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What Could We Learn from the Influence of Age on Perceptions of a CIS by the Clinical Staff of a French Hospital?

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Abstract. Previous research highlighted generation and age effects on the perceptions and uses of technology. The goal of this study was to examine the relationship between age and perceptions of a Clinical Information System (CIS) for the clinical staff (especially physicians, nurses, medical secretaries). A survey was conducted in September 2015 in a French Teaching Hospital, based on a questionnaire consisting of items on the Likert scale. As results, the impact of age has a strong impact on Perceived Ease of Use, anxiety and Self-Efficacy. The result related to Perceived Ease of Use is unexpected. Younger staff reported to be less comfortable with technology than older staff. This result is not consistent with literature. We propose an explanation consisting in the importance of clinical process and organization knowledge and skills while general technology skills of young generations may be less significant.

Keywords. Hospital, Clinical Information Systems, Electronic Medical Records, Perceptions, Ease of Use, Clinical process.

1. Introduction

In recent years, a significant amount of research has been conducted on comparing the level of technology adoption between younger and older age employees. A recent trend of research is focused on generational differences [1] and gap attitudes to technology between different generations. Generation is defined as groups, which are identifiable in terms of year of birth, age, location, and significant events at critical developmental stages [2]. Currently mains authors consider Generation Z [3], named also Digital Natives or Millennial Generation (born after 1985-1990) as having more "sophisticated technological skills" [4] which should transform the use of new technologies in the workforce.

Nevertheless, research pointed out that the generation is not homogeneous in its use and appreciation of new technologies [5]. Furthermore, literature has not come to identify if differences in technology skills and forms of technologies uses are related to generation or age effect.

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Another trend of research is focused on the age effect on technology adoption level. Authors highlighted age differences in information processing have an impact on older workers' performance of computer-based tasks (e.g., data entry, file maintenance, and inventory management) [6]. A longitudinal study [7] showed age has important influences on technology adoption and sustained usage decisions. Specifically, younger workers appear to be more driven by a cost and benefices evaluation of the use of technology whereas older workers are more motivated by social norm and the perception of their competency to use the technology. Authors suggest this difference may be related to generation effect taking into account that workers were familiarized with information technologies during their scholarship. Consequently, young workers may be more reliant on the use of technology for job accomplishment while older workers may be much more habituated to seeking and applying "no technology" solutions to job-related tasks.

Generally, older workers have a more difficult time adapting to changes in the work environment and would prefer methods that are familiar to them [6]. An older staff is negatively related to the probability of introducing new or significantly improved technologies [8].

Given this background, it may be expected that age factor influences clinical use and adoption of a Clinical Information System (CIS). Nevertheless, little or any evidence is offered to support this relationship. The aim of this paper is to measure the link between age and perceptions of the CIS in a French teaching hospital.

2. Theoretical framework

Research focused on technology adoption or on Information Systems evaluation by users identified main factors adoption decision or users' satisfaction: ease of use, usefulness [9], anxiety and self-efficacy, defined as "one's belief in his or her ability to execute a particular task/job using a computer." [10], system quality, information quality, service quality [11] and trust [12]. Ease of use and customization are main indicators of system quality [11]. System quality represents the desirable characteristics of an information system, as ease of use, flexibility, system reliability, and ease of learning, as well as system features of intuitiveness, sophistication, flexibility, and response times [11]. Thus, ease of use is one dimension of system quality. Information quality is shaped by four dimensions: completeness as the degree to which the system provides all necessary information; accuracy, meaning the user's perception that the information is correct, format, meaning the user's perception of how well the information is presented, and currency or timeliness, representing the user's perception of the degree to which the information is up to date [13].

3. Research method and design

3.1. Context

Our investigation was conducted in September 2015 in a large French University hospital. The target was composed by the care staff (6 000 employees), including anesthesiologists, physicians, surgeons, medical secretaries, nurses, auxiliary nurses,

midwives, residents, physiotherapists, social workers, pharmacists. The aim was to measure the link between age and the users' perceptions related to CIS of the hospital, namely information and system quality (security and liability), ease of use, customization, self-efficacy, anxiety, trust and usefulness.

The CIS incorporates computerized physicians order entry, medical and nursing observation, laboratory tests results, medical prescription, operating room process management, planning and billing management.

3.2. Method

A questionnaire was developed and administered online to the care staff. 1292 questionnaires were collected, which means a response rate of 19%. Each variable is measured using a question derived from a review of previous studies, adapted from different scales [7, 11, 13-16] and each question was answered using a seven-point Likert scale, with one indicating "strongly disagree" and seven indicating "strongly agree." Age is measured through 4 ordinal categories: less than 35, 35-45, 45-55, more than 55 years old. We applied the Kruskal Walls test to assess if age has an impact on the information systems variables.

We have to specify that these categories are very closely of professional status categories because the age of residents is less than 35 while permanent employment is in general more than 35. For the clinical staff, median age is 45.

4. Results

We found that age has an impact on perceived information and system quality, no customization (meaning perception of lack of adaptation of CIS to specialties), anxiety, ease of use, self-efficacy. Nevertheless, age has no influence on trust and perceived usefulness. These results are summarized in the table below:

Table 1: CIS perceptions and age: statistical correlation

Item	Significance level	Average (on Likert scale) for different ages				Total Average
		<35	35-45	45-55	> 55	
Ease of use	≤ 0,001	2,85	3,32	3,57	3,33	3,25
Self-efficacy	≤ 0,001	3,44	3,71	3,98	4,33	3,79
Anxiety	≤ 0,001	3,17	3,73	3,63	3,41	3,49
No customization	≤ 0,05	3,57	3,89	3,97	3,78	3,8
Information and system quality	≤ 0,05	4,45	4,49	4,65	4,88	4,57
Usefulness			*Not significant*			
Trust			*Not significant*			

5. Discussion

A rapid view of these results shows age has an effect on different perceptions of the CIS. The impact of age factor is very strong on Ease of Use and Self-efficacy. But, surprisingly, the first relationship is not the same as expected. Younger and older staff

reported to be less comfortable with technology than middle categories (35-45 years and 45-55 years). These results may be explained by the fact that using CIS is not intuitive [17] and requires learning and developing skills related to particular clinical process of medical specialties. Other explanation may be focused on the gap between younger staff' habits to use intuitive and ludic applications, which contrast with CIS ergonomics. Moreover, middle categories are more concerned by care management and different responsibility and monitoring tacks (as medical responsibility for physicians' seniors while residents fulfill the inpatient's discharge).

We find a similar relationship for the impact of age on Anxiety, which is also very strong and not continuous. There are the middle categories that reported the higher rate of anxiety but younger staff reported less anxiety. As for Ease of Use, this result may be explained by the fact that middle categories are more concerned by care management and different responsibility and monitoring tacks. Residents, which belong to the first category of age, are supervised by seniors for medical tasks as prescribing.

The impact of age is also very strong on Self-Efficacy. The growth of this relationship is continuous over the for age categories. This means older staff reported more self-efficacy (mastery) than the younger staff. This result may be explained by the lack of sufficient clinical and knowledge of younger staff, related to CIS use that predominates over general technology skills.

The impact of age is little on Information and System Quality (information security). This relationship is continuous. It may be connected to the impact of age on Ease of Use. Thus, younger staff stated less Ease of Use and less Information and System Quality. But, surprisingly, older staff reported more Information and System Quality. We have no explication for this result and we suggest to make further research to find out if information security is an important topic for all the age categories.

The impact of age is also little on customization, but there are the middle categories that reported less perceived lack of customization. This result may be explained by the greater medical and organizational knowledge and responsibilities of these categories and, consequently, the gap between their representations of clinical process and the configuration of clinical process by CIS.

Last, the impact of age is not significant on Usefulness neither Trust.

These mixed results do not confirm previous studies on age impact on technology use. First, the specificity of clinical process, by occupations and specialties, seems to be more important than general technological skills [17]. More in-depth research is needed to explore the link between clinical specialties (e.g. Pediatrics, Gerontology) and CIS perceptions. Second, age has not the same effect on different variables. Self-efficacy, Ease of Use and Anxiety seem to be more discriminant than other variables.

6. Conclusion

While literature pointed out generation and age effects on technology perceptions and attitudes, related to younger people technological skills, our study shows that age does have an effect of Self-efficacy, Anxiety and Ease of Use but the relationship between age and Ease of Use is not the same as expected. Younger staff reported less Self-Efficacy and Ease of Use, probably because they have less knowledge about clinical and organizational process. Other perceptions related to CIS are less or not at all

correlated with age. We conclude that age factor is not the most relevant for the analysis of CIS perceptions.

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