good (2.30 ± 0.40).

4.3. Inferential analysis

ANOVA was applied to reveal any possible correlations between demographics and the knowledge on Infosec policies, the attitude towards Infosec policies and the Infosec practices as per Table 2. The gender, the age, and the duration of employment in the same organization have not been statistically significant whilst the official or unofficial notification about Infosec policies has been correlated to the attitude towards Infosec policies (CI=95%, p=0.019<0.05), the Infosec practices (CI=95%, p=0.001<0.05) and the total Infosec awareness (CI=95%, p=0.012<0.05). Also, the additional sources that the nurses seek for Infosec information has been correlated to the knowledge on Infosec policies (CI=95%, p=0.000<0.05), the attitude towards Infosec policies (CI=95%, p=0.000<0.05), the Infosec practices (CI=95%, p=0.000<0.05) and the total Infosec awareness (CI=95%, p=0.000<0.05).

The following table (Table 3) presents the Pearson correlations which support that Infosec practices of the nursing staff are strongly and positively correlated with knowledge on the organization's Infosec policies (0.659, p=0.000<0.05) as well as with the attitude of staff towards the organization’s Infosec policies (0.740, p=0.000<0.05). The attitude of staff towards the organization’s Infosec policies is strongly and positively correlated with the knowledge on the organization’s Infosec policies (0.692, p=0.000<0.05).

5. DISCUSSION

The majority of the participants of this survey were female nurses. Half of the participants were aged between 29-50 years old and the clinical experience of the participants varied. All participants received notifications about Infosec policies either officially or unofficially, but only half of them received official written notices, email messages, or attended educational programs about Infosec policies in the organization where they work. Responses from participants who received information from other sources were polarized.

There was no correlation between gender, age, or working experience and nurses’ knowledge on Infosec policies, attitudes towards Infosec policies, Infosec practices, and Infosec awareness. However, there was a correlation between official/unofficial notification about Infosec policies and nurses’ attitudes towards Infosec policies and Infosec practices. A correlation was also established between the retrieval of Infosec information from other sources and the overall Infosec awareness. The findings do not align with the research conducted (24) in which a correlation between the duration of employment in the same organization and the Infosec practices was established. It is worth noting that personnel in public sectors in Greece received most of the Infosec guidelines after the implementation of GDPR in 2017. Thus, personnel, regardless of their grade or years of practice in the same organization received Infosec instructions from 2017 and beyond and this has may be the reason why a correlation is not reflected in the findings.

Results showed that nurses demonstrate good knowledge...
on Infosec policies in all areas of interest apart from the Internet usage and the email management in which the knowledge was estimated as average. Their attitude towards Infosec policies is good overall but their Infosec practices concerning the Internet usage and the security incidence reporting were rated as average. Their Infosec practices related to the password management, information handling, and email management were good. Nurse’s overall Infosec awareness was good apart from the internet usage which is the most vulnerable area and was rated as average. The results of the survey are not in line with those reported by (25) who noted good attitude but bad practices in password management. However, (25) included a limited number of institutions in their research whilst our sample derived from seven organizations.

In our research, the correlation between the knowledge on Infosec policies and the attitude towards Infosec policies, the correlation between the knowledge on Infosec policies and Infosec practices as well as the correlation between the attitude towards Infosec policies and Infosec practices were strong. These findings correspond with (24). However, (24) reported average Infosec practices, average to bad knowledge on Infosec policies and attitude towards Infosec policies. This could be further examined in order to comprehend further the differences in culture, the organizational climate and the specific attributes of the sample that lead to these discrepancies.

6. CONCLUSION

A self-reporting tool was utilized to record the nurses’ knowledge on Infosec policies, attitude towards Infosec policies, and Infosec practices. Although, the validity of self-reporting tools has been criticized, alternative methods such as direct observation could be difficult to implement due to the fact that Infosec practices cannot be evaluated simultaneously in multiple areas of interest. Another limitation is collaborative environment in which the nurses work which may have lead to giving socially acceptable responses a fact that is also an inherent limitation in self-reporting tools. The findings suggest a strong correlation between knowledge on Infosec policies and attitude towards Infosec policies, attitude towards Infosec policies and Infosec practices, and knowledge on Infosec policies and Infosec practices. Nurses report that they apply good Infosec practices in three out of the five areas of interest, while their practices concerning security incidence reporting and Internet usage are average. Overall, their Infosec awareness is good. Further research that incorporates other healthcare professionals, more healthcare regions in Greece and additional factors, such as individual traits and organizational factors that may influence Infosec practices is recommended.

REFERENCES

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